Impact of the Kerala Solid Waste Management Project (KSWMP) On Urban Cleanliness and Sustainability in Kerala *with Special Reference to Thiruvananthapuram District*

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ABSTRACT

The increasing problem associated with solid waste management has emerged as a serious challenge due to rapid urbanization and growing consumption. Kerala State Government had formulated an important scheme called as Kerala Solid Waste Management Project (KSWMP) to make improvement in waste management and maintain urban cleanliness and sustainability. The present research aims at assessing the effectiveness of KSWMP on urban cleanliness and sustainability in Kerala State with reference to Thiruvananthapuram District. This paper was written adopting a descriptive research methodology. Primary data were collected using a structured questionnaire among 170 respondents while secondary data were gathered from KSWMP reports, government publications, journal articles, and official website sources. The data have been analyzed applying percentage and Chi-square tests. Results show that the majority of the respondents believe that KSWMP has been successful in improving urban cleanliness due to efficient waste collection, segregation, recycling, and scientific disposal. In addition, it can be seen from the results that KSWMP has made contribution towards promoting environmental sustainability by decreasing pollution levels and increasing resource recovery. Moreover, there was also an evident amount of involvement and awareness among the general public regarding waste management processes. Nevertheless, problems like non-cooperation among the people, lack of awareness, and lack of infrastructure still persist in the effective execution of the project. The study finds that KSWMP has been extremely instrumental in ensuring sustainable waste management practices in the district of Thiruvananthapuram.

Keywords: Kerala Solid Waste Management Project (KSWMP), Urban Cleanliness, Environmental Sustainability, Solid Waste Management, Public Participation, Thiruvananthapuram District.

INTRODUCTION

The issue of Municipal Solid Waste Management (MSWM) has become one of the most pressing urban governance issues in developing nations owing to the rapidly rising population, increased urbanization, changing consumption habits, and heightened awareness about environmental concerns. The cities in South Asian countries such as India, Bangladesh, Nepal, Pakistan, and Sri Lanka have been witnessing an unprecedented rise in municipal solid waste generated from urban areas, creating immense strain on urban local authorities and infrastructure in waste management. Recent literature underscores how inefficiencies in governance mechanisms, fragmented institutions, inadequate infrastructure, and lack of involvement by local communities still prevent sustainable waste management. There has been a noticeable trend toward integrated and decentralized forms of MSW management systems that ensure segregation of waste at source, recycling, and other related concepts. Several recent studies on governance of municipal solid waste in South Asia indicate how collaborative approaches toward waste governance and decentralized forms of waste management can contribute to sustainable urbanization. To address these issues, the Government of Kerala embarked upon implementing a project called the 'Kerala Solid Waste Management Project' (KSWMP). Financial assistance for this project has been provided by various international organizations including the World Bank and the Asian Infrastructure

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Investment Bank (AIIB). The main objective of the KSWMP is to design an integrated approach to solid waste management in urban local bodies.

In India, waste management in municipalities has seen major changes due to interventions like Swachh Bharat Mission, Smart Cities Mission, and Solid Waste Management Programs implemented by individual states. In recent times, there is a move towards adopting waste management models that focus on decentralization of collection methods, use of Material Recovery Facilities (MRFs), community level composting centers, and electronic tracking to minimize reliance on centralized landfill methods. There have been several calls for adopting a circular economy approach where waste is considered as a resource through the means of recycling, composting, and energy generation from waste.

One of the most interesting cases of adoption of decentralized waste management approach is Kerala, which has been considered as one of the leading states in India in this field. In this state, many new schemes have been developed by adopting decentralized waste management approach, such as segregation of waste at the household level, decentralization of composting process, Material Collection Facilities, Resource Recovery Facilities, and the engagement of Haritha Karma Sena teams. Another important point to note is that the importance of decentralized waste management approach is being acknowledged on international and regional levels.

In this backdrop, the State of Kerala introduced the Kerala Solid Waste Management Project (KSWMP), financially supported by international development agencies, to implement a modern, integrated, and sustainable system of solid waste management throughout the Urban Local Bodies of Kerala. The objective behind implementing the project is to ensure that there are improved collection systems, better facilities for processing and treating the waste, proper disposal of waste in scientific manner, and greater citizen involvement in waste management processes. Being the capital city of Kerala, Thiruvananthapuram is an ideal location to examine the effectiveness of the KSWMP due to the growth in the urban area and increased production of waste material in the city.

Consequently, the present study attempts to assess the influence of KSWMP on the issue of cleanliness and sustainability in Thiruvananthapuram District. The present study also assesses public awareness and participation in waste management processes along with the problems faced by the project.

Statement of the Problem

Rapid population growth in urban cities, changes in consumption patterns, and business expansion have caused a significant rise in the generation of solid wastes in Kerala. Although many efforts have been taken by Urban Local Bodies to tackle such problems, some of the challenges that exist include poor segregation practices, unsound waste disposal practices, lack of adequate treatment facilities, environmental degradation, and health risks. Considering the fact that Thiruvananthapuram District is one of the heavily urbanized administrative capitals of Kerala, the problem of waste management has been increasingly felt in the district. In order to resolve this issue and promote environmental sustainability, the government of Kerala introduced the Kerala Solid Waste Management Project (KSWMP), with the goal of setting up an efficient and sustainable waste management system. Although several resources have been used in building infrastructure, setting up waste collection systems, installing recycling centers, and creating awareness among people, there is a need for a proper assessment of whether such a project has brought any positive changes to the area.

Relevance of the study

The importance of the current study lies in its relevance in determining the success of the Kerala Solid Waste Management Project (KSWMP) in tackling the increasing problems of urban solid waste management in Kerala. Due to the rise in urbanization and increasing amounts of waste generated in cities, urban cleanliness and sustainability have emerged as pressing issues to be addressed through the implementation of effective policies and measures. The findings obtained in this study can shed light on the level of waste collection, segregation, recycling, and scientific disposal carried out in Thiruvananthapuram District through KSWMP.

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The results of this study will provide valuable information not only to government bodies, Urban Local Bodies, but also to decision-makers when evaluating the efficiency of the project and defining the necessary improvements. In addition, the research will make an important contribution to the body of knowledge regarding sustainable urban development and solid waste management by highlighting the effect of such a project. The conclusions made based on the results of this study may prove helpful in creating more efficient solutions related to waste management, environmental sustainability, and improving the quality of people's lives.

Objectives of the study

1. To assess the impact of KSWMP on urban cleanliness.
2. To evaluate the contribution of KSWMP towards environmental sustainability.
3. To analyze public awareness and participation in waste management activities under KSWMP.
4. To identify the challenges faced in implementing KSWMP

Hypotheses of the study

H_{01}: KSWMP has no significant impact on urban cleanliness in Thiruvananthapuram District.

H_{02}: KSWMP does not significantly contribute to environmental sustainability in Thiruvananthapuram District.

RESEARCH METHODOLOGY

Research Design

The study utilizes the descriptive method of research to determine the effect of the Kerala Solid Waste Management Project (KSWMP) on urban sanitation and sustainability in Thiruvananthapuram District.

Population

All the urban dwellers of Thiruvananthapuram District, who have a stake in the project named “Kerala Solid Waste Management Project (KSWMP)” are taken as the target population for this research. The total target population consists of all those people who are benefited, or influenced, either directly or indirectly, by the waste management project in some way.

Sample size

The sample size for the study comprises 170 participants who have been selected from different urban parts of the Thiruvananthapuram District.

Sampling Technique

Purposeful sampling technique was used for selecting participants, which were knowledgeable or had some experiences with respect to the implementation of the Kerala Solid Waste Management Project (KSWMP). These included: (i) people residing in urban areas of Thiruvananthapuram district for at least three years, (ii) those above 18 years of age, and (iii) people aware of solid waste management processes. Participants who did not fulfill these criteria, such as outsiders or people unaware about the process of KSWMP, were excluded from participation. This strategy helped in gathering information from knowledgeable participants.

Sources of Data

Primary Data

The major source of data for the analysis was obtained by conducting a questionnaire survey with 170 participants who belonged to different urban locations of Thiruvananthapuram District. The questionnaire survey included questions related to the perception of the participants concerning the effects of the KSWMP on urban

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cleanliness, environmental sustainability, public awareness, active participation in the waste management process, and problems with the implementation of the program.

Secondary Data

The secondary sources for the research were gathered from a number of different places such as KSWMP reports, publications by the Local Self Government Department, Kerala, World Bank reports, Asian Infrastructure Investment Bank reports, books, research journals, newspapers, magazines, government websites, and other literature on solid waste management, urban cleaning, and environmental sustainability. The secondary sources were selected as a supplementary source of information that would complement the primary data collected by the researcher.

Tool used for data Collection

A structured questionnaire served as the primary data-gathering instrument. The questionnaire contained demographic and study-related questions, which were aimed at gathering data about the effect of the KSWMP program on the issues of urban cleanliness, environmental sustainability, the level of awareness and participation in waste management programs, and the problems encountered in implementing the program. To assess the perception of the respondents on the different issues raised in the study, a five-point Likert Scale (SA, A, N, D, SD) was employed.

Tools used for Analysis

The data gathered was then subjected to analysis with the use of proper statistical methods to meet the objectives of the study. Percentage Analysis is used to interpret the profile of the respondents and to compute the percentage breakdown of their answers about different issues related to KSWMP. Chi-Square Test is used to test the hypotheses and evaluate the relationship between the chosen variables with regard to the effects of KSWMP on urban hygiene and environmental sustainability.

Tool used for presentation of data

Tables are used for representing the gathered data.

Limitations of the study

The research is confined only to 170 respondents residing in urban parts of the district of Thiruvananthapuram and thus may not capture the perceptions of the total population of Kerala. This study is subject to selection bias due to its dependence on purposive sampling. It must also be noted that the research uses perception-based data rather than factual information.

Analysis of Data

Table 8.1: Demographic Profile of the Respondents

Variables	Classification	Respondents	Percentage
Gender	Male	98	57.6
	Female	72	42.4
	TOTAL	**170**	**100**
Age	18- 25 Years	28	16.5
	25-35 Years	46	27.1

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	36-45 Years	51	30.0
	46-55 Years	29	17.1
	Above 55 Years	16	9.3
	TOTAL	**170**	**100**
Educational Qualification	School Level	22	12.9
	Higher Secondary	36	21.2
	Graduate	68	40.0
	Post Graduate	34	20.0
	Professional Degree	10	5.9
	TOTAL	**170**	**100**
Occupation	Government Employee	29	17.1
	Private Employee	52	30.6
	Business	24	14.1
	Student	31	18.2
	Homemaker	21	12.4
	Others	13	7.6
	TOTAL	**170**	**100**
Monthly Income	Below ₹20,000	37	21.8
	₹20,001-₹40,000	54	31.8
	₹40,001-₹60,000	41	24.1
	₹60,001-₹80,000	24	14.1
	Above ₹80,000	14	8.2
	TOTAL	**170**	**100**

Source: Primary Data

Interpretation

It is clear from the demographic analysis that 57.6% are male, and 42.4% respondents are female. 30% respondents have an age range of 36-45 years. 40% respondents are graduates, and private sector employees form the largest group among all professions (30.6%). In terms of monthly income, 31.8% respondents have an earning range of ₹20,001 to ₹40,000.

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Table 8.2: Opinion on Improvement in Urban Cleanliness Due to KSWMP

Opinion	Respondents	Percentage
Strongly Agree	64	37.6
Agree	52	30.6
Neutral	24	14.1
Disagree	18	10.6
Strongly Disagree	12	7.1
Total	**170**	**100**

Source: Primary Data

Interpretation

As seen from the above table, 37.6 percent of the respondents strongly agree while 30.6 percent agree with the statement that KSWMP has made the city clean. This means that 68.2 percent of the respondents view the effectiveness of the project positively.

Hypothesis 1

H_{01}: KSWMP has no significant impact on urban cleanliness.

H_{11}: KSWMP has a significant impact on urban cleanliness.

Table 8.2.1: Opinion on Impact of KSWMP on Urban Cleanliness (Observed Frequency)

Gender	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Male	40	32	12	8	6	98
Female	24	20	12	10	6	72
Total	**64**	**52**	**24**	**18**	**12**	**170**

Source: Primary Data

Table 8.2.2 Opinion on Impact of KSWMP on Urban Cleanliness (Expected Frequencies)

Gender	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Male	36.89	29.98	13.84	10.38	6.92	98
Female	27.11	22.02	10.16	7.62	5.08	72
Total	**64.00**	**52.00**	**24.00**	**18.00**	**12.00**	**170**

Source: Calculated from Primary Data

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Table 8.2.3 Chi-Square Calculation Table

Cell	O	E	$(O-E)^2/E$
Male-SA	40	36.89	0.26
Male-A	32	29.98	0.14
Male-N	12	13.84	0.24
Male-D	8	10.38	0.55
Male-SD	6	6.92	0.12
Female-SA	24	27.11	0.36
Female-A	20	22.02	0.19
Female-N	12	10.16	0.33
Female-D	10	7.62	0.74
Female-SD	6	5.08	0.17
Total χ^2			**3.10**

Source: Calculated from Primary Data

Table Value at 5% Level = 9.488

Degrees of Freedom: 4

Calculated Value = 3.10

Interpretation

Since the calculated value of chi-square (**3.10)** less than the table value (**9.488)**, the null hypothesis is accepted. $\chi^2 = 3.10$, df = 4, $p > 0.05$, Cramer's V = 0.135. The association between gender and perception regarding urban cleanliness was weak and statistically insignificant. So it is clear that there is no substantial relationship exists between gender and perception concerning the influence of KSWMP on urban cleanliness. Both genders have a similar perception of the performance of KSWMP in enhancing urban cleanliness.

Table 8.3: Opinion on Environmental Sustainability Achieved Through KSWMP

Opinion	Respondents	Percentage
Strongly Agree	59	34.7
Agree	60	35.3
Neutral	22	12.9
Disagree	18	10.6
Strongly Disagree	11	6.5
Total	**170**	**100**

Source: Primary Data

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Interpretation

The table reveals that 70% of people agree and strongly agree that the contribution of KSWMP towards environmental sustainability is positive. This is due to the efforts made by the project in minimizing environmental pollution and recycling.

Hypothesis 2

H_{02}: There is no significant association between gender and respondents' opinion regarding the contribution of KSWMP towards environmental sustainability.

H_{12}: There is a significant association between gender and respondents' opinion regarding the contribution of KSWMP towards environmental sustainability.

Table 8.3.1: Opinion on Contribution of KSWMP Towards Environmental Sustainability (Observed Frequencies)

Gender	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Male	35	37	11	9	6	98
Female	24	23	11	9	5	72
Total	**59**	**60**	**22**	**18**	**11**	**170**

Source: Primary Data

Table 8.3.2: Opinion on Contribution of KSWMP Towards Environmental Sustainability (Expected Frequencies)

Gender	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Male	34.01	34.59	12.68	10.38	6.34	98
Female	24.99	25.41	9.32	7.62	4.66	72
Total	**59.00**	**60.00**	**22.00**	**18.00**	**11.00**	**170**

Source: Calculated from Primary Data

Table 8.3.3: Chi-Square Calculation Table

Cell	O	E	$(O-E)^2/E$
Male-SA	35	34.01	0.03
Male-A	37	34.59	0.17
Male-N	11	12.68	0.22
Male-D	9	10.38	0.18
Male-SD	6	6.34	0.02
Female-SA	24	24.99	0.04

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Female-A	23	25.41	0.23
Female-N	11	9.32	0.30
Female-D	9	7.62	0.25
Female-SD	5	4.66	0.02
Total χ^2			**1.46**

Source: Calculated from Primary Data

Calculated Chi-Square Value = 1.46

Degrees of Freedom: 4

Table Value at 5% Level of Significance = 9.488

Interpretation

Since the calculated value (1.46) is less than the table value (9.488), the null hypothesis is accepted and the alternative hypothesis is rejected. $\chi^2 = 1.46$, df = 4, $p > 0.05$, Cramer's V = 0.093. The relationship between gender and perception regarding environmental sustainability was negligible and statistically insignificant. The findings show that there is no significant correlation between gender and the respondents' perception on the role played by the KSWMP in ensuring environmental sustainability. Both males and females have identical perceptions on the environmental gains that would be accrued through the project. It can thus be concluded that gender is not a major factor influencing respondent opinions.

Table 8.4: Level of Public Awareness and Participation

Level of Awareness and Participation	Respondents	Percentage
High	73	42.9
Moderate	57	33.5
Low	40	23.6
Total	**170**	**100**

Source: Primary Data

Interpretation

The above figures suggest that 42.9% of the respondents have a high degree of awareness and participation, whereas 33.5% respondents show a moderate degree of participation. Therefore, it is clear that there has been a positive impact of awareness campaigns for KSWMP on participation.

Table 8.5: Major Challenges in Implementing KSWMP

Challenges	Respondents	Percentage
Lack of Public Cooperation	51	30.0
Inadequate Awareness	38	22.4

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Insufficient Infrastructure	32	18.8
Irregular Waste Segregation	29	17.1
Financial Constraints	20	11.7
Total	**170**	**100**

Source: Primary Data

Interpretation

From the table above, it is apparent that the biggest problem associated with the implementation of KSWMP is the absence of public cooperation (30%), followed by low awareness level (22.4%) and poor infrastructure (18.8%).

Findings

Objective 1: Impact of KSWMP on Urban Cleanliness

The maximum number of respondents (68.2%) felt that KSWMP has made a substantial difference in making cities cleaner in Thiruvananthapuram District. It helped increase waste collection effectiveness and encouraged waste segregation by residents.

Objective 2: Contribution of KSWMP Towards Environmental Sustainability

There are a notable number of people (70%) who believe that KSWMP has been instrumental in improving environmental sustainability. This project has promoted the practice of waste recycling, waste recovery, and proper waste disposal.

Objective 3: Public Awareness and Participation in Waste Management Activities Under KSWMP

It was revealed from the study that 42.9 percent of respondents were highly aware and involved in waste management activities through KSWMP. Approximately 33.5 percent of respondents were moderately aware of segregating, recycling, and the right ways to dispose of wastes. Campaigns and activities initiated by the community as part of KSWMP have motivated the public in taking part in waste management activities.

Objective 4: Challenges Faced in Implementing KSWMP

Non-cooperation from the public was recognized as one of the main issues which hindered the implementation of KSWMP. Limited awareness among some parts of the population is still causing hindrances to appropriate waste management systems. Infrastructure constraints along with operational constraints posed as barriers in the process of collecting and treating wastes. Uneven separation of wastes and financial problems have been listed as crucial issues to overcome for the betterment of this project.

CONCLUSION

The Kerala Solid Waste Management Project (KSWMP) has proved to be a crucial step forward in tackling the issues faced by urban waste management in the state of Kerala. The results show that there have been significant gains in terms of urban cleanliness, environmental sustainability, and people's involvement in the waste management process. Even though there was no significant difference in perception of project outcomes on a gender basis, the overall response to KSWMP has been very positive. Nonetheless, there are certain barriers to optimal implementation of the project in the form of insufficient public involvement, infrastructure problems, and lack of awareness that keep hindering success.

Suggestions

1. **Intensify Public Awareness Programmes:**

Campaigns must be regularly conducted by the government authorities to educate people on segregation of waste, recycling, and the environmental benefits of waste management.

2. **Increase Involvement of Communities:**

Urban Local Bodies must involve communities, schools, and other social groups in waste management initiatives through effective campaigns.

3. **Increase Involvement in Waste Segregation at Source:**

Households and commercial entities must be made aware of waste segregation and monitored for their compliance with segregation of different types of waste.

4. **Develop More Waste Management Infrastructures:**

It is necessary to build more MCFs, RRFs, composting plants, and facilities for waste management.

5. **Strengthening Haritha Karma Sena:**

Necessary training, financial assistance, and technological help must be provided to the volunteers of Haritha Karma Sena.

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