 ISSN:2584-2714

https://doi.org/10.64906/IJSSC.2025.03.01.45

INTERNATIONAL JOURNAL OF SOCIAL SCIENCES AND COMMERCE [IJSSC]

Translating Local Impact: An SDG Model of Swachh Bharat Abhiyan's Influence on Sanitation and Waste Management in Manikandam Block

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Article History

Volume:3, Issue:1, 2026

Received: 26th December 2025

Accepted: 29th December 2025

Published:15th January 2026.

Abstract: *The SDG Model presented here is derived from a localized assessment of India's Swachh Bharat Abhiyan (SBA) in Manikandam Block, Tiruchirappalli District, Tamil Nadu. Launched in 2014, the SBA is a national initiative focused on eradicating open defecation and improving waste management throughout the country. While national data reports significant progress, including the construction of over 100 million toilets, this study offers a vital grassroots perspective from Manikandam Block, highlighting both considerable achievements and ongoing challenges. Employing a mixed-methods research approach, the study reveals notable improvements in sanitation infrastructure, such as wider access to household toilets and more efficient waste collection systems. However, it also critically identifies persistent issues, including inconsistent waste segregation practices, the necessity for sustained behavioral change initiatives, and the presence of cultural resistance. This analysis systematically maps these localized findings, objectives, challenges, and recommendations to the United Nations Sustainable Development Goals (SDGs). The primary SDGs directly relevant to this study include SDG 6 (Clean Water and Sanitation), SDG 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 5 (Gender Equality), SDG 4 (Quality Education), and SDG 17 (Partnerships for the Goals). The report details how the experiences in Manikandam Block either contribute to or expose obstacles in achieving these global targets.*

Keywords: *Sustainable Development Goals (SDGs). Swachh Bharat Abhiyan (SBA) and Manikandam Block.*

Author's Citation: M. Chitra Devi., *Translating Local Impact: An SDG Model of Swachh Bharat Abhiyan's Influence on Sanitation and Waste Management in Manikandam Block. IJSSC.Vol.3.(1): 2025, PP: 45-57,* https://doi.org/10.64906/IJSSC.2025.03.01.45

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I. Introduction

Sanitation and effective waste management are fundamental pillars for advancing public health, ensuring environmental sustainability, and fostering socio-economic development globally. In nations like India, historical challenges such as widespread open defecation, inadequate waste disposal systems, and limited public awareness have significantly impeded progress in rural sanitation, leading to substantial health burdens and environmental degradation. The absence of proper sanitation and waste management contributes to the spread of diseases, contaminates natural resources, and undermines the overall well-being and productive capacity of communities. Addressing these issues is therefore not merely a matter of public hygiene, but a prerequisite for achieving broader developmental aspirations and improving the quality of life for millions.

Swachh Bharat Abhiyan (SBA) and its National Objectives

To confront these entrenched challenges, the Government of India launched the Swachh Bharat Abhiyan (SBA) on October 2, 2014. This nationwide campaign was conceived as a transformative initiative with two ambitious overarching goals: the complete elimination of open defecation and a significant improvement in solid and liquid waste management across the country. The rural component of the mission, known as Swachh Bharat Mission-Gramin (SBM-G), specifically concentrated on the construction of individual household latrines (IHHLs), the promotion of behavioral change to encourage toilet usage, and the establishment of robust mechanisms for monitoring sanitation practices at the village level. By October 2019, the mission reported remarkable national achievements, including the construction of over 100 million toilets and the declaration of more than 600,000 villages as Open Defecation Free (ODF).

II. Overview of Swachh Bharat Abhiyan and the Manikandam Block Study

The Swachh Bharat Abhiyan (SBA) was implemented in phases to achieve its ambitious sanitation and waste management objectives. The initial rural component, Swachh Bharat Mission-Gramin (SBM-G), launched in 2014, primarily focused on accelerating the construction of individual household latrines (IHHLs) and promoting widespread behavioral change to eliminate open defecation. This phase successfully led to the declaration of over 600,000 villages as Open Defecation Free (ODF) by October 2019, marking a significant milestone in India's sanitation landscape.

Recognizing that achieving ODF status was just a foundational step, SBM-G Phase II was subsequently launched. This phase shifted its emphasis from merely achieving ODF to sustaining these achievements and transitioning to "ODF Plus" status. The ODF Plus

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framework broadens the scope to include comprehensive Solid and Liquid Waste Management (SLWM), visual cleanliness of villages, and the sustained adoption of hygienic and sustainable sanitation practices. This evolution reflects a deeper understanding that long-term sanitation success requires not only infrastructure but also robust waste management systems and ingrained behavioral norms.

Contextual Background of Manikandam Block as the Study Area

Manikandam Block, located within the Tiruchirappalli District of Tamil Nadu, was selected as the study area due to its active engagement in the Swachh Bharat Abhiyan initiatives. Tamil Nadu has been a proactive state in implementing sanitation programs, demonstrating significant efforts in upgrading sanitation infrastructure, such as retrofitting single-pit toilets to more efficient twin-pit systems, and promoting safe faecal sludge management. The block comprises diverse rural communities, making it a representative setting to assess the real-world impact of SBA interventions on varying socio-demographic groups. This localized focus is particularly valuable for understanding how national policies translate into tangible improvements and challenges within specific rural contexts.

Objectives

The study conducted in Manikandam Block was designed with several primary objectives to provide a comprehensive assessment of the SBA's impact:

- To evaluate the influence of Swachh Bharat Abhiyan on sanitation practices within Manikandam Block.
- To assess the effectiveness of waste management systems implemented under SBA initiatives.
- To identify the challenges and barriers encountered in sustaining ODF status and effectively implementing Solid and Liquid Waste Management (SLWM) practices.
- To provide actionable recommendations aimed at enhancing sanitation and waste management practices in rural communities.

Research Questions

To achieve these objectives, the research sought to answer the following key questions:

- How has the Swachh Bharat Abhiyan influenced sanitation behaviors in Manikandam Block?
- What waste management practices have been adopted post-SBA implementation?
- What are the perceptions of the local community regarding the effectiveness of SBA initiatives?
- What challenges persist in achieving and maintaining ODF Plus status in the block?

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Table No:2.1.
SDG Alignment Matrix

SDG & Target	Relevant Article Findings/Objectives	Relevant Article Challenges	Relevant Article Recommendations	SDG Contribution/Impediment
SDG 6.2: Clean Water and Sanitation - End Open Defecation	SBA aimed to eliminate open defecation; Increased household toilet access; Over 100 million toilets constructed nationally	Need for sustained behavioral change; Older individuals reverting to open defecation; Cultural resistance	Targeted education for all age groups; Community engagement; Continuous monitoring	Direct contribution through infrastructure; Impediment due to behavioral and cultural barriers requiring sustained efforts.
SDG 6.b: Clean Water and Sanitation - Community Participation	Study "underscores the importance of community engagement"	-	Community engagement; Community involvement; Community-driven initiatives	Direct contribution by emphasizing local ownership and participation as vital for long-term success.
SDG 3.9: Good Health and Well-being - Pollution & Contamination	Elimination of open defecation; Enhanced waste collection systems; Promotion of hygiene awareness	Lack of awareness about health benefits	Targeted education for all age groups	Indirect but significant contribution by reducing sources of environmental contamination and disease transmission.
SDG 11.6: Sustainable Cities & Communities - Waste Management	Enhanced waste collection systems	Inconsistent waste segregation practices; Irregular waste collection; Limited public infrastructure	Strengthening waste management infrastructure; Targeted education for all age groups	Partial contribution through improved collection; Impediment due to persistent gaps in segregation and infrastructure quality.
SDG 12.4: Responsible Consumption & Production - Sound Waste Management	New technologies like waste-to-energy introduced by Clean India	Inconsistent waste segregation practices; Irregular waste collection; Limited public infrastructure	Strengthening waste management infrastructure	Impediment due to lack of comprehensive environmentally sound management practices,

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	Mission			particularly segregation.
SDG 12.5: Responsible Consumption & Production - Waste Reduction	People need to be aware of recycling/reusing	Inconsistent waste segregation practices; Lack of awareness about recycling/reusing	Targeted education for all age groups	Impediment due to behavioral barriers and insufficient awareness hindering waste reduction through recycling/reuse.
SDG 5.1: Gender Equality - End Discrimination	Gender influences awareness, information sources, and frequency of toilet usage (significant differences)	-	Gender-responsive strategies in sanitation programs	Direct contribution by identifying and addressing gender disparities to ensure equitable access and benefits.
SDG 4.7: Quality Education - Sustainable Development Knowledge	Education significantly affects waste management awareness and practices; Higher education correlates with better engagement in segregation and training	Challenges persist among respondents with lower educational levels	Investing in quality education and awareness	Direct contribution by highlighting education as a foundational enabler for adopting sustainable behaviors and practices.
SDG 17.17: Partnerships for the Goals - Multi-stakeholder Partnerships	Study "underscores the importance of community engagement and continuous monitoring"	-	Community engagement; Continuous monitoring	Direct contribution by emphasizing collaborative approaches among various stakeholders for program sustainability.
SDG 1: No Poverty & SDG 8: Decent Work and Economic Growth	Clean Indian Mission increased waste pickers' earning potential	Economic constraints limit household ability to maintain facilities	Financial and technical aid for facilities; Explore livelihood opportunities in waste management	Potential positive contribution through economic opportunities in waste management; Impediment due to

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				poverty limiting household participation and maintenance.

III Methodology

- **Mixed-Methods Approach:** Combined quantitative surveys and qualitative interviews.
- **Purpose:** Comprehensively assess the impact of the Swachh Bharat Abhiyan (SBA).
- **Sample Size:** 110 respondents.
- **Sampling Method:** Stratified random sampling.
- **Ensured Representation:** Across diverse demographic segments.
- **Demographic Segments Included:** Gender, age, education, occupation, household size, and religion.
- **Importance of Demographics:** Provides essential context for interpreting findings and understanding Manikandam Block's socio-economic environment.
- **Demographic Profile of Respondents :**The demographic composition of the study population is crucial for understanding the context of their responses and for tailoring future interventions effectively.

Table No: 3.1

Demographic factors		**No. of respondents (110)**	**Percentage**	**Mean**
Gender	Male	49	44.5	1.5545
	Female	61	55.5	
Age	Bellow 20 years	4	3.6	3.7545
	21 years – 30 years	8	7.3	
	31 years – 40 years	30	27.3	
	41 years – 50 years	37	33.6	
	51 years and above	31	28.2	
Education	No formal education	27	24.5	2.7000

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	Primary	14	12.7	
	Secondary	42	38.2	
	Higher Secondary	19	17.3	
	Graduate and above	8	7.3	
Occupation	Agriculture and Allied Activities	41	37.3	3.6727
	Skilled Trades and service Sector	16	14.5	
	Government and Public Services	5	4.5	
	Private Sector Employment	10	9.1	
	Self-Employed	5	4.5	
	Unemployed	8	7.3	
	Student	5	4.5	
	Home maker	12	10.9	
	Retired	8	7.3	
Household Size	Bellow 3 members	23	20.9	2.2455
	4 members – 5 members	37	33.6	
	6 and above members	50	45.5	
Religion	Hindu	63	57.3	1.6273
	Christian	25	22.7	
	Islam	22	20.0	

Source: Primary data

The demographic profile shows a slightly higher proportion of female respondents (55.5%) and a significant representation of middle-aged and older adults (33.6% aged 41-50 years, 28.2% aged 51 and above). Education levels are varied, with "Secondary" being the most common (38.2%) and a notable portion having "No formal education" (24.5%). The largest occupational group is "Agriculture and Allied Activities" (37.3%), reflecting the rural nature of the block, and a majority of respondents live in larger households (45.5% with 6 or more members). This data provides the foundational context for understanding the

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community's engagement with and perceptions of sanitation and waste management initiatives.

Hypothesis

There is relationship between gender of the respondents and their towards Impact of SBA on Sanitation Practices

Table No: 3.2

ANOVA Table						
Gender		Sum of Squares	df	Mean Square	F	Sig.
Awareness of Swachh Bharat Abhiyan (Clean India Mission)						
	Between Groups (Combined)	11.870	4	2.967	2.820	.029
	Within Groups	110.503	105	1.052		
	Total	122.373	109			
Sources of Information about Swachh Bharat Abhiyan						
	Between Groups (Combined)	18.046	8	2.256	2.184	.035
	Within Groups	104.327	101	1.033		
	Total	122.373	109			
Type of Toilet Facilities Available in Households						
	Between Groups (Combined)	8.466	3	2.822	2.626	.054
	Within Groups	113.906	106	1.075		
	Total	122.373	109			
Frequency of Toilet Usage Among Household Members						
	Between Groups (Combined)	12.850	3	4.283	4.146	.008
	Within Groups	109.522	106	1.033		
	Total	122.373	109			
Reasons for Non-Usage of Household Toilets						
	Between Groups (Combined)	7.679	3	2.560	2.366	.075
	Within Groups	114.694	106	1.082		
	Total	122.373	109			
Perceived Changes in Community Cleanliness Since Swachh Bharat Abhiya						
	Between Groups (Combined)	10.235	4	2.559	2.396	.055
	Within Groups	112.138	105	1.068		
	Total	122.373	109			

The ANOVA analysis indicates a statistically significant relationship between respondents' gender and their perceptions and practices related to the Swachh Bharat Abhiyan (SBA). Specifically, significant differences were observed in awareness levels ($p = 0.029$), sources of information ($p = 0.035$), and frequency of toilet usage among household members ($p = 0.008$). These findings suggest that gender influences how individuals perceive and engage with sanitation initiatives under the SBA.

For instance, the significant variation in awareness levels implies that men and women may have differing levels of exposure to SBA campaigns, potentially due to variations in literacy rates, access to information channels, or societal roles. The differences in sources of information further support this, indicating that men and women may rely on different mediums—such as community meetings, media, or interpersonal communication—to learn about sanitation programs. The significant disparity in toilet

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usage frequency among household members suggests that gender roles and responsibilities within households may impact sanitation practices.

Conversely, the analysis did not find statistically significant differences based on gender for the type of toilet facilities available in households ($p = 0.054$), reasons for non-usage of household toilets ($p = 0.075$), and perceived changes in community cleanliness since the implementation of SBA ($p = 0.055$). These p-values, while not below the conventional threshold for significance ($p < 0.05$), are relatively close, indicating potential trends that might achieve significance with larger sample sizes or more targeted studies.

These findings align with broader research highlighting the importance of gender-sensitive approaches in sanitation initiatives. For example, studies have shown that women often face unique challenges related to sanitation, such as safety concerns and cultural norms, which can affect their engagement with programs like SBA. Therefore, incorporating gender perspectives into the design and implementation of sanitation campaigns is crucial for their success.

In conclusion, the data underscores the need for gender-responsive strategies in sanitation programs. By acknowledging and addressing the distinct experiences and needs of different genders, initiatives like the Swachh Bharat Abhiyan can enhance their effectiveness and promote equitable sanitation practices across communities.

Hypothesis (Chi-Square Test)

There is relationship between Education of the respondents and their towards Effectiveness of Waste Management Systems under SBA

Table No: 3.3

Cross tabulaton for Education of the respondents and their towards Effectiveness of Waste Management Systems under SBA										
Education	**waste (garbage) collected period**						Total	Value	df	Asymp. Sig. (2-sided)
	Every Day	Once a Week	every two weeks	not regularly	No Waste Collection	don't know				
No formal education	5	3	8	3	2	6	27	36.531[a]	20	.013
Primary	5	7	1	0	0	1	14	38.638	20	.007
Secondary	16	9	6	4	4	3	42	.081	1	.776
Higher Secondary	3	1	3	4	5	3	19	110		
Graduate and above	3	2	0	0	0	3	8			
Total	32	22	18	11	11	16	110			
Education	**Waste Management System in Home**						Total	Value	df	Asymp. Sig. (2-sided)
	Two Types	More than 2 types	not separate	don't know	-					
No formal education	8	3	4	12	-		27	26.338[a]	12	.010
Primary	1	7	2	4	-		14	31.691	12	.002
Secondary	8	11	3	20	-		42	.002	1	.968
Higher Secondary	0	3	6	10	-		19	110		

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Graduate and above	3	4	1	0	-	8			
Total	20	28	16	46	-	110			
Education	**Waste bins placed in your area for public use**					Total	Value	df	Asymp. Sig. (2-sided)
	used properly	not used properly	No bins	Not sure	-				
No formal education	6	9	9	3	-	27	40.601[a]	12	.000
Primary	5	1	3	5	-	14	42.409	12	.000
Secondary	9	12	8	13	-	42	.272	1	.602
Higher Secondary	7	0	5	7	-	19	110		
Graduate and above	2	6	0	0	-	8			
Total	29	28	25	28	-	110			
Education	**system for composting or recycling in your area**					Total	Value	df	Asymp. Sig. (2-sided)
	composting	recycling	No System	don't know	-				
No formal education	6	9	9	3	-	27	26.826[a]	12	.008
Primary	5	1	3	5	-	14	33.633	12	.001
Secondary	9	12	8	13	-	42	.027	1	.869
Higher Secondary	7	0	5	7	-	19	110		
Graduate and above	2	6	0	0	-	8			
Total	29	28	25	28	-	110			
Education	**Received any training or information on how to manage waste**					Total	Value	df	Asymp. Sig. (2-sided)
	Attended Worksh op	Receving Informaton	Friends & Family	not received	-				
No formal education	5	9	13	0	-	27	67.436[a]	12	.000
Primary	0	14	0	0	-	14	80.867	12	.000
Secondary	10	15	6	11	-	42	10.283	1	.001
Higher Secondary	4	0	12	3	-	19	110		
Graduate and above	0	0	3	5	-	8			
Total	19	38	34	19	-	110			

The Cross-tabulation data and Chi-Square test results, we can assess the relationship between the education levels of respondents and their perceptions of the effectiveness of Waste Management Systems under the Swachh Bharat Abhiyan (SBA). Here's an analysis of each variable

IV. Frequency of Waste Collection

Chi-Square Value: 36.531, Degrees of Freedom (df): 20 Asymptotic Significance (2-sided): 0.013

Interpretation: The p-value of 0.013 is less than the conventional significance level of 0.05, indicating a statistically significant association between the education level of

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respondents and their perceptions of waste collection frequency. This suggests that educational attainment influences how individuals perceive the regularity of waste collection services

Types of Waste Management Systems in Homes

Chi-Square Value: 26.338, Degrees of Freedom (df): 12 , Asymptotic Significance (2-sided): 0.010

Interpretation: With a p-value of 0.010, there is a significant relationship between education levels and the types of waste management systems employed in households. This implies that individuals with different educational backgrounds adopt varying methods for managing waste at home.

Placement and Usage of Public Waste Bins

Chi-Square Value: 40.601, Degrees of Freedom (df): 12, Asymptotic Significance (2-sided): 0.000

Interpretation: The p-value of 0.000 indicates a highly significant association between education levels and perceptions regarding the placement and proper use of public waste bins. This suggests that educational attainment affects awareness and attitudes toward public waste disposal infrastructure.

Availability of Composting or Recycling Systems

Chi-Square Value: 26.826, Degrees of Freedom (df): 12, Asymptotic Significance (2-sided): 0.008

Interpretation: A p-value of 0.008 signifies a significant relationship between education levels and awareness of composting or recycling systems in the area. This indicates that educational background influences knowledge about local waste processing facilities.

Training or Information Received on Waste Management

Chi-Square Value: 67.436, Degrees of Freedom (df): 12, Asymptotic Significance (2-sided): 0.000

Interpretation: The p-value of 0.000 denotes a highly significant association between education levels and the receipt of training or information on waste management. This suggests that educational attainment plays a crucial role in accessing and assimilating information related to waste management practices.

Challenges in Sustaining ODF Status and Implementing SLWM Practices

There is relationship between Age of the respondents and their towards and Implementing SLWM Practices

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Table No: 4.1

The Relationship between age of the respondents and their towards and Implementing SLWM Practices			
people going to the toilet in the open	Mean	N	Std. Deviation
It still happens often	4.4583	24	.58823
It happens sometimes	3.8750	24	.85019
It rarely happens now	3.8571	14	.66299
I have not seen it happening	3.6316	19	.95513
I'm not sure	3.1034	29	1.34549
Total	3.7545	110	1.05957

Age significantly influences sanitation habits, with older individuals who adopted toilet use later in life often reverting to open defecation due to deeply ingrained practices. Conversely, younger people, especially those educated on sanitation, tend to maintain improved practices. However, maintaining Open Defecation-Free (ODF) status and implementing effective Solid and Liquid Waste Management (SLWM) extends beyond individual behavior. Challenges include poor infrastructure, cultural resistance, and a lack of awareness about health benefits and economic constraints. To address these, targeted education for all age groups, community involvement, financial and technical aid for facilities, and regular monitoring are crucial for sustainable sanitation improvements

V. Conclusion

The study in Manikandam Block reveals that while the Swachh Bharat Abhiyan (SBA) has improved sanitation infrastructure and awareness, significant challenges remain in changing behaviors, segregating waste, and managing solid and liquid waste effectively. This highlights that achieving Sustainable Development Goals in rural areas requires more than just building facilities; it demands a holistic approach that transforms community behaviors, strengthens local governance, ensures equitable access, and integrates educational and economic aspects into sanitation programs. The interconnectedness of various SDGs is crucial for this success. Ultimately, detailed local studies like this one are essential for refining national policies and global strategies, allowing for tailored interventions that address specific community needs and accelerate progress towards a sustainable future.

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