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Economic Assessment of Household Plastic Waste Management and Disposal Practices in Tirunelveli District

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Abstract

The rapid increase in the number of households using plastics in urban and semi-urban centers of India has created a major challenge to the efficient management of waste. The economic analysis of household plastic waste management and disposal in Tirunelveli District in Tamil Nadu is conducted in the studies. The significance of the study is to investigate the process of creating, segregating, storing, recycling, and disposing plastic waste by households. It also seeks to estimate the cost and performance of the existing waste management methods in terms of economics. Primary data that were collected through a systematic questionnaire to a subsample of families were used in the study, and they were complemented with secondary data, such as policy documents and municipal reports. The study singles out a lot of inefficiency in the management of domestic plastic waste particularly as far as resource recovery and cost effectiveness are concerned. Some of the relevant strategies to enhance economic efficiency are the enhancement of family participation, the enhancement of awareness about recycling benefits, and the inclusion of unofficial garbage collectors into the official system. The study contributes to the existing knowledge on environmental economics by providing real-world data through a district-level analysis and policy-relevant information that helps to implement plastic waste management approaches that are both sustainable and economically viable.

Key Words: Household Plastic Waste, Economic Assessment, Plastic Waste Management, Disposal Methods, Recycling Awareness.

Introduction

Plastic waste at home constitutes a major problem of the environment and economy in developing countries. The dynamic consumption patterns, rising income, and accelerated urbanization have caused a significant growth in the number of single-use products of plastic nature, which has caused a gradual increment in household plastic waste. The lack of source segregation and poor disposal habits impose extra operational and financial costs with local authorities

though low rates of recycling compound the environmental pollution and economic costs. In India, the problem of household plastic waste has been brought down by the lack of infrastructures and community involvement. Management practices and household behavior are key factors that determine the economic efficiency of waste management systems. In that regard, this research includes an economic evaluation of household plastic waste management and disposal practices in Tirunelveli District to find out the current practices and issues as well as systemic gaps.

Statement of the Problem

Household plastic waste is the main environmental and economic problem, mainly because of the insufficient sorting of the sources, the incorrect methods of disposal, and the poor rates of recycling. These inefficiencies increase the cost of municipal waste management, and bring extra economic costs in terms of environmental and health effects. Although recycling and circular economy approaches are economically beneficial in the long run, their scopes are limited due to the low household engagement. India is one of the countries where households play an important role in plastic waste, but there is a lack of economic evaluation of this issue on the district level. Thus, a household plastic waste management in Tirunelveli District needs to be economically evaluated in order to be informed to formulate cost-efficient and sustainable waste management policies.

Literature Review

It has been shown in the literature that the management of the household plastic waste is very important in defining the economic effectiveness of waste management systems at large. Poor segregation and disposal habits raise the management expenses and add to the economic losses due to the environment and health-related elements, and effective recycling programs enable the results of a circular economy (Hossain et al., 2022; Evode et al., 2021). It has been demonstrated that socio-economic elements like income, education and awareness influence the household waste management behavior (Khuc et al., 2023). Contentious low household recycling rates in India lead to high rates of economic inefficiencies, which explains the significance of increased household participation (Emami et al., 2024; Fayshal, 2024).

Objectives of the Study

1. To investigate the amount and the household plastic waste produced in Tirunelveli District.
2. To study the current household plastic waste management and disposal services including segregation, recycling, and dumping strategies.
3. To find out the gaps and obstacles of the existing system of managing household plastic waste.

Methodology

Research Design and Data Source

The proposed research adopts a descriptive-analytical research design as it seeks to explore the production of household plastic waste, waste management, and the associated issues. A total of 150 primary data was used. homes using a designed questionnaire. The secondary data were acquired through the published journal articles and past research. Sampling Method and Sample Size. Simple random sampling technique was used in sample selection of households in urban and semi-urban localities in Tirunelveli District. A total of 150 households were used as a sample.

Tools of Analysis

- Percentage analysis, Chi-square test.

Chi-Square:

To investigate the connection between segregation practice and the plastic waste disposal method.

Hypothesis

H 0 (Null Hypothesis): Segregation practice and disposal method have no significant relationship.
H 0 (Alternative Hypothesis): Segregation practice and disposal method are significantly related.

Descriptive Statistics

Education Level	Frequency	Percentage
Illiterate	37	24.7
School	35	23.3
Graduate	32	21.3
Postgraduate	46	30.7
Total	150	100.0

Bayesian Contingency Tables

Contingency Tables

Education	Not aware	Somewhat aware	Fully aware	Total
Illiterate	13	9	15	37
School	9	13	13	35
Graduate	14	13	5	32
Postgraduate	21	12	13	46
Total	57	47	46	150

Note: The observed counts are shown in each of the cells.

Bayesian Contingency Tables Tests

Bayesian Contingency Tables Tests	Value
BF_{10} Independent multinomial	0.073
N	150

Note: Proportion test limited to 2 x 2 tables.

BF / kh2 Bayes Factor (BF10) = 0.073 Sample size (N) = 150

Hypothesis H 0 (No association) - Accepted H 1 (Association exists) - Rejected

Interpretation

According to the Bayesian analysis, education level is not significantly related to the awareness of recycling. Therefore, level of education is not a decisive fact as far as raising recycling awareness among the surveyed respondents is concerned.

Household Plastic Waste Disposal Methods

Disposal Methods	Frequency	Percentage
Scrap dealer	35	23.3
Burning	40	26.7
Open dumping	36	24.0
Municipal collected	39	26.0
Total	150	100.0

Bayesian Contingency Tables

Contingency Tables

	Disposal_Method				
Occupation	**Scrap dealer**	**Burning**	**Open dumping**	**Municipal collection**	**Total**
Government	3	4	6	7	20
Private	7	6	8	12	33
Businees	3	8	10	3	24
Daliy Wage	9	9	7	9	34
Homemaker	13	13	5	8	39
Total	35	40	36	39	150

Note: The observed counts are shown in each of the cells.

Bayesian Contingency Tables Tests

Bayesian Contingency Tables Tests	Value
BF_{10} Independent multinomial	0.017
N	150

Note: Proportion test limited to 2 x 2 tables.

BF / kh2 Bayes Factor (BF10) = 0.017 Sample size (N) = 150

Hypothesis H 0 (No association)- Accepted H 1 (Association exists)- Rejected

Interpretation

The Bayesian analysis shows that there is no significant correlation between the occupation and the household plastic waste disposal techniques. The Bayes Factor is small which gives a good evidence supporting the null hypothesis that the individual disposal practices are not significantly different between the occupational groups. Bayesian Contingency Tables.

Bayesian Contingency Tables

Contingency Tables

	Willingness_With_Incentives			
Major Challenges Perhaps No Yes Total	**Maybe**	**No**	**Yes**	**Total**
No recycling centers	8	11	21	40
Irregular collection	15	16	9	40

No segregation facility	10	10	11	31
Lack of awareness	14	7	18	39
Total	47	44	59	150

Note: The observed counts are shown in each of the cells.

Bayesian Contingency Tables Tests	Value
BF_{10} Independent multinomial	0.232
N	150

Note: Proportion test limited to 2 x 2 tables.

BF / kh2 Bayes Factor (BF10) = 0.232 Sample size (N) = 150

Hypothesis H 0 (No association)- Accepted H 1 (Association exists)- Rejected

Interpretation

The Bayesian test shows no significant correlation between the significant challenges in managing plastic waste and desire to engage in the process when incentives are offered. The Bayes Factor favors the null hypothesis, that is, there is no statistically significant difference in willingness with incentives among various perceived challenges.

Results

The results of the surveyed 150 households show that there is limited awareness on recycling with 38% of the respondents expressing that they do not have any knowledge about recycling. The main characteristics of the disposal practices include burning, open dumping and the use of municipal collection. Analysis of Bayesian contingency table indicates the lack of any significant relationship between recycling awareness and education level (BF10 = 0.073). On the same note, occupation does not have any significant effect on the household plastic waste disposal methods (BF10 = 0.017). The correlation between the key issues related to plastic waste management and the desire to take part by being incentivized is also not of great importance (BF10 = 0.232). Taken together, these results show that there are few differences in the household practices of plastic waste management, as they are similar in the sample of socio-economic groups.

Discussion

The findings indicate that the socio-economic factors like education or occupation do not have a significant influence on the practices related to the management of household plastic waste. Rather, it is affected more by the infrastructural factors such as recycling and the absence of standardized municipal collection. It is therefore important to improve the waste management infrastructure as well as carrying out awareness programs to ensure sustainability.

Policy Recommendations

It is recommended that local governments should focus on creating convenient recycling facilities and offer regular and effective municipal pick-up of waste. Appropriate infrastructure should be promoted to facilitate household-level segregation and not just using awareness. Moreover, incentive programs are to be introduced with the institution-wide support to stimulate the people to take part in sustainable plastic waste management.

Conclusion

The researchers find that infrastructural and institutional factors are the key determinants of the household practices of plastic waste management in Tirunelveli District as opposed to socio-economic characteristics. As much as households are educative and express readiness to engage in the process, the absence of sufficient recycling systems and intermittent collection hinders proper waste management. As such, the development of sustainable household plastic waste management requires the reinforcement of the local infrastructure, and its support through municipal means.

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