Market Sustainability of Plastic Waste Management Enterprises in Chennai: An Empirical Study

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Abstract—Plastic waste refers to discarded plastic materials generated from industrial, commercial and household activities that pose serious environmental and health challenges. Due to its non-biodegradable nature, plastic waste accumulates in landfills, water bodies, and ecosystems, causing pollution and resource depletion. Market Sustainability of Plastic Waste Management Enterprises refers to the ability of enterprises engaged in plastic waste collection, segregation, and recycling to maintain long-term economic viability while complying with environmental regulations and meeting market demand. It depends on factors such as consistent availability of plastic waste, demand for recycled products, cost-effective operations, technological adoption, and policy support like Extended Producer Responsibility (EPR). In Erode, these enterprises face challenges such as fluctuating demand for recycled products, competition from virgin plastics, policy enforcement issues, and operational constraints. These challenges threaten long-term viability, making it essential to study the factors influencing the market sustainability of plastic waste management enterprises. In this junction, this study aimed to examine the market sustainability of plastic waste management enterprises in Erode by adopting an empirical research approach. A sample of 52 plastic waste management enterprise owners was selected using a random sampling method. A self-structured questionnaire was administered to collect primary data relating to respondents' demographic profile and factors influencing market sustainability. The responses were measured using a five-point Likert scale, while secondary data were gathered from published books, journals, research articles, government reports, and online sources. For analysis, the collected data were coded and entered into MS Excel and analyzed using percentage analysis, mean score, standard deviation and Analysis of Variance (ANOVA). In addition, null hypotheses were formulated to test whether significant differences exist in the mean market sustainability across selected demographic variables. This study noticed that high level of market sustainability of plastic waste management enterprises is perceived by respondents who belong to the 41–50 years age group, handled PET plastics, 6–10 employees, handling 0.6–1.0 tonne of plastic waste in a week and above 8 years of experience in the plastic recycle process.

Index Terms—Plastic Waste Management, Market Sustainability, Recycling Enterprises, Plastic Pollution, Extended Producer Responsibility, Recycling Market.

I. INTRODUCTION

Plastic pollution refers to the accumulation of plastic materials in the environment, particularly in land and water ecosystems, causing severe ecological and health impacts. Plastics persist for long periods due to their non-biodegradable nature, harming wildlife, contaminating soil and water, and disrupting food chains. Controlling plastic pollution requires effective waste management, recycling, and public awareness initiatives. Market sustainability of plastic waste management enterprises refers to the ability of enterprises engaged in plastic waste collection, segregation, recycling, and processing to sustain their operations and growth over the long term while remaining economically viable, environmentally responsible, and socially acceptable. These enterprises play a crucial role in addressing the challenges of plastic pollution by transforming waste into valuable resources and supporting circular economy initiatives. Market sustainability is influenced by several interrelated factors, including consistent demand for recycled plastic products, price competitiveness with virgin plastics, availability of raw plastic waste, and access to appropriate recycling technologies. Regulatory frameworks such as plastic ban, Extended

Producer Responsibility (EPR) norms, and government incentives significantly shape market conditions and business stability. Effective enforcement of these policies enhances material quality and market confidence, while weak implementation may create operational constraints. Financial strength, operational efficiency, and skilled manpower further determine the long-term survival of plastic waste management enterprises. Partnerships with industries, brand owners, and local bodies also strengthen market linkages and ensure stable revenue streams. Moreover, growing environmental awareness among consumers and industries positively influences the acceptance of recycled products. Thus, market sustainability enables plastic waste management enterprises to balance profitability with environmental protection, ensuring continuous growth, resilience to market fluctuations, and meaningful contribution to sustainable development goals.

II. REVIEW OF LITERATURE

In view of Kant and Kaur (2025) revealed that major obstacles such as high technological uncertainty, lack of recovery infrastructure, consumer low willingness to pay, greenwashing concerns, and competitive disadvantages. In addition, this study indicated that collaborative stakeholder engagement and targeted communication strategies are essential to overcome these barriers and accelerate sustainable packaging adoption. The researchers Anwar et al. (2024) indicated that significant disparities between developed and developing countries in recycling infrastructure, highlighting advanced chemical recycling methods such as the STRAP process as highly effective but resource-intensive. The study found that integrated technological innovation, extended producer responsibility (EPR), and context-specific policy frameworks are essential to advancing a circular economy for multilayer plastic waste management. The study of Meyersohn (2024) mentioned that EPR policies in the EU and selected U.S. states have significantly improved recycling rates, reduced landfill dependence, and incentivized eco-design in plastic packaging. Also, a collective EPR framework, supported by fee modulation and transparent governance, is the most effective policy option for advancing a circular economy in plastic packaging waste management.

According to Roy et al. (2023) illustrated that stakeholders face systemic barriers, such as inadequate infrastructure and regulatory support, alongside psychological and organizational challenges. Further, enhancing collaboration, communication, and legislative frameworks, particularly through Extended Producer Responsibility (EPR), could alleviate these barriers and improve recycling outcomes. In case of Colelli et al. (2022) observed that non-competitive EPR systems generally achieve higher recycling rates with greater cost-efficiency, while competitive systems show lower efficiency, especially for plastic packaging. Also, non-competitive EPR schemes, combined with local authority involvement in collection, are more effective in improving recycling rates and should be prioritized in the design of national waste management strategies. The researchers Kol et al. (2021) confirmed that advanced pre-treatments such as deodorization, deinking, delamination, and solvent-based extraction significantly enhance the purity and recyclability of plastic packaging waste compared to conventional washing and sorting. Further, although advanced pre-treatment technologies show strong potential for upcycling and closed-loop recycling, further optimization and large-scale industrial implementation are required.

III. STATEMENT OF THE PROBLEM

Plastic pollution has emerged as a serious environmental challenge due to the increasing generation and improper disposal of plastic waste. Despite their growing importance, many plastic waste management enterprises face significant difficulties in achieving market sustainability. In Erode district, these enterprises encounter challenges such as fluctuating demand for recycled plastic products, price competition with virgin plastics, inconsistent supply of quality plastic waste, limited access to advanced recycling technologies, and inadequate financial support. Additionally, policy-related issues, including the implementation of plastic ban and Extended Producer Responsibility (EPR) regulations, often create operational uncertainties. Social issues such as labor safety, informal sector dominance, and limited public awareness further affect enterprise performance. These constraints threaten the long-term viability and growth of plastic waste management enterprises. Hence, this study aimed to examine the

factors influencing the market sustainability of plastic waste management enterprises in Erode.

IV. OBJECTIVES OF THE STUDY

- To present the demographic profile of the selected respondents who owners of plastic waste management enterprises in Erode.
- To analyse the market sustainability of plastic waste management enterprises in the study area.

V. HYPOTHESIS OF THE STUDY

- There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to type of plastic handled.
- There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to weekly plastic waste handled (tonnes).
- There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to experience in the sector.

6. RESEARCH METHODS

This study adopted a descriptive research design. The required data were collected from both primary and secondary sources. The target population comprised owners of plastic waste management enterprises functioning in the Erode district. Primary data were collected using a structured questionnaire designed to obtain information on respondents' demographic profiles and factors influencing market sustainability. Secondary data were sourced from published books, academic journals, research articles, government reports, and online resources. A sample of 52 respondents was selected using a random sampling technique. The collected data were coded, tabulated and entered into MS Excel and subsequently analyzed using SPSS version 26.0. The statistical tools such as percentage analysis, mean score, standard deviation, and Analysis of Variance (ANOVA) were employed to analyze the collected data.

VII. RESULT AND DISCUSSION

7.1 Demographic Profile and Market Sustainability of Plastic Waste Management Enterprises

The details of demographic profile of the selected respondents and market sustainability of plastic waste management enterprises have been furnished in the following table.

Table 1: Demographic Profile and Market Sustainability of Plastic Waste Management Enterprises

No.	Variables Name	Number of Respondents	%	Mean	SD
1	Age				
	• Upto 30 years	6	11.5	3.15	0.27
	• 31 - 40 years	23	44.2	3.27	0.69
	• 41 - 50 years	14	26.9	4.26	0.27
	• Above 50 years	9	17.4	3.26	0.32
	Total	52	100.0		
2	Types of Plastic Handled				
	• PET	16	30.8	3.88	0.68
	• PP	10	19.2	3.18	0.64
	• LDPE / HDPE	8	15.4	3.84	0.77
	• PVC	14	26.9	3.47	0.49
	• Others	4	7.7	3.53	0.74
	Total	52	100.0		
3	Number of Employees				
	• 1-5 employees	12	23.1	3.40	0.58
	• 6-10 Employees	23	44.2	4.26	0.29
	• Above 10 Employees	17	32.7	3.16	0.60
	Total	52	100.0		
4	Weekly Plastic Waste Handled (tonnes)				
	• Upto 0.5 ton	14	26.9	3.03	0.37

No.	Variables Name	Number of Respondents	%	Mean	SD
	• 0.6 – 1.0 ton	20	38.4	4.29	0.21
	• 1.1 – 2.0 ton	11	21.2	3.03	0.29
	• Above 2.0 ton	7	13.5	4.16	0.27
	Total	52	100.0		
5	Experience				
	• Below 4 Years	9	17.3	3.07	0.26
	• 5-8 Years	17	32.7	3.19	0.55
	• Above 8 years	26	50.0	4.26	0.25
	Total	52	100.0		

- It is displayed from the above table that 11.5% of the respondents belong to the age group upto 30 years, 44.2% of the respondents belong to 31–40 years of age segment, 26.9% of the respondents belong to 41–50 years and 17.4% of the respondents belong to age category of above 50 years.

- It is evident from the analysis that 30.8% of the respondents handle PET plastics, 19.2% of the respondents handle PP, 15.4% of the respondents handle LDPE/HDPE, 26.9% of the respondents handle PVC and 7.7% of the respondents handle other plastics.

- The analysis measured that 23.1% of the respondents employ 1–5 workers, 44.2% employ 6–10 workers and 32.7% employ more than 10 workers.

- It is illustrated from the analysis that 26.9% of the respondents handle upto 0.5 tonne of plastic waste per week, 38.4% of the respondents handle 0.6–1.0 tonne, 21.2% of the respondents handle 1.1–2.0 tonnes and 13.5% of the respondents handle above 2.0 tonnes of plastic waste per week.

- It is confirmed that 17.3% of the respondents have below 4 years of experience in the plastic recycle effort, 32.7% of the respondents have 5–8 years, and 50.0% of the respondents possess above 8 years of experience in the plastic recycle process.

7.2 Market Sustainability of Plastic Waste Management Enterprises

The researcher has examined the market sustainability of plastic waste management enterprises in Erode. For the purpose of this study, eight statements were developed and measured using a five-point Likert scale to assess the market sustainability among plastic waste management enterprises in Erode. The Cronbach's Alpha value for the statements measuring market sustainability is 0.891, which indicates a high level of internal consistency and confirms that the scale is reliable and suitable for further analysis. The mean and standard deviation values of the market sustainability of plastic waste management enterprises are presented below.

Table 2: Market Sustainability of Plastic Waste Management Enterprises

No.	Factors	Mean Score	SD
1	Current segregation/collection practices effectively reduce plastic pollution	4.04	1.14
2	Recycling processes minimize energy use and emissions in my operations	3.60	1.16
3	Single-use plastic ban has improved waste quality for recycling	3.88	1.20
4	Partnerships with brands for EPR collection boost environmental outcomes	3.48	0.61
5	Informal workers in the chain have safe working conditions and fair wages	3.13	1.24
6	Health risks from waste handling are adequately managed	3.77	0.90
7	EPR regulations are practical and well-enforced in Tamil Nadu	2.69	1.62
8	Digital tools (apps for tracking waste) improve market efficiency	3.58	1.33

Among the factors with high mean scores, current segregation and collection practices effectively reducing plastic pollution ranks highest (Mean = 4.04), indicating that respondents strongly agree that effective segregation and collection play a crucial role in enhancing market sustainability. Similarly, the statement single-use plastic ban has improved waste quality for recycling records a high mean score (Mean = 3.88), indicating that regulatory measures have positively influenced the quality of recyclable plastic. On the other hand, the statement EPR regulations are practical and well-enforced in Tamil Nadu shows the lowest mean score (Mean = 2.69), indicating respondents' dissatisfaction with the practicality and enforcement of EPR norms. Likewise, informal workers in the chain have safe working conditions and fair wages registers a comparatively low mean score (Mean = 3.13), revealing concerns regarding labor welfare and social sustainability within plastic waste management enterprises.

TESTING OF HYPOTHESIS (ANOVA)

7.3   Relationship between demographic profile and Market Sustainability of Plastic Waste Management Enterprises

This section has analyzed that the relationship between the demographic profile and market sustainability of plastic waste management enterprises in Erode. A hypothesis has been framed in order to analyse the relationship between selected independent variables of the respondents and market sustainability of plastic waste management enterprises through ANOVA.

Type of Plastic Handled and Market Sustainability of Plastic Waste Management Enterprises

H_0:   There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to type of plastic handled.

Table 3: Type of Plastic Handled and Market Sustainability of Plastic Waste Management Enterprises

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	2.565	4	0.641	1.462	0.229[NS]
Within Groups	20.613	47	0.439		
Total	23.179	51			

Note: NS - Not Significant

It is observed from the analysis that the 'p' value is greater than 0.05 therefore the null hypothesis is accepted. Hence, there is no significant difference in mean market sustainability of plastic waste management enterprises with regard to type of plastic handled.

Weekly Plastic Waste Handled (tonnes) and Market Sustainability of Plastic Waste Management Enterprises

H_0:   There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to weekly plastic waste handled (tonnes).

Table 4: Weekly Plastic Waste Handled (tonnes) and Market Sustainability of Plastic Waste Management Enterprises

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	18.772	3	6.257	68.160	0.000*
Within Groups	4.407	48	0.092		
Total	23.179	51			

Note: Significant at 1% level

It is illustrated from the analysis that the 'p' value is lesser than 0.05 consequently the null hypothesis is rejected. So, there is a significant difference in mean market sustainability of plastic waste management enterprises with regard to weekly plastic waste handled (tonnes).

Experience and Market Sustainability of Plastic Waste Management Enterprises

H_0:   There is no significant difference in mean market sustainability of plastic waste management enterprises with regard to experience in the sector.

Table 5: Experience and Market Sustainability of Plastic Waste Management Enterprises

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	14.047	2	7.023	37.686	0.000*
Within Groups	9.132	49	0.186		
Total	23.179	51			

Note: Significant at 1% level

It is depicted from the analysis that the 'p' value is lesser than 0.05 then the null hypothesis is rejected. Therefore, there is a significant difference in mean market sustainability of plastic waste management enterprises with regard to experience in this sector.

VIII. FINDINGS

- It is indicated from the analysis that majority of the respondents fall under the 31–40 years age group. Further, a high level of Market Sustainability of Plastic Waste Management Enterprises is perceived by respondents in the 41–50 years age group (Mean = 4.26).
- It is assumed from the analysis that PET is the most commonly handled plastic type. Moreover, enterprises dealing with PET plastics exhibit a higher level of perceived market sustainability (Mean = 3.88).
- It is noticed that majority of the respondents fall within the 6–10 employee category. Further, it is observed that enterprises with 6–10 employees report a higher level of market sustainability (Mean = 4.26).
- It is obtained that majority of the respondents handle between 0.6–1.0 tonne of plastic waste per week. Further, enterprises handling 0.6–1.0 tonne of plastic waste perceive a higher level of market sustainability (Mean = 4.29).
- The result showed that most of the respondents have above 8 years of experience in in the plastic recycle process. Additionally, respondents with above 8 years of experience perceive a high level of market sustainability (Mean = 4.26).
- It is confirmed from the mean score analysis that current segregation and collection practices effectively reducing plastic pollution ranks highest (Mean = 4.04) and the statement single-use plastic ban has improved waste quality for recycling records a high mean score (Mean = 3.88).
- The 'F' test mentioned that there is no significant difference in mean market sustainability of plastic waste management enterprises with regard to type of plastic handled.
- From the Anova test, it is asserted that there is a significant difference in mean market sustainability of plastic waste management enterprises with regard to weekly plastic waste handled (tonnes).
- It is proved from the Anova analysis that there is a significant difference in mean market sustainability of plastic waste management enterprises with regard to experience in this sector.

IX. SUGGESTIONS

- It is illustrated from the findings that high level of market sustainability of plastic waste management enterprises is perceived by respondents in the 41–50 years age group. Hence, it is suggested that younger entrepreneurs should be encouraged through training programs, mentoring and awareness initiatives to strengthen their understanding and adoption of sustainable market practices.
- It could be observed from the study that enterprises dealing with PET plastics exhibit a higher level of perceived market sustainability. Therefore, this study suggested that enterprises handling other plastic categories should adopt innovative processing technologies depends on specific plastic types to improve their market demand and long-term sustainability.
- From the study, it is mentioned that enterprises handling 0.6–1.0 tonne of plastic waste perceive a higher level of market sustainability. Thus, it is suggested that enterprises operating at lower or higher volumes should streamline operations and scale processing capacity optimally to maintain stable market sustainability.
- It is noticed from the analysis that respondents with above 8 years of experience perceive a high level of market sustainability. Therefore, it is suggested that less-experienced respondents should gain practical exposure through industry collaborations, training and knowledge-sharing platforms to enhance sustainable market performance.

X. CONCLUSION

This study aimed to examine the market sustainability of plastic waste management enterprises in Erode. Market sustainability of plastic waste management

enterprises emphasizes stable operations, competitive performance and continuous growth through efficient recycling and resource utilization. This study justified that current segregation and collection practices effectively reducing plastic pollution and single-use plastic ban has improved waste quality for recycling. Further, there is a significant difference in mean market sustainability of plastic waste management enterprises with regard to selected variables like weekly plastic waste handled (tonnes) and experience in this sector.

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