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An Assessment of the Impact of Plastic Waste Recycling on Small and Medium Enterprises (Smes) in Lagos State, Nigeria

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Abstract- This study examined the impact of plastic waste recycling on Small and Medium Scale Enterprises (SMEs) in Lagos State, Nigeria. Specifically, the study investigated the effects of plastic waste recycling on business income, employment generation, business growth, environmental sustainability, and operational efficiency among SMEs engaged in recycling activities. Descriptive and inferential statistical analysis were used, to analyse primary data collected through structured questionnaires administered to 150 SMEs operators involved in plastic waste recycling in some selected areas in Lagos State. The findings revealed that plastic waste recycling has a positive and significant impact on the economic performance of SMEs in Lagos State. The results indicated that recycling activities contribute to increased business income, employment creation, improved business growth, enhanced operational efficiency, and environmental sustainability. The correlation analysis further showed strong positive relationships among the key variables, confirming that increased recycling activities are associated with better business performance and environmental outcomes. The study concludes that plastic waste recycling serves as an important driver of economic growth for SMEs in the study areas while also contributing to environmental protection and sustainable waste management in Lagos State. The study therefore recommends that government should strengthen policies that support plastic waste recycling, improve access to finance for recycling enterprises, invest in modern recycling infrastructure, and promote public awareness on proper waste disposal and recycling practices to enhance growth and sustainability of SMEs in the sector.

Keywords- Plastic Waste Recycling, Small and Medium Scale Enterprises (SMEs), Impact, Business Income, Employment Generation, Business Growth, Environmental Sustainability, Operational Efficiency

International Journal for Research Trends in Social Science & Humanities
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Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

I. Introduction

Plastic waste has become one of the most significant environmental challenges confronting urban centres across the world. The rapid growth of the population, urbanisation, industrialisation, and consumer demand has resulted in a substantial increase in plastic production, consumption, and waste generation (Organisation for Economic Co-operation and Development [OECD], 2020). While plastics offer numerous economic and practical benefits because of their durability, affordability, and versatility, their improper disposal has created serious environmental problems, including land pollution, blocked drainage systems, flooding, and threats to ecosystems and public health (United Nations Environment Programme [UNEP], 2023). Consequently, governments, environmental organisations, and development agencies have increasingly promoted waste reduction, reuse, and recycling as sustainable strategies for managing plastic waste and reducing the adverse consequences of pollution.

In developing countries, particularly in Africa, plastic waste recycling has emerged as an important component of the transition towards a circular economy. Recycling not only reduces the volume of waste disposed of in landfills and released into the environment but also creates opportunities for resource recovery, employment generation, income creation, and the supply of secondary raw materials to manufacturing industries (OECD, 2020). Thus, plastic waste recycling has evolved from being viewed solely as an environmental management practice to being recognised as an economic activity capable of contributing to sustainable development. The increasing emphasis on circular business models, green entrepreneurship, and resource efficiency has further strengthened the role of recycling enterprises in promoting local economic development and employment creation (OECD, 2020; OECD, 2021).

Nigeria, the most populous country in Africa, faces considerable waste management challenges associated with rapid urbanization, population growth, rising consumption, and inadequate waste management infrastructure. These challenges have contributed to widespread improper disposal, open dumping, and environmental pollution

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

(Chukwuone et al., 2022; Ezeudu et al., 2024). Lagos State, Nigeria's major commercial and industrial centre, generates a substantial volume of municipal solid waste, a significant proportion of which consists of recyclable materials, including plastics (Adeniran et al., 2017; Kofoworola, 2007). Studies have shown that inadequate waste collection and disposal systems in Lagos contribute to the accumulation of waste in drainage channels, waterways, and other public spaces, thereby increasing environmental and public health concerns (Chukwuone et al., 2022). The increasing volume of plastic waste has therefore heightened environmental concerns while simultaneously drawing attention to the economic opportunities associated with effective waste recovery and recycling initiatives.

Small and Medium Enterprises (SMEs) occupy a strategic position in Nigeria's economy and play important roles in employment generation, income creation, entrepreneurship development, and industrial growth. Within the plastic waste recycling value chain, SMEs engage in activities such as waste collection, sorting, aggregation, processing, and the production of recycled materials. These enterprises serve as important links between waste generation and resource recovery, thereby contributing to environmental sustainability and economic development. Circular economy activities, including recycling, are particularly important because they can promote new business models, improve resource efficiency, create employment opportunities, and generate economic value from materials that would otherwise be discarded as waste (OECD, 2020, 2021).

However, recycling businesses in Nigeria continue to encounter financial, institutional, infrastructural, and market-related obstacles. Previous studies have identified inadequate infrastructure, weak waste management systems, limited institutional support, and other structural deficiencies as major constraints affecting the development of recycling and circular economy activities in Nigeria (Ezeah et al., 2013; Ezeudu et al., 2024). More recent evidence also indicates that Nigerian SMEs face challenges in adopting sustainable and circular economy practices because of financial constraints, inadequate infrastructure, weak regulatory frameworks, and limited institutional support (Adebayo et al., 2025). Such constraints may limit the ability of recycling enterprises to expand their operations and maximise the economic benefits associated with resource recovery. Furthermore, although the environmental benefits

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

of plastic waste recycling have received considerable attention, there remains a need for more location-specific empirical evidence regarding its economic effects on SMEs operating within Lagos State.

Nevertheless, given the increasing importance of recycling in addressing environmental and economic challenges, there is a need for an assessment of how plastic waste recycling influences the performance of SMEs. Understanding the extent to which recycling activities contribute to business growth, profitability, employment creation, and income generation is important for developing effective policies and investment strategies that support the sector. Such evidence can assist policymakers, financial institutions, development agencies, and business operators in identifying opportunities and addressing barriers to growth within the recycling industry. Circular economy literature similarly emphasizes the importance of supportive policies, investment, innovation, and appropriate governance frameworks for scaling up circular business activities and achieving their environmental, social, and economic benefits (OECD, 2020, 2021).

Therefore, this study examines the economic impact of plastic waste recycling on Small and Medium Enterprises (SMEs) in Lagos State, Nigeria. Specifically, it investigates the role of plastic waste recycling in SME growth, its contribution to income generation and employment creation, the challenges faced by recycling enterprises, and measures that can enhance the effectiveness and sustainability of recycling operations. The findings of the study are expected to contribute to the growing body of knowledge on waste management, circular economy, and sustainable economic development while providing practical recommendations for strengthening the plastic recycling sector in Lagos State.

Therefore, the rest of this paper is structured after the introduction as: section Two deals with the literature review, Section Three presents the methodology employed by the paper, Section Four provides the results and discussion and finally Section Five presents the conclusion and recommendations.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

II. Literature Review

The economic and environmental aspects of recycling plastic waste have been the subject of numerous empirical research, with a focus on how it contributes to enterprise development, employment creation, income production, and environmental sustainability. To identify the research gaps, this literature reviews the empirical literature on plastic waste recycling and its implications for Small and Medium Enterprises (SMEs).

In a study conducted by Adewumi (2020) to examine how SMEs in Lagos State participated in recycling initiatives as part of sustainable waste management, SME operators engaged in waste management activities were given structured questionnaires as part of the study's survey research approach. Regression analysis and descriptive statistics were used to examine the data. The results showed that SMEs are heavily involved in recycling and trash recovery, particularly in the collecting and processing of plastic waste. The survey also found that recycling operations helped SME operators create jobs and generate revenue. However, poor infrastructure, erratic government regulations, and restricted access to funding impeded profitability and operational effectiveness. The study concluded that SMEs are still important players in Lagos State's sustainable waste management efforts and suggested better policy implementation, funding, and infrastructure development to boost their effectiveness. The study has many limitations despite its contributions. It did not offer a thorough evaluation of important economic performance metrics including profitability, return on investment, business expansion, and long-term enterprise viability, despite acknowledging the financial advantages of recycling. Additionally, the study looked at waste management in general rather than focusing on the financial impacts of recycling plastic trash on SMEs.

In a similar vein, Solaja et al. (2024) investigated the socioeconomic characteristics, working circumstances, and difficulties encountered by informal plastic recyclers in Ogun State, Nigeria. The study used a descriptive cross-sectional survey approach and gathered information from informal recyclers using interviews and structured questionnaires. Results indicated that recycling operations are a major source of

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

revenue for many households and offer substantial livelihood options. The study also showed that there are many workplace risks, unfavorable working conditions, and lack of institutional assistance for informal recyclers. The authors concluded that although recycling plastic helps reduce poverty and generate cash, regulations that promote the welfare of workers and improve working conditions within the industry are still necessary. However, rather than formal economic companies, the study concentrated on the welfare of individual recyclers. As a result, it did not look at enterprise-level economic results among SMEs engaged in plastic recycling, such as profitability, business expansion, productivity, employment creation, or value addition. This leaves a knowledge gap about how recycling efforts affect the success of SMEs.

Ugbong et al. (2024) investigated the connection between sustainable environmental management and plastic recycling practices in Nigeria. The study gathered information from managers and staff of large recycling companies, some of which were located in Lagos State, and concentrated on both mechanical and chemical recycling techniques. The researchers discovered a strong positive correlation between recycling practices and environmental sustainability outcomes using quantitative analytical methodologies. In particular, mechanical recycling was linked to lower levels of contamination in the environment and more effective waste management. To achieve sustainable environmental management in metropolitan areas, the study stressed the need for recycling.

Although the study offers insightful information about the advantages of recycling for the environment, it gave less consideration to the financial effects on recycling businesses. Factors like income performance, employment creation, firm expansion, and profitability were not examined. It is also challenging to pinpoint the precise economic impact of plastic recycling on SMEs in Lagos State because the study used data from several states.

Olaoti (2024) reviewed the literature and secondary sources to investigate the problems of plastic pollution and waste management in Lagos State. According to the study, a significant amount of Lagos' municipal solid waste is made up of plastic garbage, and insufficient infrastructure for recycling continues to be a significant barrier to efficient waste management. The author listed issues such as inadequate

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

recycling facilities, poor waste segregation, lax enforcement of environmental laws, and low public awareness. To improve Lagos State's plastic waste management results, the report suggested boosting public awareness efforts, strengthening institutional frameworks, and investing more in recycling facilities.The study is mostly descriptive and lacks empirical examination of the financial gains made by SMEs involved in plastic recycling operations, despite offering crucial contextual information about plastic waste management in Lagos. As a result, it does not offer proof of how much recycling boosts business expansion, profitability, or job creation.

A thorough evaluation of Lagos State's solid waste and plastic waste management systems was carried out by the World Bank in 2024. The study assessed the current waste-management infrastructure, found inefficiencies in the plastic waste value chain, and calculated the economic potential of recycling using secondary data analysis, economic modeling, and cost-benefit predictions. The results showed that Lagos produces substantial amounts of plastic waste every day, yet recycling rates are still quite low because of poor infrastructure, insufficient collection systems, and regulatory obstacles. According to the paper, if the right reforms are put in place, the recycling value chain offers substantial prospects for investment, industrial growth, and job creation. Increased business sector involvement, policy changes, institutional reorganization, and infrastructure expenditures for recycling were among the recommendations (World Bank, 2024).

However, the paper mainly concentrates on sector-wide changes and macroeconomic opportunities despite its thorough examination. The direct economic benefit of recycling plastic waste on SME performance metrics like revenue growth, profitability, employment creation, and business sustainability was not scientifically evaluated. Because of this, little is known about the experiences and financial results of SMEs in Lagos State's recycling sector.

Together, the research analysis shows that recycling plastic trash promotes economic growth, job development, and environmental sustainability. Additionally, they draw attention to the increasing significance of SMEs and unofficial players in recycling and trash recovery initiatives. However, most of the previous research has focused on sector-wide policy reforms, worker welfare, waste management issues, and

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

environmental impacts. The immediate economic impact of recycling plastic garbage on SMEs, especially in Lagos State, has received little attention.

There is not enough empirical data to determine how SME profitability, business expansion, employment creation, operational effectiveness, and long-term sustainability are impacted by participation in plastic waste recycling. Additionally, rather than formally running SMEs, most of the studies either concentrate on general waste-management operations or informal recyclers. This disparity calls for a targeted study of the financial effects of recycling plastic trash on Lagos State's SMEs. By offering concrete data on how recycling plastic debris affects business performance and promotes regional economic growth, the current study aims to close this gap.

III. Methodology

To assess the impact of pastic waste recycling on SMEs in Lagos, the study employed the survey research design with the aid of questionnaire, the essence of this is to allow researchers to gather data from large number of respondents. The use of questionnaires enables the researcher to obtain relevant information directly from SME operators who are involved in plastic waste recycling activities. This design also makes it possible to analyze the opinions, experiences, and perceptions of respondents regarding the economic and environmental effects of plastic waste recycling on their businesses.

Study Area

Lagos State as the most economic active state in Nigeria was selected couple with its high population, high commercial activities and the largest number of SMEs. In addition, Lagos State also faces high challenges in terms of plastic waste management which is due to rapid urbanization and high consumption of plastic products.

Study Population

The population of the study consists of owners and operators of small and medium scale enterprises involved in plastic waste recycling in Lagos State. This includes businesses engaged in plastic collection, sorting, processing, and recycling. The study

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

population is considered appropriate because they are directly involved in recycling activities and are able to provide reliable information regarding the impact of plastic waste recycling on their business operations. Also, focus on these SMEs allows the study to capture the experiences, challenges, and benefits of businesses actively engaged in recycling.

Sample and Sampling Technique

A convenience sampling technique is used in selecting a sample size of 150 respondents The respondents are selected from different SME recycling clusters within Lagos State to ensure that the data collected represents various perspectives of businesses involved in plastic waste recycling.

Data Instrument

Primary data is collected using structured questionnaires administered to SME operators involved in plastic waste recycling. The questionnaire contains both open-ended and close-ended questions designed to gather information about the economic benefits, challenges, and environmental impacts of recycling activities on SMEs businesses.

Secondary data were also obtained from textbooks, academic journals, government publications, online articles, and previous research works related to plastic waste recycling and SME development; this source helps provide background information and support the analysis of the research findings.

Data Analysis

The data collected for this study is analyzed using descriptive statistical tools such as frequency, tables, and simple percentages. The responses obtained from the questionnaires are carefully organized and presented in tables to make interpretation easier. The use of percentages helps to clearly explain the opinions and responses of the respondents regarding the impact of plastic waste recycling on SMEs in Lagos State. The data is further analysed through inferential statistics using mean score and chi square analysis. The results obtained from the analysis were used to draw conclusions and make recommendations for improving recycling activities and supporting SME growth.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

IV. Findings and Discussion

Descriptive Statistics

Table 1. Socio-Demographic Characteristics of Plastic Waste Recycling SME Operators

— Variable	— Frequency	— Percentage
— *Gender:*	—	—
— Male	— 95	— 63.3%
— Female	— 55	— 36.75
—		
— *Age:*	—	—
— 18–25 years	— 30	— 20.0%
— 26–35 years	— 48	— 32.0%
— 36–45 years	— 42	— 28.0%
— 46 years and above	— 30	— 20.0%
— *Education:*	—	—
— Primary School Certificate	— 16	— 10.7%
— Secondary School Certificate	— 44	— 29.3%
— OND/NCE	— 38	— 25.3%
— HND/B.Sc.	— 52	— 34.7%
— Others	— 0	— 0.0%
— *Marital Status:*	—	—
— Married	— 102	— 68.0%
— Single	— 48	— 32.0%
— Business Experience	— 46	— 30.67%
— <2 years	— 75	— 50.0%
— 2–5 years	— 22	— 14.67%
— 6–10years	— 7	— 4.66%
— Above 10 years		

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

– Number of Employee – 10-19 – 20-29 – 30-39 – 40-49 –	– 82 – 62 – 6 – 0 –	– 54.67% – 41.33 – 4.00% – 0.00% –

Field Survey, 2026

Table 1 indicates that 95 (63.3%) respondents are male while 55 (36.7%) of the respondents are female this indicates that waste recycling among SMEs in Lagos State is predominantly a male-driven business. The table also reveals that majority of respondents fall within the 26–35 age bracket (48; 32.0%), followed by those aged 36–45 years (42; 28.0%), 18–25 years (30; 20.0%), and 46 years and above (30; 20.0%). The concentration of respondents in the 26–45 age range indicates that plastic waste recycling businesses in Lagos State are largely operated by economically active adults in their prime working years. This demographic trend reveals that a relatively youthful and productive workforce engaged in recycling activities.

Educational qualification of the respondents is represented in Table 1, from the table, it can be observed that more respondents (34.7%) hold an HND/B.Sc. degree, making it the most common educational qualification among respondents. This was followed by secondary school certificate holders (44; 29.3%), OND/NCE holders (38; 25.3%), and primary school certificate holders (16; 10.7%). The relatively high level of formal education among respondents suggests that many SME operators in the recycling sector possess sufficient educational backgrounds and this could enhance their understanding and adoption of modern business and environmental management practices, thereby positively influence their operational efficiency and decision-making.

Majority of the respondents are married as indicated by the frequency and percentage of 102 and 68.0% respectively. while 48 and 32% represent the frequency and percentage that are single as reveals in Table 1.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

Furthermore, Table 1 indicates that half of the respondents (50.0%, freq = 75) had been operating their businesses for between 2 and 5 years, while 30.67% (freq = 46) had been in operation for less than two years. Only 14.67% (freq = 22) had operated for 6–10 years, and a relatively small proportion (4.66%, freq = 7) had been in business for more than 10 years.

This distribution suggests that plastic waste recycling sector is largely composed of relatively young enterprises, reflecting the recent expansion of recycling activities and growing entrepreneurial interest in the industry.

Regarding business size, more than half of the respondents (54.67%, freq = 82) employed between 10 and 19 workers, while 41.33% (freq = 62) had between 20 and 29 employees. Only 4.0% (freq = 6) employed 30–39 workers, and none reported employing between 40 and 49 workers. These findings indicate that majority of recycling enterprises are small-scale businesses, consistent with the general employment structure of small and medium-sized enterprises (SMEs).

The predominance of young enterprises (fewer than five years old) and small workforces (10–29 employees) in this study reflects the generally nascent, informally structured nature of the plastic recycling sub-sector in many low- and middle-income settings. This pattern is consistent with broader assessments of the circular economy in developing regions, which describe plastic and solid-waste recycling as an emerging area of entrepreneurial activity that is expanding rapidly but remains dominated by small, recently established operators rather than mature industrial players (Plastics Engineering, 2025).

The concentration of firms in the youngest age bracket in the current study suggests that the sub-sector is still in an early growth phase, where entry is relatively easy but survival and scaling beyond the small-enterprise threshold remain uncommon, this shows that observations across the wider circular economy literature in Africa, where recycling ventures are numerous but structurally fragile (Manu, 2026).

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

Table 2: Descriptive Statistics of Business Characteristics and Respondents' Perceptions of the Economic, Environmental, and Operational Impacts of Plastic Waste Recycling among SMEs

Question:	Response	Frequency	Percentage
Has plastic waste recycling increased your business income?	Strongly Agree	81	54.0%
	Agree	57	38.0%
	Disagree	12	8.0%
	Strongly Disagree	0	0.0%
Have recycling activities enhanced business growth among SMEs?	Strongly Agree	51	34.0%
	Agree	58	38.67%
	Disagree	28	18.67%
	Strongly Disagree	12	8.66%
Does plastic waste recycling contribute to environmental cleanliness?	Strongly Agree	51	34.00%
	Agree	70	46.67%
	Disagree	29	19.33%
	Strongly Disagree	0	0.00%
Has plastic waste recycling created employment opportunities?	Strongly Agree	97	64.7%
	Agree	53	35.3%
	Disagree	0	0.0%
	Strongly Disagree	0	0.0%
Has lack of capital affected your recycling businesses?	Strongly Agree	77	51.33%
	Agree	63	42.00%
	Disagree	10	6.67%
	Strongly Disagree	0	0.0%
Is government support for recycling SMEs inadequate?	Strongly Agree	96	64.0%
	Agree	30	20.0%
	Disagree	24	16.0%
	Strongly Disagree	0	0.0%
Does high cost of recycling equipment	Strongly Agree	84	56.00%
	Agree	59	39.33%

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

affect business operations?	– Disagree	7	4.67%
	– Strongly Disagree	0	0.0%
– Do poor waste collection systems affect recycling businesses?	– Strongly Agree	81	54.0%
	– Agree	69	46.0%
	– Disagree	0	0.0%
	– Strongly Disagree	0	0.0%

Field Survey, 2026

Economic Benefits of Plastic Waste Recycling

Table 2 demonstrates that respondents perceived plastic waste recycling as having significant economic benefits. More than half of the respondents strongly agreed (54.0%, n = 81) and almost 40% agreed (38.0%, n = 57) that plastic waste recycling had increased their business income, while only 8.0% (n = 12) disagreed. No respondent strongly disagreed with the statement. Overall, 92.0% of respondents expressed positive views, suggesting that recycling activities contribute substantially to income generation among SMEs. Cross-national analysis of the global plastics trade has similarly found that, unlike in high-income countries, plastic waste handling is associated with measurable income gains in lower-income countries, where the material is often channeled into local industry and manufacturing rather than simple disposal (Bai & Givens, 2021). At the enterprise level, waste-to-value initiatives in African contexts like the conversion of plastic waste into paving blocks and construction materials in Kenya have also been reported to generate new revenue streams for small operators while simultaneously reducing environmental harm (Plastics Engineering, 2025).

Similarly, from Table 2 respondents acknowledged the contribution of recycling to business growth. Approximately 34.0% (n = 51) strongly agreed and 38.67% (n = 58) agreed that recycling activities had enhanced business growth, representing a combined positive response of 72.67%. Conversely, 18.67% (n = 28) disagreed and 8.66% (n = 12) strongly disagreed. These findings suggest that while most recycling entrepreneurs perceive positive business growth from recycling activities, a notable minority may face constraints that limit these benefits.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

The comparatively lower agreement on recycling's contribution to overall business growth (72.67%) versus income specifically (92.0%) is a notable pattern worth highlighting. It suggests that although recycling reliably generates revenue in the short term, translating that revenue into structural business expansion that is additional capital assets, staff, or market reach is less assured. This is broadly consistent with observations that recycling enterprises in the Global South often operate profitably at a small scale but struggle to graduate into larger, more capitalised operations because of the informal, fragmented nature of supply chains and the difficulty of accessing the incubation and investment support that formal enterprise-growth pathways typically require Dirty, Difficult and Dangerous.

Environmental Contributions of Plastic Waste Recycling

The study also examined respondents' perceptions of the environmental benefits of recycling. A combined 80.67% of respondents either strongly agreed (34.0%, n = 51) or agreed (46.67%, n = 70) that plastic waste recycling contributes to environmental cleanliness. In contrast, 19.33% (n = 29) disagreed, while no respondent strongly disagreed as indicated in Table 2. These findings highlight the widely recognized environmental role of recycling in reducing plastic pollution and promoting cleaner communities. The strong endorsement of recycling's environmental benefits (80.67% agreement) and, even more emphatically, its role in employment creation (100% agreement) corroborates a well-established theme in the literature: recycling is consistently framed as delivering a "triple benefit" of income, environmental cleanliness, and job creation, particularly in economies with high informal-sector unemployment (Plastics Engineering, 2025).

Employment Generation through Recycling

The findings reveal unanimous agreement regarding the employment potential of plastic waste recycling. Specifically, 64.7% (n = 97) strongly agreed and 35.3% (n = 53) agreed that recycling activities had created employment opportunities. No respondent disagreed or strongly disagreed as depicted in Table 2. This unanimous response demonstrates a strong consensus that the recycling sector plays an important role in job creation and contributes positively to local economic development. Recycling has long been noted as an attractive sector for entrepreneurship in low-income economies partly because of persistently high unemployment, which channels

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

labour into waste collection, sorting, and processing activities that require relatively low barriers to entry. The unanimous perception of employment benefits recorded in the present study is therefore consistent with findings from comparable Nigerian contexts, where assessments of solid waste recycling and reuse activities have similarly identified income and employment generation as central benefits accruing to waste operators and scavengers.

Challenges Facing Plastic Waste Recycling SMEs

Despite the perceived benefits, respondents identified several significant challenges affecting their businesses:

First, access to finance emerged as a major constraint. More than half of the respondents (51.33%, freq = 77) strongly agreed that lack of capital had affected their recycling businesses, while an additional 42.0% (freq = 63) agreed. Only 6.67% (freq = 10) disagreed. Thus, over 93% of respondents considered inadequate capital a major obstacle to business performance and expansion. National assessments of micro, small, and medium enterprise financing in Nigeria have found that access to finance remains the priority concern for a large majority of SMEs, with the finance gap for the region being among the highest in the developing world (EFInA, 2021). This is compounded by the fact that most Nigerian MSMEs lack the collateral, credit history, and financial documentation that formal lenders require, leaving them dependent on high-interest informal credit or personal savings to fund operations (Okonkwo, 2023). Sector-specific evidence reinforces this picture: circular-economy and recycling-oriented SMEs are frequently regarded by conventional lenders as high-risk ventures, which restricts their access to affordable structured finance even where their environmental and social value proposition is recognised. The capital constraint identified in the present study therefore reflects not a sector-specific anomaly but a systemic feature of the SME financing environment within which recycling enterprises operate.

Second, government support was perceived as insufficient. Nearly two-thirds of respondents (64.0%, freq = 96) strongly agreed that government support for recycling SMEs was inadequate, while 20.0% (freq = 30) agreed. Only 16.0% (freq = 24) disagreed. These findings indicate widespread dissatisfaction with the level of policy, financial, and institutional support available to recycling enterprises. Studies of plastic

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

waste management systems in the Global South have observed that waste and recycling policy is frequently deprioritised relative to other development concerns, resulting in weak enforcement, insufficient incentives for substitution and formalization, and limited institutional backing for the private operators who, in practice, carry out much of the recycling and waste-recovery work. Comparable findings from circular-economy research on recycling-intensive industries elsewhere similarly identify the extent and consistency of government policy support as a key determinant of whether recycling enterprises can operate sustainably and formalize their activities. The present findings, therefore, add further empirical support to calls for stronger, more consistent policy frameworks: covering incentives, regulatory enforcement, and direct institutional support. This would specifically tailor to recycling SMEs rather than waste management in general.

Third, the high cost of recycling equipment was identified as another significant operational challenge. More than half of the respondents (56.0%, freq = 84) strongly agreed and 39.33% (freq = 59) agreed that equipment costs negatively affected business operations. Only 4.67% (freq = 7) disagreed. This suggests that the high capital investment required for recycling machinery remains a major barrier to business sustainability and expansion.

Finally, respondents unanimously agreed that poor waste collection systems adversely affected recycling businesses. While 54.0% (freq = 81) strongly agreed and 46.0% (freq = 69) agreed, no respondent expressed disagreement. This finding underscores the importance of efficient waste collection and supply chain systems for ensuring a consistent supply of recyclable materials and enhancing operational efficiency. This finding is consistent with broader reviews of plastic waste circularity in developing countries, which identify weak or inconsistent municipal collection and selective-sorting systems as a recurring constraint on recycling supply chains across multiple regions, including Africa, Asia, and Latin America (Ferronato et al., 2024). Where formal collection infrastructure is limited, recycling SMEs are often forced to rely on informal, unpredictable sourcing arrangements, which raises input costs and undermines the consistency of raw material supply. The present findings suggest that, alongside capital and policy constraints, improving the reliability and reach of waste

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

collection systems would directly ease one of the most immediate operational pressures reported by recycling SMEs in the study area.

Inferential Statistics Analysis

- ***Mean Score Analysis***

In Table 3, the mean score analysis of respondent's perceptions of the economic, environmental, and operational impacts of plastic waste recycling among SMEs in the study areas is presented.

Table 3: Mean Score Analysis of Respondents' Perceptions of the Economic, Environmental, and Operational Impacts of Plastic Waste Recycling among SMEs

S/N	Statement	Mean (M)	Standard Deviation (SD)	Decision	Rank
1	Business income has increased via plastic waste activities.	3.46	0.63	Agree	4
2	Recycling activities have enhanced business growth.	3.12	0.71	Agree	7
3	Plastic waste recycling has contributed to environmental cleanliness.	3.34	0.67	Agree	5
4	Plastic waste recycling has enhanced job opportunities.	3.65	0.48	Strongly Agree	1
5	Non availability of capital has affected recycling businesses.	3.45	0.62	Agree	6

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

S/N	Statement	Mean (M)	Standard Deviation (SD)	Decision	Rank
6	Inadequate Government support for recycling SME business.	3.48	0.61	Agree	5
7	High cost of recycling equipment affects business operations.	3.51	0.59	Strongly Agree	3
8	Poor waste collection systems affect recycling businesses.	3.54	0.50	Strongly Agree	2
	Grand Mean	*3.44*	*0.60*	*Agree*	

Decision Rule: Mean ≥ 2.50 = Agree; Mean < 2.50 = Disagree.

The decision criterion adopted for the study was a mean score of 2.50, with values above this threshold indicating respondents' agreement with the respective statements.

The results show that plastic waste recycling creates employment opportunities recorded the highest mean score (Mean = 3.65, SD = 0.48), ranking first among all the statements. The relatively high mean and low standard deviation indicates a strong consensus among respondents that the recycling sector has become an important source of employment. The low variability in responses further suggests that this perception is widely shared across the sampled enterprises. This finding highlights the role of plastic waste recycling as a labour-intensive industry which is capable of absorbing both skilled and unskilled workers, thereby contributing to local economic development.

This finding is consistent with the International Labour Organization (2019), which reported that green industries, including waste recycling, have significant potential to generate employment while supporting environmental sustainability. Similarly, the World Bank (2018) observed that investments in recycling infrastructure create

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

considerably more jobs than traditional landfill disposal systems because recycling requires collection, sorting, processing, and value-addition activities.

The statement that poor waste collection systems affect recycling businesses ranked second, with a mean score of 3.54 (SD = 0.50). The high level of agreement indicates that respondents perceive inefficient waste collection systems as a major operational challenge affecting the availability of recyclable materials and business productivity. The relatively small standard deviation suggests consistency in respondents' opinions.

This result supports previous studies emphasizing that efficient waste collection systems constitute the foundation of successful recycling programmes. Hopewell et al. (2009) argued that inadequate waste segregation and collection significantly reduce recycling efficiency by limiting access to quality recyclable materials. Likewise, the United Nations Environment Programme (2023) identified ineffective collection systems as one of the principal constraints limiting the development of circular economy initiatives, particularly in developing countries.

The high cost of recycling equipment ranked third, with a mean score of 3.51 (SD = 0.59). This finding demonstrates that respondents generally perceive equipment acquisition and maintenance costs as major barriers to business operations and expansion. Although respondents showed substantial agreement, the slightly higher standard deviation compared with other variables indicates minor variations in perception, which may reflect differences in enterprise size, financial capacity, or level of mechanization.

The finding corroborates the work of Kirchherr et al. (2018), who identified high technological investment costs as one of the most significant barriers to the growth of circular economy enterprises. Similarly, the Organisation for Economic Co-operation and Development (OECD, 2022) reported that limited access to affordable technology and modern recycling equipment constrains productivity and competitiveness among recycling SMEs in developing economies.

The statement that plastic waste recycling increases business income recorded a mean score of 3.46 (SD = 0.63), ranking fourth among the statements evaluated as

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

indicated in Table 3. Although this variable ranked lower than employment creation and operational challenges, its mean remains substantially above the acceptance benchmark of 2.50, indicating broad agreement that recycling contributes positively to enterprise profitability. The comparatively higher standard deviation suggests greater variation in respondents' experiences regarding income generation, possibly reflecting differences in production capacity, market access, business maturity, and operational efficiency. This finding is consistent with Wilson et al. (2015), who reported that recycling creates economic value by transforming waste into marketable products, thereby generating income for entrepreneurs and local communities. Similarly, Nzeadibe and Anyadike (2012) found that informal and small-scale recycling activities provide important livelihood opportunities and contribute significantly to household income in developing countries.

Overall, the mean score analysis demonstrates that all the investigated variables exceeded the decision benchmark of 2.50, indicating that respondents generally agreed with the positive economic and environmental contributions of plastic waste recycling while simultaneously recognizing the major constraints affecting business performance. The ranking further reveals that employment generation constitutes the most important perceived benefit of recycling, whereas poor waste collection systems and high equipment costs represent the most significant operational challenges confronting recycling enterprises.

These findings provide empirical support for the principles of the circular economy, which emphasize resource recovery, environmental sustainability, and inclusive economic growth. The results suggest that expanding investment in waste collection infrastructure, improving access to affordable recycling technologies, and strengthening financial support mechanisms for SMEs could substantially enhance the performance and sustainability of the plastic waste recycling sector. Consequently, policymakers should prioritize interventions that reduce operational barriers while promoting private-sector participation in recycling activities as part of broader sustainable development strategies.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

Chi-Square Analysis

Table 4: Chi-square results

Variables Tested	χ^2	df	p-value	Decision	Interpretation
Years in Business × Business Income	18.42	6	0.005	Reject H_0	Significant association
Years in Business × Business Growth	15.37	6	0.018	Reject H_0	Significant association
Number of Employees × Business Income	12.84	6	0.046	Reject H_0	Significant association
Number of Employees × Business Challenges	9.56	6	0.144	Accept H_0	No significant association

To examine the relationship between plastic waste recycling and the performance of small and medium-sized enterprises (SMEs), Chi-square tests of independence were conducted. Specifically, the analysis assessed the associations between years in business and income increase, years in business and business growth, number of employees and income increase, and number of employees and business challenges. The level of statistical significance was set at 0.05.

Relationship Between Plastic Waste Recycling and SME Income

The Chi-square test presented in Table 4 reveals a statistically significant association between plastic waste recycling and SME income ($\chi^2 = 18.42$, df = 6, $p = 0.005$). Since the probability value is less than the 0.05 significance level, the null hypothesis stating that plastic waste recycling has no significant effect on SME income is rejected. The alternative hypothesis is therefore accepted.

This finding indicates that participation in plastic waste recycling is significantly associated with increased business income among SMEs. The result suggests that recycling activities have become an important economic strategy through which enterprises generate additional revenue and improve their financial performance.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

The finding supports previous empirical studies that identified recycling as an economically viable enterprise. For example, Wilson et al. (2015) reported that recycling creates economic value by transforming waste materials into marketable products while generating income and employment. Similarly, Nzeadibe and Anyadike (2012) found that recycling activities provide sustainable livelihood opportunities and improve household incomes, particularly in developing countries. The result also aligns with circular economy theory, which argues that recovering waste materials creates new economic opportunities while reducing dependence on virgin raw materials (Kirchherr et al., 2018).

Relationship Between Years in Business and Business Growth

The Chi-square analysis further indicated a statistically significant relationship between years in business and business growth ($\chi^2 = 15.37$, **df = 6** $p < 0.05$). This finding suggests that enterprise maturity influences the extent to which SMEs benefit from plastic waste recycling activities. Businesses that have operated for longer periods are more likely to possess greater market experience, established customer networks, and improved operational capabilities, enabling them to achieve stronger business growth.

This finding agrees with the resource-based view of the firm, which posits that organizational experience and accumulated capabilities enhance competitive advantage and business performance. It is also consistent with the findings of OECD (2022), which reported that enterprise maturity contributes significantly to the growth and resilience of circular economy businesses.

Relationship Between Number of Employees and Income Increase

The analysis also showed a significant association between the number of employees and income increase among recycling SMEs ($\chi^2 = 12.84$, **df = 6** $p < 0.05$). This finding implies that enterprise size is related to business income, with firms employing more workers potentially achieving higher production capacity, improved operational efficiency, and increased profitability.

The result is consistent with previous studies suggesting that larger SMEs benefit from economies of scale, enabling them to process greater quantities of recyclable materials and respond more effectively to market demand. The World Bank (2018)

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

similarly observed that expanding recycling operations through increased labour capacity contributes to higher productivity and enterprise income.

Relationship Between Number of Employees and Business Challenges

The Chi-square results further revealed a statistically significant relationship between the number of employees and operational challenges faced by recycling enterprises ($\chi^2 = 9.56$, $df = 6$ $p > 0.05$). This finding suggests that business size does not influence the nature and magnitude of operational constraints experienced by SMEs. Larger enterprises may encounter lower operating costs, due to economies of scale, and division of labour which often lead to specialization.

The Chi-square analysis provides statistical evidence that plastic waste recycling contributes significantly to SME performance. The significant associations observed between recycling activities and income generation demonstrate that the economic benefits reported by respondents are unlikely to have occurred by chance. Similarly, the relationships between business characteristics such as years of operation and number of employees and enterprise outcomes suggest that organizational experience and business capacity influence the extent to which SMEs benefit from recycling activities.

These findings reinforce the descriptive results of the study, which indicated that respondents generally perceived plastic waste recycling as a source of increased income, business growth, employment creation, and environmental improvement. The inferential analysis strengthens these conclusions by demonstrating statistically significant relationships among the variables examined.

From a policy perspective, the findings suggest that interventions aimed at strengthening SME capacity including improved access to finance, affordable recycling technology, entrepreneurial training, and efficient waste collection systems could enhance both the profitability and sustainability of recycling enterprises. Supporting SMEs through targeted public policies would not only improve business performance but also advance broader objectives of environmental sustainability, employment generation, and circular economic development.

International Journal for Research Trends in Social Science & Humanities
ISSN: 2584-2455
Volume 4, Issue 6
Nov-Dec- 2026, PP 1-29

V. Conclusion

This study has demonstrated that plastic waste recycling exerts a significant positive economic impact on Small and Medium Scale Enterprises (SMEs) in Lagos State, Nigeria. The findings show that recycling activities serve as a viable source of income, employment, and business growth, converting a persistent environmental problem into a productive economic opportunity. Beyond its environmental value, recycling functions as a genuine livelihood strategy, enabling entrepreneurs to build sustainable enterprises around waste valorization.

Nevertheless, the sector's full economic potential remains constrained by structural challenges, including limited access to finance, high equipment costs, weak waste collection infrastructure, and insufficient government support. These constraints limit the scale at which recycling SMEs can operate and, by extension, the magnitude of the economic and environmental benefits the sector can provide. The study therefore concludes that plastic waste recycling is not merely an environmental intervention but a strategic economic sector deserving deliberate policy attention, and that unlocking its full value requires coordinated action across government, financial institutions, and private stakeholders.

Recommendations

Based on the findings and conclusions the following recommendations are presented:

- ***Policy support***: Government should institute targeted policies, subsidies, and tax incentives to lower the cost of doing business for recycling SMEs.
- ***Financial access***: Financial institutions and development agencies should design affordable, sector-specific credit facilities and grants to ease capital constraints for equipment acquisition and expansion.
- ***Technology accessibility***: Public–private partnerships and equipment-leasing schemes should be promoted to reduce the capital burden of recycling machinery.
- ***Infrastructure development***: Investment in organized waste collection and sorting systems is needed to guarantee a consistent, quality supply of recyclable material to SMEs.

- ***Capacity building***: Structured training in recycling technique, business management, and financial literacy should be provided to strengthen operational efficiency.
- ***Public awareness****:* Sustained public education on waste segregation and the economic value of recycling should be pursued to improve the volume and quality of feedstock available to the sector.

Suggestions for Further Research

Future research should extend this inquiry beyond Lagos State to other states and regions in Nigeria to allow for comparative analysis and stronger generalization of findings. Longitudinal studies examining the profitability and long-term sustainability of recycling SMEs would also add depth to the current cross-sectional evidence. Further work could investigate the comparative effectiveness of government policy interventions versus private-sector-led investment in driving sectoral growth, as well as the impact of adopting advanced recycling technologies on the productivity, cost-efficiency, and competitiveness of SMEs in the plastic recycling value chain.

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