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Influence of Energy Consumption and Waste Management on Economic Sustainability of Small and Medium Enterprises in Anambra State

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ABSTRACT: The study examined the influence of energy consumption and waste management on economic sustainability of small and medium enterprises in Anambra State. The study developed three objectives: to examine the effect of energy consumption on economic sustainability of small and medium enterprises in Anambra State; assess the influence of waste management on economic sustainability of small and medium enterprises in Anambra State. This research work is anchored on the Stakeholder theory. The study adopted survey research design. Data were generated from primary sources. The method for data collection was questionnaire which was administered randomly among the staff of the selected small and medium enterprises in Anambra state. The population of the study was 1,810 staff. The sample size of the study was three hundred and forty-eight (348) which was gotten through Borg & Gall (1973) formular, while three hundred and forty-seven (347) where retrieved. The hypotheses were tested using regression analysis method at 0.05% level of significance. The findings of the study revealed that energy consumption has significant effect on economic sustainability of small and medium enterprises in Anambra State; Waste management has significant effect on economic sustainability of small and medium enterprises in Anambra State. The study concludes that promoting efficient energy consumption and sound waste management is not only an environmental or operational necessity but also a strategic economic imperative for the sustainability and growth of SMEs in Anambra State. The study recommends that; Small and medium-scale enterprises should invest in energy-efficient equipment and technologies, such as energy-saving machines, LED lighting, and modern production tools, to improve productivity while minimizing energy wastage. This will help reduce operational costs and enhance long-term economic sustainability.

Keywords: energy consumption, waste management, economic sustainability, SMEs

1.1 INTRODUCTION

Small and medium-scale enterprises (SMEs) play a critical role in economic development through employment generation, income creation, and poverty reduction, particularly in developing economies such as Nigeria. In Anambra State, SMEs constitute a significant

proportion of business activities across manufacturing, trading, and service sectors, thereby contributing substantially to the state's economic growth. Despite their importance, many SMEs in the state face persistent challenges that threaten their long-term survival and economic sustainability (Ezeamama Orji, and Obani, (2024) One of the major challenges confronting SMEs in Anambra State is energy consumption. Reliable and affordable energy is essential for production, service delivery, and operational efficiency (Marditama, & Yusliza 2023).. However, irregular public power supply and rising energy costs compel many SMEs to rely on alternative energy sources such as generators and inverters, which significantly increase operating expenses. Inefficient energy consumption further exacerbates cost pressures, reduces profitability, and limits the ability of SMEs to sustain growth over time (Ezeamama & Orji, 2024). In addition to energy-related challenges, waste management has emerged as a critical issue affecting SME operations. Many SMEs generate various forms of waste, including solid, liquid, and packaging waste, which, if not properly managed, lead to material losses, environmental pollution, regulatory sanctions, and increased disposal costs. Poor waste management practices can negatively affect operational efficiency, corporate image, and financial performance, thereby undermining the economic sustainability of SMEs (Atueyi, & Mbanefo 2025).

Economic sustainability refers to the ability of a business to maintain stable operations, generate consistent profits, and remain viable in the long term while efficiently utilizing available resources. For SMEs in Anambra State, achieving economic sustainability requires strategic management of both energy consumption and waste generation. Efficient energy use enhances productivity and reduces operational disruptions, while effective waste management promotes cost savings, resource optimization, and regulatory compliance (Ezeamama & Obani, 2024).. Although several studies have examined sustainability and SME performance, limited empirical evidence exists on the combined influence of energy consumption and waste management on the economic sustainability of SMEs in Anambra State. This study therefore seeks to fill this gap by empirically investigating how energy consumption and waste management practices influence the economic sustainability of SMEs in the state. The findings of this study are expected to provide valuable insights for SME owners, policymakers, and other stakeholders on strategies for improving SME sustainability through efficient energy use and sound waste management practices.

1.2 Statement of the Problem

Small and medium-scale enterprises (SMEs) are widely recognized as key drivers of economic growth, employment generation, and industrial development in Anambra State. Despite their significant contributions, many SMEs in the state experience persistent operational and financial challenges that threaten their economic sustainability and long-term survival. A high rate of business failure, low profitability, and unstable cash flows remain common among SMEs, raising concerns about the factors responsible for these challenges. One of the major problems confronting SMEs in Anambra State is inefficient and costly energy consumption. Erratic public electricity supply forces many SMEs to depend heavily on alternative power sources such as generators and inverters, leading to increased fuel and maintenance costs. These rising energy expenses reduce profit margins, limit productivity, and

constrain the ability of SMEs to reinvest for growth, thereby undermining their economic sustainability. In addition, poor waste management practices pose serious challenges to SMEs in the state. Many SMEs lack structured waste management systems, resulting in excessive material waste, increased disposal costs, environmental pollution, and occasional regulatory penalties. Inefficient waste handling leads to resource losses and operational inefficiencies, which negatively affect financial performance and business stability. Although energy consumption and waste management are increasingly recognized as important determinants of business sustainability, many SMEs in Anambra State still treat them as secondary operational issues rather than strategic economic factors. Furthermore, existing empirical studies have largely focused on large firms or general sustainability issues, with limited attention given to SMEs and the combined effects of energy consumption and waste management on their economic sustainability within the Anambra State context. This gap in empirical evidence makes it difficult for SME owners, policymakers, and other stakeholders to develop informed strategies and policies aimed at improving SME sustainability. Therefore, the problem this study seeks to address is the lack of adequate empirical understanding of how energy consumption and waste management influence the economic sustainability of SMEs in Anambra State

1.3 Objectives of the Study

The general objective of this study is to examine influence of energy consumption and waste management on economic sustainability of small and medium enterprises in Anambra State.

The specific objectives of the study are to:

i. examine the effect of energy consumption on economic sustainability of small and medium enterprises in Anambra State

ii. assess the influence of waste management on economic sustainability of small and medium enterprises in Anambra State

2. REVIEW OF RELATED LITERATURE

2.1 Conceptual Framework

2.1.1 Energy Consumption

Energy consumption is pivotal component of sustainable business practice particularly in the context of Small and Medium-sized Enterprises (Jia, Fan & Xia 2023). Energy consumption involves the optimization of energy utilization to achieve desired outcomes while minimizing waste and inefficiencies (Ifechukwu-jacobs, & Atueyi, (2024). This can be accomplished through the integration of advanced technologies, streamlined processes, and informed decision-making. On the other hand, energy conservation encompasses deliberate efforts to curtail energy consumption through behavioral adjustments and conscious choices (Nwoba et al 2017). Energy consumption plays a crucial role in promoting sustainability and reducing environmental impact. Energy consumption sources, such as solar, wind, hydroelectric, and geothermal power, are environmentally friendly alternatives to traditional fossil fuels (Jia et al., 2023). By incorporating these renewable energy sources into operations, businesses decrease their carbon footprint, lower energy costs in the long run, and contribute to a more sustainable greener future. It is a key component of green management that aligns with eco-friendly practices and helps organizations operate in a

more environmentally conscious manner (Ezeamama, 2019).

Renewable energy improvements reduce the costs of energy services, and under some circumstances, increase the available income. This generates an additional increase of consumption of goods and services that need additional energy to be produced, distributed and consumed which is known as indirect rebound effect (Nwoba et al 2017).

2.1.2 Waste Management

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials (Ifechukwu-Jacobs, Arinze, & Nwangwu, & Atueyi, 2025). The term usually relates to materials produced by human activity, and undertaken to reduce their effect on health, environment or aesthetics (Olayiwola et al., 2023). Waste management is intended to reduce adverse effects of waste on human health, the environment, planetary resources and aesthetics (Gollakota, Gautam &Shu, 2020). The goal of waste management is to reduce dangerous effects of such waste on the environment and human health. Waste arises in different forms and its characterization can be expressed in several forms (Olayiwola et al., 2023). Some characteristics used in the classification of waste includes physical states, physical properties, reusable potentials, biodegradable potentials, source of production and the degree of environmental impact (Atueyi & Mbanefo 2025). Waste management practices differ from nation to nation depending on the waste sources, types, and characteristics. WAS plays a vital role in nature's ability to sustain life within its capability (Afolalu, Oladipupo, Bose, Abioye, Adejuyigbe, Ajayi & Ongbali, 2019). In many developing nations of the world, it has become a recurrent challenge, especially in urban areas (Abdoli, 2020). Waste management in Nigeria is on the increase due to the rise in population resulting from the techno-economic development in cities and the pattern of production and consumption of materials (Ahmed & Ahmaruzzaman, 2016).

2.1.3 Sustainability

Sustainability is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987; Brundtland Report 2020). It basically addresses the interlinked feature of environment, economy and social well-being. Sustainability is stated as the given task and having a potential to sustain continuously (Ankur & Rajiv 2020). In order to achieve authentic sustainability, the temporal scale should be considered in thinking. The ecosystem of this earth was introduced 5000 years ago, and the speed by which it getting changed is very high. Sustainability can be expressed as the prevention of the debasement of the natural resources in a way to support the ecological balance (Sifa, 2021). For an organization, sustainability means that it has the elements necessary to carry on and constantly enhance its activities in pursuit of a defined mission (Sifa, 2021). Organisational sustainability represents an ongoing process rather than a state of perfection (Ankur & Rajiv 2020). Dyllick and Hockerts (2022) defined it as “meeting the needs of a company’s direct and indirect stakeholders (employees, clients, pressure groups, communities, etc.), without compromising its ability to meet the needs of future stakeholders as well.” Sustainability is considered as not only addressing the needs of society but also as allowing the creation of enhanced value beyond the stakeholder’s needs (Martins, Branco, Melo, & Machado 2022).

Sustainability refers to the ability to maintain or support a process, system, or activity over time without depleting natural resources or

causing harm to the environment, social structures, or economies (Safaa, Atalay, Makutenien, Perkumien, & Bouazzaoui 2023). It involves meeting the needs of the present without compromising the ability of future generations to meet their own needs. Companies are expected to generate value by way of producing the goods and services demanded by society while generating profits for their owners as well as welfare for society (Safaa, et al., 2023). New market and social pressures are progressively ushering towards a transformation in the values of corporations' activities, as well as in their horizons and Organizations are expected to be "good citizens" (Ankur & Rajiv, 2020). Sustainability involves finding a balance between these three pillars to create a more equitable, resilient, and thriving world for all (Martins, et al 2022). Martins and his associates listed three pillars of sustainability to include: environmental sustainability (conserving natural resources, reducing pollution, and protecting ecosystems); social sustainability (promoting social justice, human rights, and community well-being) and economic sustainability (managing resources efficiently, reducing waste, and promoting long-term economic growth).

2.2 THEORETICAL FRAMEWORK

Stakeholder Theory

Stakeholder theory is a management and organizational theory that focuses on the relationships between a business and its various stakeholders. The theory was propounded by Freeman in1984. A stakeholder is any individual or group that affect or is affected by the actions, decisions, policies, or goals of an organization. Stakeholder theory suggests that businesses should consider the interest and need of all their stakeholders and not just shareholders when making decisions. Stakeholder theory relates to green performance management practices and sustainability of SMEs business performance in Anambra State by:

Identifying and Prioritizing Stakeholders: Stakeholder theory help to identify the different stakeholders associated with SMEs in Anambra State. These stakeholders include employees, customers, suppliers, local communities, regulatory agencies, and environmental Organizations, acknowledge these stakeholders, assess how green management practices impact their interests and how SMEs align their practices with stakeholder expectations.

Stakeholder Engagement and Relationships: Stakeholder Theory emphasizes the importance of building positive relationships with stakeholders by exploring how the adoption of green management practices affects stakeholder relationships. Investigate whether implementing energy efficiency and waste reduction practices enhances relationships with customers who are increasingly conscious of environmental issues. Additionally, you can assess the impact of such practices on employee morale and community perceptions.

2.3 EMPIRICAL REVIEW

Omar, Al-shari, Shah, Erkol Bayram, Zameer Rahman, and Valeri, (2024) explored how green manufacturing practices (GMP) affect the sustainable performance of small and medium enterprises (SMEs) in Iran. It examined the mediating role of green innovation (GIN) and the moderating role of managerial discretion (MD). To test the hypothesized model, data was collected from 394 manufacturing SMEs though survey and analyzed using SPSS and AMOS (SEM). The results provide evidence for the positive relationship between green manufacturing practices and corporate sustainable performance mediated by green innovation.

Furthermore, the presence of managerial discretion enhances the positive effect of green manufacturing practices on CSPR through green innovation. Thus, this study enhances the understanding of the relationship between green manufacturing practices and corporate sustainable performance including its underlying mechanism and conditional effects.

Setyaningrum, Kholid and Susilo, (2023) in India examined and analyze the influence of green creativity on business independence on competitive advantage moderated by green IT empowerment. The research population was all creative SMEs in the Tangerang, Yogyakarta and West Java regions. Samples were taken from part of the population using purposive sampling technique. The target sample in this study is 400 SMEs. Data was collected though survey and analyzed using regression However, there were only 272 SMEs who completely filled out the questionnaire and were thus analyzed. The results of the study concluded that green creativity had a significant negative influence on the performance of sustainable SMEs and a significant positive influence on green competitive advantage.

Business independence had a significant positive influence on the performance of sustainable SMEs and a significant positive influence on green competitive advantage. The research results indicate that green IT Empowerment did not moderate the relationship between green creativity and sustainable SME performance and weakened the relationship between green creativity and green competitive advantage. Likewise, the research results indicate that green IT empowerment did not moderate the relationship between business independence and sustainable business performance; it moderated the positive relationship between independence and green competitive advantage.

Marditama, and Yusliza (2023) in Indonesia examined the effect of cultivating green human resource management (GHRM) to small and medium enterprises (SMEs) for green performance. The research design for this study was Systematic Literature Review chosen since it brings theoretical results from the practical investigations. The study presented the comprehensive assessment as a model for professional development in light of the constraints of the existing human resource development procedures in Indonesian small and medium enterprises. The study concluded that green human resource management has an opportunity to encourage green performance in Indonesian small and medium enterprises in accordance with the national business objectives of decision makers after analyzing the current practice of GHRM development in Indonesia MSMEs with national and international practices reported in the published literature.

Min, Tulus, Tambunan, and Sumiyarti (2023) analysed the impact of collaboration and innovation on SMEs sustainability practices and business performance. A total of 169 samples were obtained from metal manufacturing companies located in the Tegal, Klaten, and Greater Jakarta regions through purposive sampling. The results showed that collaboration significantly and positively affected SMEs sustainability practices, using SEM-PLS analysis. Innovation also positively influenced sustainability practices and business performance. Furthermore, the positive impacts of collaboration and innovation on business performance were mediated by sustainability practices. Sustainability practices also positively affected business performance, showing that the enhancement of sustainability practices commitment was

required to achieve Sustainable Development Goals (SDGs) without sacrificing SMEs business growth.

Elshaer, Azazzand Fayyad (2023) explored the effect of green management and sustainable performance of small- and medium-sized hospitality businesses. The data was gathered from 304 small- and medium-sized hotels and travel agency middle managers using a self-administered survey approach. The collected data was analysed using the Smart PLS-structural equation modelling technique. The PLS-SEM results demonstrated that GMPs can improve environmental, economic, and social performance and these relationships can be strengthened through the moderating effects of employees' pro-environmental behaviour. The study findings revealed that small- and medium-sized hospitality businesses should focus on creating a culture of environmental stewardship and actively involve employees in green initiatives to enhance sustainable performance.

3. METHODOLOGY

3.1. Research Design

The study adopted a descriptive survey design because the data are principally primary and the results from the analysis were generalized for the entire population of interest. Besides this, Obasi (2010) noted that the use of survey is always adopted because it provides an important means of gathering information, especially when the necessary data cannot be found in any statistical records in form of secondary data (official statistics).

3.2. Nature and Sources of Data

The research was carried out with primary and secondary source of data. The data were primary in nature and were collected directly from the respondents through the administration of survey instrument (questionnaire). However, primary data was supplemented with secondary data which were sourced from journal publications, textbooks, strategic periodicals and other academic works.

3.3. Population of the Study

Population of study refers to a group of people, objects or events which a researcher deliberately decided to study, primarily to obtain necessary data needed to solve a given problem. The population of the study consisted of 1810 employees identified from selected plastic manufacturing firms in Anambra state Nigeria located across the three senatorial zones of Anambra State as shown in table

Table 3.1 Tabular presentation of the population of the Study

S/N	Firms	Population of Firms Staff
1	Louis CarterPlastics Industries Nnewi	150
2	Millennium Plastics Industries Awka	180
3	Sunflower Plastics Industries Amawbia	125
4	Ozalla Plastics Enterprises Ltd: Plot 253, Awka Ind. Estate, Awka	88
5	Dozzy Plastics: 10- 14 Dozzy Close, Industrial Layout, Onitsha	95
6	Obike Basic Plastic Industries Limited: 5/6 Onitsha/Owerri Road Onitsha.	99

7	Reliable Steel & Plastic Industry Limited: 1-5 Sir Sam Ihionu Avenue Nkpikpa Layout Obosi, Onitsha.	95
8	JoyTex Industries Limited: Km 4 Umuoji Road, Onitsha.	90
9	Ano Plastic & Metal Industries Nigeria Ltd: Km 7, Osha-Owerri Road, Onitsha	82
10	Ezenwa Plastic Industries Nigeria Ltd: No 85, Amobi Street, Onitsha.	95
11	Syndivel Plastic Industries Nigeria Ltd: Km 5, Onitsha/Owerri Road, Mgbemena Street, Awada-Obosi.	88
12	Nakpo Plastic Container Ltd: Plot 76, Niger Bridge.	104
13	Clemco Plastics Limited: Km.10, Onitsha-Owerri Road Onitsha.	90
14	Olympic Plastic Nigeria Km 5, Onitsha/Owerri Road, Mgbemena Street, Awada-Obosi	102
15	Silas poly plastic International ltd 1/3, Silas Works Road, Onitsha, Anambra State	79
16	Petters&Daniel'S Nig.Ltd 5A Ezeiweka Rd, Awada Layout, Onitsha	88
17	D & K Golden City Investment Ltd Km 3 Onitsha - OwerriExpy, Onitsha	75
18	Matonia Plastic Industry Olympic Road, Harbour Industrial Layout, Idemili, Anambra	85
	Total	**1,810**

Source: Human Resource Department of the Respective Firms, (2026)

3.4 Sample size determination

A statistical formula by Borg and Gall in 1973 for determining sample size from a finite population was used to generate the sample size of 348 employees. The estimation procedure is outlined as follows:

$$n = (z\,\alpha_{x)})^2\,(e)\,[N]$$

Where
n= Sample size determined
$z_{(\alpha x)}$ = confidence level (1.960) at 0.05
e= error margin (0.05)
N= population of interest (1810)
α = significance level

$n = (1.960)^2\,(0.05)\,[1810]$
$n = 3.8416(90.5)$
$n = 347.7$
n= 348 employees (nearest whole number).

Proportional Representation of the Sample Size.

Louis Carter Industries Nnewi= 150/1810= 0.0829*348 = 29
Millennium Industries Awka =180/1810 = 0.0994*348= 35
Sunflower Industries Amawbia = 125/1810= 0.0690*348 = 24
Clemco Plastics Limited =90/1810= 0.0497*348= 17
Dozzy Plastics =95/1810 = 0.05249*348=18
Obike Basic Plastic Industries Limited = 99/1810 = 0.05469*348 = 19
Reliable Steel & Plastic Industry Limited =95/1810 = 0.05249*348=18
JoyTex Industries Limited =90/1810 = 0.0497*348= 18
Ano Plastic & Metal Industries Nigeria Ltd =82/1810= 0.04530*348 = 16
Ezenwa Plastic Industries Nigeria Ltd =95/1810 = 0.05249*348=18
Syndivel Plastic Industries Nigeria Ltd =88/1810= 0.04862*348 =17
Nakpo Plastic Container Ltd =104/1810 = 0.05746*348 =20
Ozalla Plastics Enterprises Ltd =88/1810 = 0.04862*348=17
Olympic Plastic Nigeria =102/1810 = 0.05635*348= 20
Silas poly plastic International ltd =79/1810 = 0.04365*348=15
Petters&Daniel'S Nig.Ltd =88/1810 = 0.04862*348 =17
D & K Golden City Investment Ltd =75/1810 = 0.04144*348 =14
Matonia Plastic Industry =85/1810 = 0.04696*348 =16

Hence the sample size calculated for use was 348. In terms of selection of units of observation, systematic sampling technique was used because of its ability to spread evenly the sample across the population of interest. As could be seen from Table 3.1, the sample were allocated across the firms proportionately because of the differences in their population. The systematic sampling technique distribution of the sample size of the organisations was shown in the table 3.2 below:

Table 3.2 Sample Size Distributions

S/N	Firms	Population	Sample Allocation	Percentage
1	Louis Carter Industries Nnewi	150	29	8
2	Millennium Industries Awka	180	35	10
3	Sunflower Industries Amawbia	125	24	7
4	Clemco Plastics Limited	90	17	5
5	Dozzy Plastics	95	18	5
6	Obike Basic Plastic Industries Limited	99	19	5
7	Reliable Steel & Plastic Industry Limited	95	18	5
8	JoyTex Industries Limited	90	18	5

9	Ano Plastic & Metal Industries Nigeria Ltd	82	16	5
10	Ezenwa Plastic Industries Nigeria Ltd	95	18	5
11	Syndivel Plastic Industries Nigeria Ltd	88	17	5
12	Nakpo Plastic Container Ltd	104	20	6
13	Ozalla Plastics Enterprises Ltd	88	17	5
14	Olympic Plastic Nigeria	102	20	6
15	Silas poly plastic International ltd	79	15	4
16	Petters&Daniel'S Nig.Ltd	88	17	5
17	D & K Golden City Investment Ltd	75	14	4
18	Matonia Plastic Industry	85	16	5
	Total	**1810**	**348**	**100**

3.5. Methods of Data Collection

The data were collected using a self-administered questionnaire procedure, while the questionnaire were administered to the selected respondents through drop and pick later technique. This gave the respondents enough time to fill the questionnaire. A period of two weeks was used for administration and collection of the questionnaire.

3.6 Methods of Data Analysis

Data collected from the respondents were analyzed using simple percentage analysis to answer the research questions, and multiple regression analysis were conducted to assess the influence of energy consumption and waste management on economic sustainability of small and medium enterprises in Anambra State

4. DATA ANALYSIS AND PRESENTATION

4.1 Multiple Regression Analysis

Multiple regression result was employed to test the effect of independent or explanatory variables on the dependent variables. The result of the multiple regression analysis is presented in the tables below.

Table 4.3.1 Summary of the Regression Result

The result of the multiple regressions formulated in chapter three is presented in the tables below

Model Summary[b]

Model	R	R Square	Adjusted R	Std. Error of	Change Statistics	Durbin-

			Square	the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Watson
1	.704[a]	.696	.683	.97233	.496	169.634	2	345	.000	1.531

a. Predictors: (Constant), WTM, EYC

b. Dependent Variable: ECS

Table 4.3.1 shows that R^2 which measures the strength of the effect of independent variable on the dependent variable have the value of 69%. This implies that 69% of the variation in economic sustainability is explained by variations in energy consumption and waste management. This was supported by adjusted R^2 of 68%. In order to check for autocorrelation in the model, Durbin-Watson statistics was employed. Durbin-Watson statistics of 1.531 in table 3 shows that the variables in the model are not auto correlated and that the model is reliable for predication.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	320.755	2	160.377	169.634	.000[b]
	Residual	326.174	345	.945		
	Total	646.928	347			

a. Dependent Variable: ECS

b. Predictors: (Constant), WTM, EYC

The f-statistics value of 169.634 in table 4.5 with f-statistics probability of 0.000 shows that the independent variables has significant effect on dependent variables. Variables such as energy consumption and waste management can collectively explain the variations in top economic sustainability.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.555	.156		9.988	.000	1.248	1.861
	EYC	.538	.039	.561	13.879	.000	.462	.615
	WTM	.299	.043	.281	6.958	.000	.384	-.215

a. Dependent Variable: ECS

A'priori Criteria: This is determined by the existing business theories; it also indicates the signs and magnitude of the business parameter under review. In table 4.3.3 above, we found out that energy consumption (EYC) has a positive sign given its value as 0.538, this implies that a unit increase in energy consumption (EYC) increases the economic sustainability by 53%, this conform to the a' priori expectation. Waste Management (WTM) has a positive sign and its value is.299% this implies that a unit increase in Waste Management (WTM) increases the economic sustainability by 29%, this also conforms to theoretical expectations.

The t-test is used to measure the individual statistical significance of our explanatory parameter in the model. From table 4.5 above energy consumption (EYC) is 13.879; this is statistically significant this suggests that energy consumption has a significant positive effect on economic sustainability on small and medium enterprises in Anambra State. Waste management is 6.958, this implies that it is statistically significant this further suggest that it contributes significantly to economic sustainability on small and medium enterprises in Anambra State

4.2 Test of Hypotheses

4.2.1 Test of Hypothesis One

$H0_1$: Energy consumption has no significant effect on economic sustainability of small and medium enterprises in Anambra State

Energy consumption has a t-statistics of 13.879 and a probability value of 0.000 which is statistically significant. Therefore, we reject the null hypotheses and accept the alternative hypothesis which states that Energy consumption has significant effect on economic sustainability of small and medium enterprises in Anambra State.

4.2.2 Test of Hypothesis Two

Ho_2: Waste management has no significant effect on economic sustainability of small and medium enterprises in Anambra State

In testing this hypothesis, the t-statistics and probability value in table 4.3.3 above is used. Waste management variables have a t-statistics of 6.958 and a probability value of 0.000 which is statistically significant. Therefore, we reject the null hypothesis and accept the alternative hypotheses which state that Waste management has significant effect on economic sustainability of small and medium enterprises in Anambra State.

4.3 Discussion of the Findings

Waste Management and Economic Sustainability

The result of the study revealed that waste management has a positive and statistically significant influence on the economic sustainability of small and medium-scale enterprises (SMEs) in Anambra State. This finding implies that SMEs that adopt effective waste management practices such as waste reduction, reuse, recycling, and proper disposal—are more likely to achieve improved financial performance, cost efficiency, and long-term business viability. The positive influence indicates that efficient waste management helps SMEs to reduce operational costs associated with raw material wastage, excessive disposal expenses, and regulatory penalties. By minimizing waste generation and promoting recycling, SMEs are able to optimize resource utilization, which directly enhances profitability and supports sustained economic performance.

This aligns with the principles of the resource-based view theory, which emphasizes that efficient use of internal resources contributes to competitive advantage and sustainability. The statistical significance of the result further suggests that waste management is not merely an environmental responsibility but a critical economic strategy for SMEs in Anambra State. Many SMEs operate under tight financial constraints; therefore, improved waste handling systems provide measurable economic benefits by improving cash flow stability and reducing avoidable expenditures. This finding is particularly relevant in Anambra State, where waste disposal challenges and rising operational costs pose serious threats to SME survival. Additionally, effective waste management enhances market reputation and customer perception, which can translate into increased patronage and revenue growth. SMEs that demonstrate environmental responsibility are more likely to attract environmentally conscious consumers and business partners, thereby strengthening their market position and long-term economic sustainability.

Energy Consumption and Economic Sustainability

The result of the study indicates that energy consumption has a positive and statistically significant influence on the economic sustainability of small and medium-scale enterprises (SMEs) in Anambra State. This finding suggests that adequate, reliable, and efficiently utilized energy is a critical factor in enhancing the long-term financial performance and survival of SMEs in the state. The positive relationship implies that SMEs with greater access to energy and higher levels of productive energy consumption are able to improve operational efficiency, increase output, and generate higher revenue. In the context of Anambra State where irregular power supply remains a major challenge firms that invest in alternative energy sources such as generators, solar systems, and inverters are better positioned to sustain continuous production and service delivery. This uninterrupted operation translates into improved sales volume, customer satisfaction, and stable income streams, all of which support economic sustainability. The statistical significance of the result indicates that energy consumption is not incidental but a key determinant of SME economic sustainability. Energy enables the effective functioning of machinery, equipment, digital tools, and communication systems that are essential for modern business operations. SMEs that allocate sufficient resources to energy consumption are therefore more productive, more competitive, and more resilient to external economic shocks.

5. CONCLUSION

This study examined the influence of energy consumption and waste management on the economic sustainability of small and medium-scale enterprises (SMEs) in Anambra State. The findings revealed that both variables exert positive and statistically significant effects on the economic sustainability of SMEs. This indicates that energy availability and efficient utilization, as well as effective waste management practices, are critical drivers of long-term business viability and financial stability among SMEs in the state. Specifically, the result shows that adequate and reliable energy consumption enhances productivity, ensures continuity of business operations, and supports revenue growth,

thereby strengthening the economic sustainability of SMEs. Similarly, effective waste management practices contribute to cost reduction, efficient resource utilization, regulatory compliance, and improved corporate reputation, all of which positively influence the financial performance and survival of SMEs. The significance of both variables underscores the importance of integrating energy management and waste management strategies into SME operational and strategic planning. SMEs that invest in efficient energy use and sustainable waste practices are better positioned to withstand operational challenges, reduce unnecessary costs, and achieve sustainable economic growth. Overall, the study concludes that promoting efficient energy consumption and sound waste management is not only an environmental or operational necessity but also a strategic economic imperative for the sustainability and growth of SMEs in Anambra State. The study made the following recommendations:

i. Small and medium-scale enterprises should invest in energy-efficient equipment and technologies, such as energy-saving machines, LED lighting, and modern production tools, to improve productivity while minimizing energy wastage. This will help reduce operational costs and enhance long-term economic sustainability.

ii. SMEs should adopt effective waste management practices such as waste reduction, reuse, recycling, and proper disposal. This will minimize material losses, reduce disposal costs, and improve overall business efficiency and profitability

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