

Original Research Article

SUSTAINABILITY PRACTICES AND BUSINESS PERFORMANCE OF SMALL-SCALE RENEWABLE ENERGY ENTERPRISES IN SOUTH-EAST NIGERIA

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Abstract: This study examined the influence of sustainability practices on the business performance of small-scale renewable energy enterprises in South-East Nigeria. A survey research design was adopted, and data were collected from 318 owners and managers of registered renewable energy enterprises using a structured questionnaire. Descriptive statistics, Pearson Product-Moment Correlation, and multiple regression were used for data analysis. The findings revealed that green practices, resource-use efficiency, and social and cooperative-based sustainability practices significantly improved business performance. The study concludes that integrating sustainability practices enhances enterprise competitiveness and recommends greater environmental responsibility, efficient resource utilization, cooperative engagement, and supportive government policies.

Keywords: Sustainability practices, green practices, resource-use efficiency, business performance, renewable energy enterprises, South-East Nigeria.

1. INTRODUCTION

The use of renewable energy is recognized as a crucial factor in promoting sustainable economic growth, as it can help mitigate energy poverty, environmental pollution and joblessness. Electricity supply has been a big problem in developing countries like Nigeria, which has led to the rise in demand for alternative energy sources, giving rise to great opportunities for small-scale renewable energy businesses. Entrepreneurship is still considered one of the most important drivers of economic growth, which can promote

innovation, employment creation and wealth creation according to Owolade and Nwachukwu (2012). Likewise, Gollin (2008) states that small businesses play a significant role in stimulating economic change in terms of increasing the scope of productive activities and employment opportunities. The expansion of renewable energy businesses will need to rely on continued market demand, as well as on the implementation of effective sustainability practices that will help businesses stay viable and competitive in the long term.

Within Nigeria's entrepreneurial ecosystem, small-scale renewable energy (SRE) companies that deal with the sale, installation, and maintenance of solar photovoltaic (PV) systems, inverters, batteries, and other renewable energy technologies have gained significant importance. Imeokparia & Edigbonya (2014) noted that SMEs create employment opportunities and encourage innovations, which in turn create opportunities for economic development. Similarly, Adelekan and Tijani (2017) pointed out that the development of entrepreneurship plays a significant role in the economic growth of a nation through enterprise expansion and the creation of employment opportunities. Renewable energy (RE) companies are thus also crucial to sustainable entrepreneurship as they deliver clean energy solutions and economic value in local communities.

Sustainability of renewable energy businesses is not limited to providing environmentally friendly energy technologies, but it also involves environmentally responsible management practices, smart resource utilization, and socially responsible business models. Adegboye (2018) noted that entrepreneurship should be embedded with the concepts of sustainability for achieving long-term development outcomes in Africa. Similarly, Agu and Onah (2019) argued that sustainable entrepreneurship needs to be balanced with economic growth and environmental care, and that it contributes towards national development. Isiaka et al. (2017) also posited that entrepreneurial practices based on sustainability contribute to improved organizational efficiency, decreased operational waste and enhanced enterprise competitiveness. Thus, sustainability has emerged as a strategic capability that can support renewable energy enterprises to achieve increased profitability and operational efficiency.

One additional key issue affecting the performance of SMEs that has been identified is resource-use efficiency, especially in resource-scarce economies. Wattanaputtipaisan (2013) states that financial, material and human resources are utilized effectively, which leads to an increase in productivity and an increase in competitiveness of small businesses. In the same vein, many entrepreneurs continue to face operational problems as a result of inadequate management of resources and the lack of access to financing, as seen by Usman and Usman (2020). In renewable energy companies, efficient inventory management, wise financial planning, effective deployment of technical personnel and optimal use of equipment are all vital to improving service quality, lowering operating costs and business performance.

Social and cooperative sustainability practices also help to build enterprise resilience and sustainable growth. An environment that enables entrepreneurs to share

knowledge, access finance and market, through cooperative societies and indigenous support mechanisms, is conducive to entrepreneurship. Onu and Agu (2022) showed that cooperative-based entrepreneurial systems can significantly improve business sustainability by mentoring, skills training and sharing. Similarly, Doran et al. (2018) found that entrepreneurship can better promote economic development if enterprises have the support of good institutions and can participate in collaborative networks. Cooperative partnerships can help renewable energy companies foster innovation, boost customer trust and adapt to market fluctuations.

As the renewable energy industry becomes more relevant in Nigeria, businesses are still struggling with the issues of fluctuating profitability, inefficient use of resources, negligence of environmental management and poor stakeholder cooperation. While several studies have looked at entrepreneurship development, SME performance, and sustainable economic growth, few studies have explored the effect of sustainability practices on the performance of renewable energy entrepreneurs, specifically in South-East Nigeria. For example, Ugwu (2021) studied the growth of entrepreneurship and performance of SMEs, whereas Adeoye (2015) studied entrepreneurship and economic development but did not include sustainability practice. Likewise, Imafidon (2014) and Orishede et al. (2014) highlighted entrepreneurship as a tool catalyzing sustainable economic growth yet overlooked the practices of enterprises in the context of sustainable energy. This empirical vacuum calls for research on the relationship between green practices, resource-use efficiency and social and cooperative sustainability practices with the business performance of small-scale renewable energy enterprises in South-East Nigeria.

1.1 Statement of the Problem

Small-scale Renewable Energy businesses are still facing challenges of low profitability, operational inefficiencies and unsteady business growth though the techno-financial solutions and renewable energy sources are gaining interest globally. The difficulties are mostly blamed on the lack of sustainability practice, such as lack of environmental management, inefficient use of resources, and lack of social and cooperative involvement. While some work has looked at entrepreneurship and the performance of SMEs, there is little empirical research that has explored the relationship between the sustainability practices and the performance of renewable energy companies in South-East Nigeria. This study therefore explores the effects of sustainable practices on the business performance of small-scale Renewable Energy firms in the region.

1.2 Objectives of the Study.

This study aims to examine how sustainability practices affect the performance of SREs in South-East Nigeria. Specific objectives are to:

- i. Assess the profitability of renewable energy companies as a result of green practices.
- ii. Discuss how the efficiency of the use of resources affects the performance of renewable energy enterprises.

- iii. Identify the influence of social and cooperative sustainability actions on the performance of renewable energy companies.

1.3 Research Questions

This study aims to answer the following research questions:

- i. How can green measures improve the profitability of renewables companies?
- ii. What is the impact of resource-use efficiency on the performance of businesses in the renewable energy sector?
- iii. What is the impact of social and cooperative-based sustainability practices on the overall business performance of renewable energy businesses?

2. RESEARCH METHODOLOGY

2.1 Research Design

The study is based on a survey research design due to the fact that it was a representative sample of the target population, and the findings were representative of the target population characteristics to reflect those of the entire population. The survey approach is suitable because it can be used to collect data directly from the respondents on the sustainability practices and business performance of SREs in South-East Nigeria.

2.2 Sources of Data

The methods used for data collection included primary and secondary data. Secondary data were gathered from books, scholarly journals, conference reports, government publications, institutional reports and internet sources that are relevant to sustainability practices, entrepreneurship in renewable energy and business performance. Primary data was obtained by administering a structured questionnaire to selected renewable energy enterprises' owners and managers.

2.3 Population of the Study

The population of this study is the registered Small-Scale Renewable Energy (SRE) enterprises engaged in sales, installation, maintenance and service of Solar Photovoltaic (SPV) systems, Inverter systems, batteries, Charge controllers and other renewable energy products in the selected commercial cities in South-East, Nigeria.

The study concentrated exclusively on the entrepreneurs and managers, since they have enough information on their companies' sustainability practices and business performance. The researcher used major commercial centres in the five South-East states where renewable energy enterprises are concentrated to select the researcher's area of interest (see Table 1).

Table 1: Selected Commercial Centres and Population of the Study

S/N	Commercial Centre	Registered Renewable Energy Enterprises
1	Aba (Abia State)	186
2	Umuahia (Abia State)	112
3	Onitsha (Anambra State)	248

4	Nnewi (Anambra State)	154
5	Abakaliki (Ebonyi State)	128
6	Enugu (Enugu State)	221
7	Nsukka (Enugu State)	96
8	Owerri (Imo State)	205
9	Orlu (Imo State)	103
10	Okigwe (Imo State)	87
Total		1,540

Source: Renewable Energy Dealers' Associations and State Business Directories (2025).

The total population of the study includes 1540 registered renewable energy enterprises.

2.4 Sample Size and Sampling Technique

Sample size was determined by using the formula of Taro Yamane (1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = Sample Size

N = Population (1,540)

E = Margin of Error 5% or 0.05

1 = constant

$$n = \frac{1,540}{1 + 1,540(0.05)^2}$$

$$n = \frac{1,540}{4.85}$$

$$n = 317.5$$

Approximately, n = 318

The selected commercial centres were proportionately divided into the sample size.

Table 2: Sample Distribution

S/N	Commercial Centre	Population
1	Aba	186
2	Umuahia	112
3	Onitsha	248
4	Nnewi	154
5	Abakaliki	128
6	Enugu	221
7	Nsukka	96
8	Owerri	205
9	Orlu	103
10	Okigwe	87
Total		1,540

Source: Researcher's Computation (2025).

The high density of renewable energy ventures in the commercial centres made them a good choice for using a purposive sampling technique first. Then, simple random sampling was applied (balloting) to choose enterprises from the different locations. The study included only registered renewable energy enterprises with two or more years in business.

2.5 Instrument for Data Collection

The instrument used to collect the data is: 2.5 Self-made instrument for data collection.

This study was conducted with the survey method. A structured questionnaire was designed to meet the study objectives and data was collected using this questionnaire. There were two broad areas of the questionnaire with 20 items.

Items in section A were related to the demographic characteristics of the respondents.

The second part (section B) comprised 4 parts, each representing one of the study variables:

- Green Practices
- Resource-use Efficiency

A study of social and cooperative sustainable practices has been completed. Social and Cooperative-based Sustainability Practices: Study completed.

- Business Performance

Results were obtained by responding to questions on a five-point Likert Scale:

- Strongly Agree (5)
- Agree (4)

- Undecided (3)
- Disagree (2)
- Strongly Disagree (1)

The various response categories were coded with a numerical value for each of them for data analysis.

2.6 Reliability and Validity of Measuring Instrument

Reliability of Measuring Instrument

The reliability of the measurement instrument was determined by Cronbach's Alpha (α) and was used to conduct a reliability analysis in order to find out the internal consistency of the measurement instrument.

Table 3: Reliability Analysis

Variable	Cronbach Alpha	No. of Items	Composite Reliability
Green Practices	0.882	5	0.864
Resource-use Efficiency	0.891	5	0.873
Social & Cooperative Sustainability	0.879	5	0.858
Business Performance	0.905	5	0.887

Source: SPSS Version 29 Output.

The Cronbach's Alpha coefficients exceeded the recommended threshold of **0.70**, indicating that the instrument possesses satisfactory internal consistency and reliability.

Validity of Measuring Instrument

Validity is the degree to which a measuring instrument measures the desired substance (Asika, 2004). The questionnaire was given face as well as content validity by the experts in the field of Business Administration and Research Methodology. The construct validity was also analyzed by using factor analysis, and the factor loadings values were all higher than the level of 0.70, which showed that the measurement items well represented the constructs.

2.7 Method of Data Analysis

Demographic data of the respondents and description of the study variables were summarized using descriptive statistical techniques, which included frequencies, percentages, means and standard deviations.

Pearson Product-Moment Correlation Coefficient (PPMCC) and Multiple Linear Regression Analysis were used to ascertain the relationships between the independent variables (green practices, resource-use efficiency and social and cooperative-based sustainability practices) and the dependent variable (business performance).

The Statistical Package for the Social Sciences (SPSS) Version 29 was used for all the analyses and hypothesis testing was conducted at 5% (0.05) level of significance.

3. SUMMARY OF FINDINGS

The findings of the study, in light of the results of the analyses, are summarized as follows:

1. The profitability of small-scale renewable energy businesses in South-East Nigeria is significantly positively influenced by green practices ($\beta = 0.276$, $p < 0.05$). The discovery shows that companies that embrace environmentally responsible actions such as appropriate e-waste management, responsible batteries and solar handling, and eco-friendly business operations are more likely to have increased profitability.
2. The efficiency of using the resources has a significant effect on the operational performance of renewable energy businesses ($\beta = 0.454$, at $p < 0.05$). From the result, it is observed that the effective use of financial, material, technical and human resources helps to improve the efficiency of the operation by preventing waste, delivering better services and boosting productivity. The variables investigated were most strongly correlated with business performance when viewed in isolation from one another. When these variables were isolated from each other, resource-use efficiency proved to be the strongest predictor of business performance.
3. There is a significant positive correlation between social and collaborative sustainability practices and the overall business performance of renewable energy businesses ($\beta = 0.220$, $p < 0.05$). The discovery indicates that companies actively involved in cooperative associations, stakeholder engagement, customer education and employee development provide increased stability of business, competitiveness and long-term performance.

4.1 CONCLUSION AND RECOMMENDATIONS

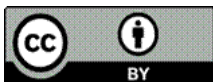
This study concludes that South-East Nigeria's small-scale renewable energy businesses have highly improved business performances through implementing sustainability practices. Green practices create a benefit for profitability, resource-use efficiency benefits business operation, and social and cooperative-based sustainability practices boost overall business performance. Thus, sustainability must be part of enterprise activities as a strategic tool to be used in enterprise competitiveness and sustainability. It is recommended that the renewable energy enterprises use efficient environmental management techniques, optimise the use of resources and enhance cooperative involvement. In addition, the government and development agencies should facilitate sustainable enterprise development and energy security by supporting renewable energy SMEs with capacity building, policy support, technical support and access to affordable finance.

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