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Renewable Energy Transition and Environmental Sustainability for Micro, Small and Medium Scale Enterprises in West Africa

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Abstract

Renewable energy transition is an engine room to promote energy security, creates jobs, and supports long-term ecological, social, and economic health. The main objective of this study is to investigates renewable energy transition: social equity, energy justice, and environmental sustainability for micro, small and medium scale enterprises in West Africa. The specific objectives are to: (i) examine the impact of renewable energy policies on MSMEs' performance (ii) evaluate the effects of energy justice system on MSMEs' performance. The study is a systematic literature review. This study, anchored on the resource-based view, and set out to identify the roles of renewable energy transition in environmental sustainability of Micro, small and medium scale enterprises. The research was motivated by the persistent power supply challenges, policies, fairness, justice in West Africa and the potential of renewable energy to serve as a sustainable alternative. Specifically, the study assessed how renewable energy transition, social equity, energy justice and environmental sustainability affects micro, small and medium scale enterprises in West Africa. The finding of the study showed that transitioning to renewable energy is critical for reducing carbon footprints and achieving carbon neutrality. The study concluded that renewable energy development plays a critical role in enhancing MSME performance. The study suggested policy interventions, financial incentives, and awareness campaigns to promote renewable energy adoption among MSMEs. These findings contribute to the discourse on sustainable environment, social equity and energy justice and offer practical insights for MSME owners, policymakers, and energy stakeholders in Nigeria.

INTRODUCTION

1.1 Background to the Study

The importance of Micro, Small and Medium Scale Enterprises (MSMEs) is one of the key and significant facilitators of the economic processes across the globe. They make significant contributions to the Gross Domestic Product (GDP), creation of employment, use of local resources, enhancing living standard and promotion of creativity, innovation and competition in most of the developed countries in West Africa like Nigeria, Ghana, Ivory Coast, Senegal, Mali, Niger, Burkina Faso, Guinea, Benin, Togo, Sierra Leone, Liberia, Mauritania, The Gambia, Guinea-Bissau, and Cape Verde. They also cannot be faulted when it comes to helping large businesses in supply of inputs, provision of services, distribution of products and the provision of information. They are said to be engines of economic growth because of the level of revenue they are delivering in Africa (Etuk et al., 2014).

The feature and grease of development is power, energy or electricity and no country can develop sustainably in the absence of adequate energy. Any human activity, such as business, needs to be of quality and possess sufficient energy to ensure success.

Regardless of this opportunity, the uptake of renewable energy in countries like like Nigeria, Benin, Togo, Sierra Leone, Liberia, Mauritania, The Gambia, Guinea-Bissau, and Cape Verde is still low and so there is

a need to investigate the impacts of this energy on the performance of MSMEs. Energy is an inalienable aspect of the entire economic activity and it is a source of wealth creation and engine of growth in all sectors of the economy (Ayodele, 2004). To boost the operations of its economy and businesses, most West African Countries are largely dependent on hydro and non-renewable sources of energy. This is even though most countries are blessed with the rich energy resources both renewable and non-renewable. The inaccessibility to viable energy has emerged as a major hurdle to the long term growth and development of all economic sectors of the country.

Nevertheless, even with such measures, the nations continue to be underdeveloped in energy access and use. It is so because of poor use of the current energy sources, poor infrastructure and policy enforcement and poor funding of renewable energy sources. Onakoya et al. (2013) assert that accessibility of dependable power is one of the key aspects in long-term growth and development of all sectors of the economy of a nation. Thus, in order to attain robust and long-term economic growth, the government should make stern actions to maximize the use of these resources, upgrade the energy infrastructure, and allocate the funds required to fund renewable energy projects. This will guarantee the provision of energy to all sectors of the economy to keep on growing and flourishing.

This study, therefore, seeks to explore the renewable energy as an alternative source for Micro, Small and Medium Scale enterprises in West Africa, focusing on social equity, energy justice, and environmental sustainability. The study also provides insights into the benefits and challenges of renewable energy adoption, the research aims to inform policy decisions and encourage investment in sustainable energy solutions for MSMEs.

1.2 Statement of the Problem

The renewable energy transition for Micro, Small, and Medium Enterprises (MSMEs) in West Africa offers significant benefits for social equity, energy justice, and environmental sustainability, but faces substantial challenges related to finance, policy, and infrastructure. The transition needs to be a "just transition" that ensures equitable distribution of benefits and burdens, and promotes social inclusion

MSMEs often suffer from unreliable power from national grids and resort to expensive, polluting diesel generators. The transition to renewables, particularly off-grid solar solutions and mini-grids, provides reliable and affordable energy access, which is crucial for business operations and productivity. For the transition to be just, local communities and MSMEs must be involved in the planning and execution of energy projects (procedural justice). This prevents the marginalization of vulnerable groups and ensures projects align with local needs, as seen in the success of community-driven projects It is based on these aforementioned problems that the study seeks to examine renewable energy transition: social equity, energy justice, and environmental sustainability for micro, small and medium scale enterprises in West Africa

1.3 Research Questions

This study aims to address the following research questions:

1. To what extent does renewable energy policies affect MSMEs' Performance?
2. How does energy justice system affect MSMEs' Performance?

1.4 Objectives of the Study

The main objective of the study is to ascertain how renewable energy transition, social equity, energy justice, and environmental sustainability affect micro, small and medium scale enterprises in West Africa. The specific objectives are to:

1. Identify how renewable energy policies affect MSMEs' performance
2. Ascertain how energy justice system affect MSMEs' performance

LITERATURE REVIEW

2.1 Conceptual Clarification

2.1.1 Renewable Energy

The reason behind renewable energy being sustainable is because, unlike non-renewable sources, renewable energies such as solar, wind, and hydropower sources are renewable and do not deplete with time and do not contribute to climate change due to the little or no emissions of greenhouse gases. This can be done by making these projects also sustainable in terms of the environment, socially sound, and economically viable over the entire lifecycle of the project, i.e., development up to operation (Chel and Kaushik, 2011).

According to Amadi, et al., (2024) renewable energy is becoming more and more popular in most African countries. In terms of energy, West Africa holds vast, largely untapped renewable energy potential, estimated at over 2,000 GW, capable of transforming the region's energy sector. Key resources include ~ 1,956 GW of solar, 106 GW of wind, and 162 GW of hydropower. Despite high, rising demand, only about 6 GW of the total 26 GW capacity was renewable as of 2024, with significant opportunities in solar in Mali and hydro in Nigeria (Shaaban & Petinrin, 2014).

2.1.2 Renewable energy in West Africa

West Africa has enormous renewable energy potentials (solar energy, wind energy, hydro energy, bioenergy) to satisfy energy demands, yet access rates are low; regional institutions are promoting policies (EREP), and initiatives (WACEC) towards integration, with the target of 48% RE by 2030 (including hydro), with mini-grids and off-grid solar, better regulation, and regional trade to address investment gaps and trade infrastructure bottlenecks (Chel and Kaushik, 2011).

Western African region possesses a large potential of renewable energy that is capable of supplying the unmet power requirements and make all people in the region access to electricity as well as aid development of the region towards a growth path with low carbon. In July 2013 the Authority of Heads of

State and Government of the Economic Community of West African States (ECOWAS) passed the ECOWAS Renewable Energy Policy (EREP); it seeks to raise the proportion of renewable energy in the overall electricity mix in the region to 35 percent in 2020 and 48 percent in 2030 (35 percent and 48 percent respectively, excluding large hydro). The ECOWAS Energy Efficiency Policy (EEEP) is an additional complement in the EREP as it is dedicated to increasing the amount of power generation capacity to 2000 megawatts due to the efforts on efficiency and eventually doubling the energy efficiency increase rates (Tijjani et al., 2013; Ellabban et al., 2014; Surya et al., 2021; Yu-Xia et al., 2022).

2.1.3 Micro, Small and Medium-sized Enterprises

Micro, Small, and Medium-sized Enterprises (MSMEs) are essential to the economies, with a notable challenge of low energy reliability leading to renewable energy (RE) being the critical element of their growth, cost reduction, and sustainability, although there are obstacles such as high initial costs and technology, which can be overcome by proposing specific-purpose financing (microfinance, Pay-As-You-Go), policies, and awareness to achieve higher incomes and lower costs through the adoption of solar and other types of renewable energy, as studies in Nigeria (NBS, 2024)

Renewable Energy Transition and Social Equity

Renewable energy transition is vital to climate ambitions, yet equity in social terms is needed to meet objectives by making advantages, such as clean energy access, new employment opportunities (women and disadvantaged people), and local ownership evenly distributed, avoiding new disparities but solving energy poverty, particularly in developing countries. This will need deliberate policies of equitable land use, fair prices, participation of communities, and backing of women leadership making the shift a fair transition that will not abandon communities but empower them (Adewale & Nwankwo, 2021).

Renewables have the means of supplying electricity to the almost 700 million in need of it, through decentralized systems (solar, mini-grids) to enhance rural growth and combat poverty. The industry generates employment, yet the policies should guarantee such opportunities, especially to women and minorities and promote the entrepreneurship in the neighborhood. Women have more time and money to learn and earn more, which is more financially independent and breaks gender expectations due to the availability of clean energy. The governments should come up with regulations, tariffs, and investments (such as Contracts-for-Difference) that do not oppress the vulnerable population or repeat the historical injustices in land and resource exploitation.

Renewable Energy Transition and Energy Justice

United Nation (2024) argues that the energy transition should be resourced through new strategies that are based on equity and justice. With the escalation of the climate crisis, the demand of minerals that are essential in clean energy technologies, e.g. lithium in electric vehicles, or selenium in solar cells will reach three and four times larger by 2030 and 2040 respectively. It is assumed that developing countries can become partners in the energy transition as a way of promoting development by offering value addition, benefits sharing, economic diversification and engagement in the critical energy transition

minerals value chains that will eventually serve the next generations, instead of just being the suppliers of raw materials (UN, 2024).

Renewable Energy Transition and Environmental Sustainability

Renewable energy transition is an international process of substituting fossil fuels by renewable (solar, wind, hydro) to fight climate change, decrease emissions, and guarantee long-term welfare, which is the pillar of the environmental sustainability as it will reduce pollution, save resources, and contribute to the economic development by providing green jobs, however, challenges with initial costs and grid integration will have to be carefully addressed and innovated to create the really equitable and effective global transition. Although the most important thing is renewables, sustainable energy should really imply efficient production, responsible utilization of resources, and as little as possible impact on the future generation. The emerging economies have the challenge of developing with little environmental degradation and sometimes through green innovations and stronger governance (Eze, & Chukwuma, 2023).

According to Muhammad et al. (2025), environmental efficiency has progressively become a fundamental metric in evaluating sustainable development, aligning closely with the Sustainable Development Goals (SDGs) of the United Nations. The SDGs, particularly goals about sustainable cities, climate action, and responsible consumption, hinge significantly on the efficiency with which countries consume and manage their natural resources. Environmental efficiency (EE) contributes significantly to climate change mitigation by reducing greenhouse gas emissions

2.1.4 Renewable Energy Sustainability and MSMEs in West Africa

The renewable energy has come in as a key solution to the energy crisis facing West Africa with renewable forms of energy being the best and cheaper alternatives to the traditional fossil fuels. Micro, Small and Medium Scale Enterprises (MSMEs) are the core of economic development of Nigeria, as they are very essential in the creation of jobs, innovation, and growth of Gross Domestic Product (GDP). It has however been established that erratic power supply, high electricity prices and reliance on fossil fuels which are very expensive have severely affected the performance of MSMEs. The adoption of renewable energy in business processes is a chance which will contribute to the productivity, efficacy and sustainability of MSMEs in Nigeria (Adenle, 2021)..

In West Africa, renewable energy sources play a critical role in the sustainability of the Micro, Small, and Medium Enterprises (MSMEs) due to availability of reliable and affordable energy, which has a great impact in the operation efficiency and the performance in the market. The expensive and unreliability of conventional sources of energy also tend to hinder the development of MSMEs, so the shift towards renewables is one of the primary factors towards economic and environmental sustainability in the long term (Yusuf, & Bello, 2022).

Source: Authors' Conceptualization, (2026)

2.2 Theoretical Framework

For this study, resource-based view of Banney, (1990) was adopted for this study, as it effectively illustrates the transition from traditional to rare and inimitable innovative energy generation and utilization methods, as well as cost-effective MSMEs management to sustain competitive advantage.

2.2.1 The Resource-Based View (RBV) theory (Banney, 1990)

The Resource-Based View (RBV) theory posits that a firm's unique resources and capabilities are critical determinants of its competitive advantage and long-term success. According to this theory, businesses that acquire and effectively utilize valuable, rare, inimitable, and non-substitutable (VRIN) resources can achieve a sustained competitive edge. In the context of micro, small and medium enterprises (MSMEs) investing in renewable energy, this resource becomes a strategic asset that enhances operational efficiency, reduces dependency on conventional energy sources, and minimizes overall costs. By integrating renewable energy into their business operations, MSMEs can not only achieve cost savings but also improve their brand reputation, attract environmentally conscious customers, and comply with sustainability regulations.

The RBV framework suggests that by treating renewable energy as a core competency, MSMEs can create a sustainable business model that fosters resilience against economic and environmental uncertainties.

2.3 Empirical Review

Several studies have examined the relationship between renewable energy (RE), electricity supply, and the growth of SMEs, highlighting both opportunities and challenges.

Eze and Oladipo (2024) examined how renewable energy adoption influences employment generation among SMEs in Nigeria. The study surveyed 180 SMEs and found that businesses using renewable energy reported a 25% increase in workforce size due to expanded business operations and reduced energy costs. Additionally, businesses that integrated solar and wind energy into their power systems reported fewer production downtimes, resulting in higher employee productivity and job satisfaction. The study emphasized the need for capacity-building programs to educate SME owners on the economic benefits of renewable energy and sustainable business practices.

Nwachukwu et al. (2024) assessed the financial performance of SMEs that adopted renewable energy solutions. Using financial data from 150 SMEs over three years, the study found that businesses with renewable energy reported an average profit margin increase of 30%, attributed to lower operational costs and improved business stability. The study also noted that SMEs relying on renewable energy had a higher likelihood of securing business loans due to improved financial performance and

creditworthiness. The authors recommended the expansion of renewable energy financing schemes to enhance SME sustainability in Nigeria.

Adebayo and Hassan (2024) explored the socio-economic implications of renewable energy deployment on SMEs in Nigeria. This study employed a large-scale survey across multiple regions in Nigeria, encompassing urban, peri-urban, and rural SMEs. The findings indicated that SMEs in urban areas benefited significantly from solar and wind energy solutions, with a reported 55% decrease in operational expenses, allowing them to reinvest in business expansion and employee welfare. In contrast, SMEs in rural areas faced accessibility issues, with only 30% of surveyed enterprises able to fully implement renewable energy solutions due to infrastructure constraints. However, among rural SMEs that managed to adopt renewable energy, there was an observable 45% increase in productivity and a reduction in business closures due to unreliable power supply. The study underscored the need for nationwide infrastructure development, improved policy frameworks, and incentives that would make renewable energy adoption seamless across various SME categories.

Chukwuma and Balogun (2024) focused on the competitive advantage of SMEs using renewable energy in Nigeria. The study conducted in-depth case studies of high-performing SMEs in the manufacturing, agricultural, and service sectors, comparing firms that used renewable energy with those that relied on conventional power sources. Results demonstrated that SMEs powered by renewable energy had a 50% higher operational stability, as they were less affected by the frequent grid power failures that plagued their competitors. Additionally, renewable energy users demonstrated greater scalability, with 70% of them expanding their production capacity due to the reliability of energy supply. The research also pointed out that businesses running on renewable energy had an increased ability to engage in export-oriented production, further boosting revenue streams. The authors concluded that while renewable energy adoption presents immense opportunities, there is an urgent need for structured public-private partnerships to drive down the cost of renewable energy solutions and enhance affordability for all SME categories.

Ojo and Maduka (2024) analyzed the impact of renewable energy on SME resilience during economic downturns. This study surveyed 250 SMEs in Nigeria, focusing on how businesses coped with economic challenges when powered by renewable energy. The findings revealed that SMEs utilizing renewable energy had a 60% higher resilience to economic shocks compared to those reliant on the national grid. These businesses managed to sustain operations during fuel price hikes and electricity shortages, leading to increased customer loyalty and stable revenue streams. The study recommended stronger government policies to incentivize SME adoption of renewable energy solutions, ensuring long-term economic stability.

Bassey and Uchenna (2024) investigated the relationship between renewable energy integration and SME digital transformation. The research focused on 200 SMEs that adopted both renewable energy and digital business models. Findings showed that businesses with renewable energy reported a 45% improvement in e-commerce operations due to reliable power supply, leading to increased online sales

and customer engagement. The study emphasized that integrating renewable energy with digital platforms could drive SME modernization and enhance global competitiveness. The authors urged stakeholders to create awareness and training programs to help SMEs maximize the benefits of renewable energy adoption.

Yusuf et al. (2023) investigated the relationship between renewable energy access and SME growth in Nigeria. The research employed a longitudinal survey design, analyzing financial and productivity data from 300 SMEs over a five-year period. The results showed that SMEs with access to renewable energy sources recorded a 40% increase in annual revenue compared to those relying solely on conventional electricity. Additionally, businesses powered by renewable energy reported higher customer retention rates, as uninterrupted power supply enabled them to maintain consistent service delivery. The study further revealed that renewable energy adoption encouraged business expansion, with 60% of SMEs reinvesting energy cost savings into scaling their operations. However, challenges such as high initial installation costs and limited technical expertise were identified as major barriers. The study recommended that the Nigerian government and financial institutions collaborate to provide SMEs with accessible financing options and technical support for renewable energy adoption.

Okonkwo and Ibrahim (2023) explored the influence of renewable energy investments on SME productivity in Nigeria. The study used a cross-sectional survey of 200 SMEs and found that firms with renewable energy access achieved a 35% improvement in efficiency compared to their counterparts relying on the national grid. Moreover, SMEs in rural areas that adopted solar energy reported a 50% increase in their daily operational hours. The research highlighted the role of decentralized renewable energy systems in bridging the energy gap, reducing reliance on unstable grid electricity, and enhancing overall business resilience. The study concluded that targeted financial assistance and infrastructure development are key to encouraging renewable energy adoption among SMEs.

Bello et al. (2023) investigated the relationship between renewable energy adoption and business growth among SMEs in Rivers State. Using a mixed-method approach, the researchers surveyed 150 SMEs and conducted in-depth interviews with business owners. The study found that renewable energy adoption significantly enhanced business sustainability, with firms recording a 25% increase in profitability and a 20% expansion in market reach. The study also highlighted challenges such as high installation costs and inadequate government support as major barriers to renewable energy adoption. The authors concluded that increased access to financing and technical training would enhance the adoption rate of renewable energy among SMEs in Rivers State.

Eze and Chukwuma (2022) examined the effect of renewable energy development on the performance of SMEs in Rivers State, Nigeria. The study employed a quantitative research approach, collecting data from 200 SMEs operating in the manufacturing and service sectors. The findings revealed that SMEs that adopted renewable energy sources experienced a 40% increase in productivity and a 30% reduction in operational costs. Furthermore, the study found that SMEs with access to renewable energy had improved customer satisfaction levels due to the consistent power supply, leading to increased revenue.

The authors recommended policy interventions to provide financial support for SMEs willing to transition to renewable energy solutions.

Olayemi and Adekunle (2022) examined the impact of renewable energy adoption on the operational efficiency of SMEs in Nigeria. Using a mixed-method research approach, the study collected data from 250 SMEs across various industries, including manufacturing, retail, and services. The findings indicated that SMEs utilizing renewable energy solutions experienced a 45% reduction in operational costs due to lower electricity expenses. Furthermore, businesses with stable power supply from renewable sources reported a 30% increase in production efficiency and overall output. The study also highlighted the positive environmental impact, noting that renewable energy adoption reduced the carbon footprint of SMEs by 25%. The authors concluded that the widespread integration of renewable energy into SME operations could significantly enhance business sustainability, but financial barriers and policy inconsistencies hindered large-scale adoption. They recommended government incentives, such as tax relief and low-interest financing, to support SMEs in transitioning to renewable energy sources.

Oduyoye et al. (2013) evaluated the infrastructure support activities of the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) in fostering the growth of cooperative-financed SMEs in Ogun State between 2005 and 2010. Using 135 questionnaires and descriptive statistics, the study found that SMEDAN’s infrastructure support had no significant impact on SME growth. However, the study's reliance on descriptive statistics and a broad examination of infrastructure rather than RE specifically highlights the need for a more empirical and focused study on RE and SME development.

2.5 Gap in Literature

Despite the growing body of research on renewable energy like the study of Eze and Oladipo (2024), Adebayo and Hassan (2024), Nwachukwu et al. (2024), no study has tapped into renewable energy transition with the focus on social equity, energy justice, and environmental sustainability for micro, small and medium scale enterprises in West Africa. As a result, several gaps remain unaddressed. Firstly, most studies like Chukwuma and Balogun (2024), Okonkwo and Ibrahim (2023), Olayemi and Adekunle (2022), Oduyoye et al. (2013) focused on the financial and operational impact of renewable energy adoption, with limited exploration of its long-term sustainability effects on MSMEs. Secondly, there is a lack of region-specific analyses that consider how geographical disparities affect MSME access to renewable energy solutions, particularly in West Africa. Most of the studies worked on SMEs and not MSMEs which is part of the gap the study seeks to fill. Thirdly, existing research does not sufficiently examine the role of technological innovations in making renewable energy more accessible and affordable for MSMEs. Additionally, studies rarely explore the impact of policy frameworks and regulatory structures on the successful integration of renewable energy into MSME operations. Future research should address these gaps by conducting longitudinal studies, region-based impact assessments, and policy-focused evaluations to develop more comprehensive insights into the role of renewable energy in the Norther Africa and Southern Africa

Conclusion and Recommendations

Based on the findings of this study, it is clear that renewable energy transition is imperative and highly beneficial for Micro, Small, and Medium Enterprises (MSMEs) in West Africa, achieving it justly and sustainably requires targeted interventions to overcome significant financial and policy barriers. Adopting renewable energy, especially solar and biomass, allows MSMEs to significantly cut greenhouse gas (GHG) emissions and local air pollutants compared to the widely used, but harmful, diesel generators. Utilizing biomass energy sources can help manage agricultural and organic waste, promoting a circular economy and reducing environmental degradation

A reliable power supply from renewables increases operational efficiency and productivity, directly contributing to job creation and local economic development.. Access to reliable electricity can improve quality of life, empower women-owned enterprises, and support essential services like health and education in underserved communities. A "just transition" is crucial to ensure the benefits are equitably distributed and do not exacerbate existing inequalities. Without inclusive management, economic disruption and inequality may increase

it is clear that renewable energy plays a critical and transformative role in enhancing the performance of micro, small and medium enterprises (MSMEs) in West Africa. In a region where electricity supply is notoriously unstable and often insufficient for sustaining daily business operations, renewable energy serves as a viable alternative that empowers MSMEs to maintain consistent workflow and service delivery.

The study on the renewable energy (RE) transition and environmental sustainability in West Africa is critical for understanding the shift away from fossil fuels for MSMEs, yet studies in this region face significant, interrelated limitations. This study, focusing on ECOWAS countries like Nigeria, Ghana, and Senegal, is frequently constrained by data scarcity, financial limitations, and weak institutional frameworks

Future studies on the renewable energy transition should focus on the transition between the theoretical potential research to survey, interdisciplinary research on grid modernization, financing and socio-economic justice. Some of the recommendations are exploration of hybrid mini-grids, creation of finer resource maps, and reviewing of policy frameworks to enhance investments on the ground using quantitative data for analysis

Based on the findings, the following recommendations are made:

1. To enhance the performance of Micro, Small and Medium Enterprises (MSMEs) through the adoption of renewable energy, the study recommended that government policies should focus on financial incentives, streamlined regulations, and educational support to overcome key barriers like high upfront costs and knowledge gaps
2. To promote renewable energy (RE) justice and enhance Micro,Small and Medium Enterprises' (MSMEs) performance, the focus should be to address financial, knowledge, and policy barriers through targeted support mechanisms. The study recommended that energy justice should involve

and ensure fairness and equity in the energy transition, particularly concerning the distribution of benefits and burdens

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Figures

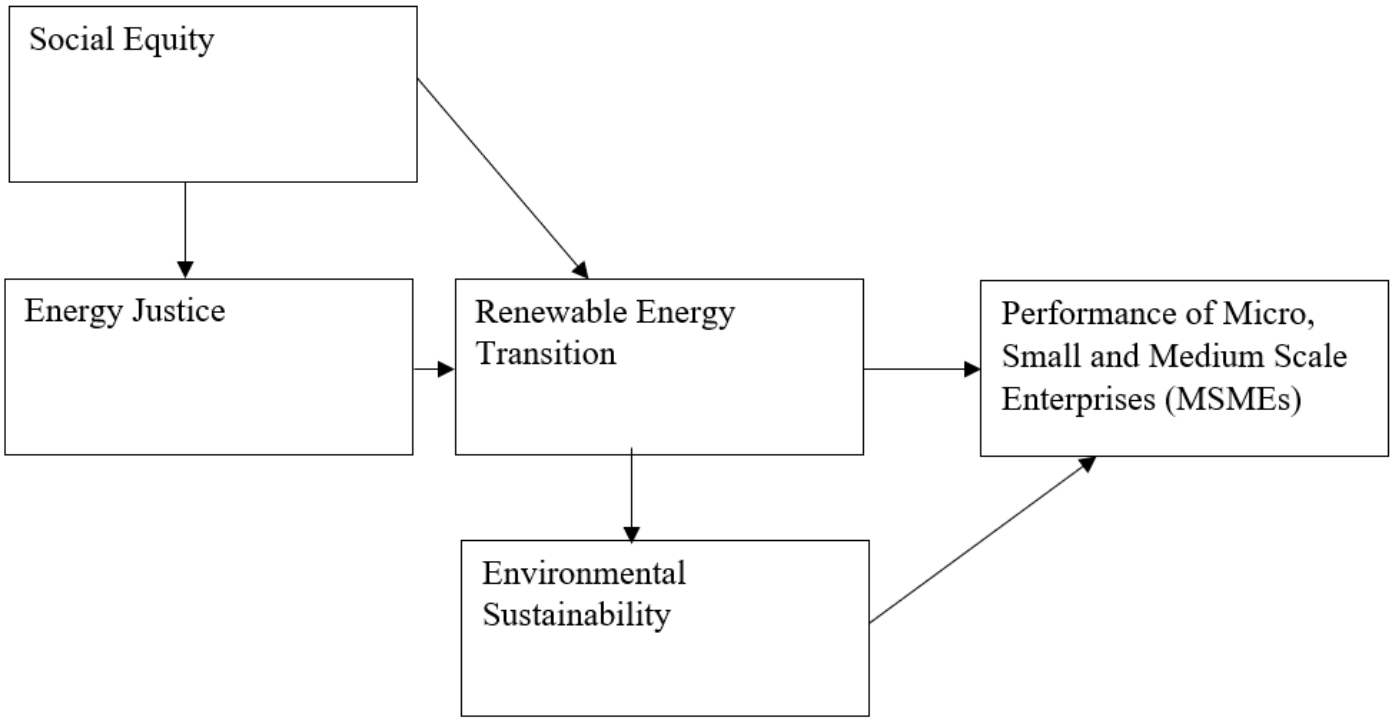


Figure 1

Conceptual Framework

Source: Authors' Conceptualization, (2026)