Sustainable Practices in Coping with Global Economic Challenges in Metalwork Industries in Lagos State

by
[1]Omego Nwabueze Godfrey, [2]Dawodu Rasheed Adegbenro & [3]Adegunle Felix Omotayo
[1]DEPARTMENT OF INDUSTRIAL TECHNICAL EDUCATION
UNIVERSITY OF NIGERIA NSUKKA

[2, 3]DEPARTMENT OF TECHNOLOGY EDUCATION
LAGOS STATE UNIVERSITY OF EDUCATION
OTTO/AJANIKIN, LAGOS STATE

Abstract
The study was conducted to determine sustainable practices in coping with global economic challenges in metalwork industries in Lagos State. The study answered four research questions. The study adopted a descriptive survey research design. Population for the study was 42 technologists in registered metal industries in Lagos State. No sampling due to manageable size. Instrument for data collection was a structured questionnaire developed by the researchers, validated by three experts in the Department of Industrial Technical Education University of Nigeria Nsukka. The reliability coefficient of the instrument was 0.72. Mean was used to analyse data for answering research questions. The study revealed that: (i) eight resource management practices are required in coping with global challenges in metalwork industries, (ii) eleven innovation and efficiency practices are required in coping with global challenges in metalwork industries, (iii) eight energy conservation practices are required in coping with global challenges in metalwork industries, and (iv) ten waste reduction practices are required in coping with global challenges in metal work industries. It was recommended that all the practices should be implemented in order to coping with global challenges in metalwork industries.
Keywords: Resource; Innovation Energy conservation; Waste reduction and Industries

Introduction

Sustainability refers to the ability to maintain ecological balance while meeting present needs without compromising future generations' ability to meet theirs. Thomas &Mantri, (2022) stated that sustainability encompasses three key dimensions environmental, economic,and social. Sustainable practices aim to minimize resource depletion and environmental degradation, integrating social equity and economic vitality (Perchinunno et al., 2023). The United Nations' Sustainable Development Goals (SDGs) serve as a framework for achieving sustainable resource globally by addressing issues like poverty, inequality, and climate change (Duane et al., 2020)

Sustainable resource management involves the responsible use of natural resources to meet current needs while ensuring their availability for future generations. Ali et al., (2023) state the key frameworks include the United Nations Framework Classification for Resources (UNFC) andthe United Nations Resource Management System (UNRMS), which promote transparency and consistency in resource management practices. This approach integrates ecological, economic, and social dimensions to foster sustainability, addressing challenges like resource depletion and environmental degradation (Sgroi, 2020). The effective sustainable management is critical for achieving global sustainability goals and enhancing resilience against climate

change impacts and community initiatives (Zahid et al., 2022).

Community initiatives focus on collective efforts to address local challenges and promote sustainability. Malik et al., (2021) stated that Community-based sustainability initiatives are voluntary, place-based efforts aimed at enhancing social, economic, and environmental well-being, often involving diverse local actors to tackle specific issues like climate change or community resilience. Sustainable community's initiative aims to stabilize subjects provide affordable housing, and create jobs through cooperative enterprises in fostering self-governance and community control (HrvojeMikulčić et al., 2023). Therefore, organization empowering communities through community initiatives andsustainable development practices, focusing on good governance, gender inclusion, and environmental management and energy conservation.

Energy conservation involves reducing energy consumption through efficient practices and behavioral changes. According to Shahbaz et al., (2022) energy conservation is turning off appliances when not in use to prevent waste. Using energy-efficient devices, such as LED bulbs and Energy Star-rated appliances.Implementing programmable thermostats for better temperature control.Conducting energy audits to identify inefficiencies and improvement opportunities educatingcommunities about sustainable practices to foster a culture of conservation.These actions not only lower utility bills but also reduce environmental waste impact and contribute to sustainability efforts.

Waste reduction focuses on minimizing waste generation at the source, promoting practices that conserve resources and reduce environmental impact. Lojo-Lendoiro et al., (2024) stated that avoiding excess packaging by choosing products with minimal packaging. Using reusable items, such as coffee mugs and shopping bags, to replace disposable options (Ishfaq et al., 2024). Buying in bulk to decrease packaging waste. Composting organic waste to divert it from landfills. Conducting waste audits to identify and address high waste areas (Hira et al., 2018). These efforts not only save money but also contribute to a healthier environment by reducing landfill use and pollution sustainable practices especially in Lagos State metalwork industries.

Sustainable practices encompass strategies that promote environmental health, social equity, and economic vitality. Reid et al., (2022) stated that Corporate Social Responsibility (CSR) Businesses integrate social and environmental goals alongside profit motives, fostering sustainable operations and community engagement. Resource Management efficient use of natural resources ensures they meet current needs without compromising future availability (Moldovan et al., 2023). Sustainable practices areresponsible for sourcing and minimizing waste. Community-Based Initiatives local efforts that address sustainability challenges, enhancing social and environmental well-being through collective action (Luo& Yun, 2023) these practices aim to create resilient communities and ecosystems for future generations of Lagos State metalwork industries.

Metal is a versatile material that can be recycled repeatedly without losing its properties. According to Liao et al., (2018) the recycling process involves several steps 1. Collection: Scrap metal is gathered from various sources, including households and businesses.2. Sorting: Metals are separated by type (ferrous and non-ferrous) and cleaned to ensure quality.3. Processing: The metal is compacted, shredded, and prepared for melting.4. Melting:Shredded metal is melted in furnaces, consuming significantly less energy than producing virgin metal.5.

Purification and solidifying. The melted metal is purified and then solidified for reuse in manufacturing.Recycling metals conserves natural resources, reduces greenhouse gas emissions, and saves energy, making it an essential practice for sustainability in Lagos State metalwork industries. (Anderson et al., 2017).

Metalwork encompasses the techniques and processes used to shape and manipulate metals into functional and decorative objects. Nguyen et al., (2020) observes that the methods include CuttingTechniques like milling, turning, and sawing remove material to achieve desired shapes. JoiningProcesses such as welding and soldering combine metal pieces for structural integrity. FormingTechniques like forging and bending reshape metals without removing material, utilizing heat and pressure (Zhang et al., 2020). Casting involves pouring molten metal into molds to create complex shapes.Metalworking is essential across various industries, from construction to jewelry making, highlighting its versatility and historical significance in human development in Lagos State metalwork industries. (Liao et al., 2018).

Metalwork technology encompasses various techniques and processes used to shape and manipulate metals into functional and decorative items. Cutting techniques such as milling, turning, and CNC machining remove material to achieve desired shapes; often using tools like plasma cutters for precision Joining (Mariya-Vorobyova et al., 2023). Metalwork technology involves welding and soldering to combine metal pieces. Welding is suitable for larger projects, while soldering is often used for smaller, intricate work.FormingTechniques like forging and bending reshape metals using heat and pressure without adding or removing material. Casting involves pouring molten metal into molds, allowing for the creation of complex shapes economically and efficiently (Crespo-Monteiro et al., 2022). These processes are vital across industries, from construction to art, highlighting the versatility of metalwork industries.

Metalwork industries encompass various sectors involved in the production, processing, and fabrication of metals. According to Hassan & Ibrahim Abdullah Alnaser, (2024) Sustainable Practices in the industry is increasingly adopting eco-friendly techniques such as using recycled materials, energy-efficient processes, and water conservation methods to minimize environmental impact and enhance resource efficiency. Economic Impact globally for instance, the metal fabrication sector employs over 42,600 people and generates significant revenue, emphasizing its role in economic stability while transitioning towards sustainable practices. Technological Innovations advancements like 3D printing and automation are driving sustainability by reducing waste and energy consumption in metal fabrication (Rajendran et al., 2023). Hence, initiatives aim to balance industrial growth with environmental responsibilityLagos State metalwork industries.

Industry refers to the production of goods or services within an economy, encompassing various sectors such as manufacturing, agriculture, and technology. Sustainable practices in industry are increasingly vital, addressing environmental concerns and promoting economic resilience. According to Adrianus-Amheka et al., (2022)Innovation in Industries are adopting sustainable practices to drive innovation, reduce waste, and enhance efficiency, which can lead to economic benefits and competitive advantages. Corporate responsibility companies are integrating sustainability into their operations, focusing on environmental, social, and governance (ESG) metrics to improve brand reputation and attract consumers to cope withchallenges of Lagos

State metalwork industries. (Hyuk et al., 2024).

Copying in the context of global economic challenges refers to the imitation of successful strategies or policies from one country or industry to address similar issues elsewhere. Copying practice can be beneficial but also poses risks, especially when considering the complexities of diverse economic environments (Harrison et al., 2020). Innovation and productivity many countries face a productivity slowdown despite technological advancements. Copying successful innovations can help boost productivity but must be tailored to local contexts to be effective. Investment Gaps developing economies often struggle with investment. Learning from nations that have successfully navigated similar challenges can provide insights into stabilizing fiscal policies and encouraging sustainable investment growth (Peng et al., 2021). Global Cooperation addressing interconnected crises such as inflation, climate change, and geopolitical tensions requires collaborative approaches. Copying effective multilateral strategies can enhance resilience against these global challenges (Harrison et al., 2020). In summary, while copying successful strategies can offer solutions to economic challenges, it is crucial to adapt these practices to fit local conditions and foster genuine innovation to balance global economic challenges on the metalwork.

There is increasing concern about the impact of global economic challenges on the metalwork technology industry in Lagos State, Nigeria. In order to address these challenges and ensure long-term sustainability, it is important to implement sustainable practices within the industry. These practices can include using eco-friendly materials, reducing energy consumption, and implementing waste management strategies. By adopting these practices, the metalwork technology industry in Lagos State cannot only survive in the face of economic challenges, but also contribute to a more sustainable future. The questions for the study are what specific energy conservation strategies were identified? How does recycling impact natural resource conservation? What economic challenges specifically affect Lagos metal industries? Hence the need to determine Coping with global economic challenges a sustainable practice in metal work industries in Lagos State

Statement of the Problem

Challenges of resources management in Lagos State metalwork industries combined with global economic hardship in metalwork processing and production make the metal industry not to have expected and significant resource management amid to meet global economic certainties. The key issues affected include Supply-Demand imbalance,post-pandemic recovery has led to mismatches between supply and demand, causing price volatility. Geopolitical tensions that increased resource nationalism and trade conflicts complicate supply chains, impacting metal availability. Sustainability Pressures, the shift towards greener technologies necessitates environmentally responsible practices, which can be costly and complex to implement. Technological adaptation embracing innovations like AI for process optimization is essential but requires substantial investment

The major factors collectively challenge the industry's resilience and adaptability inLagos State metalwork industries is implementation. The metal industry faces multiple challenges in implementing innovation and efficiency practices amid global economic pressures. High Costs of Technology adoption in integrating advanced technologies like automation and IT are expensive, making it difficult for companies to justify initial investments while managing operational costs. Poor supply chain disruptions economic uncertainties and inflation have led to material shortages and increased costs, complicating

the implementation of efficient practices. Balancing innovation types in Lagos State metalwork industries or companies struggle to find the right mix of incremental and radical innovations, risking resource duplication and overlooking potential improvements in different operational areas Meeting environmental regulations while innovating can be challenging, as companies must balance efficiency with eco-friendly practices.Metalwork production is inherently energy-intensive, making it difficult to reduce consumption without compromising output quality or efficiency. Upgrading to energy-efficient technologies and equipment requires significant upfront capital, which can deter companies from making necessary changes. Companies must navigate the trade-off between maintaining production levels and adopting sustainable practices, often leading to resistance to change. Non-metallic materials often contaminate recyclable metals, complicating sorting and increasing processing costs. Economic downturns can lead to reduced demand for recycled metals, making waste reduction efforts less profitable and sustainable. Many parts of Lagos State lack the necessary facilities for efficient waste metal and nonmetal collection and processing, leading to bottlenecks and inefficiencies, Low public knowledge about proper recycling practices contributes to contamination and inefficient waste management, hindering effective recycling initiatives in Lagos State metalwork industry

Purposes of the Study

The specific objectives of the study were to determine:

1. resource management practices in coping with global challenges in metalwork industries
2. innovation and efficiency practices in coping with global challenges in metal work industries
3. energy conservation practices in coping with global challenges in metalwork industries
4. waste reduction practices in coping with global challenges in metalwork industries

Research questions

The following research questions were answered by the study:

1. What are the resource management practices in coping with global challenges in metalwork industries?
2. What are the innovation and efficiency practices in coping with global challenges in metal work industries?
3. What are the energy conservation practices in coping with global challenges in metal work industries?
4. What are the waste reduction practices in coping with global challenges in metal work industries?

Results

Data for answering the research questions and testing the hypotheses were presented in the following tables.

Table 1: Resources management practices in coping global challenges in metal work industries

s/n	Sustainable resource management involves	X	SD	RMKS
1.	natural resources to meet current needs of industries	4.40	0.91	A
2.	Responsible use while ensuring their availability for future generations.	4.00	0.83	A
3.	transparency and consistency in resource management practices	2.79	1.35	DA
4.	integrates ecological, dimensions to foster sustainability, resource depletion	1.62	0.99	DA
5.	integrates economic, and social dimensions to foster sustainability,	2.24	1.34	DA
6.	integrates social dimensions to addressing challenges l environmental degradation	3.83	1.10	A
7.	management is critical for achieving global sustainability goals against climate change	3.17	1.10	DA
8.	critical for sustainability goals and enhancing resilience against impacts	2.29	0.97	DA

Table 1 shows mean of 1.62 to 4.40 that items number 1, 2 and 6 are above 3.50 meaning the items are agreed. While items number 3, 4, 5, 6 and 7 was below 3.50 meaning it is not agreed. While standard deviation ranges from 0.83 to 1.34 meaning there is close relationship in the responses on Resources management practices in coping global challenges in metal work industries in Lagos State.

Table 2: Innovative and efficiency practices in coping with global challenges in metal work industries

	Sustainable Innovation management involves	X	SD	RMKS
1.	Industries adopting sustainable practices to drive Industries to adopt innovation, reduce waste	2.36	1.03	DA
2.	Industries enhance efficiency	3.45	1.25	DA
3.	Industries adopt economic benefits	3.17	1.34	DA
4.	Industries adopt ways lead to and competitive advantages	3.60	1.13	A
5.	industry is increasingly adopting eco-friendly techniques	3.24	1.19	DA
6.	Industries various sectors involved in the production, processing, and fabrication	3.55	1.02	A
7.	Industries adopt recycled materials, energy-efficient processes	3.31	1.12	DA
8.	Industries adopt transitioning towards sustainable practices	4.02	1.02	A
9.	Industries provide insights into stabilizing fiscal policies and encouraging sustainable investment growth	4.10	1.21	A
10.	Inflation, climate change, and geopolitical tensions requires collaborative approaches.	3.57	1.27	A
11.	Adapt practices to fit local conditions and foster genuine innovation.	2.88	1.21	DA

Table 2 shows mean of 2.36 to 4.10 that items number 4, 6, 8, 9 and 10 are above 3.50 meaning the items are agreed. While items number 4, 5, 6 and 7 was below 3.50 meaning it is not agreed. While standard deviation ranges from 1.02 to 1.34 meaning

there is close relationship in the responses on Innovation and efficiency practices in coping global challenges in metal work industries in Lagos State.

Table 3: Energy conservation practices in coping global challenges in metal work industries

	Energy conservation involves	X	SD	RMKS
1.	reducing energy consumption through efficient practices	2.88	1.21	DA
2.	reducing energy consumption through behavioral changes	2.74	1.25	DA
3.	Turning off appliances when not in use to prevent waste	2.31	1.00	DA
4.	Using energy-efficient devices, such as LED bulbs and Energy Star-rated appliances.	2.36	1.51	DA
5.	Implementing programmable thermostats for better temperature control.	2.48	1.15	DA
6.	Conducting energy audits to identify inefficiencies and improvement opportunities.	2.67	1.51	DA
7.	Educating communities about sustainable practices to foster a culture of conservation.	2.52	1.11	DA
8.	lower utility bills to reduce environmental impact	2.57	1.40	DA
9.	lower utility bills to contribute to sustainability efforts	3.69	1.07	A

Table 3 shows mean of 2.31 to 3.69 that only item number 9 is above 3.50 meaning the items are agreed. While items number 1, 2, 3, 4, 5, 6, 7 and 8 was below 3.50 meaning it is not agreed. While standard deviation ranges from 1.00 to 1.51 meaning there is close relationship in the responses on Energy conservation practices in coping global challenges in metal work industries in Lagos State.

Table 4: Waste reduction practices in coping global challenges in metal work industries

	Energy conservation involves	X	SD	RMKS
1.	Avoiding excess packaging choosing products with minimal packaging.	3.60	1.17	A
2.	Waste reduction focuses on minimizing waste generation	3.14	1.28	DA
3.	source, promoting practices	3.93	1.16	A
4.	conserve resources and reduce environmental impact	3.69	1.07	A
5.	Using reusable items, such as coffee mugs and shopping bags, to replace disposable options	3.81	0.86	A
6.	Buying in bulk to decrease packaging waste	3.64	0.79	A
7.	Composting organic waste to divert it from landfills	4.02	1.02	A
8.	Conducting waste audits to identify and address high waste areas.	4.10	1.21	A
9.	efforts to save money to contribute to a healthier environment by reducing pollution	3.57	1.27	A
10.	save money to contribute in reducing landfill	2.88	1.21	DA

Table 4 shows mean of 2.88 to 4.10 that items number 1, 3, 4, 5, 6, 7, and 9 were above 3.50 meaning the items are agreed. While items number 2 and 10 were below 3.50

meaning it is not agreed. While standard deviation ranges from 0.79 to 1.28 meaning there is close relationship in the responses on Energy conservation practices in coping global challenges in metal work industries in Lagos State.

Discussion

The study found that there were underscores in the urgent need for sustainable practices in the metal work industries ofLagos State. This is according to Hassan & Ibrahim Abdullah Alnaser, (2024) which stated that sustainable practices in the industry is increasingly adopting eco-friendly techniques such as using recycled materials, energy-efficient processes, and water conservation methods to minimize environmental impact and enhance resource efficiency. Also, Sustainable practices aim to minimize resource depletion and environmental degradation, integrating social equity and economic vitality (Perchinunno et al., 2023). The study Sustainability defines maintaining ecological balance while fulfilling present needs without jeopardizing future generations, encompassing environmental, economic, and social dimensions.

In highlighting the importance of responsible resource use, technological innovation, supportive fiscal policies, and a commitment to environmental stewardship. The literature expresses that Technological Innovations advancements like 3D printing and automation are driving sustainability by reducing waste and energy consumption in metal fabrication (Rajendran et al., 2023).

Energy conservation strategies include turning off unused appliances, using energy-efficient devices, and implementing programmable thermostats to enhance energy management. The study highlighted that Energy conservation involves reducing energy consumption through efficient practices and behavioral changes. This according to Shahbaz et al., (2022) energy conservation is turning off appliances when not in use to prevent waste

Waste reduction focuses on minimizing waste generation through practices like avoiding excess packaging, using reusable items, and composting organic waste, which also benefits the environment Lojo-Lendoiro et al., (2024) stated that avoiding excess packaging by choosing products with minimal packaging, using reusable items, such as coffee mugs and shopping bags, to replace disposable options. Ishaq, et al., (2024) went contrary to state that buying in bulk to decrease packaging waste.

The recycling of metals is highlighted as a crucial sustainability practice, conserving natural resources and reducing greenhouse gas emissions through a multi-step process from collection to purification. Anderson et al., (2017) support that recycling metals conserves natural resources, reduces greenhouse gas emissions, and saves energy, making it an essential practice for sustainability in Lagos State metalwork industries.

Conclusion

Coping with Global Economic Challenge in a Sustainable Practices in Metal Work Industries in Lagos State" presents several key conclusions regarding the adaptation and sustainability of metal work industries in the face of economic challenges need for sustainable Practices. The findings indicate a critical need for metal work industries in Lagos State to adopt sustainable practices. This is essential not only for survival but also for long-term viability in a rapidly changing global economic landscape. The industries must transition towards eco-friendly methods to ensure they can meet current demands while preserving resources for future generations.Utilization of Natural Resources The study emphasizes the importance of responsibly utilizing natural resources. Industries should focus on meeting current needs without depleting resources, ensuring their availability for future

generations. This responsible approach is vital for sustainability and economic resilience. Adoption of Technological Innovations.

The conclusions highlight that embracing technological innovations can significantly enhance sustainability efforts. By integrating advancements such as automation and energy-efficient technologies, metal work industries can reduce waste and energy consumption, thereby improving their overall efficiency and environmental impact. Fiscal Policies and Investment Growth: The study suggests that stabilizing fiscal policies and encouraging sustainable investment growth are crucial for the metal work industries. These measures can provide a supportive environment for industries to thrive and adapt to economic challenges, fostering a culture of sustainability and innovation. Reliability of Research Findings The study's reliability coefficient of 0.72 indicates a strong foundation for the conclusions drawn. This reliability supports the insights provided on how industries can adapt and thrive amidst global economic challenges, reinforcing the need for sustainable practices.This includes transitioning towards eco-friendly materials, implementing waste management strategies, and focusing on energy conservation. By doing so, the metal work industries can not only survive economic challenges but also contribute positively to environmental sustainability.

Recommendations

The following recommendations were made:

1. Lagos State government should make effort for industries in natural resources to meet current needs
2. Lagos State metalwork Industries should adopt transition towards sustainable waste reduction practices
3. Lagos State metalwork industries to provide insights into stabilizing fiscal policies and encouraging sustainable investment growth
4. Lagos State develop policy composting organic waste to divert it from landfills
5. Lagos State government should be conducting waste audits to identify and address high waste areas.

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