



Circular Economy Reporting and Financial Performance: Evidence from Nigerian Listed Manufacturing Firms

James Osabuohien ODIA^{*1} and Samuel IMHODIBIE²

¹Department of Accounting, University of Benin, Benin City, Nigeria

^{*}(Corresponding author; E-mail: james.odia@uniben.edu)

²Department of Accounting, University of Benin, Benin City, Nigeria. E-mail: samuel.imhodibie@clicktgi.net

To Cite this Article

James Osabuohien ODIA & Samuel IMHODIBIE (2026). Circular Economy Reporting and Financial Performance: Evidence from Nigerian Listed Manufacturing Firms. *Journal of Business Reporting*, 1: 1, pp. 97-119.

Abstract: This paper examines the impacts of circular economy (CE) practices on the financial performance of listed manufacturing firms in Nigeria, with a focus on recycling, dematerialisation, refurbishment, and renewable energy from 2013 to 2022. A longitudinal research design was adopted, using data extracted from the annual reports of forty-six (46) listed manufacturing firms on the Nigeria Exchange Group. Panel data regression was used to test the hypotheses. The results indicate that refurbishment and renewable energy practices have a positive and significant effect on financial performance, whereas recycling and dematerialisation exhibit positive but insignificant effects. The study concludes that adopting a circular business model, particularly through refurbishment and renewable energy management, enhances financial performance. The results also emphasise the significance of open business reporting, since companies may educate stakeholders, increase accountability, and boost investor confidence by disclosing CE initiatives in annual and sustainability reports. In order to optimise both financial and non-financial gains, the paper suggests that the government, manufacturing companies, and other stakeholders focus more on CE practices and integrate them with corporate strategies and reporting structures.

Keywords: Circular Economy, Financial Performance, Refurbishment, Recycling, Dematerialization, Renewable Energy, Business Reporting, Sustainability Disclosure.

Introduction

Although production drives economic growth, it also generates a large waste of natural resources, which has harmful long-term effects on the ecosystem (Sarfraz *et*

al., 2023). The limitation of natural resources and the concerns about the survival of the environment have made sustainable operations of assets and the pollution of the environment one of the major global issues in current times (Odia, 2022). According to Atlin and Gibson (2017), the extreme use of non-renewable resources driven by the speed of economic development has influenced the atmosphere negatively and increased several environmental concerns. Odia (2022) opined that there are optimised pressures from society and government bodies for organisations to adopt economic models that will promote sustainability. The manufacturing sector faces the highest pressure from stakeholders due to its tendency to produce more waste of natural economic resources, which creates an imbalance in the environment. The business climate in current times has experienced several changes, creating more complexities and uncertainties (Taouab & Issor, 2019). Therefore, for a business to be competitive, it must explore plans that identify the organisation's long-term ways of using existing resources in achieving its goals (Fatihudin *et al.*, 2018).

An economic model that emphasises taking, making, and discarding is known as the linear economy (Upadhayay & Alqassimi, 2018). The linear economy model under solid waste management results in increased waste deposits into landfills and waterways during resource extraction, manufacturing for consumption, and final disposal procedures. However, despite the usefulness and success of the linear economy in the 20th century, Sariatii (2017) argues that it could not cope with the demands of the new millennium, and if it is uncontrolled, it might lead to environmental collapse. Similarly, Ogunmakinde *et al.* (2022) argue that altering the linear economy model would require a change in production and consumption practices.

The circular economy (CE) is a regenerative approach to managing natural resources, unlike the linear strategy, which is unsustainable. Innovative transformational technologies, such as those in the digital and engineering fields, along with innovative CE thinking, are causing profound changes along the whole value chains, not limited to industries or types of materials. Thus, CE comprises renewed interests in waste valorisation, cleaner manufacturing, life cycle thinking, and green consumption (Ezeudu & Ezeudu, 2019). According to Khan *et al.* (2021), the assessment of a company's operational effectiveness, profitability, and sustainability, with financial performance, serves as a critical evaluation of its overall effectiveness. Within the context of CE and sustainable development, evaluating financial performance takes on a greater level of importance as companies strive to balance economic growth with environmental responsibility and social impact.

Furthermore, modern corporate governance frameworks place a strong emphasis on the function of business reporting in informing stakeholders about sustainability-related tactics and results. Businesses can reveal environmental practices, resource efficiency programs, and circular economy strategies that could affect long-term financial value through business reporting tools including sustainability reports and integrated reports (Eccles & Krzus, 2018). In addition to improving corporate responsibility, transparent reporting of such initiatives enables investors and other stakeholders to assess the impact of sustainability policies on both financial and non-financial performance (Adams, 2015). As a result, including circular economy practices into corporate reporting frameworks has grown in importance as a way for businesses to show their dedication to sustainable development while boosting stakeholder trust and organisational legitimacy.

The pursuit of sustainable financial performance transcends simple profit generation; it aims to deliver enduring value to all stakeholders (Mochalova, 2020). To achieve this, corporations should embrace a holistic approach to financial management that integrates environmental and social risks alongside traditional financial metrics. Implementing the Circular Economy (CE) approach necessitates a cognitive shift from focusing on short-term profits to prioritising long-term sustainability (Galant and Cadez, 2017). This strategy includes reallocating resources toward sustainable energy, minimising waste and emissions, and enhancing workplace diversity and inclusivity. Additionally, fostering open communication and collaboration between organisations and their stakeholders is crucial to building

One challenging issue confronting humanity today is how to decouple economic development from resource usage through implementing policies effectively, developing social and physical infrastructure, creating markets, and transforming corporate practices along global value chains. This should also entail efficiently managing natural resources, reducing garbage and pollution, recycling, and sustainable consumption by 2030 (Dantas *et al.*, 2021; Morton *et al.*, 2017; Schroeder *et al.*, 2018). Nasrollahi *et al.* (2020) noted that as the natural capital base diminishes, every corporate and political institution of the 21st century would face a major problem. It has been shown that the implementation of a CE may have a positive impact on numerous economic sectors. Natural resources that may be used by businesses should not be depleted but rather preserved. Natural resources are regarded as perpetual phenomena; non-renewable resources are finite, while renewable ones change forms with grave repercussions for mankind (Ogunsanwo

& Ayo-Balogun, 2020). Poor environmental practices usually lead to colossal ecological damage and threaten sustainability and organisational performance. The economic and environmental difficulties facing Nigeria require a reorientation of the nation's development strategy and a quick or holistic shift toward a CE to curb environmental harms and harness economic advantage.

Škrinjarić (2020) examined the subject with respect to European countries, including Germany, the Netherlands, Denmark, France, and Italy. Güney (2019) evaluated the literature in terms of 40 developed nations, and Sarfraz *et al.* (2023) conducted their study in relation to countries within the European member nations. However, only a handful of related literature could be found for African nations, particularly Nigeria. Furthermore, studies such as Güney (2019), Hysa *et al.* (2020), Inglesi-Lotz (2016), and Ogunsanwo and Ayo-Balogun (2020) examined the impact of only two CE practices (recycling or reuse) on financial performance. This creates a gap in the extent CE practices affect a firm's financial performance. Hence, this paper fills the knowledge gaps as it examines four CE practices—recycling, dematerialisation, refurbishment, and renewable energy—and their impacts on the financial performance of listed manufacturing firms in Nigeria. The paper contributes to existing literature by examining how listed manufacturing companies can improve their financial performance by adopting circular economy practices. The rest of the paper is divided into four sections. The immediate section presents the literature review on circular economy, CE practices, and their impacts on financial performance. Section three describes the materials and methods, section four presents the results, section five discusses the findings, and section six concludes with policy implications.

2. Literature Review

2.1. Concept of the Circular Economy

The CE is “a regenerative system in which resource input and waste, emissions, and energy leakage are reduced by gradually closing and narrowing energy and material loops” (UNFCC, 2019). The CE slows, closes, and narrows material and energy loops to reduce resource input, wastes, emissions, and energy leakages (Geissdoerfer *et al.*, 2020). Corvellec *et al.* (2022) defined CE as the “creation and consumption of commodities through closed loop material flows that internalize environmental externalities connected to virgin resource extraction and waste generation (including pollution)”. They see the CE main objective as reducing resource consumption,

pollution, and waste throughout the product's life cycle. The CE revolutionizes the function of resources (Massaro *et al.*, 2021); it ensures economic growth and sustainability (Benz, 2022; Walker *et al.*, 2021), and promotes an alternative to the linear business model (Uhrenholt *et al.*, 2022). The CE focuses on recycling, restricting and re-using the physical inputs to the economy, utilizing wastes as a resource, and lowering the depletion of primary resources. Grafström and Aasma (2021) noted that an important aspect of CE entails how to keep and prolong the life of resources and materials in order to obtain the greatest value from them. According to Valavanidis (2018), the CE centres on turning products into resources for others after their useful lives are over, closes loops in industrial ecosystems, reduces wastes, and uses sustainable business practices. Every product generated in this CE paradigm can become a secondary raw material. A closed loop of material flow changes from the traditional linear relationship of resources, products, waste, and emissions into a circular relationship of “resources, products, and resources” to reduce the over-dependence on primary natural resources.

Accenture (2020) identifies six factors that have expedited movements towards a CE in recent years, including (1) the shift in the preferences of end-consumers toward sustainable and eco-friendly products for which they are willing to pay a premium; (2) the engagement of brand owners in voluntary sustainability commitments that are now altering the structure and dynamics of existing markets and demand; (3) the application of strict organisational sustainability targets in investment decisions by participants and stakeholders who are aiming to contribute to this shift; (4) a significant increase in the number of regulations in various countries and the European Union (EU); (5) investment by both established and start-up companies in the development of new recycling technologies; and (6) the establishment of a diverse array of public and private initiatives around the world. The circular business model is affected by industry barriers and institutional challenges such as lack of a national policy framework, lack of data and capability, regulatory and institutional gaps, silo procurement, market barriers, and the persistence of traditional business models (OECD, 2024). African Union (2024) highlights the challenges of CE in the African continent, including lack of a holistic approach to adopting CE, limited awareness and communication of the benefits of CE, market entry barriers for innovation and growth of CE business models, limited coordination of CE strategies and action plans, as well as little monitoring of circular initiatives, and insufficient and misaligned financing mechanisms.

The first practical effort towards the CE model in Nigeria was the creation of 26 recycling plants in 26 cities and Abuja (Onogwu, 2019). Sadly, several state administrations abandoned recycling operations following official handover from one government to another (Ogunsanwo & Ayo-Balogun, 2020). Although the CE has not received much attention in private and public debates, Nigeria has several sectors that would benefit from CE practices. For instance, Rajput *et al.* (2020) identified the agriculture, plastics/packaging, and waste management sectors as promising for CE growth in Nigeria. Furthermore, Onogwu (2019) stated that due to Nigeria's expanding population, high unemployment, and youth unrest, the CE model might be the nation's solution. This consolidates the position of Orji *et al.* (2022) and Ogunsanwo and Ayo-Balogun (2020) that Nigeria's economic issues include poverty, poor capital creation, inequality in the distribution of resources/wealth, unemployment, inflation, inefficient mobilization of resources, and failure to diversify the economy.

2.2. Circular Economy Principles and Practices

According to the Ellen MacArthur Foundation (2015), there are three core principles of the CE: (1) design waste and pollution out of systems; (2) keep products and materials in use; and (3) regenerate natural systems. The CE frameworks include reducing, reusing, recycling, recovering, remanufacturing, and refurbishing (Su *et al.*, 2013). 'Reducing' refers to decreasing the consumption of resources and generation of pollutants by adopting more advanced technologies or facilities (Anderson, 2007). 'Reusing' means utilising resources as many times as possible or in diverse ways (Brunori *et al.*, 2005), while 'recycling' involves converting end-of-life products into renewable energy or resources with the possibility for a new product life cycle (Hicks *et al.*, 2005).

Recycling plays a critical role in CE practices as it promotes efficient resource utilisation and waste reduction. Recycling contributes to reducing the consumption of non-renewable resources such as oil, coal, and gas, which are essential for producing new materials. Recycling also reduces the environmental impact of waste disposal, as it decreases the volume of waste sent to landfills and lowers the energy required to produce new products (Yildirim, 2022).

Dematerialisation refers to the process of reducing or eliminating the physical use of materials in the production, delivery, or consumption of goods and services (Kasulaitis *et al.*, 2019). It emphasises doing more with less by minimising resource

input while maximising efficiency and value creation. Bag and Rahman (2021) define it as a decline in the volume of materials used in industrial end products. Refurbishment involves the restoration, improvement, or upgrading of existing structures, products, or systems rather than constructing entirely new ones. It contributes to environmental, social, and economic sustainability through benefits such as resource conservation, energy savings, waste reduction, extended product lifespan, and economic benefits, including job creation.

2.3. Circular Economy Practices and Financial Performance

There is a research gap on the relationship between CE and financial performance (Usón *et al.*, 2019). According to the Ellen MacArthur Foundation (EMF, 2012), circularity promotes strategic opportunities, new profit pools, and long-term revenue streams. Kwarteng *et al.* (2021) found that CE practices such as reuse, recycle, reduce, regenerate, and recover resources influence financial performance positively. Shavkatov *et al.* (2024) also found a positive and statistically significant relationship between CE practices and financial performance, providing robust evidence to support the business case for a CE transition in sustainable manufacturing.

Krystofik *et al.* (2018) found that dematerialisation practices enhance operational efficiency through process streamlining, waste reduction, and reduced material usage, thereby improving productivity and profitability. Dematerialisation also encourages innovation because firms are incentivised to develop new products and processes that require fewer resources, leading to competitive advantages and potentially higher profits (Ogiemwonyi & Eneizan, 2024). However, Ezeudu and Kennedy (2024) argued that the transition to dematerialised processes may disrupt existing business models and supply chains because organisations may face resistance from stakeholders accustomed to traditional methods, potentially leading to temporary disruptions in production and sales. Cordella *et al.* (2020) further noted that reductions in material usage could potentially compromise product quality or performance. By refurbishing materials and components, firms can reduce raw material and production costs, thereby improving financial performance (Pinto, 2020), although refurbished products may sometimes be perceived as inferior to new products.

According to Gonçalves (2022), obstacles to the adoption of CE practices targeted at enhancing financial performance include business size, initial investment outlay, risk exposure, and complex business structures. Additionally, the CE helps

businesses generate greater economic value from material life cycles (Stahel, 2016) and addresses climate change issues (Ellen MacArthur Foundation, 2021). It has been demonstrated that cutting costs through efficient resource use, such as waste and water management, boosts long-term competitive advantage, strengthens market position, and increases profits (Moric *et al.*, 2020).

Mazzucchelli *et al.* (2022) found that three CE practices—waste treatment, reduction, and recycling—along with brand reputation promote firm performance, while brand reputation serves as a mediator in the relationship. Yu *et al.* (2022) examined the role of Industry 4.0 in CE practices and supply chain capability to improve firm performance based on a survey of 286 firms. The results show that Industry 4.0 enhances CE implementation and supply chain capability. Although CE practices have a positive relationship with operational and economic performance, supply chain capability was found to have a positive relationship with operational performance but an insignificant relationship with economic performance.

Kwarteng *et al.* (2022) examined the moderating effect of organisational culture on the relationship between CE business models and firms' financial performance across diverse business sectors in Ghana through the administration of 617 questionnaires. The study found that CE implementation policies based on the 5Rs—reduce, reuse, recycle, recover, and restore—used in manufacturing, distribution, and consumption processes led to improved financial efficiency. Organisational culture was also found to positively moderate the relationship.

Beyond operational benefits, the reporting and disclosure of sustainability and circular economy initiatives have also gained attention in business reporting literature. Firms increasingly communicate their environmental practices through sustainability reports and integrated reports in order to improve transparency and stakeholder engagement. Such disclosures enable investors and other stakeholders to assess how sustainability strategies contribute to long-term value creation and corporate performance (Eccles & Krzus, 2018). Adams (2015) argues that integrated reporting enhances accountability by linking financial and non-financial information, thereby providing a more comprehensive view of how organisations create value over time. Similarly, de Villiers *et al.* (2020) note that sustainability-related disclosures strengthen organisational legitimacy and improve stakeholder confidence. In this regard, the disclosure of circular economy initiatives within corporate reporting frameworks can signal responsible resource management and potentially influence financial outcomes.

Kuo and Chang (2021) evaluated the factors that determine CE information disclosure and its impact on corporate economic sustainability using 3,768 firms in China between 2011 and 2017. Their findings reveal that firms disclosing more CE information experience higher sustainable growth and return on equity. They also found that larger firms and those operating in environmentally sensitive industries are more likely to disclose CE-related information, reflecting greater stakeholder pressure and regulatory scrutiny.

3. Materials and Methods

3.1. Population and Sample Size

The study employed a longitudinal research design because the variables of the CE practices covered an extended period. The study comprised all fifty-nine (59) manufacturing companies listed on the NGX as of December 31st, 2022. The justification for selecting these manufacturing companies is their application of sustainable consumption and production in Nigeria. The sampling filtering technique accommodated manufacturing firms based on certain selection criteria, which include (1) firms must be listed on the NGX during the 10 years (2013–2022); (2) manufacturing firms that joined the NGX after the year 2013 were excluded from the sample to enable homogeneity of period scope in order to obtain balanced panel data. (2) Sampled firms with unequal observations were accommodated, but consideration was given to firms whose annual financial reports were available for at least 8 years within the period under consideration, allowing for an unbalanced panel data structure. Notably, the unbalanced panel data analysis approach has been previously employed and ratified in prior studies such as Yaffee (2003), Mahdavi (2008), and Wooldridge (2019). Therefore, following the selection criteria, the study employed a sample filtering process of thirteen (13) listed manufacturing firms. Four (4) observations were taken away; that is, Morison Industries Nigerian Plc for 2022, Premier Paints Nigerian Plc for 2022, and Thomas Wyatt Nigerian Plc for 2021 & 2022 were excluded due to the unavailability of the annual financial reports for those specific periods. This selection brought down the final sample to forty-six (46) listed manufacturing firms and four hundred and fifty-six (456) observations for the data analysis. The data was collected from the financial statements of the 46 selected companies from 2013 to 2022.

3.2. Measurement Using Content Analysis

We employed a content analysis procedure on various relevant annual reports of the sampled manufacturing firms (Abd *et al.*,2014). The sentence count considered more appropriate (Ganda & Milondzo,2018) was used to measure the CE practices. The scoring was:1 if CE practice was indicated in the firm's annual report, otherwise 0.

3.3. Model Specification

The model of Sarfraz *et al.* (2023) was adapted for the study. Their model specifies the relationship between firms' financial performance and performance measures of circular economy sustainability of G7 countries. The financial performance measures were WACC and ROA while the CE practices include resource use, waste recycled, emission, and management practice (ISO 9000, ISO14000, lean manufacturing, Six Sigma, TQM etc.). The model was stated as

$$WACC_{ij} \ \& \ ROA_{ij} = \alpha_0 + \alpha_1 Resource \ use_{ij} + \alpha_2 Waste \ recycled_{ij} + \alpha_3 Management \ System_{ij} + \alpha_4 Emission_{ij} + \alpha_5 Resource \ use. \ Innovation_{ij} + \alpha_6 Governance. \ Strategy_{ij} + \alpha_7 Management. \ Compensation_{ij} + e_{ijkt} \quad 1$$

Submitting the CE practices of recycling, materialization, refurbishment and renewable energy, therefore, the functional form of our model is:

$$Return \ on \ Total \ Asset = f(Recycling, \ Dematerialization, \ Refurbishment, \ Renewable \ Energy) \quad 2$$

Then, the model expressed in its econometric form is given as.

$$ROA_{it} = g_0 + \gamma_1 REC_{it} + \gamma_2 DEM_{it} + \gamma_3 REF_{it} + \gamma_4 REN_{it} + \gamma_4 FSIZE_{it} + \mu_{it}$$

Where: ROA = Return on Assets; REC = recycling; DEM = dematerialization; REF = refurbishment; REN = renewable energy FSIZE = Firm Size

3.4. Operationalization of Variables

Table 1: Measurements of Variables

S/No	Variables	Type of Variable	Measurement	A priori Expectation	Source
1	Financial Performance	Dependent	Profit After Tax Divided by Total Assets (ROA)		Sarfraz <i>et al.</i> (2023)

S/No	Variables	Type of Variable	Measurement	Apriori Expectation	Source
2	Recycling Practices	Independent	Dummy (0,1)	Positive	Esposito <i>et al.</i> (2023)
3	Dematerialization Practices	Independent	Dummy (0,1)	Positive	Gaustad <i>et al.</i> (2012)
4	Refurbishment	Independent	Dummy (0,1)	Positive	Sarfraz, <i>et al.</i> (2023)
5	Renewable Energy	Independent	Dummy (0,1)	Positive	Esposito <i>et al.</i> (2023)
6	Firm Size	Control	Natural logarithm of total asset	Positive	Kasbar <i>et al.</i> (2023).

Sources: Researchers compilation

The panel data regression analysis was employed to test our hypotheses because the data includes properties of time-series and cross-sectional data. Moreover, the Hausman test was conducted to determine whether to use either the random effect or the fixed effect. The results of the Hausman test [$p=0.9999$] indicates the adoption of the random effect model instead of the fixed effect model. The test result for normality of residua for the random effect model shows a statistically significant idiosyncratic error $e = 11.18 (0.0037)$ and $u = 7926.21 (0.0000)$ which suggests the presence of cross-sectional effect. This violates the assumption of homoscedasticity of the error term. Therefore, the robust panel regression analysis technique was employed instead of the random effect in other to control for the random effect error, and consequently employed to test the formulated hypotheses.

4. Results

4.1. Descriptive Statistics Analysis

The descriptive statistics analysis is shown in Table 2. Return on Assets (ROA), a key measure of financial performance, has a mean value of 3.19%, reflecting a modest level of profitability across the sample. However, the wide standard deviation (15.22%) and the extreme minimum (-179.92%) and maximum (108.9%) values underscore considerable disparities in firm performance. These variations suggest that while some firms are thriving, others are struggling with substantial losses, likely due to economic volatility and operational inefficiencies. Similar findings were observed by Ailemen *et al.* (2015), who attributed such disparities to the capital structure and management quality of Nigerian firms.

Table 2: Descriptive Statistics Analysis Result

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	456	3.194759	15.21635	-179.92	108.9
REC	456	.0942982	.2925642	0	1
DEM	456	.0635965	.2443008	0	1
REF	456	.0679825	.2519923	0	1
REN	456	.1425439	.349991	0	1
FSIZE	456	7.145746	.8999264	5.24	9.38

Source: Output from

Adoption of CE practices is often low, as indicated by dummy variables for recycling (REC), dematerialisation (DEM), refurbishing (REF), and renewable energy (REN). The mean values for these practices—9.4%, 6.4%, 6.8%, and 14.3%, respectively—show that CE integration among Nigerian manufacturing companies is still in its early stages. Growing knowledge of the advantages of switching to sustainable energy sources is indicated by the comparatively higher mean value for renewable energy adoption, which is probably due to rising energy costs and governmental incentives. Additionally, as noted by Mutezo and Mulopo (2021), it might result from recent changes in policy and international funding for sustainable energy projects.

However, the low adoption and practice rates for other CE practices reveal significant barriers, such as limited technical capacity and financial resources, consistent with the study of Debrah *et al.* (2022). Firm size (FSIZE), expressed as the natural logarithm of total assets, shows a mean value of 7.15, with a narrow standard deviation (0.90), suggesting that the sampled firms are predominantly medium- to large-sized entities. The range of firm size values (5.24 to 9.38) indicates that smaller firms might face unique challenges, such as limited access to credit and higher operational costs, which constrain their ability to engage in CE activities. The relatively low standard deviations for most variables suggest some degree

Table 3: Correlation Matrix

	ROA	REC	DEM	REF	REN	FSIZE
ROA	1.0000					
REC	-0.0572	1.0000				
DEM	-0.0309	0.5309	1.0000			
REF	-0.0774	0.4196	0.3937	1.0000		
REN	-0.0794	0.6197	0.5621	0.4880	1.0000	
FSIZE	0.3346	-0.0160	-0.0308	-0.0256	-0.1305	1.0000

of uniformity in firm characteristics, with outliers likely driving the observed disparities in financial performance and practice adoption.

4.2. Correlation Analysis

Table 3 shows the results from the spearman rank correlation of the independent variables with ROA, to include recycling CE practice reporting (-0.0572/6%), dematerialization CE practice reporting (-0.0309/3%), refurbishment CE practice reporting (-0.0774/8%) and renewable CE practice reporting (-0.0794/8%) are negatively correlated with the dependent variable: return on total asset. However, FSIZE is positively correlated with ROA.

4.3. Regression Analysis

Table 4. Regression Analysis

	<i>ROA Model (Pooled OLS)</i>	<i>ROA Model (Fixed Effect)</i>	<i>ROA Model (Random Effect)</i>	<i>ROA Model (Robust Regression)</i>	<i>Panel</i>
REC	-1.053 (0.739)	0.127 (0.901)	0.030 (0.969)	0.036 (0.382)	
DEM	-1.479 (0.680)	-0.132 (0.898)	0.070 (0.936)	0.0001 (0.989)	
REF	-1.562 (0.627)	-0.009 (0.992)	-0.347 (0.662)	0.079** (0.038)	
REN	-0.114 (0.968)	-0.588 (0.473)	-0.199 (0.772)	0.088 ** (0.007)	
FSIZE	4.480 *** (0.000)	0.658 (0.597)	0.230 (0.226)	-0.097 ** (0.052)	
Cons	-28.503 (0.000)	4.204 (0.629)	-1.244 (0.387)	0.869** (0.006)	
F-stat/Wald Stat	7.29*** (0.0000)	0.84 (0.6268)	13.15 (0.5150)	10.52*** (0.0000)	
R- Squared	0.0749	0.0288	0.0276		
VIF Test	1.57				
Hausman Test Prob>chi2	2.07 (0.9999)	Breusch and Pagan Lagrangian multiplier test for random effects	0.11 (0.3696)	Joint Test for Normality e: = 11.18 (0.0037) u: = 7926.21 (0.0000)	

Note: **, ***, significance at 5% and 1% respectively

REC= recycling, DEM= dematerialization; REN=renewal energy, REF=refurbishment, FSIZE=firm size

Table 4 shows the R-squared regression results for Pooled OLS, fixed effect and random effect were 7%, 3% and 3% respectively. Moreover, the F-statistic value was significant at 1% for Pooled OLS (7.29, $P=0.000$) and robust regression (10.52, $p=0.000$). The VIF values are within the benchmark value of 10, indicating the absence of multi-collinearity. The robust regression analysis result reveals that refurbishment and renewal energy have a positive and significant impact on financial performance, whereas recycling and dematerialization have a positive but insignificant impact on financial performance.

5. Discussions

The refurbishment has a significant positive impact on the financial performance of manufacturing firms. This may be attributed to the combination of factors such as strategic sustainability practices, market responsiveness, alignment with stakeholder expectations, and regulatory requirements. This outcome underscores the potential financial benefits of embracing CE principles in the context of Nigeria's business landscape. As global and local regulations increasingly focus on sustainable business practices, manufacturing firms in Nigeria must proactively report on refurbishment to align with these expectations, resulting in a positive impact on financial performance.

Sony *et al.* (2015) and Kumar and Ghodeswar (2015) found that consumers are becoming more environmentally conscious, and there is a growing preference for products from sustainable and socially responsible companies. Therefore, manufacturing firms reporting on refurbishment, which emphasises resource efficiency and waste reduction, may appeal to a consumer base that values sustainability, thereby leading to increased demand for their products. Such disclosures may also signal a commitment to sustainable and responsible business practices, which can contribute to an improved corporate image, goodwill, corporate responsibility, resilience, and climate change mitigation, and subsequently higher financial performance (Omar, 2020; Kwarteng *et al.*, 2022).

These results emphasise the significance of open disclosure of refurbishment efforts in sustainability and integrated reports from the standpoint of business reporting. In addition to improving accountability, reporting such circular economy projects helps stakeholders better understand how operational sustainability policies result in the generation of financial value. This is in line with the goals of business reporting research, which aims to show how stakeholders' assessments

of a company's performance and long-term value are influenced by non-financial sustainability disclosures.

The significant positive effect of CE underscores the potential financial benefits of embracing renewable energy practices such as solar and wind power in the Nigerian business environment due to the huge cost savings in the long run. Manufacturing firms which report on their adoption of renewable energy experience reduced energy costs and increased operational efficiency. This result has implications for Nigeria and developing countries having challenges relating to energy security and the reliability of the power supply in that manufacturing firms' investment in renewable energy sources not only enhances their energy resilience, reducing dependency on inconsistent grid power and leading to increased reliability, positively influencing production efficiency, but also results in a positive return on total assets.

Moreover, the finding reflects the opinion of Raybould *et al.* (2020) that government policies and regulations supporting renewable energy adoption can incentivise manufacturing firms to invest in sustainable practices. The result is also consistent with Odu (2019), who documents that investors are including ESG criteria in their investment decisions. Therefore, firms which report on renewable energy initiatives will attract investors who prioritise sustainable and responsible business practices, positively influence firms' valuation and financial performance, mitigate climate-related risks, and increase resilience to supply chain disruptions. Transparent disclosure of renewable energy adoption supports the goals of business reporting by bolstering the credibility of sustainability reporting and giving stakeholders and investors important information for making decisions. By showing how sustainability investments contribute to long-term financial stability and business value generation, such reporting standards aid in bridging the gap between environmental initiatives and financial achievements. This result validates earlier research by Kuo and Chang (2021), Majeed and Luni (2020), and Mazzucchelli *et al.* (2022).

The outcome shows that recycling has no effect on profitability. The results of Yu *et al.* (2022) are in line with this. Finally, the outcome demonstrates that dematerialisation as a CE practice has no appreciable impact on financial performance, which is in line with Oliveira *et al.* (2023). These results also imply that not all circular economy disclosures instantly result in quantifiable financial outcomes from the perspective of company reporting. However, disclosing such practices is still crucial since it improves openness, facilitates thorough sustainability

reporting, and enables stakeholders to assess a company's wider environmental and strategic commitments in addition to its immediate financial success.

6. Conclusions, Policy Implications, Direction for Future Research

This paper concludes that CE practices such as refurbishment and renewable energy have a significantly positive effect on corporate financial performance, indicating that the circularity of the business model influences the financial outcomes of manufacturing firms in Nigeria. The findings suggest that firms that actively implement and disclose refurbishment and renewable energy initiatives can achieve improved operational efficiency, cost savings, and enhanced financial returns. From a business reporting perspective, the results also highlight the growing importance of transparent disclosure of circular economy initiatives in sustainability and integrated reports, enabling stakeholders to better evaluate how environmental practices contribute to financial value creation. This supports the broader objective of business reporting research that links sustainability disclosures with firm performance and accountability (Eccles & Krzus, 2018).

Firstly, given the significant positive impact of CE practices (particularly refurbishment) on financial performance, policymakers may consider the following recommendations: (1) Collaborate with industry stakeholders to establish clear reporting standards for CE practices—especially refurbishment and renewable energy—by developing guidelines that define key indicators, measurement methodologies, and disclosure requirements; (2) organise training programmes and provide resources to manufacturing firms to enhance their capacity to implement and report CE practices through workshops, seminars, and access to technical information; (3) provide financial incentives such as tax credits and grants to encourage firms to invest in sustainable CE practices and report transparently on refurbishment and renewable energy initiatives; and (4) incorporate CE considerations, including refurbishment reporting, into corporate governance codes while instituting recognition programmes that reward firms demonstrating exemplary and internationally aligned CE practices.

Secondly, since renewable energy practices have a positive effect on return on total assets, policymakers may foster a regulatory environment that supports sustainable energy integration through several measures. These include (1) introducing incentives such as tax credits and subsidies to motivate firms to invest in renewable energy infrastructure; (2) instituting feed-in tariffs that guarantee fixed

payments for renewable energy generated by manufacturing firms; (3) simplifying permit processes for installing renewable energy systems to reduce bureaucratic barriers; (4) setting clear renewable energy standards requiring a proportion of firms' energy consumption to come from renewable sources; (5) encouraging public-private partnerships to support renewable energy projects; and (6) collaborating with financial institutions to create specialised financing programmes for renewable energy investments with favourable interest rates and repayment periods. In addition, encouraging firms to disclose renewable energy investments within sustainability and integrated reporting frameworks can enhance the credibility, comparability, and decision-usefulness of corporate reports for investors and regulators.

Lastly, the government should reinvigorate policies on recycling and dematerialisation to stimulate their adoption by manufacturing firms. Although these practices did not show a significant financial effect in this study, continued reporting of such initiatives remains important for comprehensive sustainability disclosure and long-term environmental accountability within corporate reporting frameworks.

The limitations include the restriction of scope to only the manufacturing sector of the Nigerian Exchange Group. Future studies may consider (1) conducting a longitudinal study to explore causality and temporal relationships between circular economy practices and financial performance in the manufacturing and other sectors such as financial services, oil and gas, and telecommunications; (2) examining the impacts of other CE practices on ESG performance; and (3) examining the moderating and mediating roles of macroeconomic factors such as interest rates and inflation on the relationship between CE practices and financial performance. Future research may also investigate the quality, extent, and comparability of circular economy disclosures in corporate sustainability and integrated reports to better understand how CE-related information is communicated to stakeholders. Additionally, scholars could explore how standardised business reporting frameworks influence firms' transparency in reporting circular economy initiatives and how such disclosures affect investor decision-making and corporate accountability.

Acknowledgement

The authors acknowledge the efforts of the anonymous reviewers for their insightful comments on the manuscript, which helped in improving the quality of the paper.

Conflict of Interest

There is no conflict of interest involved in the publication of this article

References

- Adams, C. A. (2015). The international integrated reporting council: A call to action. *Critical Perspectives on Accounting*, 27, 23–28.
- de Villiers, C., Hsiao, P. C. K., & Maroun, W. (2020). Developing a conceptual model of influences around integrated reporting. *Meditari Accountancy Research*, 28(5), 1–23.
- Eccles, R. G., & Krzus, M. P. (2018). *The Nordic model: An analysis of leading practices in ESG disclosure and performance*. Nordic Council of Ministers.
- Abd Rahman, N. R., Rasid, S. Z. A., & Basiruddin, R. (2014). Exploring the relationship between carbon performance, carbon reporting and firm performance: A conceptual paper. *Procedia-Social and Behavioral Sciences*, 164, 118-125.
- Accenture. (2020). *Winning in a circular economy: Practical steps for the European chemical industry*. Retrieved from https://www.accenture.com/_acnmedia/PDF-117/Accenture-Winning-In-A-Circular-Economy-Executive-Summary.pdf&ved
- African Union (2024). Continental circular economy action plan for Africa (2024-2034). AU
- Andersen, M. S. (2007). An introductory note on the environmental economics of the circular economy. *Sustainability Science*, 2(1), 133-140.
- Brunori, C., Cremisini, C., Massanisso, P., Pinto, V., & Torricelli, L. (2005). Reuse of a treated red mud bauxite waste: studies on environmental compatibility. *Journal of Hazardous Materials*, 117(1), 55-63.
- Buallay, A., Fadel, S. M., Al-Ajmi, J. Y., & Saudagaran, S. (2020). Sustainability reporting and performance of MENA banks: is there a trade-off? *Measuring Business Excellence*, 24(2), 197-221.
- Cordella, M., Alfieri, F., Sanfelix, J., Donatello, S., Kaps, R., & Wolf, O. (2020). Improving material efficiency in the life cycle of products: a review of EU ecolabel criteria. *The International Journal of Life Cycle Assessment*, 25, 921-935.
- Corvellec, H., Stowell, A.F., & Johansson, N. (2022). Critiques of the circular economy. *Journal of Industrial Ecology*, 26(2), 421-432.
- Dantas, T.E., De-Souza, E.D., Destro, I. R., Hammes, G., Rodriguez, C.M.T., & Soares, S. R. (2021). How the combination of circular economy and industry 4.0 can contribute towards achieving sustainable development goals. *Sustainable Production and Consumption*, 26, 213-227.

- de Oliveira, R. T., Ghobakhloo, M., & Figueira, S. (2023). Industry 4.0 towards social and environmental sustainability in multinationals: Enabling circular economy, organizational social practices, and corporate purpose. *Journal of Cleaner Production*, 139712.
- Eccles, R. G., & Krzus, M. P. (2018). *The Nordic model: An analysis of leading practices in ESG disclosure and performance*. Cambridge, MA: Harvard Business School.
- Ellen MacArthur Foundation. (2012). Towards the Circular Economy. Economic and business rationale for an accelerated transition (Vol. 1).
- Ellen MacArthur Foundation (2021). *Completing the picture: How the circular economy tackles climate change*. Ellen Macarthur Foundation
- Esposito, B., Raimo, N., Malandrino, O., & Vitolla, F. (2023). Circular economy disclosure and integrated reporting: The role of corporate governance mechanism. *Business Strategy and the Environment*, 32(8), 5403-5419.
- Ezeudu, O., & Kennedy, C. (2024). Insights and dynamics of circular business model in developing countries' context: The empirical analysis of the returnable glass bottles process. *Business Strategy & Development*, 7(1), 349.
- Ezeudu, O.B., & Ezeudu, T.S. (2019). Implementation of circular economy principles in industrial solid waste management: Case studies from a developing economy (Nigeria). *Recycling*, 4(4), 42. Retrieved from <https://doi.org/10.3390/recycling4040042>
- Fatihudin., D., Jusni, & Mochklas, M. (2018). How measuring financial performance. *International Journal of Civil Engineering and Technology*, 9(6), 553-557.
- Galant, A., & Cadez, S. (2017). Corporate social responsibility and financial performance relationship: A review of measurement approaches. *Economic Research-Ekonomska Istrazivanja*, 30(1), 676-693.
- Ganda, F., & Milondzo, K. S. (2018). The impact of carbon emissions on corporate financial performance: Evidence from the South African firms. *Sustainability*, 10(7), 2398.
- García-Barragán, J. F., Eyckmans, J., & Rousseau, S. (2019). Defining and measuring the circular economy: a mathematical approach. *Ecological Economics*, 157, 369-372.
- Gaustad, G., Krystofik, M., Bustamante, M., & Badami, K. (2018). Circular economy strategies for mitigating critical material supply issues. *Resources, Conservation and Recycling*, 135, 24-33.
- Geissdoerfer, M., Pieroni, M.P.P., Pigosso, D.C.A., Soufani, K. (2020). Circular business models: A review. *Journal of Cleaner Production*, 277, 1-17.
- Gonçalves, B.d.S.M., Carvalho, F.L.d., & Fiorini, P.d.C. (2022). Circular economy and financial aspects:A systematic review of the literature. *Sustainability*,14,3023. <https://doi.org/10.3390/su14053023>

- Grafstrom, J., & Aasma, S. (2021). Breaking circular economy barriers. *Journal of Cleaner Production*, 292, 1-25. doi:10.1016/J.JCLEPRO.2021.126002
- Guney,T.(2019). Renewable energy, non-renewable energy and sustainable development. *International Journal of Sustainable Development & World Ecology*, 26(5), 389-397.
- Hysa, E., Kruja, A., Rehman, N.U., & Laurenti, R. (2020). Circular economy innovation and environmental sustainability impact on economic growth: An integrated model for sustainable development. *Sustainability*,12(12), 1-16.
- Inglesi-Lotz, R. (2016). The impact of renewable energy consumption to economic groth: A panel data application. *Energy Economics*, 53, 58-63.
- Kasulaitis, B. V., Babbitt, C. W., & Krock, A. K. (2019). Dematerialization and the circular economy: Comparing strategies to reduce material impacts of the consumer electronic product ecosystem. *Journal of Industrial Ecology*, 23(1), 119-132.
- Khan, P.A., Johl, S.K., & Akhtar, S. (2021). Firm sustainable development goals and firm financial performance through the lens of green innovation practices and reporting: A proactive approach. *Journal of Risk and Financial Management*,14, 1-24. Retrieved from <https://doi.org/10.3390/jrfm14120605>
- Korhonen, J., Honkasalo, A., & Seppala, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics*, 143, 37-46.
- Kravchenko, M., Pigosso, D. C., & McAloone, T. C. (2019). Towards the ex-ante sustainability screening of circular economy initiatives in manufacturing companies: Consolidation of leading sustainability-related performance indicators. *Journal of Cleaner Production*, 241, 118318.
- Kumar, P., & Ghodeswar, B. M. (2015). Factors affecting consumers' green product purchase decisions. *Marketing Intelligence & Planning*, 33(3),330-347.
- Kuo, L., & Chang, B. G. (2021). The affecting factors of circular economy information and its impact on corporate economic Sustainability-Evidence from China. *Sustainable production and consumption*, 27, 986-997.
- Kwarteng, A., Simpson, S. N. Y., & Agyenim-Boateng, C. (2022). The effects of circular economy initiative implementation on business performance: the moderating role of organizational culture. *Social Responsibility Journal*, 18(7), 1311-1341.
- Ma, W., Hao, J. L., Zhang, C., Di Sarno, L., & Mannis, A. (2023). Evaluating carbon emissions of China's waste management strategies for building refurbishment projects: contributing to a circular economy. *Environmental Science and Pollution Research*, 30(4), 8657-8671.
- Massaro, M., Secinaro, S., Dal-Mas, F., Brescia, V., & Calandra, D. (2021). Industry 4.0 and circular economy: An exploratory analysis of academic and practitioners' perspectives. *Business Strategy and the Environment*, 30(2),1213-1231.

- Mazzucchelli, A., Chierici, R., Del Giudice, M., & Bua, I. (2022). Do circular economy practices affect corporate performance? Evidence from Italian large-sized manufacturing firms. *Corporate Social Responsibility and Environmental Management*, 29(6), 2016-2029.
- Mochalova, L. A. (2020). Circular economy in the context of implementing the concept of sustainable development. *Journal of New Economy*, 21(4),5-27.
- Moric, I., Jovanovic, J. S., Dokovi - c, R., Pekovic, S., & Perovic, D. (2020). The effect of phases of the adoption of the circular economy on firm performance: Evidence from 28 EU countries. *Sustainability*, 12(6), 2557
- Morton, S., Pencheon, D., & Squires, N. (2017). Sustainable development goals (SDGs) and their implementation. *British Medical Bulletin*, 124, 81-90. doi:10.1093/bmb/ldx031
- Mutezo, G., & Mulopo, J. (2021). A review of Africa's transition from fossil fuels to renewable energy using circular economy principles. *Renewable and Sustainable Energy Reviews*, 137. Retrieved from <https://doi.org/10.1016/j.rser.2020.110609>
- Nasrollahi, M., Beynaghi, A., Mohamady, F.M., & Mozafari, M. (2020). Plastic packaging, recycling, and sustainable development. *Responsible Consumption and Production*, 544-551.
- Odia, U. (2022). Impact of recycling sustainability on organizational performance. *Linguistics and Culture Review*, 6(1), 93-105.
- Ogiemwonyi, O., & Eneizan, B. (2024). Environmental ethics and green practices in the manufacturing sector: The role of green innovation and environmental policy. In *Natural Resources Forum*. Oxford, UK: Blackwell Publishing Ltd.
- Ogunmakinde, O.E., Egbelakin, T., & Sher, W. (2022). Contributions of the circular economy to the UN sustainable development goals through construction. *Resources, Conservation and Recycling*, 178,1-38. doi:10.1016/j.resconrec.2021.106023
- Ogunsanwo, A. O.-B. (2020). *Circular economy: A prototype for sustainable development in Nigeria*. The Tenth International Conference on Engaged Management Scholarship. doi:10.2139/ssrn.3687567
- Omar, A. O. (2020). *Effect of circular economy practices on supply chain performance of chemical and allied sector firms in Kenya* (Doctoral dissertation, University of Nairobi).
- Onogwu, D. J. (2019). *An essay on the transition to circular economy in Nigeria*. Lagos: Oak Business School.
- Organisation for Economic Co-operation and Development[OECD]. (2019). *Global Material Resources Outlook to 2060 Economic Drivers and Environmental Consequences*. OECD Publishing.
- OECD (2024). Material resources: Material resources. OECD Environment Statistics (database), <https://doi.org/10.1787/data-00695-en> (accessed on 19 August 2024).

- Orji, I. J., U-Dominic, C. M., & Okwara, U. K. (2022). Exploring the determinants in circular supply chain implementation in the Nigerian manufacturing industry. *Sustainable Production and Consumption*, 29, 761-776.
- Pinto, L. (2020). Green supply chain practices and company performance in Portuguese manufacturing sector. *Business Strategy and the Environment*, 29(5), 1832-1849.
- Rajput, J., Potgieter, J., Aigbokhan, G., Felgenhauer, K., Smit, T.A.B., Hemkhaus, M.,... McGovern, M. (2020). *Circular economy in Africa- EU cooperation: Country report for Nigeria*. Luxembourg: European Union.
- Raybould, B., Cheung, W. M., Connor, C., & Butcher, R. (2020). An investigation into UK government policy and legislation to renewable energy and greenhouse gas reduction commitments. *Clean Technologies and Environmental Policy*, 22, 371-387.
- Rehman-khan, S.A., Yu, Z., Sarwat, S., Godil, D. I., Amin, S., & Shujaat, S. (2022). The role of block chain technology in circular economy practices to improve organisational performance. *International Journal of Logistics Research and Applications*, 25(4-5), 605-622.
- Sarfraz, M., Ivascu, L., Artene, A.E., Bobitan, N., Dumitrescu, D., Bogdan, O., & Burca, V. (2023). The relationship between firm's financial performance and performance measures of circular economy sustainability: An investigation of the G7 countries. *Economic Research-Ekonomiska Istrazivanja*, 36(1), 1-28. Retrieved from <https://doi.org/10.1080/1331677x.2022.2101019>
- Sariatli, F. (2017). Linear economy versus circular economy: A Comparative and analyzer study for optimization of economy for sustainability. *Visegrad Journal on Bioeconomy and Sustainable Development*, 6(1), 31-34.
- Sharma, N. K., Govindan, K., Lai, K. K., Chen, W. K., & Kumar, V. (2021). The transition from linear economy to circular economy for sustainability among SMEs: A study on prospects, impediments, and prerequisites. *Business Strategy and the Environment*, 30(4), 1803-1822.
- Skrinjaric, T. (2020). Empirical assessment of the circular economy of selected European countries. *Journal of Cleaner Production*, 255.
- Sony, A., Ferguson, D., & Beise-Zee, R. (2015). How to go green: Unraveling green preferences of consumers. *Asia-Pacific Journal of Business Administration*, 7(1), 56-72.
- Stahel, W. R. (2016). The circular economy. *Nature*, 531(7595), 435-438.
- Shavkatov, N., Abdurakhimova, D., Sherkuziyeva, N., Omonov, S., & Rakhmedova, M. (2024). Circular economy practices and their effect on corporate financial performance. *Economic Annals-XXI*, 207(1-2), 4-9. doi: <https://doi.org/10.21003/ea.V207-01>
- Su, B., Heshmati, A., Geng, Y., & Yu, X. (2013). A review of the circular economy in China: moving from rhetoric to implementation. *Journal of Cleaner Production*, 42, 215-227.

- Taouab, o., & Issor, Z. (2019). Firm performance : Definition and measurement models. *European Scientific Journal*, 15(1). doi:10.19044/esj.2019.v15nlp93
- Uhrenholt, J. N., Kristensen, J. H., Gil, M. C. R., Jensen, S. F., & Waehrens, B. V. (2022). Circular economy: Factors affecting the financial performance of product take-back systems. *Journal of Cleaner Production*, 130319
- United Nations Framework Convention o Climate Change[UNFCCC]. (2019). *Circular economy crucial for Paris climate goals*. Retrieved from <https://unfccc.int/news/circular-economy-crucial-for-paris-climate-goals>
- Uvarova,I., Atstaja,D., Volkova,T., Grasis,J.,& Ozolina-Ozola,I. (2023). The typology of 60R circular economy principles and strategic orientation of their application in business. *Journal of Cleaner Production*,10,137189 <https://doi.org/10.1016/j.jclepro.2023.137189>
- Valavanidis, A. (2018). Concept and practice of the circular economy. *Scientific Reviews*, 1-29. Retrieved from <https://www.researchgate.net/publication/326625684>
- Wang, P., Che, F., Fan, S., & Gu, C. (2014). Ownership governance, institutional pressures and circular economy accounting information disclosure: An institutional theory and corporate governance theory perspective. *Chinese Management Studies*, 8(3), 487-501.
- Yildirim, S. (2022). The consumer role for sustainable development: How consumers contribute to sustainable development goals. In *Research Anthology on Measuring and Achieving Sustainable Development Goals* (pp. 872-888). IGI Global.
- Yu, Z., Khan, S. A. R., & Umar, M. (2022). Circular economy practices and industry 4.0 technologies: A strategic move of automobile industry. *Business Strategy and the Environment*, 31(3), 796-809
- Zheng Liu, Nick Clifton, Homeira Faqdani, Songdi Li & Gary Walpole (2025).Implementing circular economy principles: evidence from multiple cases. *Production, Planning and Control, The Management of Operations* 36(13), <https://doi.org/10.1080/09537287.2024.2415417>