International Journal of Development and Economic Sustainability, 14 (1), 1-32, 2026
Print ISSN: 2053-2199 (Print),
Online ISSN: 2053-2202(Online)
Website: https://www.eajournals.org/
Publication of the European Centre for Research Training and Development -UK

Exploring How Innovative Capacity Moderates the Relationship Between Circular Economy Practices and Financial Performance of Listed Manufacturing Firms in Nigeria

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doi: https://doi.org/10.37745/ijdes.13/vol14n1132 Published February 01, 2026

Citation: Appah E. (2026) Exploring How Innovative Capacity Moderates the Relationship Between Circular Economy Practices and Financial Performance of Listed Manufacturing Firms in Nigeria, *International Journal of Development and Economic Sustainability*, 14 (1), 1-32

Abstract: *This study investigates circular economy practices (CEP) and financial performance (FP) and the moderating role of innovative capacity in strengthening this link in Nigeria. The study employed a survey research design from a population of 42 listed consumer and industrial goods manufacturing companies on the Nigerian Exchange Group as of December 31, 2025. The unit of analysis for the study was 1250 knowledgeable and competent staff members within the production, marketing, and accounting departments of the 25 sampled manufacturing companies, and a sample size of 303 was derived using Taro Yamene formula. Primary and secondary data were used. The primary data was collected from a structured questionnaire after reliability and validity tests. The responses obtained from the administered questionnaires were analysed using descriptive statistics, correlation matrix and multiple regression analysis. The findings revealed a significantly positive relationship between resource efficiency, product life cycle, waste management and circular material use on the financial performance of manufacturing firms in Nigeria. Additionally, innovative capacity positively and significantly moderates the link between CEP and FP. This suggests that innovation acts as a strategic enabler, enhancing the effectiveness and profitability of circular practices. The study contributes to the growing literature on sustainable business strategies by highlighting the synergistic role of innovation in maximising the economic benefits of circularity. Implications for managers and policymakers, limitations, and directions for future research were also discussed.*
Keywords: circular economy, innovative capacity, financial performance, manufacturing firms, Nigeria.

INTRODUCTION

The global economy is growing, and the atmosphere is being polluted and degraded daily due to the urbanization of society. According to Fernandes and Ferrão (2023), the fast growth of urban

populations, tied with unsustainable production and consumption practices entrenched in the linear "take-make-use-waste" pattern, has transformed urban areas into centres of resource consumption, waste and emissions. Paiho et al (2020) argue that urban zones today contribute about three-quarters of worldwide resource use, greenhouse gas (GHG) emissions and solid waste generation, thereby contributing to severe ecological difficulties at local, regional and international scales, comprising air and water pollution, global warming and ecosystem degradation. Gonçalves, et al (2022) contend that the existing economic system is largely based on a linear logic for finding capital: extraction of natural resources, production, consumption, and, finally, disposal. The authors further noted that if we live in an economy based on linear production and consumption processes, the destruction of environments, the loss of biodiversity, and consequences such as climate change and water and air pollution will continue, causing irreversible changes that render it difficult to sustain life on planet Earth. Ferasso et al. (2020) uphold that providing further justifiable business models to enhance the use of inputs and the handling of the waste formed becomes a thing of interest to members of society. Hence, the concept of circular economy comes into play, as it provides a link between the use of resources and waste disposal, thus converting the linear system into a circular system. Agarwal and Ojha (2024), Awan and Sroufe (2022), and Kristensen, and Mosgaard (2020) assert that the concept of a circular economy has gained significant attention in recent years as a promising method to address pressing ecological challenges. According to Haar (2024), as universal resource use continues to intensify and the adverse effects of linear economic models become ever more apparent, policymakers and firms are turning to circular economy practices as an avenue of integrating economic growth with environmental sustainability.

The concept of Circular Economy (CE) has gained significant attention globally as a strategic pathway to achieving sustainable development by minimising waste and maximising resource efficiency (Petit-Boix et al., 2022). The CE is a concept encompassing a range of principles and system-wide innovations that aim to increase resource efficiency, maintain resource value, minimize waste and emissions, and build environmental, social and economic capital (Kristensen & Mosgaard, 2020; Voulvoulis, 2022). Circular economy (CE) is defined as an economic system grounded by business models that change the concept of linear logic through options such as recycling, reuse, use of renewable energy, and product design, operating from the micro sphere to a macro perspective (eco-industrial parks, cities, governments), thus forming a balance between the environment and economic prosperity (Khan et al, 2024). It comprises those activities aimed at recycling products at the end of their life cycle (Le et al., 2023). Furthermore, CE also includes activities to reduce input resources and reuse defective materials or products (Khan & Haleem, 2021). CE can help decrease the environmental effects of production activities and support businesses advance sustainably (Singh & Singh, 2019). Mazzucchelli et al. (2022) explored CE, including waste treatment, reduction and recycling, on financial performance. The outcome disclosed that CE improved financial performance through the moderating influence of brand reputation. Yu et al. (2022) established that CE positively influenced financial performance through the moderating influence of environmental and innovation performance. Likewise, CE also improves economic and sustainable performance (Chowdhury et al., 2022). Nguyen et al (2025) study of Vietnam revealed that CEP positively influence financial performance through the moderating influence of green innovation. The study also revealed that big data analytics also

positively influences the relationship between CEP and green innovation. In Nigeria, Ndem et al (2024) found that recycling and material recovery practices had a significant positive effect on financial sustainability among local firms, indicating that CE principles can improve economic outcomes even in resource-constrained environments.

For manufacturing firms, circular economy practices are particularly relevant because manufacturing activities are resource-intensive and generate significant waste. By adopting CE strategies such as product life cycle, material recovery, waste valorization and eco-design, manufacturers can reduce production costs, optimize resource use, and improve financial performance (Murray et al, 2017). Consequently, the association between CE and financial performance has become an emerging research area in both developed and developing economies (Esposito et al, 2024). The manufacturing sector covering industries such as cement, food processing, beverages, textiles, and consumer goods contribute significantly to GDP but also generate high levels of solid and industrial waste. Despite these challenges, CE adoption in Nigeria remains relatively low due to limited infrastructure, weak policy enforcement, and low awareness among firms (Adama et al, 2025). However, there are emerging initiatives aimed at promoting circular practices. For example, several manufacturing firms in Lagos, are adopting recycle, reuse, and eco-innovation strategies to cut production costs, and meet environmental standards (UNIDO, 2022). Therefore, CE adoption can enhance financial performance through cost savings, improved operational efficiency, enhanced corporate reputation, and access to new revenue streams.

Various studies explore CEP and financial performance to provide empirical evidence for researchers and policymakers. The results of these studies are still inconsistent. Some studies find that CEP has a positive influence on financial performance (Nguyen et al, 2025; Chen & Dagestani, 2023; Mazzucchelli et al., 2022; Yu et al., 2022), while others suggest that CEP has no influence or a nonlinear impact on financial performance (D'Angelo et al., 2023). Previous studies on the role of CEP on financial performance have been mainly conducted in developed countries (Halog & Anieke, 2021; Sarfraz et al., 2023). There are very few studies on the role of CEP on financial performance in developing countries because developing countries face technical barriers to applying CEP (Gedam et al., 2021). Globally, studies have established links between CE and improved financial performance (Esposito et al, 2024; Nguyen et al, 2025). However, in Nigeria, the literature is still emerging, and few studies have empirically explored this link within the manufacturing sector. The available studies (e.g., Ndem et al, 2024; Akinleye & Owoniya, 2024) often focus on sustainability reporting, not directly on CE practices and firm financial outcomes. Existing studies in Nigeria have not adequately explored how CE practices affect firm's performance. This lack of empirical evidence leaves a critical gap in understanding the economic value of circular practices in Nigeria's industrial landscape.

This study is justified by the growing need to understand how circular economy practices influence financial performance of manufacturing firms in Nigeria and the role of innovative capacity in strengthening this link. Although CE has been globally recognized for improving profitability, empirical evidence from Nigeria remains limited and inconsistent. Most existing studies focus on sustainability reporting or green practices (Akinleye & Owoniya, 2024; Ndem et al, 2024), with little attention to how firms' innovation capacities affect the financial outcomes of CE adoption. Given that many Nigerian manufacturing firms face resource constraints, weak infrastructure, and

limited technological capabilities (UNIDO, 2022), innovative capacity may determine whether CE practices translate into improved profitability and competitiveness. By examining innovative as a moderator factor, this study extends the resource-based view theory, offering theoretical and empirical insights into how internal capabilities influence sustainable performance. Practically, the study will guide managers and policymakers on how investing in innovation can enhance the economic benefits of circular economy initiatives in Nigeria's manufacturing sector. Consequently, this study explores the moderating influence of innovative capacity on the link between circular economy practices on the financial performance of listed manufacturing firms in Nigeria. The specific objectives of this study are as follows:

1. To investigate the relationship between resource efficiency and ROA and ROE of listed manufacturing firms in Nigeria.
2. To evaluate the relationship between product life cycle and ROA and ROE of listed manufacturing firms in Nigeria.
3. To ascertain the relationship between waste management and ROA and ROE of listed manufacturing firms in Nigeria.
4. To determine the relationship between circular material use and ROA and ROE of listed manufacturing firms in Nigeria.
5. Investigate the moderating effects of innovation capability on the relationship between circular economy practices and the profitability of listed manufacturing firms in Nigeria.

The following research questions were analysed in this study:

1. What is the relationship between resource efficiency and ROA and ROE of listed manufacturing firms in Nigeria?
2. What is the relationship between the product life cycle and ROA and ROE of listed manufacturing firms in Nigeria?
3. What is the relationship between waste management and ROA and ROE of listed manufacturing firms in Nigeria?
4. What is the relationship between circular material use and ROA and ROE of listed manufacturing firms in Nigeria?
5. Does innovation capability moderate the relationship between circular economy practices and the profitability of listed manufacturing firms in Nigeria?

The following null hypotheses were tested in this study:

Ho_1: There is no statistically significant relationship between resource efficiency and ROA and ROE of listed manufacturing firms in Nigeria.

Ho_2: There is no statistically significant relationship between product life cycle and ROA and ROE of listed manufacturing firms in Nigeria.

Ho3: There is no statistically significant relationship between waste management and ROA and ROE of listed manufacturing firms in Nigeria.

Ho4: There is no statistically significant relationship between circular material use and ROA and ROE of listed manufacturing firms in Nigeria.

Ho5: Innovation capability does not significantly moderate the relationship between circular economy practices and the profitability of listed manufacturing firms in Nigeria.

LITERATURE REVIEW

Conceptual Review

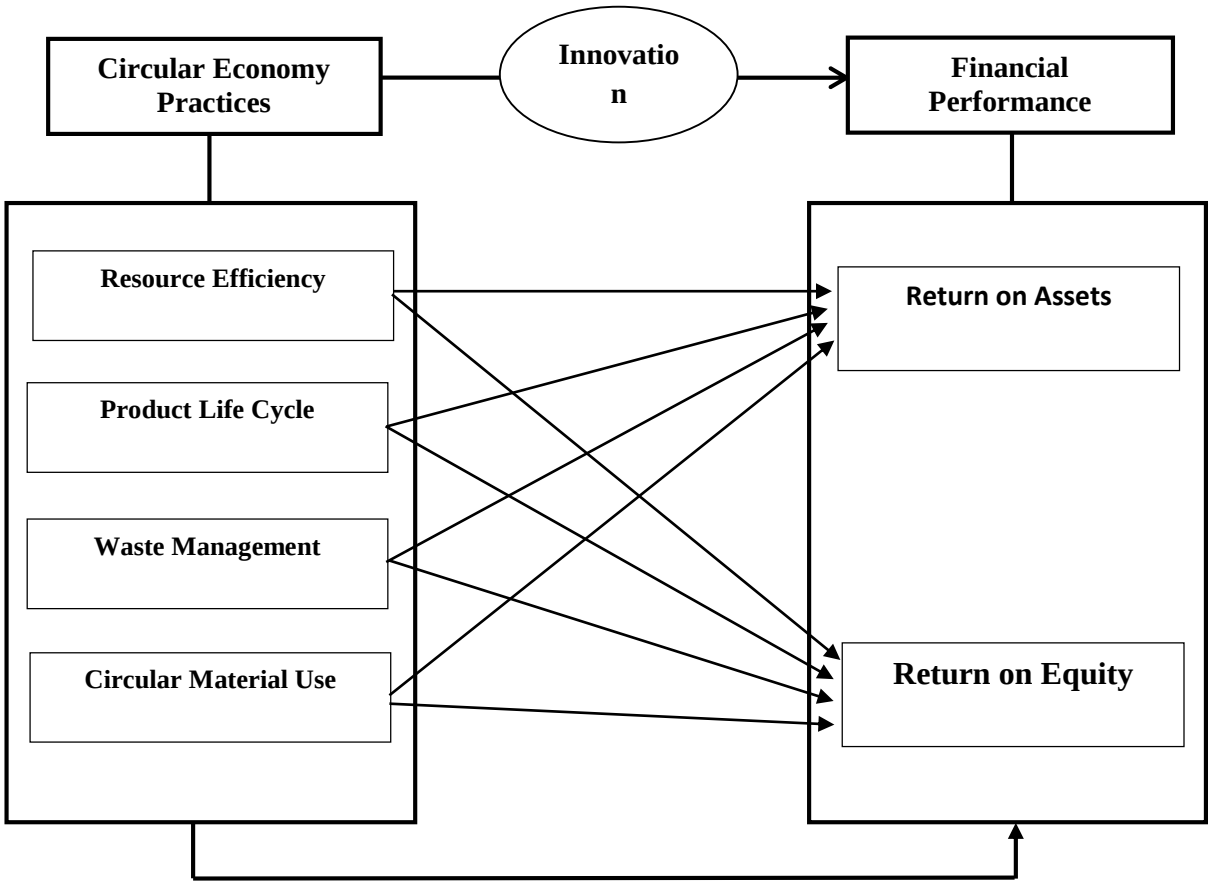

Figure 1: Conceptual Framework Authors Creation

Concept of Circular Economy: Circular economy is a business model that is designed to decouple economic growth from resource use by designing out waste, keeping products and materials in use for as long as possible, and regenerating natural systems (Ellen MacArtghur Foundation, 2013). According to Gonçalves et al (2022), it is an economic system based on commercial models that change the concept of linear logic through options such as recycling,

reuse, use of renewable energy, and product design, operating from the micro domain to a macro-outlook, hence forming an equilibrium between the environment and economic success. Khan et al (2024) described circular economy as an economy that offers several value creation instruments which are decoupled from the use of finite resources. The authors added that it is a method that would convert the function of resources into the economy. Waste from manufacturing firms would become a treasured input to another process – and products could be repaired, reused or upgraded instead of destroyed. D'Angelo et al (2023) suggest that circular economy is an economic and business system based on the recycling of products and raw materials, and the restorative volume of natural resources. Khan & Haleem (2021) argue that CEP are those activities in which ecological worries are unified into business processes. CEP is a system to encourage the development of economy and justifiable performance (Chau et al.,2023). Kristoffersen et al., (2021) maintain that in a circular economy, products and materials are condensed and recycled as much as possible. Nguyen et al (2025) stress that CE aims to attain best production by abating natural resource use and pollution emission concurrently, and lowest wastage by reprocessing the wastes from production and least pollution by reprocessing and reestablishing the technically unusable wastes. It is also observed that CE is a production and consumption model required to guarantee economic growth and sustainability (Benz, 2022; Di Vaio et al., 2022), established as another method to the existing linear business model (Uhrenholt et al., 2022). Gonçalves et al (2022) argue that this concept comprised of diverse dimensions, and it is probable to state that it correlates from significant environmental concepts, such as cradle to cradle, industrial ecology, industrial symbiosis, sustainable supply chain management, performance-based economy, and blue economy. The concept comprised three pillars of industrial ecology, clean production, and ecological modernization and it is categorized as being regenerative, intensifying natural capital, optimizing stocks and the production of resources, and showing potential for innovation, job generation, and economic growth. The circular economy can be promoted through government subsidies, effective legislation, economic incentives, and development and research. CEP allows business actions that are good for the economy, society, and the environment in many ways (Farrukh & Sajjad, 2024; Noja et al., 2024; Le et al., 2023). Chowdhury et al (2022) stress that CE practices comprised lean practices, sustainable oriented innovation and sustainable practices. A circular economy extends the traditional cycle of the resources involved in the pro duction through an extension of their life and so obtain results not only in reducing resources consumption and waste disposal but also in emissions and pollution with positive impact on financial, environmental, and social performance (Rodrıguez Espındola et al., 2022). Hence, as awareness of the impact of economic activities on the environment increased, the circular economy became a desirable model necessary to be adopted by firms (Sarfraz et al, 2022). Nevertheless, changing to this method is not an easy procedure, as physical industry barriers and institutional challenges have been acknowledged (Aloini et al., 2020; Tan et al., 2022).

Concept of Financial Performance: Financial performance is defined as the ability of a firm to maximize its cost of operations, efficiently use its assets and maximize the value of shareholders (Appah, 2023). It shows the effectiveness and efficiency of management in the use of corporate resources. It is further defined as the attempt by a firm to meet established goals or effectiveness of productivity. Also, it is a measure of the firm's earnings, profits and appreciation in its value, which is disclosed by the rise in the market value of shares (Appah & Tebepah, 2023). Dang and

Hieu (2024) state that performance is measured by three indicators. The first is financial performance measured by profit, return on assets (ROS), or return on investment (ROI). The second indicator is market performance, measured by market share and revenue. The third indicator is shareholder returns, measured by shareholder returns or the enterprise's added value. Nguyen et al (2025) argue that several reasons influence a firm's financial performance. Dang and Hieu (2024) analysed the reasons that influence financial performance, such as government support, innovation, quality management practices, and enterprise characteristics impact financial performance. Yu et al. (2022) found that CEP positively impacted financial performance through the mediating role of environmental and innovation performance. Zhai et al. (2022) examined the impact of digital transformation on firm performance, utilising data from Chinese enterprises. They found that digital transformation has a positive impact on enterprise performance. When enterprises implement digital transformation, they have lower costs, better efficiency in operation, and better innovation. These outcomes lead to improved financial performance (Alkaraan et al, 2023).

Concept of Innovative Capacity: Innovation capacity refers to the ability of firms to generate, adopt, and implement new ideas, technologies, or processes that lead to improved performance, competitiveness, and long-term growth. It encompasses both the resources and the capabilities that enable sustained innovation. Innovation capacity is a process and is a combination of several activities that could be investigated to improve financial performance. Oanh et al (2020) described innovative capacity as the ability to continuously transfer knowledge and ideas to create new systems, processes, and products that benefit firms. Sepulveda and Collazos (2023) argue that innovation capabilities are linked to the capability of firms to initiate, develop and achieve innovation results using the set of technological and organisational skills. Innovation capabilities are considered a special asset of a company. They are an important source of competitiveness to the extent that their exploitation enables the introduction of new products and the adoption of new processes. The innovation capabilities of firms are explained from different dimensions, such as learning capability, R&D capability, capability to take advantage of resources, manufacturing capability, marketing capability, firm capability, and strategic capability. Several existing studies show the link between innovation capacities and financial performance (Jalil et al, 2021). The study carried out by YuSheng and Ibrahim (2020) in Ghana on innovation capabilities and firm performance revealed a significantly positive correlation between innovation capabilities and firm performance in the banking sector.

Theoretical Review

This study is grounded on the Natural Resource-Based View (NRBV) theory, which is an extension of the traditional Resource-Based View (RBV) proposed by Hart (1995), highlights that an organization's long-term competitive advantage and superior performance depend on its ability to manage environmental resources effectively. The NRBV emphasizes strategic significance of developing capabilities that minimize environmental impacts and create value through sustainability-oriented innovation (Nguyen et al, 2025; Hart, 1995). According to the NRBV, organisations that integrate environmental considerations into their strategic resources can achieve sustained competitive advantage through three strategies of pollution prevention, product stewardship, and sustainable development (Hart, 1995). These strategies are directly relevant to

circular economy practices, which emphasise closing material loops, minimizing waste, promoting resource efficiency, and regenerating natural systems (Geissdoefer et al, 2017). In this context, pollution prevention is associated with CE philosophies by reducing waste and emissions at the source through cleaner production and eco-efficiency. Product stewardship reflects circular strategies such as eco-design, recycling, remanufacturing, and extended producer responsibility activities that ensure products are sustained throughout their life cycle (De Sousa Jabbour et al, 2019). Finally, sustainable development capabilities involve integrating environmental and social objectives into long-term business strategy, supporting corporate objectives with global sustainability framework (Esa et al, 2022). In this study, we use NRBV theory to suggest that organisations can generate financial benefits by leveraging environmental capabilities as strategic resources. Hence, implementing CE practices such as recycling and renewable resource utilization can reduce operational costs, minimize dependency on virgin materials, and foster innovation in product and process design (Geng et al, 2019). These outcomes translate into improved financial performance through cost savings, enhanced brand image, and market differentiation. In addition, the NRBV underscores the dynamic association between environmental sustainability and financial performance. As firms develop better circular capabilities, they build resilience to environmental risks, gain access to green markets, and attract sustainability-oriented investors – factors that contribute to long-term financial performance (Ludeke-Freund et al, 2020). Consequently, NRBV provides a theoretical foundation for connecting CE practices to financial performance. It posits that firms achieving excellence in managing natural resources through pollution prevent, product stewardship, and sustainable development can transform environmental responsibility into economic value.

Empirical Review

Nguyen et al (2025) explored the moderating effects of big data analytics on the link between circular economy, green innovation on financial performance in Vietnam. This study employed quantitative research with survey research design. The population comprised of manufacturing firms in Vietnam and 413 manufacturing firms, selected using stratified random sampling. Data for the study was obtained from primary and secondary sources. The study used circular economy practices as independent variable, financial performance as dependent variable comprising revenue, profit and return on assets, green innovation as mediating variable, big data analytics as moderator variable while quality management practice and firm size as control variables. The primary and secondary data collected were analysed using descriptive statistics, correlation analysis and regression analysis. The results from the analysis showed that circular economy practices positively influence financial performance through the mediating role of green innovation. Also, big data analytics positively influence the relationship between circular economy practices and green innovation. Furthermore, digital transformation positively influence financial performance, but quality management practices do not affect financial performance of manufacturing firms in Vietnam. Shavkatov et al (2024) investigated circular economy practices and financial performance of manufacturing firms in Europe. The study utilized a longitudinal design from 2018 to 2022. The sample covered 200 manufacturing firms, selected using stratified random sampling. Data for the study was collected from primary and secondary sources of sustainability reports, structured questionnaires, and third-party assessments. The study used

circular economy as the independent variable consisting of design for circularity, resource efficiency and waste reduction, reuse and remanufacturing, recycling and material recovery, and circular business models, the dependent variable of financial performance consisting of Return on Investment (ROI), profit margins (both gross and net), and Total Shareholder Return (TSR) and control variables of firm size, industry subsector, R&D intensity, leverage ratio, market-to-book ratio, and country-specific factors. The primary and secondary data were analysed using descriptive statistics, trend analysis and panel data analysis. The panel data regression analysis revealed a positive, statistically significant relationship between CEI (resource efficiency and waste reduction, reuse and remanufacturing, recycling and material recovery, and circular business models) and financial performance (Return on Investment (ROI), profit margins (both gross and net), and Total Shareholder Return (TSR). A one-point increase in CEI was associated with increases of 0.152 percentage points in ROI, 0.087 in Gross Profit Margin, 0.063 in Net Profit Margin, and 0.203 in Total Shareholder Return. These findings provide robust evidence in support of the business case for circular economy transitions in manufacturing, with implications for managerial decision-making and policy development in sustainable manufacturing. Chen & Dagestani, (2023) analysed circular economy practices and performance of firms in China. This study employed an ex post facto research design, and the population consisted of all listed manufacturing firms on the Shanghai and Shenzhen stock exchanges from 2009 to 2019, serving as the study sample. The data were mined from the China Stock Market and Accounting Research Database (CSMAR). The research used 14,969 firm-year observations. The data collected were analysed using descriptive statistics, correlation analysis and regression analysis. The results revealed that circular economy practices improve the performance of manufacturing firms using resource-based theory. Secondly, innovation and digital transformation strategies do strengthen the positive impact, and resource use efficiency improvements are the principal means for circular economy practices. Thirdly, firm heterogeneity influences circular economy practices on corporate performance, and only appropriate circular economy practices positively influence the firm performance of listed firms in Shanghai and Shenzhen stock exchanges for the period under review. Hence, the study concluded that circular economy practices are an effective model for sustainable corporate development. Dong et al (2022) investigated the mediating influence of environmental performance on the relationship between circular economy implementation and business performance in the Chinese energy production enterprises. The study tested whether there is a positive effect of the reduction, reuse and recycle principle on environmental performance (measured, e.g., by the emission level of air pollutants or discharge level of solid pollutants) and market and financial performance (measured by ROA, ROI and ROS) and whether environmental performance itself has a positive effect on market and financial performance. The findings revealed a positive and significant link between the circular economy and business performance, and that environmental performance mediates the link between circular economy and business performance of firms in China. Tang et al (2021) explored circular economy practices and business management strategies for environmental sustainability. The findings showed a slightly positive influence of CE practices such as green manufacturing, green design, remanufacturing and recycling on firms' economic and environmental performance and organisational effectiveness. Yu et al. (2022) examined the relationship between CE practices (for which ecological design and investment recovery are considered) and innovation, environmental and financial performance and found that "environmental and innovation performances mediate the positive effects of circular economy

practices on financial performance. Rodríguez-González et al. (2022) proved that financial performance can be affected by the implementation of CE practices. Also, the relatively small influence of CE performance on the financial performance of companies was proven by Sarfraz et al. (2023). As financial performance indicators, they used WACC and ROA, and as CE indicators, they used resource use, waste recycled, management systems and emissions. Kwarteng et al. (2022) explored CE practice of reducing, reusing, recycling, recovery, restoration of resources, distribution and consumption processes implementation on business performance. The findings suggested a positive link between CE practices and business performance. Li et al. (2022) examined circular economy practices and financial performance. The study used cross sectional survey design. The findings disclosed that circular economy practices such as reinvest, rethink and restore positively influence the financial performance of organisations. Ioannidis et al. (2021) investigated the reduce, reuse and recycle principles on short-term and long-term financial performance of the hospitality sector. The findings disclosed a positive influence of CE practices of reduction, reuse and recycle on both short-term and long-term financial performance in the hospital industry. Mazzucchelli et al. (2022) explored the connection between waste treatment, reduction and recycling and brand reputation and financial performance. The study used constructs that were measured using several scale items. For example, the financial performance construct was measured by five scale items such as productivity, market share or ROI. Not all hypotheses were confirmed; however, the research proved that reduction has a positive effect on financial performance.

METHODOLOGY

This study employs a quantitative research design, specifically a descriptive survey design, to investigate the moderating role of innovation capacity on the relationship between circular economy practices and the financial performance of listed manufacturing firms in Nigeria. The choice of this design is justified because it enables the investigator to collect empirical data from a larger number of participants and analyse the relationship between variables using statistical methods. The target population comprises the 42 listed consumer and industrial goods manufacturing companies on the Nigerian Exchange Group as of December 31, 2025. The unit of analysis for the study was 1250 knowledgeable and competent staff members within the production, marketing, and accounting departments of the 25 sampled manufacturing companies. These individuals were selected because they are directly involved in the implementation of the circular economy and can provide reliable insights into how such practices influence financial performance. The sample size of 303 was derived using Yamene's (1967) formula for sample size determination, ensuring a statistically adequate representation of the population. A simple random sampling technique was employed to give each member of the population an equal chance of being selected, thereby minimising errors (Appah, 2020). The study used primary data, collected through structured questionnaires. Secondary data was also sourced from academic journals, textbooks, and industry reports to support the empirical findings. The major instrument for data collection was a structured questionnaire, designed on a 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). The questionnaire was divided into four sections: section 1 comprising demographic information of respondents; section 2 consisting of circular economy practices of resource efficiency, product life cycle, waste management, and circular material use

adopted from Dong et al (2022), Khan et al (2021), Tang et al (2022), Yu et al (2022), Antonioli et al (2022), Kwarteng et al (2022), Li et al (2022), section 3 comprises of financial performance measures of ROA and ROE adopted from Bogdan et al. (2022), Antonioli et al (2022), Bartolacci et al (2018), Rodrıguez-Espındola et al (2022 and Section 4 consisting of innovation capacity adopted from Sepulveda and Collazos (2023), Jalil et al (2021), YuSheng and Ibrahim (2020), Phan et al (2024). The instrument was validated using content validity, where it was reviewed by academics and professionals (ICAN & ANAN) members in Yenagoa, Bayelsa State. Also, Cronbach's Alpha coefficient was used to ascertain the internal consistency of the instrument, with a benchmark of 0.83. The questionnaire was administered both physically (paper-based) and electronically (online form) to ensure wider coverage and a higher response rate. Follow-ups were made to increase participation. The data collected was coded and analysed using the Statistical Package for Social Sciences (SPSS). The analysis was performed using descriptive statistics (mean, standard deviation, frequencies) to summarise responses. Correlation analysis was performed to determine the strength and direction of the relationship between the variables, and regression analysis was performed to test the effect of the connection between the independent, dependent and moderator variables. This study is guided by the functional relationship to test the hypotheses as presented as follows:

$$ROA = \beta_0 + \beta_1 RSE + \beta_2 PLC + \beta_3 WAM + \beta_4 CMU + \beta_5 IVC + \beta_6 (RSE * IVC) + \beta_7 (PLC * IVC) + \beta_8 (WAM * IVC) + \beta_9 (CMU * IVC) + \varepsilon \quad \ldots\ldots (1)$$

$$ROE = \beta_0 + \beta_1 RSE + \beta_2 PLC + \beta_3 WAM + \beta_4 CMU + \beta_5 IVC + \beta_6 (RSE * IVC) + \beta_7 (PLC * IVC) + \beta_8 (WAM * IVC) + \beta_9 (CMU * IVC) + \varepsilon \quad \ldots\ldots (2)$$

Where:

RSE = Resource Efficiency, PLC = Product Life Cycle, WAM = Waste Management, CMU = Circular Material Use, INC = Innovation Capacity, ROA = Return on Assets, ROE = Return on Equity, $\beta_0 - \beta_4$ represent the regression coefficient; $\beta_5 - \beta_9$ represent the moderating effects coefficients, while ε represents the error term.

RESULTS AND DISCUSSION OF FINDINGS

This section evaluated the data from the field in the light of the objectives stated. It is an analysis of the empirical results obtained from primary data collected for this study. It discusses the moderating effect of innovative capacity on the relationship between circular economy practices and financial performance of manufacturing firms in Nigeria. The section is arranged in accordance with the objectives and hypotheses of the study.

Table 1: Questionnaire Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Number of Questionnaires Returned	215	71.0	71.0	71.0
	Number of Questionnaires not Return	76	25.1	25.1	96.1
	Number of Questionnaires not properly filed	12	3.9	3.9	100.0
	Total	303	100.0	100.0	

Table 1 showed that, the researcher distributed a total of 303 questionnaires to the 25 sampled manufacturing companies in Nigeria, out of these, 215 respondents representing 71.0% filled the questionnaires correctly and returned the questionnaires, whereas 76 respondents representing 25.1% did not returned the questionnaires while 12 respondents representing 3.9% filled the questionnaires wrongly and returned the questionnaires. Due to time constraints the researcher could not continue waiting for the respondents who were not available to return their questionnaire on the appointed date. Therefore, 215 representing a response rate of 71.0% was used as new respondents sample size for the study.

Demographic Analysis

This study was interested in the respondents' demographic data characteristics that include gender, working age, work experience, level of education and etc of the respondents drawn from accessible research population of manufacturing companies in Nigeria.

Table 2: Gender Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEMALE	62	28.8	28.8	28.8
	MALE	153	71.2	71.2	100.0
	Total	215	100.0	100.0	

The gender distribution presented above in table 2 show that one-hundred and fifty-two (152) respondents represented 71.2% of the total respondents were male, while the total number of female respondents was sixty-two (62) represented by 28.8% of the entire respondents. The margin in the ratio between the male and female showed that listed manufacturing companies in Nigeria employ more male than female due to the nature of work.

Table 3: Age Range

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 – 25 years	47	21.9	21.9	21.9
	26 – 35 years	75	34.9	34.9	56.8
	36 – 45 years	62	28.8	28.8	85.6
	46 – 55 years	31	14.4	14.4	100.0
	Total	215	100.0	100.0	

Results in Table 3 disclosed the age range of the respondents. 47 respondents representing 21.9% are between 18 – 25 years of age, 37 respondents representing 34.9% are 26 – 35 years, 62 respondents representing 28.8% are 36 – 45 years, and 31 respondents representing 14.4% are above 46 – 55 years. This implies that there was a good distribution of age among the target respondents in the listed manufacturing firms.

Table 4: Educational Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	OND/HND	35	16.3	16.3	16.3
	Bachelor's Degree	68	31.6	31.6	31.6
	Master's Degree	53	24.7	24.7	24.7
	Doctorate Degree	23	10.7	10.7	10.7
	Professional Certification	36	16.7	16.7	100.0
	Total	215	100.0	100.0	

Table 4 shows the educational background of the respondents, 35 of the respondents representing 16.3% have OND/HND qualification, 68 of the respondents representing 31.6% have bachelor's degree qualification, 53 of the respondents representing 24.7% have master's degree qualification, 23 of the respondents representing 10.7% have master's degree qualification and finally, 36 of the respondents representing 16.7% have Professional Certification. This implies that at least the respondents could understand the issues in the questionnaire concerning circular economy practices and financial performance of listed consumer and industrial sectors manufacturing firms in Nigeria.

Table 5: Department and Job Function

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Finance/Accounting	37	17.2	17.2	17.2
	Sustainability	56	26.0	26.0	43.2
	Operations/production	45	20.9	20.9	64.1
	General Management	52	24.2	24.2	88.3
	Others	25	11.7	11.7	100.0
	Total	215	100.0	100.0	

Results in table 5 disclosed the respondents' department and job function in the sampled firms. However, 37 respondents representing 17.2% belong to finance/accounting, 56 respondents representing 26.0% belong to Sustainability, 45 respondents representing 20.9% belong to operations/production, 52 respondents representing 24.2% belong to operations/production and 25 respondents representing 11.7% belong to other departments outside the above listed departments.

Table 6: Position in the Organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Officer/staff	85	39.5	39.5	39.5
	Supervisor	55	25.6	25.6	25.6
	Manager	32	14.9	14.9	14.9
	Executive/Director	25	11.7	11.7	11.7
	Consultant/Advisor	18	8.3	8.3	100.0
	Total	215	100.0	100.0	

Results in table 6 disclosed the respondents' position in the organization of the sampled manufacturing firms. However, 85 respondents representing 39.5% employed as Officer/staff, 55 respondents representing 25.6% employed as supervisors, 32 respondents representing 14.9% employed as manager, 25 respondents representing 11.7% employed as executive/director and finally, 18 respondents representing 8.3% employed as consultants.

Table 7: Years of Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	30	14.0	14.0	14
	1 – 5 years	42	19.5	19.5	33.5
	6 – 10 years	73	34.0	34.0	67.5
	11 – 15 years	45	20.9	20.9	88.4
	Over 15 years	25	11.6	11.6	100.0
	Total	215	100.0	100.0	

Results in table 7 disclosed the respondents' years of service in the sampled manufacturing firms. However, 30 respondents representing 14.0% had worked for less than 1 year, 42 respondents representing 19.5% had worked for 1 – 5 years, 73 respondents representing 34.0% had worked for 6 – 10 years. Also, 45 respondents representing 20.9% had worked for 11 – 15 years and finally, 25 respondents representing 11.6% had worked for Over 15 years.

Descriptive Analysis

In this part of the study, descriptive analysis has been done on the various variables and presented below. Using the Likert scale, the keys to the tables are as KEY: SA= Strongly Agree, A= Agree, UD= Undecided, D= Disagree, SD= Strongly Disagree

Table 8: Descriptive Statistics of Resource Efficiency

S/N	Items	N	Min	Max	Mean	Std. D
1	Our organization prioritizes the reuse and recycling of materials in production processes	215	1.00	5.00	3.164	1.321
2	We use renewable or recovered energy sources to reduce reliance on virgin energy inputs	215	1.00	5.00	3.352	1.243
3	Water is reused or recycled whenever possible in our operations.	215	1.00	5.00	3.218	1.428
4	Production and service processes are designed to minimize losses and waste generation	215	1.00	5.00	3.416	1.325
5	Our products are designed to be durable, repairable, and recyclable	215	1.00	5.00	3.532	1.315
Valid N (listwise)		**215**			**3.336**	**1.326**

Source: Field Survey (2025)

The results in table 8 presented the descriptive statistics of the mean and standard deviation responses on resource efficiency using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses on resource efficiency. Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.336; Std. D =1.326**) respectively.

Table 9: Descriptive Statistics of Product Life Cycle

S/N	Items	N	Min	Max	Mean	Std. D
1	Our products are designed for durability and long service life	215	1.00	5.00	3.241	1.383
2	Our manufacturing processes minimizes waste and maximise material efficiency	215	1.00	5.00	2.937	1.461
3	Our products are designed for easy maintenance and repair during use.	215	1.00	5.00	2.847	1.362
4	We use secondary (recycled) materials as inputs in production whenever possible	215	1.00	5.00	2.746	1.281
5	Our product materials and components are reused, recycled or remanufactured after collection.	215	1.00	5.00	3.416	1.263
Valid N (listwise)		**215**			**3.037**	**1.350**

Source: Field Survey (2025)

The results in table 9 presented the descriptive statistics of the mean and standard deviation responses on product life cycle using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses on product life cycle. Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.037; Std. D =1.350**) respectively.

Table 10: Descriptive Statistics of Waste Management

S/N	Items	N	Min	Max	Mean	Std. D
1	Our employees are trained and encouraged to reduce waste in daily operations	215	1.00	5.00	3.831	1.435
2	We segregate and recycle waste according to established circular economy standards.	215	1.00	5.00	3.237	1.613
3	Waste-to-energy or other recovery methods are used to extract value from waste.	215	1.00	5.00	3.142	1.412
4	We measure and track waste generation, recovery, and disposal rates.	215	1.00	5.00	3.834	1.315
5	Our organization continuously seeks innovative ways to reduce and manage waste more effectively	215	1.00	5.00	3.143	1.326
Valid N (listwise)		**215**			**3.437**	**1.420**

Source: Field Survey (2025)

The results in table 10 presented the descriptive statistics of the mean and standard deviation responses on waste management using five questionnaire items that were designed on a five-point

Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses on waste management. Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.437; Std. D =1.420**) respectively.

Table 11: Descriptive Statistics of Circular Material Use

S/N	Items	N	Min	Max	Mean	Std. D
1	Our organization prioritises the use of recycled and renewable materials in production.	215	1.00	5.00	2.943	1.314
2	Recycled or recovered materials are actively reintegrated into the production process	215	1.00	5.00	2.837	1.542
3	Circular materials are used in both products and packaging whenever feasible	215	1.00	5.00	3.526	1.543
4	We invest in developing new products or processes that use circular materials	215	1.00	5.00	3.462	1.412
5	Circular material use is a key performance indicator in our sustainability strategy.	215	1.00	5.00	3.812	1.363
Valid N (listwise)		**215**			**3.316**	**1.435**

Source: Field Survey (2025)

The results in table 11 presented the descriptive statistics of the mean and standard deviation responses on circular material use using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses of circular material use. Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.316 Std. D =1.435**) respectively.

Table 12: Descriptive Statistics of Return on Assets

S/N	Items	N	Min	Max	Mean	Std. D
1	Our organization achieves a high return on its total assets compared to industry benchmarks	215	1.00	5.00	3.423	1.426
2	The organization efficiently uses its assets to generate profits	215	1.00	5.00	2.675	1.524
3	Asset investments consistently contribute positively to overall financial performance	215	1.00	5.00	3.125	1.426
4	Management monitors and optimises asset utilization to improve returns	215	1.00	5.00	3.282	1.315
5	Our ROA performance shows consistent growth over time	215	1.00	5.00	3.428	1.386
Valid N (listwise)		**215**			**3.187**	**1.415**

Source: Field Survey (2025)

The results in table 12 presented the descriptive statistics of the mean and standard deviation responses on return on assets (ROA) using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses of return on assets (ROA). Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.187 Std. D =1.415**) respectively.

Table 13: Descriptive Statistics of Return on Equity

S/N	Items	N	Min	Max	Mean	Std. D
1	Our organization achieves high returns on shareholders' equity compared to industry benchmarks.	215	1.00	5.00	3.243	1.526
2	Equity investments are efficiently managed to maximise profitability	215	1.00	5.00	2.825	1.812
3	Management regularly monitors ROE to ensure financial performance	215	1.00	5.00	3.512	1.268
4	Our organisation's strategies consistently improve ROE over time.	215	1.00	5.00	3.352	1.531
5	Shareholder value is enhanced through effective utilization of equity capital.	215	1.00	5.00	3.412	1.643
Valid N (listwise)		**215**			**3.269**	**1.556**

Source: Field Survey (2025)

The results in table 13 presented the descriptive statistics of the mean and standard deviation responses on return on equity (ROE) using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses of return on equity (ROE). Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.269 Std. D =1.556**) respectively.

Table 14: Descriptive Statistics of Innovative Capacity

S/N	Items	N	Min	Max	Mean	Std. D
1	Our organization effectively implements innovative ideas into products, services, or processes	215	1.00	5.00	3.432	1.564
2	Innovation is recognized and rewarded within the organization.	215	1.00	5.00	3.453	1.623
3	Our organization adapts quickly to technological changes and market trends	215	1.00	5.00	3.412	1.534
4	We continuously explore new ideas to improve efficiency and competitiveness	215	1.00	5.00	3.352	1.642
5	Employees have the necessary skills and knowledge to contribute to innovation.	215	1.00	5.00	3.526	1.452
Valid N (listwise)		**215**			**3.435**	**1.563**

Source: Field Survey (2025)

The results in table 14 showed the descriptive statistics of the mean and standard deviation responses on innovative capacity using five questionnaire items that were designed on a five-point Likert scale. Thus, the questionnaire items labelled, and the mean and standard deviation of the five items were calculated to determine the overall mean and standard deviation responses of innovative capacity. Notwithstanding, all the items mean are above the cut-off point of 2.5. However, the grand mean and standard deviation responses on the questionnaire items disclosed (**Mean =3.435 Std. D =1.563**) respectively.

Table 15: Results of Correlation Matrix

	ROA	RSE	PLC	WAM	CMU	IVN
ROA Pearson Correlation	1					
Significant (2 tailed)	.000					
N	215					
RSE Pearson Correlation	.654**	1				
Significant (2 tailed)	.000	.000				
N	215	215				
PLC Pearson Correlation	.642**	.635**	1			
Significant (2 tailed)	.000	.000	.000			
N	215	215	215			
WAM Pearson Correlation	.682**	.642**	.764**	1		
Significant (2 tailed)	.000	.000	.000	.000		
N	215	215	215	215		
CMU Pearson Correlation	.728**	.645**	.658**	.642**	1	
Significant (2 tailed)	.000	.000	.000	.000	.000	
N	215	215	215	215	215	
IVC Pearson Correlation	.648**	.724**	.682**	.746**	.624**	1
Significant (2 tailed)	.000	.000	.000	.000	.000	.000
N	215	215	215	215	215	215

Source: Computed by Researcher's Via SPSS (2025)

The Pearson Product Moment Correlation Coefficient (PPMC) analysis in table 15 shows the relationship between circular economy practices and financial performance of listed manufacturing firms in Nigeria. The table shows a strong and positive relationship (r = 0.654, P = 0.00) between resource efficiency (RSE) and return on assets (ROA) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.642, P = 0.000) between product life cycle (PLC) and return on assets (ROA) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.682. P = 0.000) between waste management (WAM) and return on assets (ROA) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.728, P = 0.000) between circular material use (CMU) and return on assets (ROA) of listed manufacturing firms in Nigeria, and a strong and positive (r = 0.648, P = 0.000) between innovative capacity (IVC) return on assets (ROA) of listed manufacturing firms in Nigeria. The findings therefore revealed a strong and positive relationship between circular economy practices and financial performance (ROA) of listed manufacturing firms in Nigeria.

Table 16: Results of Correlation Matrix

	ROE	RSE	PLC	WAM	CMU	IVN
ROE Pearson Correlation	1					
Significant (2 tailed)	.000					
N	215					
RSE Pearson Correlation	.648**	1				
Significant (2 tailed)	.000	.000				
N	215	215				
PLC Pearson Correlation	.625**	.653**	1			
Significant (2 tailed)	.000	.000	.000			
N	215	215	215			
WAM Pearson Correlation	.647**	.628**	.743**	1		
Significant (2 tailed)	.000	.000	.000	.000		
N	215	215	215	215		
CMU Pearson Correlation	.684**	.652**	.683**	.626**	1	
Significant (2 tailed)	.000	.000	.000	.000	.000	
N	215	215	215	215	215	
IVC Pearson Correlation	.728**	.746**	.628**	.762**	.642**	1
Significant (2 tailed)	.000	.000	.000	.000	.000	.000
N	215	215	215	215	215	215

Source: Computed by Researcher's Via SPSS (2025)

The Pearson Product Moment Correlation Coefficient (PPMC) analysis in table 16 presented the relationship between circular economy practices and financial performance (ROE) of listed manufacturing firms in Nigeria. The table shows a strong and positive relationship (r = 0.648, P = 0.00) between resource efficiency (RSE) and return on equity (ROE) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.625, P = 0.000) between product life cycle (PLC) and return on equity (ROE) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.647. P =

0.000) between waste management (WAM) and return on equity (ROE) of listed manufacturing firms in Nigeria, a strong and positive (r = 0.648, P = 0.000) between circular material use (CMU) and return on equity (ROE) of listed manufacturing firms in Nigeria, and a strong and positive (r = 0.728, P = 0.000) between innovative capacity (IVC) return on equity (ROE) of listed manufacturing firms in Nigeria. The findings therefore suggested a strong and positive relationship between circular economy practices and financial performance (ROE) of listed manufacturing firms in Nigeria.

Table 17: Multiple Regression Analysis Model One
Dependent Variable: ROA
Method: Least Squares
Date: 12/20/25 Time: 13:12
Sample(adjusted): 1 215
Included observations: 215 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.736261	1.623524	2.301328	0.0273
RSE	1.423752	0.623728	2.282649	0.0372
PLC	1.553286	0.713246	2.177770	0.0384
WAM	1.754321	0.652348	2.689241	0.0271
CMU	1.646328	0.597486	2.755425	0.0284
IVC	1.573842	0.675324	2.330789	0.0373
RSE*IVC	1.465743	0.675324	2.170249	0.0342
PLC*IVC	1.467584	0.643983	2.263983	0.0352
WAM*IVC	1.356534	0.568756	2.385089	0.0325
CMU*IVC	1.476532	0.715324	2.064144	0.0324

R-squared	0.686532	Mean dependent var	12.99346
Adjusted R-squared	0.556432	S.D. dependent var	3.098167
S.E. of regression	2.718266	Akaike info criterion	4.997962
Sum squared resid	1234.711	Schwarz criterion	5.116803
Log likelihood	-3126.3441	F-statistic	5.654328
Durbin-Watson stat	2.5463248	Prob(F-statistic)	0.000000

Source: e-view output

Table 17 revealed the multiple regression analysis for the moderating influence of innovative capacity on the association between circular economy practices and financial performance (ROA) of manufacturing firms in Nigeria. The findings revealed a significantly positive (0.0372 < 0.05) relationship between resource efficiency (RSE) and financial performance (ROA) of manufacturing firms in Nigeria, a significantly positive (0.0384 < 0.05) relationship between product life cycle (PLC) and financial performance (ROA) of manufacturing firms in Nigeria, a significantly positive (0.271 < 0.05) association between waste management and financial performance (ROA) of manufacturing firms in Nigeria, and a significantly positive (0.0284 < 0.05) relationship between circular material use (CMU) and financial performance (ROA) of manufacturing firms in Nigeria. Hence, that there is a significantly positive relationship between circular economy practices and financial performance (ROA) of manufacturing firms in Nigeria. The R^2 (coefficient of determination) of 0.686532 and adjusted R^2 of 0.556432 shows that the variables combined determines about 69% and 56% of circular economy practices and financial performance (ROA) of manufacturing firms in Nigeria. The multiple regression analysis also

indicated that the moderator variable of innovative capacity (IVC) positively and significantly moderates the relationship between resource efficiency, product life cycle (PLC), waste management (WAM) and circular material use (CMU) with p-values of 0.0342, 0.0352, 0.0325 and 0.0324 < 0.05. Hence, innovative capacity moderates significantly positive association between circular economy practices and financial performance (ROA) of manufacturing firms in Nigeria. The F-statistics and its probability shows that the regression equation is well formulated explaining that the relationship between the independent variables combined affects financial performance (ROA) in Nigeria are statistically significant (F-stat = 5.654328; F-pro. = 0.000000).

Table 18: Multiple Regression Analysis Model One
Dependent Variable: ROE
Method: Least Squares
Date: 12/21/25 Time: 14:28
Sample(adjusted): 1 215
Included observations: 215 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.736261	1.623524	2.301328	0.0273
RSE	1.423752	0.623728	2.282649	0.0342
PLC	1.553286	0.713246	2.177770	0.0354
WAM	1.754321	0.652348	2.689241	0.0253
CMU	1.646328	0.597486	2.755425	0.0246
IVC	1.573842	0.675324	2.330789	0.0352
RSE*IVC	1.465743	0.675324	2.170249	0.0364
PLC*IVC	1.467584	0.643983	2.263983	0.0342
WAM*IVC	1.356534	0.568756	2.385089	0.0342
CMU*IVC	1.476532	0.715324	2.064144	0.0345

R-squared	0.662384	Mean dependent var	12.99346
Adjusted R-squared	0.542472	S.D. dependent var	3.098167
S.E. of regression	2.718266	Akaike info criterion	4.997962
Sum squared resid	1234.711	Schwarz criterion	5.116803
Log likelihood	-3126.3441	F-statistic	5.429318
Durbin-Watson stat	2.5463248	Prob(F-statistic)	0.000000

Source: e-view output

Table 18 presented the multiple regression analysis for the moderating influence of innovative capacity on the association between circular economy practices and financial performance (ROE) of manufacturing firms in Nigeria. The findings revealed a significantly positive (0.0342 < 0.05) relationship between resource efficiency (RSE) and financial performance (ROE) of manufacturing firms in Nigeria, a significantly positive (0.0354 < 0.05) relationship between product life cycle (PLC) and financial performance (ROA) of manufacturing firms in Nigeria, a significantly positive (0.0253 < 0.05) association between waste management and financial performance (ROE) of manufacturing firms in Nigeria, and a significantly positive (0.0246 < 0.05) relationship between circular material use (CMU) and financial performance (ROA) of manufacturing firms in Nigeria. Hence, that there is a significantly positive relationship between circular economy practices and financial performance (ROE) of manufacturing firms in Nigeria. The R^2 (coefficient of determination) of 0.662384 and adjusted R^2 of 0.542472 shows that the variables combined determines about 66% and 54% of circular economy practices and financial

performance (ROE) of manufacturing firms in Nigeria. The multiple regression analysis also indicated that the moderator variable of innovative capacity (IVC) positively and significantly moderates the relationship between resource efficiency, product life cycle (PLC), waste management (WAM) and circular material use (CMU) with p-values of 0.0364, 0.0342, 0.0342 and 0.0345 < 0.05. Hence, innovative capacity moderates significantly positive association between circular economy practices and financial performance (ROE) of manufacturing firms in Nigeria. The F-statistics and its probability shows that the regression equation is well formulated explaining that the relationship between the independent variables combined affects financial performance (ROE) in Nigeria are statistically significant (F-stat = 5.429318; F-pro. = 0.000000).

Discussion of Findings

Resource Efficiency and Financial Performance: The findings of this study revealed a positive and significant link between resource efficiency and financial performance of listed manufacturing firms in Nigeria. This study is supported by Safiri and Nani (2020) study which found that eco-efficiency has a positive and significant effect on financial performance for Indonesian firms. The study showed a strong positive link between eco-efficiency and ROA. In a study carried out by Noor et al (2022), the finding shows a positive effect of eco-efficiency on firm value. Malapa and Ngwakwe (2025) study of eco-efficiency on ROA listed manufacturing firms in Johannesburg Stock Exchange revealed that eco-efficiency has a negative and significant effect on ROA. Issa et al (2023) also investigating efficiency and financial performance found a negative and significant association between eco-efficiency and financial performance. However, some studies have presented a negative or no link between resource efficiency and financial performance. Septianninggrum (2022) found a negative significant link between eco-efficiency and firm value. The findings of this study provide tangible mechanisms for cost optimization. By reducing material use, minimizing energy consumption, and lowering waste, firms can improve margins and increase ROA and ROE. Operational managers should continuously monitor key performance indicators associated with resource consumption to capitalize on financial gains.

Product Life Cycle and Financial Performance: The results of this study revealed a positive and significant link between product life cycle and financial performance of listed manufacturing firms in Nigeria. This study is supported by Omaliko et al (2022), Al Rasyid et al (2022), Gao et al (2023), Visnjic et al (2021) that found a significant positive link between PLC stages and financial performance of firms. However, some other studies (e.g., Mohammad et al, 2024; Amin et al, 2023; Nova et al, 2024) conducted revealed a negatively significant connection between PLC stages and financial performance. The findings of a significantly positive relationship between product life cycle (PLC) and financial performance of listed manufacturing firms in Nigeria suggests that a company's ability to manage its products across diverse PLC stages has direct and vital financial implications. In other words, as firms effectively navigate the PLC stages, they experience measurable improvements in financial results. Hence, the results emphasize that successful PLC management contributes expressively to the financial health of organisations. Therefore, firms that monitor their PLC strategies are more likely to improve financial strength.

Waste Management and Financial Performance: The results of this study revealed a positive and significant link between waste management and financial performance of listed manufacturing

firms in Nigeria. The findings of this study concur with the studies of Dulshan and Nayanajith (2025), Ogbulafor et al (2025), and Gull et al (2022) that found a significant positive correlation between waste management practices and financial performance. But some studies (e.g., Etuk et al, 2024; De Haan and Peeters, 2024; Kornom-Gbarabe and Chukwuemeka, 2022) showed a negative association between waste management practices and financial performance. Hence, the finding suggests that waste management practices, when properly implemented, are a value-creating activity. Firms that proactively manage waste gain both financial and reputational advantages, explaining the statistically significant positive link observed in the study.

Circular Material Use and Financial Performance: The results of this study revealed a positive and significant association between circular material use and financial performance of listed manufacturing firms in Nigeria. The findings of this study concur with the investigation carried out by Dzomonda and Fatoki (2021), Mazzucchelli et al (2022), Serrano et al (2024), Yin et al (2023, Phan et al (2024)) that circular economy practices significantly impact on the financial performance of firms. Nevertheless, several other studies showed a negative effect of circular economy practices and financial performance. Ilyas and Huq (2023) investigated circular economy adoption and firm performance. The study found no significant improvement and, in some cases, negative connection with financial performance. In a study carried out by Daddi et al (2021) showed no significant improvement in financial performance for firms investing in recycling and material recovery. Therefore, circular material use does more than support environmental objectives. It also serves as a strategic driver of cost savings, market advantage, innovation, and investment attractiveness, all of which improves teh financial performance of organisations.

Innovative Capacity and Financial Performance: The results of this study revealed a positive and significant connection between innovative capacity and financial performance of listed manufacturing firms in Nigeria. The result is consistent with the studies conducted by Kong et al (2022), Hameed et al (2021). Kong et al (2022) study of innovative capability and firm performance revealed that innovative capability positively and significantly impacts profitability and market value. The study carried out by Hameed et al (2021) on product and process innovation capabilities positively and significantly affect the financial performance of manufacturing firms.

CONCLUSION, POLICY IMPLICATIONS, LIMITATIONS AND FURTHER RESEARCH

The findings of this study demonstrate a positive and significant association between resource efficiency and financial performance of listed manufacturing firms in Nigeria, a positive and significant association between product life cycle and financial performance of listed manufacturing firms in Nigeria, a positive and significant association between waste management and financial performance of listed manufacturing firms in Nigeria, a positive and significant association between circular material use and financial performance of listed manufacturing firms in Nigeria, and innovative capacity positively and significantly moderates the link between circular economy practices and financial performance of listed manufacturing firms in Nigeria. This means that manufacturing firms with stronger innovative capabilities are better able to transform circular

strategies such as resource efficiency, product life cycle, waste management and circular resource use into tangible financial gains. High innovative capacity improves the effectiveness of circular initiatives by enabling new technologies, creative problem solving, and the development of novel business models. Accordingly, firms that combine circular economy practices with robust innovative capabilities achieve superior financial outcomes compared to those with lower innovative capacity. This highlights the strategic importance of fostering innovation to maximise the economic benefits of circularity.

The result of a positive and significant association between circular economy practices and financial performance of listed manufacturing firms in Nigeria has vital policy implications for authorities, government institutions, and management. First, since innovative capacity improves the financial benefits of circular economy practices, policymakers should expand grants, tax incentives, and low-interest financing for R&D, eco-innovation, and technology adoption. Second, government can facilitate partnerships between industry, universities, and research institutions to accelerate innovation related to circular processes. Innovation hubs, incubators, and knowledge sharing networks can help firms access new technologies and best practices more easily. Third, public policies should support experimentation with new business models. Regulatory frameworks that lower barriers for such models will enable innovative firms to scale circular solutions more effectively. Fourth, training and educational programs in eco-design, digital technologies, materials science, and circular supply chain management can improve the innovative capacity of the workforce, strengthening the connection between circular practices and financial performance. Fifth, governments can introduce standards and performance indicators that reward firms for innovative circular solutions. Public procurement policies prioritizing circular and innovative products can also stimulate market demand. Finally, managers should prioritize building innovation capacity through R&D investment, new technologies, and skill development because it strengthens the financial impact of circular economy practices.

Notwithstanding the significant contributions to literature, this study has several limitations. First, the study relies on cross-sectional data, which limits the ability to infer causality between circular economy practices, innovative capacity, and financial performance. Temporal dynamics and lagged effects may not be fully captured. Second, much of the information on circular economy practices and innovative capabilities may depend on managerial perceptions, which can introduce bias such as social desirability or overestimation. Third, the sample was restricted to manufacturing firms. This limited generalizability means the findings might not apply to all sectors, especially those with different regulatory pressures or innovative environments. Fourth, the indicators used to assess circular economy practices, innovative capacity, and financial performance did not capture their full complexity. Financial performance may be influenced by external market factors not controlled in the model.

To build on current research and address its limitations, future studies could consider the following directions:

1. Future studies should track firms over time to better understand how circular economy practices evolve and how innovative capacity influences long term financial outcomes.

2. Researchers could examine other potential influences such as digital transformation, environmental turbulence, leadership style, or organizational culture, which may shape the circularity and performance link.
3. Future research could incorporate audited financial records, sustainability reports, or industry data to reduce reliance on self-reported measures.
4. Further studies could adopt case studies, interviews, and mixed method designs to help uncover how firms implement circular strategies and how innovation capacity is developed in practice.

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