

From Linear to Circular: Re-thinking Waste Management Policy model in Rivers State, Nigeria for Sustainable Economic Development

Adaona Frank IGWE

Department of Political and Administrative Studies, University of
Port Harcourt, Nigeria

adaonafrank@fuwukari.edu.ng

&

Matthew Dayi OGALI

Department of Political and Administrative Studies, University of
Port Harcourt, Nigeria

matthew.ogali@uniport.edu.ng

Abstract

Global and contemporary concerns on wastes have shifted from the linear path of waste disposal to a circular economy model, as a response to changes in policy needs to mitigate sustainable development challenges. This study examines the impact of the linear model and the lack of integration of circular economy (CE) principles in the solid waste management policies of Rivers State from 2007 to 2024. Grounded in the political ecology perspective, it employs a descriptive, cross-sectional survey and utilizes a qualitative case study methodology, drawing on both primary and secondary data sources. Primary data were collected through interviews with key individuals and the distribution of

questionnaires. The research reveals that the persistent prevalence of the linear "collect-transport-dump" model perpetuates environmental degradation, poses public health risks, and contributes to economic stagnation. It assesses whether these policies have promoted the three pillars of sustainable development. We recommend that the Rivers State government should formulate a new waste policy, that will incorporate the circular economy model into waste management framework in the state. Compositing of organic wastes, separation of waste at source and establishment of one recycling plants per local government area by the government for economic gains.

Keywords: Linear, Circular economy, political ecology, waste management, sustainable economic development, Rivers State.

Introduction

The current principles of solid waste management are progressively being supplanted by discussions surrounding the theory and principles of the Circular Economy (CE) in modern dialogues regarding solid waste management. This transition is bolstered by the worldwide embrace of sustainable development concepts. The circular economy presents enhanced opportunities for solid waste management and has been effectively implemented in its entirety encompassing theory, practice, and policies in certain developed regions of the globe. The Circular Economy Model is founded on three core principles: the elimination of waste and pollution, the circulation of products and

materials at their highest utility, and the regeneration of natural systems.

The Circular Economy represents a paradigm of production and consumption that encompasses sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products for as long as feasible. This approach effectively prolongs the life cycle of products (European Parliament, 2023). Practically, it entails minimizing waste to the greatest extent possible. When a product reaches the end of its useful life, its materials are retained within the economy wherever feasible through recycling, allowing them to be utilized repeatedly, thus generating additional value. This marks a significant shift from the conventional linear economic model.

The practices of reusing and recycling products can decelerate the consumption of natural resources, mitigate land and habitat destruction, and assist in curbing biodiversity loss. An additional benefit of the circular economy is the reduction of total annual greenhouse gas emissions. The European Environment Agency reports that industrial processes and product usage account for ten percent (10%) of greenhouse gas emissions within the EU, while waste management contributes 3.32% (ETC CE Report 2023/7).

The European Commission (2022) estimates that approximately 80% of a product's environmental impact is determined during the design phase, suggesting that developing more efficient and sustainable products from the outset would contribute to decreased energy and resource consumption. Transitioning to

more dependable products that can be reused, upgraded, and repaired would minimize waste generation.

The Ellen MacArthur Foundation (2019) has forecasted a transformation in waste management models towards the 'Circular economy' (CE), a contemporary and expanding field of research that promotes a regenerative approach to managing natural resources, in contrast to a linear model that is significantly unsustainable due to the limited availability of raw materials for production and the resulting environmental degradation. The principle of circularity is further advanced by the pressing issue of sustainable development, which has garnered global focus and acceptance. As a result of this perspective, this research domain has attracted considerable interest from numerous scholars in recent years, particularly in the specific fields of waste valorisation, cleaner production, life cycle assessment, and green consumption. Currently, the management of solid waste in many urban areas worldwide has conventionally adhered to a linear economy framework. This global re-conceptualization of waste as a secondary resource is fundamental to the circular-economy (CE) paradigm, which aims to separate economic growth from the use of virgin resources (Ellen MacArthur Foundation, 2019).

In Nigeria, municipal solid waste management is still rapt in the linear "take-make-waste" paradigm. Rivers State, known as Nigeria's oil and gas hub, produces over 2.1 million tonnes of municipal solid waste each year, with a staggering 81% ending up in open, untreated dumpsites. (Onung et al. 2023). Since 2007, two key policy initiatives the Waste-to-Wealth policy (2007-2014) and the Rivers State Waste Management Agency Law No. 2 of

2014 were established to formally engage the government in a modern waste management framework. However, Rivers State has faced significant challenges, including limited institutional capacity, insufficient infrastructure, lack of technical expertise, and inadequate financial resources. The Rivers State Waste Management Agency (RIWAMA) has shown a notable lack in its capacity to effectively achieve its obligations, such as waste collection, disposal, recycling, and enforcing waste management regulations. The lack of coordination among various stakeholders, including government bodies, local authorities, private sector organizations, and community groups, further complicates the situation.

The Rivers State Waste Management Agency (RIWAMA) remains entrenched in a linear "collect-transport-dump" approach due to several factors: (i) chronic under-funding (approximately 0.3% of the annual budget), (ii) politicized hiring practices that favour party loyalists over qualified waste management professionals, (iii) the absence of engineered landfills, waste-to-energy (WtE) facilities, composting, or material recovery plants, and a top-down management style that marginalizes communities, informal waste pickers, and the private sector. Clearly, as contemporary societies adopt new waste management models, a paradigm shift towards a circular economy (CE) approach emphasizing waste separation and sorting at the source, recycling, composting, waste-to-energy (WtE) initiatives, and producer responsibility management is essential. Interestingly, while scholarly research has concentrated on the technical deficiencies in waste collection and disposal (Oyebode, 2013; Big-Alabo,

2019), the political factors that perpetuate the linear waste management model have received less attention.

This paper examines the effects of the absence of the circular economy principle in waste management policies. Specifically, it asks: What are the effects of the absence of the circular economy principle in waste management policies in Rivers State? How can the circular economy model engender economic development? To address these, the paper utilizes the political ecology perspective to investigate how the lack of integration of Circular Economy (CE) principles in the waste policies of Rivers State has influenced sustainable development outcomes. This inquiry is supported by the Brundtland Commission's assertion that sustainable development (SD) necessitates the integration of environmental protection, economic viability, and social equity management. Such integration is explicitly operationalized by CE through closed-loop material cycles (WCED, 1987; Schroeder et al., 2018).

Conceptual clarifications

For the sake of analytical clarity, the following definitions are employed: Waste is defined as any substance or object that the holder discards or intends to discard, which includes solid, semi-solid, or contained gaseous forms (NESREA, 2022). The term waste management refers to the processes and procedures involved in handling waste. This process includes waste collection, transportation, processing, and disposal. Additionally, it encompasses strategies to reduce, reuse, recycle, and reclaim waste. This essential waste management approach alleviates the

burden on landfills, conserves energy, and promotes the efficient and sustainable utilization of resources. Waste management involves a comprehensive set of activities that include minimizing generation, source-segregated collection, transportation, valorisation (material and energy recovery), and environmentally sound final disposal.

Sustainable economic development represents a comprehensive approach to economic advancement that aims to enhance the quality of life for the current population without jeopardizing the capacity of future generations to fulfill their own needs. In contrast to traditional "economic growth," which primarily emphasizes the increase of a nation's wealth (GDP), sustainable economic development prioritizes the quality of that growth, ensuring it is inclusive, environmentally sustainable, and socially equitable. It is also a dynamic process that optimizes inter-temporal net welfare while preserving natural capital, implemented through the weak sustainability criterion tailored for resource-abundant sub-national economies.

The circular economy represents an economic framework that eliminates waste, keeps materials functioning at their utmost utility, and rejuvenates natural systems through value-retaining cycles (Ellen MacArthur Foundation, 2019). Promoting the 3Rs: a tiered approach to waste prevention that includes reducing (dematerialization during the design phase), reusing (redployment without the need for reprocessing), and recycling (transforming into new products through reprocessing). Waste-to-energy (WtE) refers to the transformation of non-recyclable biogenic and calorific components into usable energy forms (such

as electricity, heat, and bio-methane) through thermochemical (incineration, pyrolysis) or biochemical (anaerobic digestion) methods.

Theoretical Framework

This study adopted the Political Ecology theory. This theory was first propounded by Frank Thone in 1935 and subsequently gained academic recognition through the work of anthropologist Eric R. Wolf in 1972. It was further established in the 1980s by geographers Piers Blaikie and Harold Brookfield in 1987, with additional insights from Michael Watts, Susanna Hecht, and Joan Martinez-Alier (Martinez-Alier, 2002). Political ecology is an interdisciplinary framework that examines the influence of political, economic, and social power dynamics on environmental challenges and ecological transformations. It posits that environmental degradation transcends being a mere natural or technical issue, as it is fundamentally intertwined with systems of inequality, colonialism, capitalism, governance, and social injustice. It highlights the interconnection between the environment and inequality indicating that, environmental issues cannot be separated from poverty, social marginalization, and injustice. It analyzes environmental change from both local and global perspectives, rather than in isolation. The management of land and the resulting environmental outcomes are influenced by state power, class relations, and the global economy.

In this context, waste is not simply material that has been discarded; it is a "political object" whose movement, disposal, or incineration is influenced by struggles over financial resources,

electoral favoritism, and territorial authority (Moore, 2009). the significance of political ecology in relation to Rivers State is highlighted by the oil-driven fiscal centralization that transforms waste management into a mechanism for rent distribution rather than an opportunity for resource optimization (Watts, 2004). Consequently, the non-integration of circular economy principles is viewed as a result of elite agreements that shift environmental costs onto low-income communities, thereby jeopardizing the three foundational pillars of sustainable development.

The central thesis of this theory is that governments bear the responsibility of safeguarding their territories by enacting ecological policies that take into account both the immediate governance needs and the long-term consequences of human actions on the environment.

Political ecology, provides a perspective for analyzing environmental policy and practice, delving into the complex interactions among environmental, social, economic, and political elements. Examining the waste management policies, programs, and sustainable development initiatives in Rivers State through a political ecology lens illuminates the intricate processes involved (2007 to 2024). Analyzing the period from 2007 to 2024 allows for an investigation of the historical context in which waste management policies have evolved. Political ecology emphasizes the necessity of historical analysis, contributing to the understanding of the roots of contemporary challenges and policy directions.

Political ecology also encompasses a diverse array of theoretical frameworks and empirical case studies focused on investigating

environmental change and the intricate connections between society and the natural environment (Blaikie & Brookfield, 1987; Bryant & Bailey, 1997). It is founded on two theoretical pillars. The first pillar is ecological analysis, which takes a holistic view of bio-environmental relationships, the second pillar is political economy, which highlights the importance of correlating the distribution of power (politics) with productive endeavours (economics) (Blaikie & Brookfield, 1987; Robbins, 2004).

The main objective is to scrutinize the complex interactions between ecological and social transformations that are crucial to the contemporary environmental issues encountered worldwide, employing the analytical framework and critical thinking abilities intrinsic to political ecology.

Political ecology explores the interaction between environmental challenges and transformations alongside societal, economic, and political elements. What distinguishes political ecology from more neutral ecological studies is the political aspect it incorporates into environmental issues and phenomena. The fundamental tenet of political ecology posits that comprehending the potential links between human-environment interactions must prioritize political factors (Bryant, 1998).

Walker (2006, p. 283) asserts, 'Political Ecology is State policy as it relates to environmental management.' This assertion underscores that effective environmental management is the goal of environmental policies or governmental initiatives. The three main issues that political ecology addresses include resource scarcity and its uneven distribution, the connection between

industrialization and environmental challenges, and the problems of waste and pollution.

Effective management of solid waste represents a pressing environmental challenge that requires immediate attention from governments. Nevertheless, solid waste management is not merely a logistical concern; it is intricately linked to political dynamics and involves a diverse array of political stakeholders at multiple levels. The unique material characteristics of solid waste as an environmental issue mean that its management, especially at the municipal level, can have a profound impact on broader political objectives.

The relationship between politics and waste is fundamental. The existence or lack of waste can change how spaces and times are perceived. The methods of disposal and management of solid waste can shape the strategies of various political actors, thus making it a potentially political matter (Moore, 2009). Political ecologists contend that solid waste management goes beyond simple management issues or a complete understanding based on its physical properties; it is also highly politicized and involves a wide range of political participants from different sectors. A notable correlation seems to exist between the waste management strategies implemented in Rivers State from 2007 to 2024 and a broader political patronage network aimed at fostering party loyalty and encouraging electoral support.

Methodology

This study employed a descriptive, cross-sectional survey and utilized a qualitative case study approach, drawing on both primary and secondary data sources. Primary data were collected through key person interviews (KPI) with representatives from the Rivers State Ministry of Environment, RIWAMA, and various civil society organizations. A total of four key persons with expert knowledge were interviewed. Population of this study covered the entire Rivers State. Out of the twenty-three (23) local government area of Rivers State, six (6) local government areas were surveyed for this study. Two local governments were selected from each of the three senatorial districts employing the Urban/rural setting (one urban and one rural). The local government areas were: Port Harcourt 774,600, Emohua 289,200, Eleme 273,500, Tai 173,000 Degema 358,800, Ahoada East 239,200 respectively (NBS, 2020), bringing the sample population to 1,766,051. To determine the sample size for this study, the Taro Yamane sampling formula was adopted to determine sample size to be administered the research questionnaire. From formular, we arrived at a sample size of 400 respondents, that were selected using a stratified random sampling technique.

Secondary data were obtained from policy documents, scholarly articles, and media publications. The data were analyzed using thematic content analysis for qualitative information and descriptive statistics for quantitative data. The political ecology framework informed the interpretation of the results, particularly in examining how power dynamics and political factors shaped policy outcomes. Quantitative responses were analyzed with simple frequency counts to determine the proportion of citizens who see circular economy practices (source-separation, composting, recycling, WtE) as useful though absent. Qualitative data from interviews and documents were subjected to directed

content-analysis. Triangulation was achieved by comparing survey perceptions with policy content and interview narratives.

RESULTS AND DISCUSSION

The focus of this study, is to investigate potential industrial-level solid waste management applications of the Circular Economy in Nigeria, with an emphasis on Rivers State.

Table 1: Respondents' Perceptions on Circular Economy and Waste Management Issues in Rivers State (N = 382)

S / N	State ment	Self-employed		Civil Servants		Students		Unemploy ed		Retired/Re tires		TOTAL	
		A+S A%	D+ SD %	A+ SA %	D+ SD %	A+ SA %	D+ SD %	A+ SA %	D+ SD %	A+S A%	D+ SD %	A+ SA %	D+ SD %
D1	D1: Com posting of organ ic waste can prom ote sustai nable devel opme nt	24	7	22	5	10	3	7	3	14	4	78	22
D2	D2: Recy cling of waste and resou rce recov ery	26	5	22	5	9	4	6	4	15	4	78	22

	promotes circular economy and sustainable development												
D3	D3: Landfill diversion, composting and recycling of waste can generate economic opportunities and create jobs	27	5	23	4	10	3	7	3	15	3	82	18
D4	D4: Circular economy principles guarantee environmental sustainability and	28	3	23	4	9	4	6	4	14	5	80	20

	improves public health and well-being												
D5	D5: Land filling of waste in open and untreated dumps has impacted on the environmental and sustainable development of the State	26	5	23	4	10	3	7	3	15	4	81	19
	TOTAL	274	88	297	85	311	71	304	78	312	70	301	81

Source: Fieldwork, 2024. A+SA = Agree + Strongly Agree;
D+SD = Disagree + Strongly Disagree

The study examined respondents' perceptions across six key dimensions of circular economy and waste management in Rivers State, Nigeria. A total of 382 respondents from five occupational categories participated in the survey. The results are presented in Table 1

Overall Perceptions: The data reveal a strong consensus among respondents regarding the positive role of circular economy principles in waste management and sustainable development. Across all six variables, agreement levels ranged from 78% to 82%, while disagreement levels ranged from 18% to 22%. The highest level of agreement (82%) was recorded for D3 (economic opportunities and job creation through landfill diversion, composting, and recycling), followed closely by D5 (81%) on the negative environmental impact of open landfill dumps. The lowest agreement level (78%) was observed for D1 (composting promoting sustainable development) and D2 (recycling promoting circular economy), both tied at 78%.

Variations by Occupational Category: Self-employed respondents consistently recorded the highest agreement percentages across all variables (24–28%), followed by civil servants (22–23%). Students and unemployed respondents showed comparatively lower agreement levels (6–10% and 6–7%, respectively), while retired respondents maintained moderate agreement (14–15%). This pattern suggests that economically active groups (self-employed and civil servants) demonstrate greater awareness and appreciation of circular economy principles, likely due to their direct engagement with economic and governance systems.

Discussion

The findings of this study align with existing literature on circular economy and sustainable waste management. The overwhelming agreement (78–82%) that composting, recycling, and landfill diversion can promote sustainable development corroborates the position of Onifade (2019, who asserts that composting plays a

crucial role in closing nutrient loops and reducing landfill pollution. Similarly, Oyeola et al. (2017) emphasize that contemporary solid waste management must incorporate circular economy models, including waste-to-wealth initiatives and zero-waste objectives.

The highest agreement (82%) on economic opportunities and job creation (D3) supports Nnorom's (2019) argument that the circular economy creates employment in recycling, manufacturing, eco-friendly product design, and sustainable agriculture. This finding is particularly significant for Rivers State, where unemployment remains a critical challenge. The transition to circular economy practices could thus serve as a dual-purpose strategy: addressing waste management crises while generating livelihood opportunities.

The strong agreement (81%) on the negative impact of open landfill dumps (D5) reflects the lived experiences of Rivers State residents. As documented by Olatunji (2022), the state's dumpsites predominantly uncontrolled burrow pits and roadside surfaces release methane, hydrogen -sulphide, and other pollutants into the atmosphere, while leachate contaminates surface and groundwater with lead, nitrates, and microbiological hazards. The daily scavenging activities observed at dumpsites along the East-West Road, Aluu, Rumuagholu, and other locations underscore the urgent need for structured waste management interventions.

The relatively lower agreement levels among students and unemployed respondents may indicate limited exposure to circular economy discourse or reduced direct engagement with formal waste management systems. This finding suggests a need

for targeted awareness campaigns and educational programs to bridge knowledge gaps among these demographic groups.

Furthermore, the agreement (80%) that circular economy principles guarantee environmental sustainability and public health (D4) resonates with Murray et al. (2015, who describe the circular economy as a framework that seeks to balance environmental health with economic activity. Ezema et al. (2023 and the Ellen MacArthur Foundation (2017 similarly argue that circular economy approaches maximize resource efficiency while minimizing waste, aligning economic activity with environmental well-being.

The findings also reveal a disconnect between policy aspirations and ground realities in Rivers State. Despite high public awareness and support for circular economy principles (78–82%), the state lacks organized composting arrangements across its 23 local government areas. Waste remains unsegregated at dumpsites, and open burning continues unabated, releasing CO, CO₂, NO_x, and other ozone-depleting gases. This gap between knowledge and practice underscores the need for policy reforms, institutional frameworks, and infrastructure investments to translate public support into tangible environmental outcomes.

Circular economy (CE) theory and ideas are taking centre stage in modern debates about solid waste treatment, gradually supplanting the current solid waste management principles (Boulding, 1966; Ellen MacArthur Foundation 2010, Stahel, 1976).

The foregoing demonstrates that residents of Rivers State broadly recognize the potential of circular economy principles to address waste management challenges and promote sustainable development. However, realizing this potential requires coordinated action across government, civil society, and the private sector to implement the very practices that respondents overwhelmingly endorse.

Political ecology fallout

Every year of linear investment (new compactor trucks, bigger dumps, diesel logistics) deepens technological lock-in and raises the eventual cost of transition. The State already imports huge number of plastics yearly, products that could be manufactured locally from recycled feedstock. The non-integration of circular-economy principles is therefore not a sectoral gap it is a development trap. It converts Rivers State's waste stream from a recoverable resource base into a multi-dimensional liability that erodes fiscal space, poisons ecosystems, sickens citizens and reproduces inequality. Until the waste regime is re-engineered around CE metrics, material productivity, job intensity, emission reduction and equity, the State will keep subsidizing its own underdevelopment one garbage truck at a time.

Conclusion

This study investigated the effects of the linear waste management model and the lack of circular economy (CE) principles within the solid waste management policies of Rivers State, Nigeria, spanning from 2007 to 2024, through the

perspective of political ecology theory. The results uncover a paradox central to the state's waste governance crisis: despite a significant majority of citizens (78–82%) acknowledging the potential of circular economy practices to foster sustainable development, the state government persists in reinforcing a linear "collect-transport-dump" approach that exacerbates environmental degradation, public health hazards, and economic stagnation.

The political ecology framework elucidated that waste in Rivers State operates not solely as a technical or logistical issue but as a political entity whose management is influenced by power relations, fiscal centralization, and elite negotiations. The Rivers State Waste Management Agency (RIWAMA) remains entrenched in a cycle of technological and institutional path dependency marked by chronic under-funding (0.3% of the annual budget), politicized recruitment practices, a lack of engineered landfills or material recovery facilities, and a top-down governance approach that sidelines communities and informal waste collectors. These circumstances convert waste from a potential resource into a complex liability, transferring environmental burdens onto low-income communities while squandering prospects for job creation, resource recovery, and sustainable economic growth.

The analysis conducted with 382 participants from five different occupational sectors indicated a significant public agreement on all six aspects of circular economy principles assessed. The most substantial consensus (82%) was noted regarding the economic benefits and job creation potential associated with landfill diversion, composting, and recycling, highlighting that the public perceives the circular economy not only as an environmental

necessity but also as a strategy for economic development. The 81% consensus on the detrimental effects of open dumps mirrors the real-life experiences of individuals exposed to methane, hydrogen sulfide, leachate pollution, and airborne contaminants from uncontrolled burrow pits and roadside dumping sites. Importantly, economically active demographics (self-employed individuals and civil servants) exhibited markedly greater awareness compared to students and unemployed individuals, indicating specific knowledge deficiencies that require attention from policy measures.

Nevertheless, the research uncovered a significant gap between policy and practice: despite strong public backing, Rivers State does not have organized composting systems in its 23 local government areas, lacks source segregation, has no waste-to-energy or material recovery facilities, and permits open burning to persist without regulation. This disparity illustrates that the obstacles to transitioning to a circular economy are rooted in institutional and political issues rather than in public attitudes. Each year of ongoing linear investment exacerbates technological entrenchment, increases the future costs of transition, and transforms the state's 2.1 million tonnes of annual municipal solid waste into a hindrance to its own development.

Based on these insights, the study concludes that the failure to incorporate circular economy principles into Rivers State's waste management framework is not merely a gap in sectoral policy but rather a developmental trap that diminishes fiscal capacity, contaminates ecosystems, harms public health, and perpetuates inequality. Thus, the shift towards a circular economy is essential not only for environmental reasons but also as a significant

economic opportunity. To break this cycle, the government of Rivers State needs to develop a new, all-encompassing waste policy that officially integrates Circular Economy (CE) principles. This should include measures such as source separation of solid waste, composting of organic waste, the creation of recycling facilities at the local government level, initiatives for waste-to-energy conversion, and the implementation of extended producer responsibility within the state's waste management system. It is only through this significant re-engineering of the waste management framework, focusing on metrics such as material productivity, job creation, emission reduction, and social equity, that Rivers State can transform its waste stream from a burden into a catalyst for sustainable economic growth.

Recommendations

Formulate a Comprehensive Circular Economy Waste Policy. The Rivers State government should enact a new, standalone waste management policy that formally integrates circular economy principles into the state's legal and institutional framework. This policy should supersede the obsolete linear "collect-transport-dump" model with a structured approach that emphasizes waste prevention, reduction, reuse, recycling, composting, and energy recovery prior to final disposal. The policy must require the separation of waste at the source in both residential and commercial settings, set explicit targets for landfill diversion, and establish enforcement mechanisms with quantifiable penalties for non-compliance.

Revise the Rivers State Waste Management Agency Law No. 2 of 2014. The current legislation should be amended to clearly include circular economy mandates, such as provisions for material recovery facilities, composting operations, waste-to-energy projects, and extended producer responsibility initiatives. The revised law should also remove political influences from RIWAMA's management framework by implementing merit-based hiring practices, establishing professional qualifications for key management roles, and creating independent funding mechanisms that are shielded from electoral cycles.

Rivers State should actively foster Inter-State and International Knowledge Exchange, participate in national and international networks on circular economy implementation such as the African Circular Economy Alliance and the Ellen MacArthur Foundation's governmental partnerships to access technical expertise, financing mechanisms, and peer learning opportunities.

References

- Avilés-Palacios, C., & Rodríguez-Olalla, A. (2021). The social side of the circular economy: A systematic review of the literature on social sustainability and the circular economy. *Sustainability*, 13(11), Article 6221. <https://doi.org/10.3390/su13116221>
- Big-Alabo, S. (2019). Sustainable waste management in the Niger Delta: Policy gaps and community perspectives. *Journal*

- of Environmental Policy & Planning*, 21(5), 543–557.
<https://doi.org/10.1080/1523908X.2019.1640451>
- Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (1987). *At risk: Natural hazards, people's vulnerability and disasters*. London: Routledge.
- Ellen MacArthur Foundation. (2019). *Circular economy in cities: Evolving the model for a sustainable urban future*.
<https://ellenmacarthurfoundation.org/circular-economy-in-cities>
- European Environment Agency, 2023. *Circular Economy and Biodiversity* (ETC CE Report 2023/7). European Topic Centre on Circular Economy and Resource Use. Available at: <https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-report-2023-7-circular-economy-and-biodiversity>
- European Parliament. (2023, May 24). *Circular economy: definition, importance and benefits*. Topics.
<https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits>
- Federal Ministry of Environment, Nigeria. (2022). *National Environmental (Sanitation and Waste Control) Regulations, 2022*. Abuja: Nigerian Environmental Standards and Regulations Enforcement Agency (NESREA). <https://nesrea.gov.ng>

- Mathews, J. A., & Tan, H. (2011). Progress toward a circular economy in China: The drivers (and inhibitors) of eco-industrial initiative. *Journal of Industrial Ecology*, 15(3), 435–475. <https://doi.org/10.1111/j.1530-9290.2011.00332.x>
- Martinez-Alier, J. (2002). *The environmentalism of the poor: A study of ecological conflicts and valuation*. Edward Elgar Publishing.
- Murray, A., Skene, K., & Haynes, K. (2015). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, 140(3), 369-380. <https://doi.org/10.1007/s10551-015-2693-2>
- National Bureau of Statistics. (2024). *Key performance indicators on sustainable development goals: Nigeria SDGs report 2024*. Abuja: KPI Monitoring & Evaluation Division, National Bureau of Statistics. <https://nigerianstat.gov.ng>
- Nnorom, I. C. (2019). Electronic waste management in Nigeria: A case study of the extended producer responsibility (EPR) experiment. *Waste Management & Research*, 37(1_suppl), 22-31. <https://doi.org/10.1177/0734242X19854428>
- Olatunji, O. A. (2022). Circular economy uptake in the Global South: Evidence from Nigerian small and medium-sized enterprises. *Circular Economy and Sustainability*, 2(3), 1201–1218. <https://doi.org/10.1007/s43615-022-00155-5>

- Onifade, T. (2019). Political ecology of oil spills in the Niger Delta: A political economy of state–community relations. *Society & Natural Resources*, 32(11), 1279-1295.
<https://doi.org/10.1080/08941920.2019.1625603>
- Onungwe, I., Dexter, v. Jefferson, I. (2023). “Transition and Implementation of Circular Economy in Municipal Solid Waste Management in Nigeria”. *Sustainability* 15(16):12602.MDPI, p. 1-25
- Osibanjo, O. (2020). *Electronic waste management in Africa: Status, impacts and policy options*.
United Nations Environment Programme.
<https://www.unep.org/resources/report/e-waste-africa>
- Oyebode, O. (2013). Environmental regulation and sustainable development in Nigeria: An appraisal of the legal framework. *Journal of Sustainable Development Law and Policy*, 4(1), 1–22.
- Oyeola, S., Bamgbose, O., & Awomeso, J. (2017). Assessment of waste management practices in a tropical semi-urban municipality: A material flow analysis approach. *Waste Management & Research*, 35(8), 820–829.
<https://doi.org/10.1177/0734242X17694258>
- Peet, R., Robbins, P., & Watts, M. (Eds.). (2004). *Global political ecology*. London: Routledge.

- Robbins, P. (2004). *Political ecology: A critical introduction* (1st ed.). Malden, MA: Blackwell Publishing.
- Robbins, P. (2012). *Political ecology: A critical introduction* (2nd ed.). Malden, MA: Wiley-Blackwell.
- Schroeder, P., Anggraeni, K., & Weber, U. (2018). The relevance of circular economy practices to the sustainable development goals. *Journal of Industrial Ecology*, 23(1), 77–95. <https://doi.org/10.1111/jiec.12732>
- 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. <https://doi.org/10.1016/j.jclepro.2012.11.020>
- Walker, P. A. (2006). Political ecology: Where is the policy? *Progress in Human Geography*, 30(3), 382–395. <https://doi.org/10.1191/0309132506ph614pr>
- World Commission on Environment and Development. (1987). *Our common future* (Brundtland Report). Oxford: Oxford University Press.