CIRCULAR ECONOMY AND SUSTAINABLE HUMAN DEVELOPMENT- A COMPARISON OF SERBIA AND NIGERIA

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Abstract: *This paper explores Serbia and Nigeria are implementing circular economy practices. It examines the current state of sustainable practices in both countries. specifically in the areas of waste management, renewable energy and sustainable agriculture. It also shows how each country is adapting to changes related to sustainability and opportunities available within its own social, economic, and environmental landscape. By making a comparison between Serbia, an emerging European economy, with Nigeria, a developing African nation, insight is gained into the different strategies and results of adopting circular economy principles. The study in the process also highlights key barriers like policy gaps, technological limitations, and social constraints. Moreover, this study gives an understanding of how practices supporting circular economy can aid economic growth, healthier environments, and social well-being in diverse developmental settings.*

Keywords*: Circular Economy, Sustainability, Waste management, Renewable energy, Sustainable agriculture*

1. INTRODUCTION

The United Nations Sustainable Development Goals (SDGs), introduced in 2015, caused a worldwide push for a more sustainable future, particularly focused on how we consume and produce. This paper explores how Serbia and Nigeria are approaching this challenge by adopting circular economy practices. We will look into how these two countries, with their unique social, economic, and environmental situations, are making this transition. Serbia is an emerging European economy, while Nigeria is a developing African nation – each faces its own distinct hurdles and potential rewards. This study aims to: Analyze the current progress of circular economy practices in both countries. We will look specifically at waste management, sustainable resource use, and eco-friendly production methods. By comparing Serbia and Nigeria, this research offers a look at the different paths countries can take towards a circular economy, depending on their level of development. This side-by-side analysis reveals the delicate balance between economic growth, environmental protection, and social progress.

2. CIRCULAR ECONOMY PRACTICES IN SERBIA: AN EXPANDED OVERVIEW

2.1 Overview and Current Status

Serbia has faced challenges, in developing an economy due to political factors. Unlike countries such as Denmark which has taken steps, Serbia has focused on rebuilding its market economy after the communist era and addressing issues stemming from conflicts and international sanctions (Rajaković, 2021).

Ristanović (2022) found that this has led to a lack of emphasis on matters causing Serbia to fall behind European nations in terms of sustainability. However, as Serbia aims for EU membership it must adhere to standards.

2.2 Waste Management

Poor waste management in developing nations suggests that the amount of waste generated is mostly influenced by the economic status of a society, their weak social economic factors affected by lack of robust environmental laws, financial control, and administrative capabilities (Ilić & Nikolić, 2016).

Josimović et al. (2022) believe that Serbia has made strides in improving its waste management systems, with a focus on reducing landfill use and enhancing recycling processes. While the Waste Management Strategy from 2010 to 2019 made some headway by introducing updated rules and new infrastructure it lacked aspects such as waste collection, recycling practices, and the closure of unsanitary landfills. In line, with the principles of circular economy Serbia acknowledges the importance of waste management. Recent studies have highlighted that embracing the concept of an economy involves utilizing resources to their potential. One proposed solution is to incorporate practices that facilitate the reintegration of waste into the production cycle encompassing sectors of the economy (Milanović et al., 2022). This strategic approach is crucial as Serbia advances towards implementing waste management strategies crucial, for enhancing environmental sustainability and economic effectiveness.The launched Waste Management Program spanning from 2022 to 2031 recognizes these shortcomings showcasing Serbia's understanding of the hurdles involved in translating policies into effective measures (Ministry of Environmental Protection, Republic of Serbia, 2022). Bjelić et al. (2024) noted that this new approach in line, with the objectives of the EU highlights the importance of reducing waste production and optimizing resource use. It signifies a change in Serbia's waste management strategy moving away, from disposing of waste to appreciating resources in a sustainable cycle.

2.3 Renewable Energy

Korhonen et al. (2018) state that the Utilization of renewable energy plays a key role, in creating circular products and resources encompassing the entire process from designing and manufacturing components of renewable facilities to their construction, operation, and eventual disposal.

Kosanović, Miletić, & Marković (2021) noted that the shift towards renewable energy is pivotal in Serbia's circular economy strategy, and for that happenings such as Investments in solar, wind, and biomass energy to reduce the country's reliance on fossil fuels and decrease carbon emissions. Khajuria et al. (2022) stated that renewable energy sector not only contributes to environmental sustainability but also presents opportunities for economic development and job creation. According to Knäble et al. (2022), sustainable development and circular economies can only be achieved by promoting and adopting renewable energy since the economy relies on energy as a fundamental input for goods and services. Challenges such as financing renewable energy projects and the need for policy support are being addressed through partnerships with international organizations and the European Union (Renewable Energy Association of Serbia, 2021).

2.4 Sustainable Agriculture

Serbia is faced with an issue of food wastage posing both a challenge and an opportunity to enhance its agriculture industry (Vukelić et al., 2023). Reports show that around 770,000 tons of food are wasted yearly with most of it ending up in landfills and contributing to greenhouse gas emissions (UNECE, 2022). Given the crucial role agriculture plays in Serbia's economy, where food production makes up 10.4% of exports and 6% of the GDP. Addressing this problem through a circular economy approach is seen as a priority (Gajić et al., 2021). The UNECE offers Serbia support in terms of guidance and tools to measure and tackle food loss and waste along the supply chain (Joshi, 2022).

3. CIRCULAR ECONOMY PRACTICES IN NIGERIA: AN IN-DEPTH EXAMINATION

3.1 Overview and Current Status

The population of Nigeria has been approximated at 229.2 million people as of 2024, calculated with 2.39% growth index from 2023 (Macrotrends, 2024). Onungwe et al. (2023) noted that the nation's abundant natural resources have somehow played a role, in driving its economic growth leading to its consistent ranking as one of the top economies in sub Saharan Africa since 2004. Nigeria is still new to exploring the possibilities in waste management and the circular economy sector which offers a chance for progress (Ezeudu & Ezeudu, 2019). Ogunsanwo & Ayo-Balogun in their research work stated that, to make the most of this opportunity Nigeria requires a defined plan for embracing the economy. Steps should be outlined, practices should be endorsed, and economic growth should be stimulated.

3.2 Waste Recycling and Management

The environmental challenges faced by the Sub-region are significant and Nigeria is no exception when it comes to managing municipal solid waste (MSW) (Adedara et al., 2023). In Nigeria, there is a major problem with waste collection with an estimated average collection rate of 44% across African nations (Adedara et al., 2023; Kaza et al., 2018). 80% of components of MSW end up in dumpsites while only 12% are actually recycled (Kehinde et al., 2020). The management of MSW in Nigeria and other developing countries is characterized by a lack of data on waste generation, absence of waste sorting systems, limited service coverage, inefficient operations, low recycling rates, and poor practices (Wikurendra et al., 2022; Nnaji, 2015).

Although there have been some improvements in landfill infrastructure and private partnerships (PPP) related to MSWM in Nigeria recent challenges such as urban migration, insufficient funding for the waste sector lack of infrastructure development and absence of innovative technologies continue to hinder progress (Nwosu & Chukwueloka, 2020; Aliu et al., 2014). This situation has resulted in a subpar state for the MSWM system. Similar issues have been observed in the past due to policies, inadequate funding, and lack of data, on waste collection that have negatively impacted the MSWM system.(Nwosu & Chukwueloka, 2020; Aliu et al., 2014)

3.3 Renewable Energy Transition

In Nigeria, the transition to renewable energy within the framework of a circular economy is progressing, but challenges remain. The country, rich in solar, wind, and biomass potential, has taken steps towards leveraging these resources to reduce dependency on fossil fuels and promote environmental sustainability. Recent initiatives focus on integrating circular economy principles into sectors like solid waste management, which is seen as a crucial component for sustainable energy production, particularly in biomass (Onungwe, Hunt, & Jefferson, 2023). However, the transition is hindered by infrastructural deficits, financial constraints, and a lack of widespread technical expertise (Ezeudu & Ezeudu, 2019).

To combat these challenges, strategies are being implemented to foster better resource management and waste reduction, which are central to the circular economy model. Efforts include promoting recycling and the reuse of materials in various industries, including construction, which significantly contributes to sustainability and resource efficiency (Bello & Idris, 2023). The government, along with private sector partners, is increasingly recognizing the importance of digital technologies in enhancing the effectiveness of these strategies, driving the country closer to a circular economy that supports renewable energy transition (Olaghere, Inegbedion, & Osiobe, 2023).

3.4 Sustainable Agriculture

The agricultural sector, which plays a role in Nigeria’s economy by providing food and employment opportunities has the potential to lead the way in sustainable practices (Omodero, 2021). However issues like soil salinity and degradation pose challenges to productivity and sustainability (Kayode et al., 2021; Usman et al., 2018).

While efforts to embrace circular economy principles in Nigeria show promise, they also encounter obstacles such as lack of infrastructure, weak regulations and limited professional involvement (Onungwe et al., 2023). The shift towards a circular model in areas like solid waste management and construction is essential for sustainable agriculture since these sectors offer crucial resources and infrastructure for agricultural development (Aremu et al., 2019; Bello & Idris 2023).

Innovative approaches like leveraging technologies in service delivery are starting to transform the agricultural sector by enhancing supply chain efficiency and reducing wastage thereby supporting the circular economy initiatives, in Nigeria (Olaghere et al., 2023).

In addition educating agricultural extension workers on methods can speed up the acceptance of these principles, in regions boosting food security and reducing poverty by enhancing agricultural productivity (Alabi & Ajayi 2018).

4. ANALYSIS

Table 1 presents a side, by side analysis of waste recycling and management practices in Serbia and Nigeria. According to a report, by EU za Tebe (2024) Serbia produces around 2,950,000 tons of waste each year with 79.45% of it not managed and disposed of in landfills indicating significant waste management challenges. The recycling rate in the country is currently at 15.45% suggesting there is room for improvement in waste processing practices. On the other hand, Agbo (2023) highlights Nigeria's pressing waste management issues. With a waste generation of 32,000,000 tons about 25% is recycled in Nigeria while a staggering 75% of the waste remains unmanaged and ends up in landfills. These statistics underscore the need for waste management systems, in both countries to address environmental concerns and encourage sustainable practices.

Table 1: Waste recycling and management

Metrics	**NIGERIA**	**SERBIA**
Total waste produced yearly	32,000,000	2,950,000
Unmanaged waste/disposed in landfills	75%	79.45%""
Recycled rate	25%	15.45%

SOURCES: European Union Delegation to Serbia (2024); Agbo (2023).

Table 2: Sustainable Agriculture

Metrics	**SERBIA**	**NIGERIA**
Organic Farmin hectares	23,527.03	58,028,000
Renewable energy utilization	60% of agricultural waste used for biomass (2020)	Emerging efforts in bioenergy, no specific percentage available
Increase in agricultural output	11.7%	3.58 %
Impact on nation’s GDP	6.29%	24.17%

SOURCES: Milovanović et al. (2022); Willer et al. (2023); Škrbić et al. (2020); Ministry of Agriculture; Nature and Food Quality of the Netherlands (2021); National Bureau of Statistics, Nigeria (2023); (O’Neil, 2024).

In Table 2 you will find a comparison of metrics related to sustainable agriculture practices in Serbia and Nigeria. In their examination of farming practices, Milovanović et al. (2022) found that Serbia has dedicated 23,527.03 hectares to organic cultivation demonstrating a strong commitment, to environmentally friendly agriculture. In contrast, Nigeria has taken an approach with the research by Willer et al. (2023) indicating that 58,028,000 hectares are under farming. Further enabling sustainability efforts, Škrbić et al. (2020) highlight the progress in renewable energy utilization in both Serbia and Nigeria through the conversion of agricultural waste into biomass for energy production with Serbia utilizing 60% of agricultural waste. This transition is reflected in agricultural outputs by Ministry of Agriculture, Nature and Food Quality of the Netherlands, (2021), where Serbia saw a 11.7% increase while Nigeria experienced a 3.58% growth rate (National Bureau of Statistics, Nigeria, 2023) showcasing significant improvements in agricultural productivity, for both nations. These advancements also contributed to the GDP; agriculture contributes 6.29% (O'Neil, 2024) to Serbia's GDP and influences 24.17% of Nigeria's GDP underscoring the vital role of agriculture in their respective economies.

Key Challenges

- Both countries face infrastructure challenges, albeit in different contexts. Serbia's challenges lie in enhancing its waste management infrastructure and transitioning to renewable energy, while Nigeria struggles with basic waste collection services and energy access.

- Public awareness and participation are common hurdles. Despite Serbia's progress, increasing public engagement remains crucial. Nigeria, too, must enhance awareness to encourage participation in recycling programs and sustainable practices.

- Financial and technical resources are significant barriers. Serbia needs investment to modernize its infrastructure and adopt green technologies, whereas Nigeria requires substantial investment to develop its circular economy initiatives and renewable energy projects.

Opportunities for Growth

- EU integration offers Serbia opportunities for funding, technical assistance, and policy guidance in circular economy practices. For Nigeria, international partnerships and investment in circular economy startups present significant opportunities for sustainable growth and innovation.

- Both countries can leverage education and capacity building to overcome challenges related to public awareness and participation. Fostering a culture of sustainability through education can drive long-term changes in attitudes and behaviors towards the circular economy.

Insights and Recommendations

The analysis reveals that while Serbia and Nigeria are at different stages of circular economy implementation, they share common goals of sustainable development, environmental protection, and economic resilience. Both nations can benefit from:

- Enhancing policy frameworks to provide clearer guidelines and incentives for circular economy practices.

- Investing in technology and infrastructure to improve waste management, recycling, and renewable energy capabilities.

- Fostering public-private partnerships to mobilize resources, share knowledge, and innovate in circular economy solutions.

- Prioritizing education and awareness campaigns to build public support and participation in circular economy initiatives.

5. CONCLUSION

This research compares how Serbia and Nigeria are embracing circular economy principles despite being, in stages of growth and facing unique challenges on their path to sustainable development. Serbia has made progress in waste management and renewable energy aligning itself with European Union standards. The country's efforts to incorporate practices span sectors, supported by policy driven initiatives and infrastructure upgrades aimed at reducing environmental impact and boosting economic efficiency.

On the other hand Nigeria in natural resources faces obstacles primarily due to infrastructure deficiencies and gaps in policies. The nation is still evolving its approach to the economy with potential for advancements in waste recycling renewable energy and sustainable agriculture. Nigeria's advancement relies on strong policies implementation increased investments in technology and infrastructure as building partnerships locally and globally.

For both countries advancing involves not expanding initiatives but also deeply embedding circular economy principles into policymaking processes and community involvement. This entails promoting a sustainability culture across society levels and utilizing support, for knowledge exchange to tackle challenges effectively.

The results of this comparison highlight the importance of creating customized approaches that address the situations of each country guaranteeing that the concepts of an economy result, in real advantages for nature, finances and communities as a whole.

While Serbia and Nigeria confront their obstacles their journeys provide lessons on the complex and diverse process of integrating circular economy tactics on a worldwide scale. The dedication, to enhancement and adjustment is vital as both countries aim for more enduring futures.

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