



Strategies for e-waste management in West Africa: A comparative study of Nigeria and Ghana

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Abstract

The growing problem of electronic waste (e-waste) management in West Africa requires a thorough examination of current techniques management in key countries such as Nigeria and Ghana. This study contrasts the strategy of condonation, characterized by lax enforcement and informal sector interaction, with a more structured and regulatory approach. The study emphasizes the multifaceted economic, environmental, and social effects of these strategies on achieving Sustainable Development Goal 8 (Decent Work and Economic Growth). While Nigeria has taken a more relaxed approach, with extensive participation from the informal sector, Ghana has implemented stronger laws to control e-waste. The findings reveal that, despite the short-term economic gains and job opportunities provided by condonation in Nigeria, there are significant challenges posed by long-term environmental deterioration and health risks. In contrast, Ghana's legislative approach, while ensuring safer disposal techniques and encouraging formal sector involvement, faces implementation issues and the potential exclusion of informal labor. The discussion underscores the importance of developing a synergistic model that combines the benefits of both systems to create a comprehensive e-waste management plan in West Africa. This plan should prioritize decent work, economic growth, and environmental sustainability.

Keywords: Child Labour; E-waste; SDG; Decent Work; Economy

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1. Introduction

Electrical and Electronic Equipment (EEE) is defined as equipment that relies on electric currents or electromagnetic fields to function properly. This includes equipment for the generation, transfer, and measurement of such currents and fields (Environmental Agency, 2021). Waste is any substance or object that is discarded, intended to be discarded, or required to be discarded under national laws. Waste is also defined as any substance that is no longer useful or has reached the end of its life. However, there is a debate about when EEE becomes waste. Some scholars argue that once equipment is discarded by the original owner, it becomes waste, whether functional or not. Others believe that EEE remains a resource if it can be refurbished, reused, or have components extracted for manufacturing, and should not be considered waste (ILO, 2019). Regardless of the argument, e-waste is any electric-powered device that has been discarded by its owners (Greenpeace, 2008).

The challenge with e-waste lies in management. Proper management of e-waste can bring economic advancement and environmental sustainability to West Africa, while improper management poses economic, health, and environmental hazards. This paper focuses on e-waste management strategies in West Africa, with specific attention to Nigeria and Ghana, the largest markets for e-waste trade and management in West Africa. The paper compares Nigeria's and Ghana's e-waste management approaches, weighing the benefits and drawbacks of condonatory and regulated methods. The study aims to highlight the complexities of developing e-waste management methods that promote economic growth, maintain good working conditions, and uphold environmental integrity across West Africa by exploring economic, social, and environmental factors.

This paper is divided into seven sections. Following this introduction, section two reviews literature on electronic waste management in West Africa. Section three outlines the methodology used in this research. Section four focuses on Nigeria's e-waste management approach, while section five evaluates Ghana's approach. Section six examines SDG Goal 8 and how the two management approaches have helped or hindered the goal's achievement. Finally, section seven concludes the paper.

2. Literature review

The proliferation of e-waste is due to the shift to digital technologies. Modernization, industrialization, and customer demand for new technologies have made managing electronic waste more challenging. The lifespan of computers and ICT accessories has decreased from 5–10 years to 3–4 years as devices are designed for replacement rather than repair (Agamuthu et al., 2015). Omobowale (2012) argued that many people in emerging economies like Nigeria and Ghana can only afford used electronic equipment. Orisakwe et al. (2019) noted that second-hand EEE gives low-income individuals access to market and price information, promoting sustainable development. Developed countries have regulations, infrastructure, and expertise to handle e-waste. They have adopted the Extended Producer Responsibility (EPR) policy, assigning e-waste handling responsibility to EEE manufacturers (Fraige et al., 2012). China has over 109 recycling centers, exceeding recycling requirements (Ghosh et al., 2016).

While industrialized countries have laws and infrastructure for e-waste recycling, it seems profitable for them to transport e-waste to less developed countries in the Global South, where regulations are lacking. This leads to a buildup of e-waste in these countries (Nganji and Brayshaw, 2010). Importing countries like Nigeria

and Ghana lack robust legislation and infrastructure for e-waste management, thereby posing environmental and health risks. Developing nations face an increasing burden due to the projected rise in global e-waste production, expected to surpass 53 million metric tonnes by 2021 (Baldé et al., 2017). Informal e-waste handlers in developing countries use crude methods like incineration, impacting laborers and local populations (Bakhiyi et al., 2018). Moreover, there is illicit cross-border transportation of hazardous waste from developed to underdeveloped nations, disguised as trade commodities or recyclable materials (Amankwah-Amoah, 2016; Hopson and Puckett, 2016).

Research on e-waste quantities in Ghana and Nigeria is limited due to inadequate infrastructure (Mmereki et al., 2015; Orisakwe et al., 2019). The lack of a national approach to e-waste management in developing nations contributes to the scarcity of data on e-waste generation (de Oliveira et al., 2012; Orisakwe et al., 2019). Kreinin and Aigner (2021) propose conceptual changes to SDG 8, suggesting a revised framework aligned with Sustainable Development Goals and Agenda 2030.

Bohnenberger (2022) presents a unique technique that establishes a systematic connection between gainful employment and environmental factors. A new taxonomy of sustainable employment incorporates many perspectives and definitions of "green jobs" (ILO, 2018), "greenness-of-tasks" (Janser, 2018), and "sustainable work" (Barth et al., 2016). The main argument of these authors is that the key modifications needed to make output more environmentally friendly are the conversion of plants and businesses and the decommodification of the environment. Additionally, the authors suggest that promoting environmentally sustainable occupations can be achieved through environmental labor law, vocational guidance, and alternative income sources. Lastly, the author proposes that equalizing income and employment time can help improve sustainable work lifestyles.

Peneder et al. (2021) opine that policy measures can incentivize enterprises to enhance their energy efficiency and reduce their carbon footprint. They recommend that policymakers adopt a comprehensive policy mix where each instrument makes use of distinct transmission mechanisms. While there have been some efforts made to address e-waste management in Nigeria and Ghana, limited attention has been given to utilizing e-waste management to achieve Sustainable Prosperity Goal 8, which focuses on promoting decent work and economic prosperity for all. This study seeks to present a comprehensive analysis of the status of e-waste management in Nigeria and Ghana with the aim of finding ways to improve their management strategies towards attaining SDG Goal 8. The article further suggests that Nigeria and Ghana should collaborate to promote decent work and economic development by effectively managing e-waste in both nations.

3. Methodology

This study adopts a mixed-methods approach, incorporating both doctrinal research and comparative policy analysis to explore the effectiveness of e-waste management strategies in Nigeria and Ghana. The doctrinal component involves an examination of primary legal sources, including case laws, statutes, and regulatory policies from both countries. This analysis aims to clarify the legal frameworks governing e-waste management and to interpret how these laws are structured and applied within each jurisdiction. Simultaneously, the comparative policy analysis enables us to evaluate and contrast the actual implementation and outcomes of these legal frameworks in practice. By examining the socio-economic and environmental impacts of e-waste

management strategies in Nigeria and Ghana, this approach facilitates a comprehensive understanding of how different regulatory environments affect sustainable development goals related to e-waste management.

Primary data were collected from legal documents and official regulations, while secondary data were gathered from relevant book chapters, journal articles, online sources, and conference papers. The collected data were then subjected to content analysis, focusing on identifying, comparing, and synthesizing the similarities and differences in legislative responses and their practical applications in both countries.

4. E-waste management structure in Nigeria

The management of e-waste in Nigeria is problematic due to the volume of e-waste coming into the country. This is caused by the high demand for used and obsolete electronic devices, giving importers a thriving market. Regulatory agencies find it difficult to regulate inflow as it comes in through different means that are cumbersome to detect (Obaje, 2013). In many instances, electronic waste is concealed inside imported used cars, and none of the officials make any effort to check those cars (Bamako COP, 2018). Nigeria has moved from being a destination country to being a transit route for distribution to other countries in Africa (Ogungbuyi, 2012).

Since many Nigerians are technologically dependent on discarded electrical electronic equipment, demands for those devices rise exponentially, and enforcing applicable laws becomes more difficult (Eriksen, 2016). Used Electrical Electronics Equipment (UEEE) and End of Life (EOL) devices have become so relevant to Nigerians that even many Nigerians in Europe and America create diverse means of livelihood through gathering, sorting, and shipping Used EEE down to Africa and Nigeria in particular (Burrell, 2016). Many Nigerians desire expensive brands like Apple, Samsung, etc., which they cannot afford. Therefore, they prefer to spend a little just to get the used or near-end-of-life devices of those luxurious brands instead of buying new devices with lower brand names. Others also believe that Used EEE are superior in quality and last longer than the new ones (Eriksen, 2016).

Nigeria has managed e-waste through various means, some slightly effective, others completely ineffective. Some trending options which have been adopted in Nigeria include electronic waste buyback programs (Kirti et al., 2024). Nigeria has also attempted a circular economy system for e-waste management. A circular economy system was announced by the Nigerian government in 2019. This was in conjunction with the Global Environment Facility and UN Environment, with an investment of \$15 million. The objective of the project was to revamp the electronics industry and mitigate the hazardous impact of inadequate electronic waste management in Nigeria. A significant number of individuals, estimated to be up to 100,000, are employed in the informal electronic waste industry in Nigeria, where they handle and recycle more than 500,000 metric tons of discarded electronic devices annually (Rukikaire, 2019).

The ultimate goal was to promote environmental conservation while generating secure employment opportunities for a significant number of Nigerians (Rukikaire, 2019). Very prevalent in Nigeria is informal recycling. Informally practiced recycling occurs when recycling is not carried out through an organized system using safe technology and is not governed by official government agencies (Abubakar, 2022). Recycling is also informal when it is not registered and operates outside legal bounds (Chi et al., 2011). Nigerians usually resort to informal recycling to recover valuables like copper and aluminum by dismantling, burning, acid leaching, etc., since they lack the necessary technology and recycling facilities (Azeta et al., 2022).

One of the injustices of informal recycling is that e-waste is shipped from the global north to Nigeria and other developing countries for recycling, which is mostly done informally to recover gold and other precious metals, after which the global north, especially China and other European nations, return to harvest the recovered resources, thereby leaving Nigeria with the waste. Impliedly, the whole arrangement of informal recycling, as far as the global north is concerned, is an arrangement for waste dumping. Moreover, when there is a high market for used electronics and domestic recycling infrastructure is lacking, informal recycling thrives (Oradi, 2019).

Informal recycling options in Nigeria include toner sweeping, commonly practiced in places where toner and cartridge-using printers are repaired or recycled. Workers in this industry often do not use safety gear like face masks, gloves, or coats, making the process extremely hazardous. Long-term workers are exposed to carcinogens that can cause respiratory infections, skin allergies, irritations, and even cancer when toners are absorbed through the bloodstream (Morton et al., 2022). Another prevalent option used by many Nigerians is open burning, often to retrieve copper wire, sometimes in or near residential areas (Abiodun, 2022). In some cases, electronic waste is still burned as a final disposal method even after extracting other valuable elements. Another technique involves slamming circuit boards violently against a hard surface or material to remove solder for later resale.

Regarding the regulatory management of e-waste, Nigeria lacks a specific law on e-waste, unlike in other environmental concerns such as oil and gas pollution, climate change, deforestation, and loss of biodiversity. However, several environmental protection laws in Nigeria indirectly apply to e-waste due to the scope of those laws. These laws include the Harmful Waste (Special Criminal Provisions, etc.) Act (Cap H1 LFN 2004) and the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007, which is the primary legislation for all environmental matters in Nigeria. Additionally, Nigeria has the National Environmental (Sanitation and Wastes Control) Regulations 2009, covering environmental sanitation, including electronic and other solid waste. The National Environmental (Electrical/Electronics Sector) Regulations 2011 is a major e-waste regulatory framework in Nigeria, covering both old and new electrical and electronic equipment. Nigeria also has the Guide for Importers of Used Electrical and Electronic Equipment into Nigeria, which permits only used electronic gadgets in good working condition to enter the country.

The Basel Convention, Basel Amendment Ban, and the Bamako Convention have played significant roles internationally in addressing e-waste issues in Nigeria, particularly the Basel Amendment Ban. While the original Basel Convention did not address e-waste, the amendment filled in the gaps. It is important to note that laws are ineffective without institutions to enforce them (Kang et al., 2019).

Institutions responsible for managing e-waste in Nigeria include the National Environmental Standards and Regulations Enforcement Agency, established by the NESREA Act 2007, the Nigerian Customs Service, the Nigerian Ports Authority, the Federal Ministry of Environment, and the Standards Organisation of Nigeria. However, the challenge of weak implementation in Nigeria's e-waste management regime has led to continued proliferation and improper management of e-waste, creating a sense of condonation.

The European Commission's 2013 survey through the Countering WEEE Illegal Trade (CWIT) program highlighted challenges faced by customs officers in discerning between waste and non-waste due to uncertainties in global regulations on waste electrical and electronic equipment (WEEE). Port authorities lack sufficient staff for physical inspections on all containers exported from Europe, and there is a shortage of

specialized training on WEEE for customs officials and law enforcement personnel. Additionally, authorities lack the technological capabilities to assess the hazardousness of WEEE exports (Hintsä, 2024).

Furthermore, there are gaps in existing laws (Nnorom, 2008) and a lack of uniform enforcement standards between Nigerian environmental laws and international laws. For example, the Basel Convention treats waste as a trade commodity requiring prior informed consent, while the Bamako Convention imposes a total ban on waste importation into Africa (Nnorom, 2008). This poses a challenge for Nigeria in deciding which international convention to align with. Additionally, the lack of a system for prosecuting e-waste offenses in Nigeria has led to few prosecutions in this area (Okposin, 2020).

The Nigerian legal system's technicalities make it challenging for courts to provide adequate remedies for environmental matters, including environmental litigation, lack of awareness, government commitment to court judgments, and institutional corruption. Other factors hindering compliance include procedural injustice, high regulatory compliance costs, failure of deterrence, regulatory officials' incapacity, failure of persuasion, and lack of civil society involvement (Emmanuel and Potgieter, 2024).

The volume of e-waste entering Nigeria poses a significant challenge for its management, driven by high demand for used and obsolete electronic devices. Regulatory agencies struggle to regulate the inflow, which often comes through difficult-to-detect means (Obaje, 2013). In many cases, electronic waste is concealed inside imported used cars, and officials do not inspect these vehicles (Bamako COP, 2018). Nigerians' technological dependence on discarded electronic equipment leads to rising demands for these devices, making enforcement of applicable laws more challenging (Eriksen, 2016). Many Nigerians engage in informal recycling to recover valuable materials like copper and aluminum due to a lack of technology and recycling facilities (Azeta et al., 2022). One popular informal recycling method is toner sweeping, where workers are exposed to hazardous carcinogens (Morton et al., 2022). Open burning is another prevalent option used by Nigerians to retrieve materials like copper wire, even in residential areas (Abiodun, 2022).

Nigeria has attempted various means to manage e-waste, including electronic waste buyback programs and a Circular Economy System announced in 2019, in partnership with the Global Environment Facility and UN Environment, with a \$15 million investment. The goal is to revamp the electronics industry and improve electronic waste management while creating employment opportunities for Nigerians (Rukikaire, 2019). However, challenges persist in informal recycling practices, where waste is shipped from developed countries to Nigeria for informal recycling, leaving Nigeria with the waste and little benefit (Oradi, 2019).

5. E-waste management approach in Ghana

Ghana is Africa's second-largest importer of electronic waste, following Nigeria. The rapid increase in the importation of used EEE into Ghana is driven by the same factors that fuel demand for such imports in Nigeria (Burrell, 2012). The country imports a significant amount of used EEE, some of which are broken, resulting in a considerable amount of e-waste being generated locally. This has negative impacts on the environment and people's health (Daum, 2017). A large portion of Ghana's population relies on used or secondhand electronic devices due to budget constraints. In Accra, secondhand laptops can be available for as little as 30% of the price of a new comparable device (Oteng-Ababio, 2010).

E-waste management in Ghana is primarily carried out through the informal sector (Prakash et al., 2010). This involves an unstructured process of collection, recycling, refurbishing, and reuse, as well as the disposal of unusable materials. Even unusable materials are sometimes collected and repurposed into valuable items. In Agbogbloshie, the hub of Ghana's e-waste industries, everything is considered to have value, and there is no concept of waste. Televisions and computers are bought, sold, disassembled, and reassembled daily. Electronic devices are broken down into their metal, glass, and plastic components using simple tools like hammers, wrenches, chisels, and bare hands.

The collection process serves as the initial entry point into the e-waste business. The majority of the workforce in the e-waste trade consists of young collectors who gather used electrical and electronic equipment (EEE) from various sources, including private residences, institutions, landfill sites, and transfer stations. Waste collectors generate their livelihoods through these activities rather than traditional employment (Oteng-Ababio, 2010). After collection, the next informal practice involves refurbishment and reuse activities. Reusing obsolete electronic products is a common practice in Ghana and is the most environmentally friendly way to handle e-waste. It also provides economic opportunities for many individuals. Ghana also engages in crude recycling activities, where valuable materials are recovered by disassembling and recycling electronic waste. This has become a profitable industry in Ghana, with operations in Agbogbloshie focusing on dismantling outdated electronics to extract metals like copper and aluminum.

Ghana faces challenges with improper data management, making it difficult to determine the rate of obsolescence in electronics. Additionally, the country's porous land borders allow unmonitored shipments of e-waste. In response to the growing e-waste trade and increased awareness of environmental issues, there are calls for the government to establish a formal recycling system (Oteng-Ababio, 2010). The Ghanaian government is taking steps to establish formal recycling facilities, with support from donor agencies such as the German Federal Ministry for Economic Cooperation and Development (GIZ), Setsoafia (2019), the European Union (EU), Helmhaus (2021), and the Swiss State Secretariat of Economic Affairs (SECO) (SRI, 2018).

Instead of banning e-waste imports outright like Nigeria, Ghana has chosen to regulate and manage them sustainably through legislation on transboundary e-waste movement (Liddane, 2016). The Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917), aims to control, manage, and dispose of hazardous and electronic waste in Ghana. The Act prohibits the import and export of used EEE, including e-waste, without meeting specified requirements, such as paying an eco-levy and registering with the EPA. The EPA can issue permits for e-waste importation for recycling purposes, even without payment of the eco-levy. This clause raises concerns about funding for responsible e-waste management and mitigation of its negative effects. The Act is expected to create jobs and improve the organization of e-waste handling in Ghana (Ghana's Hazardous Waste Act, 2016). Ghana's approach to e-waste importation aligns with other African countries like South Africa and Kenya, which have established large-scale e-waste recycling facilities through supportive policies (Christian et al., 2022).

6. Towards attainment of goal 8 of the sustainable development goals

To properly contextualize this discourse, it is necessary to understand the United Nations Sustainable Development Goals, particularly Goal No. 8. The goal is to promote development-oriented policies that support

productive activities, decent job creation, entrepreneurship, creativity, and innovation, and encourage the formalization and growth of micro, small, and medium-sized enterprises, including through access to financial services. The desire to empower individuals through decent work is the primary focus of the Sustainable Development Goals (SDGs) adopted by world leaders during the 70th General Assembly of the United Nations in New York in September 2015. In furtherance of this goal, some targets were set to engineer its achievement.

The management techniques for electronic waste have a direct impact on many specific targets of Sustainable Development Goal 8 (SDG 8). SDG 8 aspires to foster continuous, inclusive, and sustainable economic growth, as well as create full and productive employment opportunities and decent work for everyone.

Target 8.4 is to improve progressively, through 2030, global resource efficiency in consumption and production and endeavor to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programs on sustainable consumption and production, with developed countries taking the lead. This target is aptly pointed towards informal electronic waste management in Nigeria and Ghana, where people make their living at the expense of the environment. The establishment of formal recycling facilities in Nigeria and Ghana and the implementation of a strong waste import regime would greatly help the achievement of this target. Collaboration by both countries to put in place e-waste management solutions would enhance resource efficiency through the promotion of electronic waste recovery, recycling, and appropriate disposal. This diminishes the necessity for unused resources, preserves energy, and reduces environmental deterioration linked to the exploitation of raw materials.

Target 8.5 aims to attain complete and efficient employment and satisfactory work for all individuals, regardless of gender, age, or disability. It also seeks to ensure equitable compensation for labor that is of equal worth. An efficient electronic waste (e-waste) management system will generate job prospects in many industries, such as waste retrieval, recycling, restoration, and e-waste processing facilities and manufacturing. These occupations offer means of subsistence for both skilled and unskilled laborers, hence fostering favorable employment prospects and financial autonomy, especially in emerging nations. Target 8.9 projects that by the year 2030, states should establish and execute policies aimed at encouraging sustainable tourism that generates employment opportunities and supports the preservation and promotion of local culture and products. A well-structured management of e-waste is crucial to achieving this goal. This is because implementing sustainable procedures for managing electronic waste helps preserve the environment, which is crucial for the promotion of sustainable tourism. Appropriately disposing of electronic waste reduces the contamination of water bodies, soil, and air, thus safeguarding natural resources and ecosystems that are frequently significant attractions for tourists.

Target 8.10 aims to enhance the capabilities of local financial institutions in order to promote and broaden the availability of banking, insurance, and financial services to all individuals. Effective management of electronic waste necessitates substantial investment in infrastructure, technology, and human resources. Enhancing the ability of financial institutions to support sustainable e-waste management projects will provide easier access to capital for these initiatives, thereby fostering economic growth and creating employment prospects.

Furthermore, Target 8.A aims to enhance assistance for trade in developing countries, specifically the least developed countries, by providing increased support through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries. E-waste is both an environmental and a trade issue

since it is imported, and money is exchanged just like every other trade commodity. Aid for Trade programs can offer technical assistance, capacity-building, and investment support to poor nations in order to help them construct efficient e-waste management systems, thus supporting e-waste management. This support improves their capacity to effectively handle electronic waste in a sustainable manner, thereby promoting economic growth and the generation of employment opportunities. Efficient electronic waste management not only tackles environmental issues but also promotes economic growth, employment generation, and social integration, directly correlating with the objectives and milestones of Sustainable Development Goal 8. In summary, Goal 8 stands on four strategic pillars, which include employment creation and enterprise development, social protection, standards and rights at work, governance, and social dialogue.

According to the International Labor Organization (ILO) (2019), "decent work" entails opportunities for productive work that pays a fair wage, workplace security and social protection for families, better prospects for personal development and social integration, as well as active participation in decisions that affect their lives and equality of opportunity and treatment for all men and women. Decent work, as a vehicle for poverty reduction and fair globalization, is achieved through the four previously described strategic pillars, with gender equality as a cross-cutting goal. Work that is decent is essential to people's well-being because it provides income, prepares the path for larger social and economic growth, and improves individuals, families, and communities. Decent employment is linked to the concept of human development—a process of enabling choices, freedom to live one's values, and management of one's affairs. (Aryeetey, 2016).

In order to effectively implement its decent work and economic growth agenda, Nigeria's immediate past Federal administration launched its economic blueprint on April 5, 2017, with the goal of leaving Nigeria with a more diverse and inclusive economy by 2020, leveraging on the ingenuity and resilience of its citizens. The "Economic Recovery and Growth Plan (ERGP)" had as its target the creation of new jobs, with an increase from 1.5 million in 2017 to 3.8 million, 4.3 million, and 5.1 million jobs in 2018, 2019, and 2020, respectively. In order to attain the SDG8 targets by 2030, the Nigerian government plans to build on the gains it hopes to record in the development of decent jobs through its new economic blueprint. However, these plans are yet to come to fruition (Manhart, 2011).

Nigeria's unemployment rate for 2022 was 5.76%, a 0.18% decline from 2021. Additionally, the unemployment rate for 2021 was 5.94%, a 0.06% decline from 2020. In 2020, the Nigerian unemployment rate due to the COVID-19 pandemic was 6.00%, a 0.79% increase from 2019. The unemployment rate for 2019 was 5.21%, a 0.24% increase from 2018 (Macrotrends, 2010–2024). Currently, over half of Nigeria's 220 million residents live in cities with significant unemployment rates. In March 2014, the Nigeria Immigration Service conducted a nationwide recruitment exam, resulting in approximately 18 job applicants losing their lives and many others being injured, highlighting the severe impact of unemployment (Fasan, 2014). The persistently high unemployment rate has worsened poverty levels. According to the National Bureau of Statistics, the unemployment rate in Q2 2020 was 27.1%, up from 23.1% in Q3 2018 (National Bureau of Statistics, 2020).

Despite ratifying 40 ILO conventions, Nigeria still lacks adequate labor standards. The government has yet to ratify several vital conventions crucial for addressing decent work deficiencies in the labor market and the pressing issues of poverty and social exclusion, particularly in the current economic climate. Conventions such as C122, C129, C150, C187, and C188 on labor market regulation, C102 on social security, C181 on private employment agencies, and C189 on domestic workers remain pending (NBS, 2020). Many unemployed

Nigerians have turned to e-waste management as a means of survival, with thousands engaging in various informal e-waste management activities, notably informal recycling (Oradi, 2019).

When considering the SDG Goal 8 indicators, questions arise about the decency of informal recycling practices in Nigeria. The informal nature of e-waste management in Nigeria hinders the government from accurately tracking per capita economic growth. As a consumption-driven nation, Nigeria lacks economic productivity increases through diversification, technical advancements, and innovation, particularly in high-value-added and labor-intensive sectors, due to inadequate investment in these areas. Nigeria also lacks development-oriented policies supporting productive activities, decent job creation, entrepreneurship, creativity, innovation, and the formalization and growth of micro, small, and medium-sized enterprises, including through financial services. While the government provides funding for businesses falling under these categories, there is little evidence of such assistance being extended to e-waste management businesses.

Furthermore, a thorough examination of Nigeria's e-waste management system reveals the country's failure to contribute to global resource efficiency in consumption and production, unlike countries like Japan and China, which have made significant contributions to the global economy through the recycling of existing technologies and transitioning from consumption to production (Venkatesha and Seeram, 2022).

Ghana, like Nigeria, grapples with poverty and unemployment challenges. Ghana's unemployment rate in 2022 was 3.87%, a 0.05% decrease from 2021. In 2021, Ghana's unemployment rate was 3.92%, a 0.15% increase from 2020. Goals 1 and 8 are closely linked, with discussions on decent work also addressing poverty challenges. The percentage of Ghanaians living below the international poverty line decreased from 13.6% in 2013 to 11.9% in 2017, with similar trends observed in urban and rural areas. However, the Upper East and Northern regions experienced an increase in overall poverty during this period (Ghana Voluntary National Review Report, 2019). In 2017, an estimated 26.4% of Ghanaian youths were unemployed, marking a 15.5 percentage point increase from the previous year. The high labor underutilization rate of 42% contributes to a significant number of young people being jobless, particularly in urban areas where female youth unemployment rates are disproportionately high. The government's "Agenda for Jobs: Creating Prosperity and Equal Opportunity for All, 2017–2024" aims to address the growing challenges faced by young people by creating job opportunities.

The majority of Ghanaians work in the informal economy, which offers minimal protections and low wages for workers. Achieving decent work in the informal sector, which employs a substantial portion of Ghanaians, poses challenges. The informal e-waste sector falls under this category, with individuals working in various dumpsites, including the infamous Agboshile site, facing risks while receiving inadequate compensation for their efforts (Manhart, 2011). Ghana faces challenges in establishing a functional and up-to-date administrative statistics and information management system to ensure successful implementation, monitoring, and reporting on national, sub-national, and globally coordinated development efforts (Viraja, 2023). Other hurdles include a lack of human and technological skills necessary to develop the expertise needed for effective implementation (Tandoh-Offin, 2019).

Despite these challenges, Ghana has taken steps to address unemployment and achieve the SDGs. Key interventions include the Nation Builders Corps (NABCO) Programme, Planting for Food and Jobs, Rearing for Food and Jobs, One District, One Factory, and the Digital Marketing Entrepreneurship Programme (Yeboah, 2022). In 2018, the Ghana Audit Service conducted a performance audit to assess the government's readiness to implement the SDGs, focusing on integration of the 2030 Agenda, resource allocation, capacity building, and

monitoring mechanisms (Martin et al., 2024) The audit examined policy coherence and integration, the legislative framework, institutional arrangements, communication and stakeholder involvement, capacity and finance arrangements, monitoring and evaluation systems, indicators and data production, and communication strategies. The audit revealed that the government had developed policies and plans for implementing the SDGs in a participatory manner. National development strategies have been aligned with the SDGs and budgeted using the current integrated budgeting framework. (Xu et al., 2022)

Comparatively, in terms of achieving the SDG 8 target, Ghana has made more progress than Nigeria. Ghana has implemented several frameworks to address the challenge of unemployment. Successive governments in Ghana have made significant efforts to create jobs and ensure that every individual is included in the economic progress. (Soudabeh et al., 2023). Building on the contributions of Flt. Jerry John Rawlings to sustainable growth through programs like the Structural Adjustment and Economic Recovery Programs, President Kufuor, upon taking office, reiterated the government's commitment to creating a platform for increased private sector investments and business operations, thereby generating business and employment opportunities for its citizens. (Aryeetey et al., 2016) By the end of 2007, Ghana had achieved middle-income status. According to Aryeetey and Baah-Boateng (Aryeetey et al., 2016), Ghana became one of the fastest-growing economies, with a growth rate of about 15% in 2011. "The economy of Ghana grew annually by 5.8 percent compared to the 3.7 percent recorded in Sub-Saharan Africa between 1991 and 2013" (Government of Ghana, 2017). When assessing the targets of goal 8, it is evident that Ghana has outperformed Nigeria, providing opportunities for Nigeria to learn from its neighbor. (Abubakar, 2022)

Analyzing the approaches of both countries, it is clear that Ghana has made efforts to formalize e-waste management through rules and policies. Initiatives like the Hazardous and Electronic Waste Control and Management Act (2016) aim to regulate the importation, disposal, and recycling of electronic waste. Ghana also hosts programs like the Agbogloboshie Makerspace Platform, which promotes environmentally friendly e-waste recycling practices. Formalizing e-waste management through regulation in Ghana has the potential to create decent jobs by establishing standards for recycling facilities and providing worker training to ensure safer working conditions.

While informal e-waste activities may bring short-term economic benefits to Nigerians, the long-term consequences, such as environmental degradation and health risks, hinder sustainable economic growth. In contrast, Ghana's regulated approach to e-waste management supports long-term economic growth by promoting a formal sector that adheres to environmental and labor standards. This paper does not undermine the efforts made by Nigerians so far; however, it suggests that Nigeria could benefit from adopting a similar regulatory approach to e-waste management to provide more decent work opportunities for its citizens.

The approaches of Nigeria and Ghana to e-waste management have broad implications. Since both West African countries face similar challenges in e-waste management, Ghana's legislative framework can serve as a model for other countries in the region, fostering cooperation and collaborative action to achieve sustainable development goals. Considering that the primary objective is sustainability, it is important to note that while Nigeria's permissive approach to e-waste treatment may yield short-term economic gains for individuals, Ghana's regulatory approach offers a more sustainable path to achieving decent work and economic progress in West Africa. Enhanced collaboration between Nigeria and Ghana could facilitate the achievement of Goal 8 in both countries.

7. Conclusion

The comparison of Nigeria's and Ghana's e-waste management approaches reveals a complex system with challenges, obstacles, and opportunities. While Nigeria's lenient stance has led to short-term economic benefits and increased informal sector employment, it also poses risks of long-term environmental degradation and health hazards, hindering sustainable development goals. On the other hand, Ghana's regulatory path demonstrates a concerted effort to align with global best practices and mitigate environmental and health risks, as evidenced by the Hazardous Waste Act 2016. However, challenges such as informal labor marginalization, implementation delays, and adapting to evolving e-waste dynamics persist. Synthesizing these contrasting concepts highlights the need for a nuanced, context-specific approach that combines the economic vitality of the informal sector with effective regulatory frameworks. Such a synergistic model would prioritize environmental sustainability, foster equitable growth, and ensure fair working conditions, aligning with the broader sustainable development goals of the region.

The necessity for a synergistic model between Nigeria and Ghana arises from their significant roles in e-waste commerce and management in West Africa, home to the largest e-waste dumpsites in the region. One strategy to establish synergy is aligning e-waste management laws in both countries through robust bilateral agreements. This would enable coordinated law enforcement and cross-border monitoring of e-waste management. Both countries can also advocate for well-implemented Extended Producer Responsibility and compel manufacturers to manage the lifecycle of their products responsibly. Collaborative capacity-building initiatives, including training programs and technology transfer, can be facilitated through partnerships between government agencies, academic institutions, and international organizations.

Since both countries manage e-waste through informal means, they can synergize to formalize their informal sectors. This would help them adopt more sustainable practices. Collaboration between formal recycling facilities and informal collectors can improve the efficiency and sustainability of e-waste management while providing livelihood opportunities for informal workers. Moreover, collaborative research projects between universities, research institutions, and industry stakeholders can lead to the development of novel recycling techniques, resource recovery methods, and sustainable business models tailored to the context of Nigeria and Ghana. Both countries could also engage with international partners, including donor agencies, multilateral organizations, and industry alliances, to mobilize financial resources, technical expertise, and knowledge exchange opportunities for improving e-waste management.

As the West African region grapples with the growing issues posed by e-waste proliferation, the need for a comprehensive, coordinated, and adaptive solution remains critical. The region can navigate the e-waste maze with united efforts, as noted above, informed policy-making, and inventive solutions, producing a future marked by decent work, economic growth, and environmental sustainability. It is strongly believed that this study would be used as a basis for future research efforts to investigate e-waste management procedures in other West African nations, thereby enhancing awareness of the regional situation. This might also entail conducting longitudinal studies to monitor the evolution of e-waste creation, management solutions, and environmental consequences over time. This would enable decision-makers to make informed choices based on empirical evidence.

Moreover, this study would provide valuable insights to policymakers and lawmakers for the creation and improvement of e-waste management policies and regulations in Nigeria, Ghana, and potentially other

countries in West Africa. It is also necessary to employ policies as a tool to incorporate informal sector participants into formal e-waste management systems, emphasizing the requirement for comprehensive and sustainable approaches that prioritize the welfare of workers and communities. The comparison of Nigeria's and Ghana's approaches to e-waste management reveals a diverse world fraught with complexities, obstacles, and opportunities. While Nigeria's permissive posture has resulted in short-term economic advantages and increased employment in the informal sector, it is plagued with long-term environmental degradation, health risks, and potential setbacks in reaching sustainable development goals. The rise of informal e-waste recycling activities, although providing prospects for livelihood, highlights the need for a more structured, holistic strategy that combines economic imperatives with environmental and social imperatives.

Ghana's regulatory trajectory, on the other hand, illustrates a concerted attempt to conform with worldwide best practices and mitigate environmental and health hazards, as seen from Ghana's Hazardous Waste Act 2016. This strategy, however, is not without difficulties, such as the marginalization of informal labor, implementation delays, and the need for ongoing adaptation to new technical landscapes and global e-waste dynamics.

Synthesizing these opposing concepts reveals that neither condonation nor stringent regulation provides a solution to West Africa's e-waste management dilemma. Instead, what is required is a nuanced, context-specific approach that combines and utilizes the economic vitality of the informal sector while creating effective regulatory frameworks. Such a synergistic model would prioritize environmental sustainability, create equitable growth, and provide fair working conditions, thus aligning with the region's broader sustainable development goals.

References

- Abiodun, B. (2022), "Nigeria has an electronic waste problem, but an e-waste bill may not be the solution", *Techpoint Africa*, available at: <https://techpoint.africa/2022/09/05/e-waste-in-nigeria/> (accessed 8 January 2024).
- Abubakar, A., Zangina, A.S., Maigari, A.I., Badamasi, M.M., Ishak, M.Y., Abdullahi, A.S. and Haruna, J.A. (2022), "Pollution of heavy metal threat posed by e-waste burning and its assessment of human health risk." *Environ Sci Pollut Res Int*, Vol. 29 No. 40, p. 61065.
- Agamuthu, P., Kasapo, P. and Nordin, N.A.M. (2015), "E-waste flow among selected institutions of higher learning using a material flow analysis model", *Resources, Conservation, and Recycling*, Vol. 105 No. A, pp. 177-185.
- Amankwah-Amoah, J. (2016), "Global business and emerging economies: Towards a new perspective on the effects of e-waste", *Technological Forecasting and Social Change*, Vol. 105, pp. 20-26.
- Aryeetey, E. and Baah-Boateng, W. (2016), "Understanding Ghana's Growth Success Story and Job Creation Challenges", available at: <https://www.brookings.edu/wp-content/uploads/2016/07/Understanding-Ghanas-growth-success-story-and-job-creation-challenges.pdf> (access 28 May 2024).
- Azeta, J., Bolu, C.A. and Oyawale, F.A. (2022), "Design and simulation of a mobile robot platform for navigation and obstacle detection", *Engineering Review*, Vol. 42 No. 1, pp. 56-65.

- Bakhiyi, B., Gravel, S., Ceballos, D., Flynn, M.A. and Zayed, J. (2018), "Has the question of e-waste opened Pandora's box? An overview of unpredictable issues and challenges", *Environment International*, Vol. 110 pp. 173-192.
- Baldé, C., Forti, V., Grey, V., Kuehr, R. and Stegmann, P. (2017), "The global e-waste monitor 2017 (ITU)", available at: <https://www.itu.int/en/ITU-D/Climate-Change/Documents/GEM%202017/Global-E-waste%20Monitor%202017%20-%20Executive%20Summary.pdf> (access 28 May 2024).
- Bamako COP (2018), "Bamako COP Affirms Commitment to Pollution-Free Africa", *International Institute for Sustainable Development*, available at: <https://sdg.iisd.org/news/bamako-cop-affirms-commitment-to-pollution-free-africa/> (access 4 June 2024).
- Barth T., Jochum G., and Littig B. (eds.) (2016), "Nachhaltige Arbeit: Soziologische Beiträge zur Neubestimmung der gesellschaftlichen Naturverhältnisse", Campus Verlag, Frankfurt.
- Bohnenberger, K. (2022), "Greening work: labour market policies for the environment", *Empirica*, Vol. 49, pp. 347-368.
- Burrell, A. and Oteng-Ababio, M. (2012), "Electronic Waste Management in Ghana-Issues and Practices", In: S. Curkovic (ed), *Sustainable Development-Authoritative and Leading-Edge Content for Environmental Management* (2012), p. 149.
- Burrell, J. (2016), "What environmentalists get wrong about e-waste in West Africa", Berkeley Blog, available at: <http://blogs.berkeley.edu/2016/09/01/what-environmentalists-get-wrong-about-e-waste-in-west-africa/> (accessed 8 January 2024).
- Chi, W., Lisic, L. and Pevzner, M. (2011), "Is Enhanced Audit Quality Associated with Greater Real Earnings Management?", *Accounting Horizons*, Vol. 25 No. 2, pp. 315-335.
- Christian, J.E., Robel, A.A. and Catania, G. (2022), "A probabilistic framework for quantifying the role of anthropogenic climate change in marine-terminating glacier retreats", *The Cryosphere*, Vol. 16, pp. 2725-2743.
- Daum, K., Stoler, J. and Grant, R. J. (2017), "Towards a More Sustainable Trajectory for E-Waste Policy: A Review of a Decade of E-Waste Research in Accra, Ghana", *International Journal of Environmental Research and Public Health*, Vol. 14, p. 135.
- de Oliveira, C.R., Bernardes, A.M. and Gerbase, A.E. (2012), "Collection and recycling of electronic scrap: A worldwide overview and comparison with the Brazilian situation", *Waste Management*, Vol. 32 No. 8, pp. 1592-1610.
- Emmanuel O.A. and Potgieter, H. (2024), "Discarded e-waste/printed circuit boards: a review of their recent methods of disassembly, sorting, and environmental implications", *Journal of Material Cycles and Waste Management*, Vol. 26, pp. 1277-1293.
- Environment Agency (2021), "Electrical and Electronic Equipment Covered by the WEEE Regulations", available at: <https://www.gov.uk/government/publications/electrical-and-electronic-equipment-eee-covered-by-the-weee-regulations/electrical-and-electronic-equipment-eee-covered-by-the-weee-regulations> (accessed 8 January 2024).

- Eriksen, F.C. (2016), "Nigeria: Investigation—Inside Nigeria's Toxic "Tokunbo" Trade", Premium Times, 20 December, available at: <https://www.premiumtimesng.com/news/headlines/218472-investigation-inside-nigerias-toxic-tokunbo-trade.html> (accessed 8 January 2024).
- Fasan, R. (2014), "Immigration Service debacle: the siege on the Nigerian future", Vanguard. available at <https://www.vanguardngr.com/2014/03/immigration-service-debacle-siege-nigerian-future/> (accessed 8 January 2024).
- Fraige, F.Y., Al-Khatib, L.A., Alnawafleh, H.M., Dweirj, M.K. and Langston, P.A. (2012), "Waste electric and electronic equipment in Jordan: willingness and generation rates", *Journal of Environmental Planning and Management*, Vol. 55 No. 2, pp. 161-175.
- Ghosh, S.K., Debnath, B., Baidya, R., De, D., Li, J., Ghosh, S.K., Zheng, L., Awasthi, A.K., Liubarskaia, M.A., Ogola, J. S. and Tavares, A.N. (2016), "Waste electrical and electronic equipment management and Basel Convention compliance in Brazil, Russia, India, China, and South Africa (BRICS) nations", *Waste Management & Research*, Vol. 34 No. 8, pp. 693-707.
- Government of Ghana (2017), "The Coordinated Programme of Economic and Social Development Policies: An Agenda for Jobs, Creating Prosperity, and Equal Opportunity for All Presented by Nana Addo Dankwa Akufo Addo to the 7th Parliament of the 4th Republic."
- Greenpeace (2008), "E-Waste Toxic-Not in Our Backyard," available at: <https://www.greenpeace.org/usa/research/toxic-tech-not-in-our-backyard/> (accessed 8 January 2024).
- Hemkhaus, M. (2021). "From Grave to Cradle: E-waste Management in Ghana (E-MAGIN Ghana)", available at: <https://www.adelphi.de/en/project/grave-cradle-e-waste-management-ghana-e-magin-ghana> (accessed 8 January 2024).
- Hintsä, J. (2024), "The EU Cracks Down on E-Waste Crime", Panorama: Cross-Border Research Association. available at: <https://mag.wcoomd.org/magazine/wco-news-79/the-EU-cracks-down-on-e-waste-crime/> (accessed 8 January 2024).
- Hopson, E. and Puckett, J. (2016), "Scam recycling: e-dumping on Asia by US recyclers. The e-Trash Transparency Project. Seattle: Basel Action Network", available at: <https://www.resource-recycling.com/images/BANReportTwo.pdf> (accessed 10 June 2018).
- ILO (2018), *World Employment and Social Outlook 2018: Greening Jobs*, International Labour Organisation.
- ILO (2019), "Decent work in the management of electrical and electronic waste (e-waste)," available at: https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/sector/documents/publication/wcms_673662.pdf (accessed January 8, 2024).
- Janser, M. (2018), "The Greening of Jobs: Empirical Studies on the Relationship between Environmental Sustainability and the Labour Market", Dissertation, University of Bamberg.
- Kang, A., Antonelou, M., Wong, N., Tanna, A., Arulkumaran, N., Tam, F. and Pusey, C. (2019), "Dr. Kang, et al Reply", *The Journal of Rheumatology*, Vol. 46 No. 9.
- Kirti, D.M., Srinjana, R., Bibhuti, K.J., Theodosios, C., Judhajeet, B., Subhamoy, C., Dipankar, B. and Ilaria, E. (2024), "Differential Rotation of the Solar Chromosphere: A Century-long Perspective from Kodaikanal Solar Observatory Ca ii K Data", *American Astronomical Journey*, Vol. 961, No. 1.

- Kreinin H. and Aigner E. (2021), "Decent work and economic growth" to "Sustainable work and economic degrowth": a new framework for SDG 8", *Empirica*, Vol. 49, pp. 289-311.
- Liddane, M. (2016), "Ghana is the shining star for e-waste law in Africa", *Compliance and Risks*, 25.
- Manhart, A. et al. (2011), "Others, Informal e-waste management in Lagos, Nigeria: socio-economic impacts and feasibility of international recycling co-operations: Final report of component 3 of the UNEP SBC E-waste Africa Project," Ko-Institute. V. 2011, 23.
- Martin, B. et al. (2024), "Studies of the Ecology of the Benguela Current Upwelling System: The TRAFFIC Approach", In: von Maltitz, G.P., et al. (eds), *Sustainability of Southern African Ecosystems under Global Change. Ecological Studies*, Vol. 248. Springer, Cham
- Mmereki, D., Li, B. and Li'ao, W. (2015), "Waste electrical and electronic equipment management in Botswana: prospects and challenges", *Journal of the Air & Waste Management Association*, Vol. 65 No. 1, pp. 11-26.
- Morton, E., Nicholas, J., Yang, L., Lapadat, L., Barnes, S.J., Provencher, M.D., Depp, C., Chan, M., Kulur, R. and Michalak, E.E. (2022), "Evaluating the quality, safety, and functionality of commonly used smartphone apps for bipolar disorder mood and sleep self-management", *Int J Bipolar Disord*, Vol. 10 No. 1, p. 10.
- National Bureau of Statistics (2020), "Labour Force Statistics: Unemployment and Underemployment Report Q2 2020—Abridged Labour Force Survey Under VID-19", available at: <https://nigerianstat.gov.ng/elibrary/read/1135> (accessed 8 January 2024).
- NESREA (2007), "Guide for Importers of Used Electrical and Electronic Equipment into Nigeria", available at: <https://www.env.go.jp/recycle/yugai/pdf/GuideforImportersofUsedElectricalandElectronicEquipmentreserved.pdf> (accessed 8 January 2024).
- Nganji, J. and Brayshaw, M. (2010), "Is green IT an antidote to e-waste problems", *Innovation in Teaching and Learning in Information and Computer Sciences*, Vol. 9 No. 2, pp. 1-9.
- Nnorom, I.C. and Osibanjo, O. (2008), "Overview of Electronic Waste (E-Waste) Management Practices and Legislations, and Their Poor Applications in Developing Countries", *Resources Conservation and Recycling*, Vol. 52 No. 6, p. 843.
- Obaje, S.O. (2013), "Electronic Waste Scenario in Nigeria: Issues, Problems, and Solutions", *International Journal of Engineering Science Invention*, Vol. 2 No. 11, pp. 31-32.
- Ogungbuyi, O. (2012), "e-Waste Country Assessment Nigeria" (e-Waste Africa Project of the Basel Convention, May 2012), available at: http://ewasteguide.info/files/Ogungbuyi_2012_BCCC-Empa.pdf (accessed 3 February 2023).
- Okposin, A. (2020), "Curbing E-Waste Menace in Nigeria: Assessing the Regulatory Framework", *Chukwuemeka Odumegwu Ojukwu University Journal of Commercial And Property Law*, Vol. 2 No. 1, pp. 29-52.
- Omobowale, A.O. (2012), "Global e-waste management and second-hand consumption in the third world: substandard context and the Tokunbo phenomenon in Nigeria", *The Nigerian Journal of Sociology and Anthropology*, Vol. 10 No. 1, pp. 88-99.
- Oradi. (2019), "SDG # 8: The Challenges of Decent Work and Economic Development in Nigeria", available at: <http://www.oradi.org/publications/item/45-sdg-8-the-challenges-of-decent-work-and-economic-growth-in-nigeria.html> (accessed 8 January 2024).

- Orisakwe, O., Frazzoli, C., Ilo, C. and Oritsemuelebi, B. (2019), "The public health burden of e-waste in Africa", *Journal of Health and Pollution*, Vol. 9 No. 22, pp. 1-12.
- Oteng-Ababio, M. (2010), "E-waste: an Emerging Challenge to Solid Waste Management in Ghana", *Int. Development Planning Review (IDPR)*, Vol. 32, p. 2.
- Peneder M., Arvanitis S., Rammer C., et al. (2021), "Policy instruments and self-reported impacts of the adoption of energy-saving technologies in the DACH region", *Empirica*, Vol. 49, pp. 369-404.
- Prakash S., Manhart, A., Amoyaw-Osei, Y. and Agyekum O. (2010), "Socio-economic Assessment and Feasibility Study on Sustainable E-waste Management in Ghana", available at: <https://www.oeko.de/oekodoc/1057/2010-105-en.pdf> (access 28 May 2024).
- Rukikaire, K. (2019), "Nigeria Turns the Tide on Electronic Waste." United Nations Environmental Program", available at: <https://www.unep.org/news-and-stories/press-release/nigeria-turns-tide-electronic-waste> (accessed 8 January 2024).
- Setsoafia, E.D., Nkegbe, P.K., Abdelkrim, A., Abu, B.M., Ustarz, Y., Alhassan, H. and Abdul-Wahab, S. (2019), "Encouraging Non-Farm Work to Increase Agricultural Commercialization in Ghana", *Partnership for Economic Policy*.
- Soudabeh, A., Randon, P., Eberbeck, D., Rainer, K., Jaufenthaler, A., Baumgarten, D. and Wiekhorst, F. (2023), "Temperature Dependent Magnetorelaxometry of Magnetic Nanoparticle Ensembles", *Phys. Med. Biol.* Vol. 68 No. 17.
- Sustainable Recycling Industries (SRI) (2018), "Ghana's way towards sustainable e-waste recycling—first country in Africa to officially launch guidelines for environmentally sound e-waste management", available at: <https://www.sustainable-recycling.org/ghanas-way-towards-sustainable-e-waste-recycling-first-country-in-africa-to-officially-launch-guidelines-for-environmentally-sound-e-waste-management/> (accessed 8 January 2024).
- Tandoh-Offin, P. (2019), "Ghana and Global Development Agendas: The Case of The Sustainable", *AJPSDG*, Vol. 2, No. 1, p. 49.
- Venkatesha, M. and Seeram, R. (2022), "A Review on Global E-Waste Management: Urban Mining towards a Sustainable Future and Circular Economy," *Sustainability, MDPI*, Vol. 14 No. 2, pp. 1-18.
- Viraja, B. (2023), "E-waste management and Achieving SDG Challenges in Indian Context.", *IOP Conference Series: Earth and Environmental Science*, Vol. 1161.
- Xu, K., Lin, C., Lee, S.Y., Mao, L. and Meng, K. (2022), "Comparative analysis of complete Ilex (Aquifoliaceae) chloroplast genomes: insights into evolutionary dynamics and phylogenetic relationships", *BMC Genomics* Vol. 23 No. 203.
- Yeboah, S.A. (2022), "Achieving SDG 8: Decent Work and the Old Pension Security Nexus in Ghana", *International Journal of New Economics and Social Sciences*, Vol. 15 No. 1, pp. 135-144.