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# The Contribution of E-Waste Recycling in Promoting Green Growth. A Case of Enviroserve Rwanda Green Park

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**ABSTRACT**
Electronic wastes (E-wastes) management to promote green growth has raises awareness about proper e-waste management, and encourage Rwandans to recycle their e-waste. However, e-waste management cause various challenges especially in less developing countries like Rwanda. The study aims to examine the issues. It was conducted at Enviroserve, the only e-waste recycling company in Rwanda. The rapid growth in ICT has led to an improvement in the capacity of computers but simultaneously to a decrease in the products lifetime. As a result, a large quantities of electrical waste and electronic equipment (e-waste) are generated annually. These are known as trashes but they must promote green growth in other hand. This relationship between e-waste recycling and green growth is explored through whether the recovered materials are used for final product production, if the repaired equipment are resold, whether he purified materials are safely disposed in environment. This study found that e-waste management encourages the return of old and end-of-life electrical and electronic equipment. Furthermore, the practice is positively affecting livelihood of involved people. The challenges facing the e-waste recycling include: the absence of infrastructure for appropriate e-waste recycling, lack of awareness of general knowledge on e-waste, an absence of legislation in dealing specifically with e-waste. Lastly, there is an absence of a framework for end-of-life (EoL) product take-back or implementation of extended producer responsibility (EPR).Investment in infrastructure, such as collection centers and recycling facilities, is vital to ensure the safe handling and processing of electronic waste.

**KEYWORDS:** E-waste, Recycling, promotion, Green growth, Enviroserve Rwanda, Green Park.

## I. INTRODUCTION TO THE STUDY

The e-waste, an essential resource on which the entire race depends on is becoming scary. Many people are facing the problem caused by waste in the environment. As a result, people are getting affected by diseases caused by poor waste management. E-waste is frequently seen as a severe environmental concern. However, it is a benefit to green development strategies as it continues to benefit from it's recycling. Investing in recycling technology is an innovation that will support circular economy and increase awareness and comply with laws of waste disposal through e-waste collection, safer recycling, and processing, sustainable e-waste management(Razzaq, 2021). This will protect the environment and public health from dangers posed by burning combined with rising e-waste levels. It can also fight poverty and help unemployed youth find green jobs. Recycling e-waste can lessen the burden on finite natural resources and serve as a useful source of secondary raw material recovery(Fevrier, 2020 and Twagirayezu, 2023). This study aim to assess the contribution of E-Waste Recycling in Promoting Green Growth in Rwanda.

The Role of E-Waste Recycling on the environment

According to Wang (2008), recycling has a significant advantage in terms of saving landfill space. It can also reduce waste toxicity, prevent sickness, provide a replacement energy source, and preserve energy (for example, melting aluminum cans requires less energy than manufacturing them from ore). Recycling centers can create local jobs and may return thousands of dollars to the community by selling recyclable materials (Wang, 2008).

**Green Job creation**

The structure of an economy is determined by the type of jobs that are present in an economy. Therefore, the creation of green jobs is one of the components of the "going green" process. Using occupational data for 27 Brazilian states between 2003 and 2013, this paper examines whether the level of economic complexity of a state explains why one state has a greener occupation space than another (Darmond, 2021).

In South Africa for example, between 85,000 to 275,000 new green jobs are forecast by 2030 – mainly in energy and power production, and agriculture and nature. The solar sector leads job creation in South Africa with 140,000 jobs projected. Nigeria predicted to put on between 60,000 and 240,000 new green jobs by 2030. Aquaculture and poultry lead job creation, with 69,000 jobs projected. Kenya predicted to put on between 40,000 to 240,000 green jobs by 2030. The solar sector leads this job creation, with estimates that it will generate 111,000 jobs in the country by the decade's end. Ethiopia will see between 30,000 and 130,000 new green jobs by 2030, mainly in energy and power production. Hydropower generation leads as a job-creating sector, with 33,000 jobs projected. Democratic Republic of Congo (DRC) is predicted to put on between 15,000 to 45,000 new green jobs by 2030; mainly in energy and power production and distribution. Again, hydropower is expected to lead job creation as a sector with 16,000 jobs expected.(Kevin,2024)

Reducing emission and pollution

The improper disposal of e-waste constitutes a huge environmental danger. Many electrical equipment includes dangerous materials including lead, mercury, cadmium, and brominated flame retardants(Ankit,2021). When e-waste winds up in landfills or is burnt, these harmful compounds can leak into the soil, water, and air, producing pollution and threatening human health (Saha, 2021). The municipalities which provide both drop off and curbside services for trash, food and yard waste present better performance regarding the air quality (Eleftherios, 2015).

Lowering our carbon footprint helps to reduce methane emissions from landfill sites, which contribute to climate change (Purnima M.,2020).Effective e-waste management techniques may assure the safe handling, treatment, and disposal of hazardous items. Recycling and correct disposal procedures assist limit the discharge of dangerous compounds into the environment, which protects ecosystems, reduces pollution, and safeguards human well-being (Saha, 2021). Recycling and correct disposal procedures assist limit the discharge of dangerous compounds into the environment, which protects ecosystems, reduces pollution, and safeguards human well-being (Saha, 2021).

Sustainable use of resource

Processing e-waste might be profitable since it contains precious metals that can be recovered and used again if treated carefully. Recycling e-waste may also eliminate the need to produce new materials. E-waste recycling aims to create sustainable businesses, safely remove hazardous and toxic substances without harming people or the environment, and effectively recover valuable metals. Recycling influences society because it creates jobs and attracts firms to the recycling industry (Mason, 2006). After you've meticulously retrieved every last one of those precious metals, you may think about your options for sending them back to the maker to be reused. As an alternative, you may give your neighborhood scrap yard a call to find out how much your items are worth. You continue to make money while keeping things out of the trash. Win-win (Henderson, 1996).

Safe Disposal and Prevention of biodiversity loss

Human activities pollute water, air, and soil, which has a negative impact on the environment. Despite the significant efforts made in recent years to clean up the environment, pollution remains a serious issue that presents continuous health hazards(Shilpa,2023). Despite the fact that water covers 71% of the Earth's surface, just 0.3% of it is suitable for human use. Furthermore, the quality of freshwater in ground and surface systems is a major problem, since consumable water must include a certain amount of minerals (U.M., 2022). When e-waste is improperly disposed of in regular landfills or illegally dumped, heavy metals and flame retardants can seep directly into the soil, contaminating underlying groundwater and crops that may be planted nearby or in the area in the future. When the soil is polluted with heavy metals, crops become sensitive to absorbing these poisons, which can cause a variety of ailments and reduce field productivity (Alengebawy, 2021).

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## II. MATERIALS AND METHODS

The study followed a mixed methods. It was conducted at the enviroserve Rwanda green park a recycling company located in special economic zone in Bugesera District. Survey Data were analyse following relevant statistical methods. The researcher conducted face-to-face interviews with three experts from Enviroserve, which helped to capture a broader range of perspectives, experiences, and expertise related to e-waste recycling in Enviroserve operations, processes, and utilization. Therefore enhancing the reliability and validity of the research findings.

Data for this study were collected from 108 workers including e-waste pickers, Dismantlers ,... then were analysed using descriptive statistics to generate meaningful findings. Among the respondents, there were 35 females, accounting for 32.4% of the sample, and 73 males, comprising 67.6% of the sample. In terms of educational attainment, 82 individuals have competed secondary level,11 have diploma and 15 completed University level.These literacy levels among respondents indicate a robust dataset, with the majority holding at least secondary education. This level of education enhances the reliability and credibility of the research findings, as it suggests an informed participant group capable of providing insightful contributions.

**The recycling practice at Enviroserve**

The study found that at the studied company three electronic dives are recycled; Television, Mobile, and DC Battery. According to the Expert 1 the E-waste management practices are presented as follows. “Damaged Televisions are taken into the assembler’s workshop if the warranty is available of the Television. The assemblers try to repair the Television by replacing the rejected parts with previously recovered parts of discarded Television or brand-new parts if particular parts are unavailable. If the Television is not possible to repair, it is thrown away as a discarded/rejected television. Before that, the workable parts are taken and reserved for reusing in another damaged Television”.

The study sought to ascertain Enviroserve Rwanda's e-waste recycling system. E-waste collection, the percentage of materials recovered, the presence of collection sites, and the presence of e-waste collecting facilities were used to evaluate the e-waste recycling system. The findings from the study revealed that 84.3% of respondents agreed that E-waste Collection is done in a good way in Enviroserve Rwanda. The mean score of respondents was 1.15 with a 0.3658 as standard deviation. 97.2% of respondents agreed that the rate of materials recovery is high in Enviroserve Rwanda. The mean score of respondents was 1.02 with a 0.16 as standard deviation. Moreover, 88.0% of respondents agreed that the collection points are not enough in Enviroserve Rwanda. The mean score of respondents was 1.12 with a 0.32 as standard deviation. Finally, 100.0% of respondents strongly agreed that there are insufficient e-waste collection facilities in Enviroserve Rwanda. The mean score of respondents was 2.00 with a 0.00 as standard deviation. The majority of respondents agreed and strongly agreed with the assertion.This study concurs with the findings from the work of (Kabera,2023) who demonstrated that E-waste could not be handled in the same way as general wastes because of its unique composition, which include non-biodegradable materials that can be harmful to the environment. It did not also contradict the report of Rwanda Utilities Regulatory Authority (RURA) in 2019. In this regard, the ministry of Trade and Industry authorized Enviroserve Rwanda to free-of-charge collect all types of e-waste government organizations and when private companies give their e-waste materials to Enviroserve, they not only contribute to the protection of the environment and human life but also earn income from selling e-waste materials.

The role of Enviroserve in promoting Green Growth in Rwanda

Although the informal recycling of e-waste poses some environment and health effects. Apart from creating employment for many urban youth, e-waste recycling increases people's access to electronic products through reuse.Recycling centers can create local jobs and may return thousands of dollars to the community by selling recyclable material.

When e-waste winds up in landfills or is burnt, these harmful compounds can leak into the soil, water, and air, producing pollution and threatening human health. Recycling and correct disposal procedures assist limit the discharge of dangerous compounds into the environment, which protects ecosystems, reduces pollution, and safeguards human well-being (Saha,2021).

In order to better understand how Enviroserve contribute the green growth in Rwanda, the following criteria were used in this analysis: management of landfill space to increase crop land and habitation; avoidance of biodiversity loss to save environment; safe use of natural

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resources to increase economy; and decreasing carbon economy to reduce climate change.

| Statement | Agree | | Strongly Agee | | | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **Mean** | **Standard Deviation** |
| Lowering carbon economy may reduce climate change | 68 | 63.0 | 40 | 37.0 | 1.37 | 0.48 |
| Prevention of biodiversity loss save environment | 0 | 0.01 | 108 | 100.0 | 2.00 | 0.01 |
| Safe use of natural resource increase economy | 0 | 0.01 | 108 | 100.0 | 0.01 | 0.01 |
| Landfill space management increase crop land and habitation | 93 | 86.1 | 15 | 13.9 | 1.13 | 0.34 |

The results presented in this table are indicating that 63.0 of respondents agreed that lowering carbon economy might reduce climate change in EnviroserveRwanda. The mean score of respondents was 1.37 with a 0.48 as standard deviation. In addition, 100.0% of respondents strongly agreed with the prevention of biodiversity loss save environment in Enviroserve Rwanda. The mean score of respondents was 2.00 with a 0.01 as standard deviation. Moreover, 100.0% of respondents preponderantly strongly agreed with the safe use of natural resource increase economy in Enviroserve Rwanda. The mean score of respondents was 2.00 with a 0.01 as standard deviation. Finally, 86.1% of respondents strongly agreed with the existence of landfill space management increase cropland and habitation in Enviroserve Rwanda. The mean score of respondents was 1.13 with 0.34 as standard deviations. The majority of respondents agreed and strongly agreed with the assertion. It concurs with the work of the potential next phases of the facility include lead-acid battery recycling and precious metals recovery. With a mission to build a 'Green Rwanda' through sustainable E-waste management (Olivier,2017

The challenges facing the e-waste recycling business

One of the key challenges in e-waste management is the prevalence of informal recycling practices. In many regions, e-waste is managed through these informal channels, which often involve hazardous and unsafe methods of handling electronic waste. This not only poses a significant risk to the environment but also compromises the health and safety of those involved in the recycling process.

Informal recyclers often resort to dangerous techniques such as burning or acid leaching to extract valuable materials from electronic waste. These methods release toxic fumes into the air and leave behind harmful residues that can contaminate soil and water sources. Additionally, informal recycling practices occur in unregulated environments, further exacerbating the risk and impact on the ecosystem.

Accorning to the expert NO:) "E-waste contains multiple known and suspected neurotoxic ants, including lead and mercury that may disrupt the development of the central nervous system during pregnancy, infancy, childhood and adolescence. Some harmful toxicants from e-waste may also affect the structural development and function of the lungs." Another interviewee evidences "the consequences of not properly recycling e-waste can be harmful to society.

One of the significant challenges in e-waste management is the lack of adequate infrastructure to handle the growing volume of electronic waste. This lack of infrastructure hinders the proper handling and processing of e-waste, leading to environmental and health risks.Infrastructure gaps exist in various aspects of e-waste management. Firstly, there is a shortage of collection points and facilities for the proper disposal of electronic devices. Many consumers find it inconvenient to access drop-off locations or

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recycling centers, resulting in improper disposal methods such as throwing electronic waste in regular trash bins. This leads to e-waste ending up in landfills, where harmful chemicals and substances can seep into the soil and water sources.A significant obstacle to addressing the e-waste crisis is a lack of awareness among consumers, businesses, and policymakers. Many people are uninformed about the proper disposal and recycling options for electronic devices, leading to improper e-waste management. Without sufficient knowledge, individuals may discard their electronic waste in regular trash bins or donate it to charity organizations that may not have the means to handle e-waste appropriately.

Relationship between e-Waste Recycling and Green Growth

| Statement | Agree | | Strongly Agee | | | |
|---|---|---|---|---|---|---|
| | **N** | **%** | **N** | **%** | **Mean** | **Standard Deviation** |
| The recovered materials are used for final product production | 60 | 55.6 | 40 | 44.4 | 1.44 | 0.49 |
| The repaired Equipment sent to the saler | 67 | 62.0 | 41 | 38.0 | 1.37 | 0.48 |
| The Purified materials are safely disposed in environment | 52 | 48.1 | 56 | 51.9 | 3.07 | 2.00 |

This table states that 55.6% of all questioned respondents agreed with the recovered materials use for final product production inEnviroserve Rwanda. The mean score of respondents was 1.44 with a 0.49 as standard deviation. Moreover, 62.0% of respondents agreed with the repaired Equipment sent to the saler in Enviroserve Rwanda. The mean score of respondents was with a 0.48 as standard deviation. Furthermore, 51.9% of respondents significantly strongly agreed with the Purified materials are safely disposed in environment in Enviroserve Rwanda. The mean score of respondents was 3.07 with a 0.200 as standard deviation. Finally, 100.0% of respondents strongly agreed with the fact that e-waste collection creates green jobs in Enviroserve Rwanda. The mean score of respondents was 2.00 with 0.01 as standard deviations. The majority of respondents agreed and strongly agreed with the assertion.This research is relevant since it did not contradict the work conducted Kabera et al (2023), E-Waste Management in Rwanda, A Situational and Capacity Need Assessment. This study analyzed e-waste management and capacity need assessment for both the city of Kigali and secondary cities in Rwanda, found that there are several challenges for Rwanda's management of e-waste. This study found out that waste pickers sell those e-wastes to unknown people before arriving at the dumpsites, and the study found inadequate regulatory enforcement, frictions in markets for end-of life products, and the development of policies for e-waste management in the private institutions, and public institutions played a big role in enabling better markets for e-waste.

The statistical evidences depict that there is a relationship between E-waste recycling and green growth with a degree of correlation equal to 0.98 interpreted as positive high correlations. Therefore, these numbers measure the strength and direction of the linear relationship between the two variables. A direct correlation was found between e-waste volume and gross domestic product per capita at purchasing power parity. The study concurred with the work of Ndikumana et al (2015) who asserted that recycling and composting industry offers huge entrepreneurial opportunities, room for innovations and investment prospect.

## III. CONCLUSION AND RECOMMENDATIONS

The significance of this study lies in its potential to contribute to the environmental management sector, environmental sustainability, and economic growth in Rwanda. By investigating the contribution of e-waste recycling. The study revealed that the most significant obstacles are limited technological infrastructure, financial

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constraints, and a lack of awareness.. If properly utilized by industries requiring heat for their operations, this could enhance resource efficiency, and decrease environmental pollution in Rwanda and Africa.

As a citizen, It's our fundamental responsibility to supplement the efforts of the governments with our actions of collecting e-wastes at the collection centers or to Enviroserve Rwanda. Re-use ,reduce ,refurbish and recycle e-wastes are the first steps to enhance green growth. Effective management of e-waste in Rwanda demands the implementation of EPR( Extended Producer Responsibility is an environmental policy approach that holds producers responsible for product management through the product's lifecycle), the establishment of product re-use through re-manufacturing and the introduction of efficient recycling facilities. To plan awareness campaigns, mass media like radio and television should be used, as well as community engagement activities like "umuganda," which is community labor that mostly occurs at the village level on the last Saturday of each month. To carry out Enviroserve Rwanda's excellent program of training informal repairers and recyclers, To incorporate an e-waste recycling course into the curricula of ICT programs in secondary schools and postsecondary educational establishments. To offer rewards to promote involvement in e-waste recycling with nearby communities and offer incentives to promote product reuse and refurbishing before submitting e-waste to Enviroserve, to construct more infrastructure for e-waste recycling and disposal and every public and private entity has to keep track of how much e-waste they produce.

## REFERENCES

[1]. Wang, J. H. (2008). The collection system for residential recyclables in communities in Haidian District, Beijing: . A possible approach for China recycling. Waste Management,, 28(9), 1672-1680.

[2]. Saha, L. K. (2021). Electronic waste and their leachates impact on human health and environment: Global ecological threat and management. Environmental Technology & Innovation,, 24, 102049.

**[3].** Mason, C. M. (2006). After the exit: . Acquisitions, entrepreneurial recycling and regional economic development. Regional studies,, 40(1), 55-73.

[4]. Alengebawy, A. A. (2021). Heavy metals and pesticides toxicity in agricultural soil and plants:. Ecological risks and human health implications. Toxics, , 9(3), 42.

[5]. A review of global issues. International journal of environmental research and public health. ((2019)). 16(6), 1060.

[6]. Ahmad, F. &. (2010). Alem, D. D. (2020). An overview of data analysis and interpretations in research. . International Journal of Academic Research in Education and Review, , 8(1), 1-27.

[7]. Bernstein, J. (2004). Social assessment and public participation in municipal solid waste management. World Bank Working Paper,, 463617-1202332338898. Browne, M. N. (2007). Asking the right questions: A guide to critical thinking. Pearson Education. Carlson, A. E. (2001).

[8]. DeJonckheere, M. &. (2019). Semistructured interviewing in primary care research:. a balance of relationship and rigour. Family medicine and community health,, 7(2). 41 EPA. (2012). Everett, T. I. (2010). Economic growth and the environment.

[9]. EZEUDOYE, J. N. (2022). Evaluation of the Effect of Physical Facilities Management and Maintenance in Nnamdi Azikiwe University. Awka, Anambra State Nigeria.

[10]. Fanthi. (2021). Ferronato, N. &. (2019). Waste mismanagement in developing countries: A review of global issues. International journal of environmental research and public health,, 16(6), 1060.

[11]. Fevrier, K. M. (2020). Race and waste: The politics of electronic waste recycling & scrap metal recovery in. Agbogbloshie, Accra, Ghana. Firdaus7. (n.d.).

[12]. Ikhlayel, M. (2018). An integrated approach to establish e-waste management systems for developing countries. Journal of cleaner production,, 170, 119-130.insider, l. (2023). 42 ITU. (2013). ITU. (2019).

[13]. Jadon, J. K. (2021). An evaluation of the state of electronic trash recycling methods. ACADEMICIA: An International Multidisciplinary Research Journal,, 11(10), 511-518.

[14]. Jaffe, A. B. (2005). A tale of two market failures: Technology and environmental policy. Ecological economics,. 54(2-3), 164-174.

[15]. Jennings, P. D. (1995). Ecologically sustainable organizations: An institutional

approach. Academy of management review,, 20(4), 1015-1052. Johnson. (2017).
[16]. Jomo, K. S. (2016). Public-private partnerships and the 2030 Agenda for Sustainable Development: fit for purpose?.
[17]. Kabera, T. N. (2023). E-Waste Management in Rwanda: . A Situational and Capacity Need Assessment. Sustainability,, 15(16), 12271.
[18]. Kasztelan, A. (2017). Green growth, green economy and sustainable development: terminological and relational discourse. Prague Economic Papers,, 26(4), 487-499.
[19]. Kumar, A. C. (n.d.). Electronic waste and existing processing routes. canada: Institute of mining engineering. Kumar, A. (n.d.). Stores road. vancouver: BC V6T1Z4.
[20]. Li, Y. S. (2013). Modelling and analysing the dynamics of disease progression from crosssectional studies. Journal of biomedical informatics,, 46(2), 266-274.
[21]. Limberger, S. D. (2023). Transformative Policy Approaches for Sustainable Resource Use and a Circular Economy-How to Monitor International Progress. . Available at SSRN 4308629.
[22]. Luo, X. Y. (2019). Enhancing statistical charts:. toward better data visualization and analysis. Journal of Visualization, , 22, 819-832. 43 Manhart, A. O. (2011). Informal e-waste management in Lagos . Nigeria–socio-economic impacts and feasibility of international recycling co-operations. Final report of component, 3, 1- 129.
[23]. Meyer, P. (2010). Understanding measurement:. reliability. Oxford University Press. Minghua. (2009).
[24]. Moore, J. (2011). Behaviorism. The Psychological Record,, 61, 449-463. Moyen Massa, G. &. (2023). Electrical and electronic waste management problems in Africa: . Deficits and solution approach. Environments,, 10(3), 44.
[25]. Mugenda. (2015). Mugenda, M. &. (2003). nnwteam. (2020). Obalola. (2019). O'Connor. (2018). OECD. (2000).
[26]. Ongondo, F. O. (2011). How are WEEE doing? A global review of the management of electrical and electronic wastes. Waste management,, 31(4), 714-730.
[27]. Onyara. (2020). Oteng-Ababio, M. (2010). E-waste: An emerging challenge to solid waste management in Ghana. . International Development Planning Review, , 32(2), 191-206.
[28]. Puzzo, G. &. (2024). Psychological correlates of e-waste recycling intentions and behaviors: . A meta-analysis. Resources, Conservation and Recycling,, 204, 107462. 44
[29]. Radeny, M. A. ((2022).). Review of Policies and Frameworks on Climate Change, Agriculture, Food and Nutrition Security in Eastern Africa: . Ethiopia, Kenya, Rwanda, Tanzania, and Uganda.
[30]. Rahman, M. A. (2017). E-waste management: A study on legal framework and institutional preparedness in Bangladesh. The Cost and Management,, 45(1).
[31]. Rajesh, R. K. (2002). Electronic waste: A critical assessment on the unimaginable growing pollutant, legislations and environmental impacts. Environmental Challenges, 7, 100507.
[32]. Ramachandran, V. S. (1990). Visual perception in people and machines. . AI and the Eye, 21-77.
[33]. Razzaq, A. S. (2021). Dynamic and causality interrelationships from municipal solid waste recycling to economic growth, carbon emissions and energy efficiency using a novel bootstrapping autoregressive distr.
[34]. Reilly, J. M. (2012). Green growth and the efficient use of natural resources. Energy Economics, 34, S85-S93. Rip, A. &. ( 1998). Technological change. In Human choice and climate change: . Resources and Technology Battelle Press., Vol. II, (pp. 327-399).
[35]. Rizos, V. &. (2022). Implementation of circular economy approaches in the electrical and electronic equipment (EEE) sector: Barriers, enablers and policy insights. Journal of Cleaner Production,, 338, 130617.
[36]. Rodic. (2010). Rodrigues, S. M. (2009). A review of regulatory decisions for environmental protection: . Part I Challenges in the implementation of national soil policies, 35(1. Rwanda, T. r. (2016). Rwanda, T. r. (2016).
[37]. Sáez-Martínez, F. J. (2016). Drivers of sustainable cleaner production and

sustainable energy options. Journal of cleaner production,, 138, 1-7.

[38]. Schindler, C. &. (2011). Shakil, M. U. (2013). Process flow chart and factor analysis in production of a jute mills. Journal of Industrial and Intelligent Information , Vol, 1(4).

[39]. Shakil, M. U. (2013). Process flow chart and factor analysis in production of a jute mills. Journal of Industrial and Intelligent Information , Vol, 1(4). Shakil, M. U. (2013). Process flow chart and factor analysis in production of a jute mills. . Journal of Industrial and Intelligent Information , Vol, 1(4).

[40]. Sharma. (2020). Shittu. (2021). Smith, P. G. (1997). Developing products in half the time:. new rules, new tools. John Wiley & Sons.

[41]. Taguchi, T. (2010). Questionnaires in second language research. Routledge, United States:. United States: Walsworth Publishing Company.

[42]. Tsanakas, J. A. (2020). Towards a circular supply chain for PV modules: . Review of today's challenges in PV recycling, refurbishment and re-certification. Progress .

[43]. Twagirayezu. (2021). Twagirayezu, G. U. (2023). Towards a sustainable and green approach of electrical and electronic waste management in Rwanda:. a critical review. Environmental Science and Pollution. Unitednation. (2015).

[44]. Wang, J. H. (2008). The collection system for residential recyclables in communities in Haidian District, Beijing: . A possible approach for China recycling. Waste Management,, 28(9), 1672-1680. WHO. (2020).

[45]. Xavier, L. H. (2023). A comprehensive review of urban mining and the value recovery from e-waste materials. Resources, Conservation and Recycling,.

[46]. Dordmond, G., de Oliveira, H.C., Silva, I.R. et al. The complexity of green job creation: An analysis of green job development in Brazil. Environ Dev Sustain **23**, 723–746 (2021).

[47]. A.Sulich,(2020)Green jobs, definitional issues, and the employment of young people: An analysis of three European Union countries. Wroclaw University of Economics, Faculty of Management, Computer Science and Finance, ul. Komandorska 118-120, 53-345, Wroclaw, Poland.

[48]. Kevin M.(2024) Forecasting green jobs in Africa, main report ,Supported by Boston Consulting Group. World Bank, UNEP, UN Habitat; BCG Analysis.

[49]. Ankit,Lala S. (2021)Electronic waste and their leachates impact on human health and environment: Global ecological threat and management.Environmental Technology Innovation

[50]. Volume 24.

[51]. Purnima M.,(2020)Landfill Emissions and Their Impact on the EnvironmentInternational Journal of Engineering Research & Technology (IJERT) Vol. 9 Issue 08, August-2020.

[52]. Shilpa S.,(2023) Environmental pollutants and their effects on human health. Volume 9