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LOGÍSTICA REVERSA: UM ESTUDO DE CASO COM OPERADORES ECONOMICOS DO ESCTOR DE EEEDE EM ANGOLA

REVERSE LOGISTICS: A CASE STUDY WITH ECONOMIC OPERATORS IN THE EEE SECTOR IN ANGOLA

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Comunicação:
O XII SINGEP foi realizado em conjunto com a 12th Conferência Internacional do CIK (CYRUS Institute of Knowledge) e com o Casablanca Climate Leadership Forum (CCLF 2024), em formato híbrido, com sede presencial na ESCA Ecole de Management, no Marrocos.

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Objetivo do estudo
Este estudo de caso visou compreender, a partir das atitudes, representações e práticas dos operadores económicos os principais obstáculos que impedem a prática da logística reversa de equipamentos elétricos e eletrónicos em Angola.

Relevância/originalidade
A logística reversa de equipamentos elétricos e eletrónicos é um tema atual e bastante sensível, contudo, o conhecimento produzido a partir desta investigação será útil para encorajar o governo angolano na formulação de um diploma legal especifico no âmbito da logística reversa

Metodologia/abordagem
Neste estudo recorreu-se a uma metodologia mista, orientada por um paradigma de natureza interpretativa. Utilizamos duas técnicas de recolha de dados: inquérito por questionário e observação.

Principais resultados
Os resultados indicam que, no panorama político, parece consensual a Logística Reversa faça parte integrante dos discursos e dos documentos normativos produzidos a vários níveis, na prática não parece ter avanços significativos ao nível da formalização da logística reversa de EEE.

Contribuições teóricas/metodológicas
A logística reversa de EEE é um tema atual e bastante sensível, contudo, o conhecimento produzido a partir desta investigação será útil para encorajar o governo angolano na formulação de um diploma legal no âmbito da logística reversa de EEE.

Contribuições sociais/para a gestão
A dinamização da logística reversa pós-consumo contribui significativamente para melhoria do bem-estar da população, impulsionar a diversificação da economia angolana e quebrar a dependência da indústria petrolífera; e promover a criação de emprego.

Palavras-chave: Gestão de resíduos, Logística reversa, Equipamentos Elétricos e Eletrónicos, Desenvolvimento Sustentável

REVERSE LOGISTICS: A CASE STUDY WITH ECONOMIC OPERATORS IN THE EEE SECTOR IN ANGOLA

Study purpose
This case study aimed to understand, based on the attitudes, representations and practices of economic operators, the main obstacles that prevent the practice of reverse logistics of electrical and electronic equipment in Angola.

Relevance / originality
The reverse logistics of electrical and electronic equipment is a current and very sensitive topic, however, the knowledge produced from this research will be useful to encourage the Angolan government to formulate a specific legal diploma within the scope of reverse logistics.

Methodology / approach
In this study, a mixed methodology was used, guided by an interpretative paradigm. We used two data collection techniques: questionnaire survey and observation.

Main results
The results indicate that, in the political panorama, it seems consensual that Reverse Logistics is an integral part of the discourses and normative documents produced at various levels, in practice there does not seem to be significant progress in terms of formalizing

Theoretical / methodological contributions
EEE reverse logistics is a current and very sensitive topic, however, the knowledge produced from this investigation will be useful to encourage the Angolan government in formulating a legal diploma within the scope of EEE reverse logistics.

Social / management contributions
Boosting post-consumer reverse logistics contributes significantly to improving the well-being of the population, boosting the diversification of the Angolan economy and breaking dependence on the oil industry; and promote job creation.

Keywords: Waste Management, Reverse Logistics, Electrical e Electronic Equipment, Sustainable Development

REVERSE LOGISTICS: A CASE STUDY WITH ECONOMIC OPERATORS IN THE EEE SECTOR IN ANGOLA

1 Introduction

Waste constitutes one of the most complex problems of modern society, with its growth paralleling economic development and the inherent difficulties in its management assuming great prominence in social policy (Decreto Presidencial nº. 196/12, de 30 de Agosto). The Republic of Angola, as a member state of the United Nations, has adopted international legal instruments and implemented waste management practices. The experience accumulated in recent years, both internationally and nationally, has produced a new global awareness regarding the environmental implications of human development, reflected in the increasing responsibility of society as a whole. One of the topics related to waste management, which is the subject of many studies, is logistics. The promotion of the reverse logistics sector significantly contributes to economic development and the improvement of living conditions without compromising the supply of goods to future generations. Reverse logistics is a critical component of waste management and the circular economy, as it facilitates the reintegration of products into the production cycle, reducing the need for new raw materials and minimizing environmental impacts (Rogers & Tibben-Lembke, 1998). In light of this, the aim of this study was to understand, from the attitudes, representations, and practices of economic operators, the main obstacles that hinder the practice of post-consumer reverse logistics of electrical and electronic equipment in Angola. The general objective guiding the research is: 1. To understand the main obstacles that hinder the practice of post-consumer reverse logistics in Angola, particularly in the electronic equipment sector. The specific objectives are: 1. To understand the attitudes and practices of economic operators in the electronic equipment sector within the scope of post-consumer reverse logistics; 2. To characterize post-consumer reverse logistics of electronic equipment; 3. To describe the management of electronic waste in Angola; 4. To identify post-consumer reverse logistics practices in the electronic equipment sector in Angola; 5. To identify strategies that enhance reverse logistics.

2 Theoretical Framework

Since the Industrial Revolution, linear logistics has been the dominant economic model, characterized by the "use and discard" theory. Products become waste because there is no recovery or reuse in the linear paradigm (extraction, production, consumption, and disposal) (Abad-Segura et al., 2020, as cited by Khan, Su, & Khurshid, 2022). According to Khan, Su, & Khurshid (2022), this model is known for its inefficiency and unsustainability, as well as its severe environmental repercussions. Currently, it is possible to distinguish another operational area of business logistics: reverse logistics, which is the newest area of logistics and is subdivided into post-sale reverse logistics and post-consumer reverse logistics (Leite, 2009). According to Leite (2003), reverse logistics is a business area responsible for the flow of information and the return of post-sale and post-consumer goods to the production chain, using the distribution channels of goods, thereby generating economic, environmental, and social advantages and value. The same author classifies post-consumer and post-sale goods into three types: Disposable goods; Durable goods; Semi-durable goods (Leite, 2003).

Post-sale goods are characterized by having little or no use, distinguishing them from post-consumer products, which are characterized by being used until the end of their life or eventually until they no longer have utility to the first owner, who makes them available or sells them for extended use (Leite, 2003, p. 206).

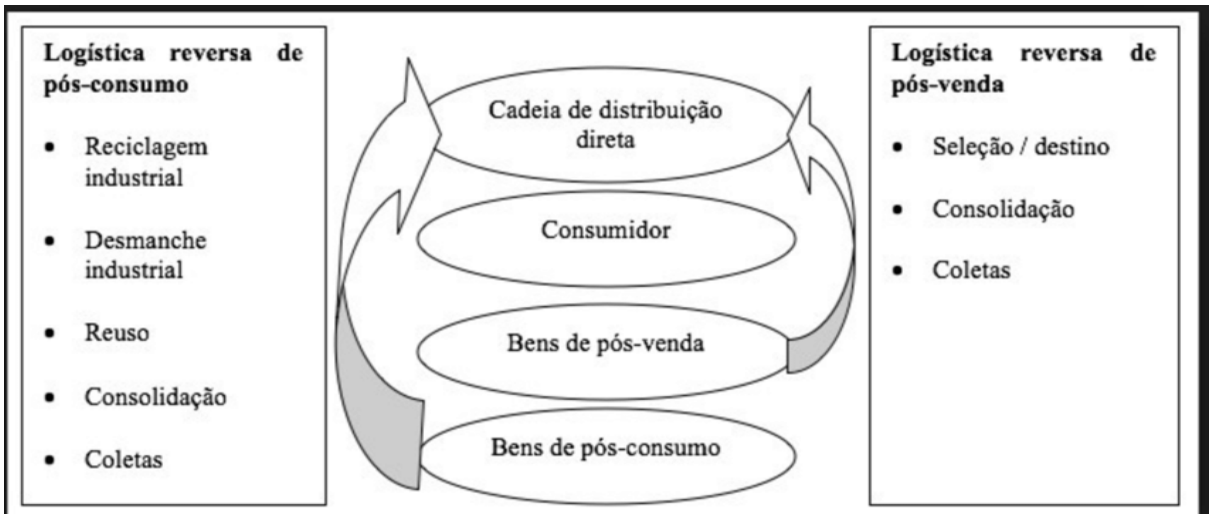

Figure 1: Post-Consumer Reverse Logistics and Post-Sale Reverse Logistics. Source: Leite, 2009.

In Angola, in cases of non-conformity of a good or service, the consumer has the right to demand replacement within 30 days for the provision of services and non-durable goods, or within 90 days for the provision of services and durable goods. The maximum warranty period is one year, as agreed upon by the parties, according to Article 13 of lei nº.. 15/03 de 22 de Julho, the Consumer Protection Law. Post-sale reverse logistics is responsible for adding value to products returned after being sold to the final consumer, which may have issues such as order processing errors, product warranty problems, defects, or even failures (Sousa, Hammes & Rodriguez, 2018).

The increasing speed of product disposal after their first use, driven by the noticeable increase in product disposability in general, and the lack of properly structured and organized post-consumer reverse distribution channels, causes an imbalance between the quantities discarded and those reused, leading to a significant growth in post-consumer products (Leite, 2003). Reverse logistics acts in reintroducing the product that would otherwise be discarded by the market back into the production cycle, meaning a product is only discarded as a last resort. Post-consumer reverse logistics is related to the revaluation of discarded products, using them as secondary raw materials without extracting new primary materials. In this way, post-consumer goods aim for recovery or disposal without harming the environment and society (Silva et al., 2006).

According to Barker and Zabinsky (2010, as cited by Sousa, Hammes & Rodriguez, 2018), there are three major reasons why companies invest in post-consumer reverse logistics:

1. The first reason is compliance with legislation regarding the correct disposal of products in post-sale and post-consumer phases. Some countries require companies to be responsible for post-consumer waste.
2. The second reason presented by the authors is the motivation due to the economic value of post-consumer products.
3. The third reason is concern for brand image, as consumers are increasingly paying attention to the environmental aspects of products and companies, and demanding environmental preservation solutions from them.

The recovery of a product's value through reverse logistics occurs in the recovery of post-consumer products. In this case, the objective is to add value to a product composed of goods that may still have some functionality through reuse, disassembly, recycling, remanufacturing, and reutilization processes (Leite, 2002).

According to data from the Agência Nacional de Resíduos (ANR), the Republic of Angola currently spends approximately 100 million US dollars on waste collection and basic

sanitation systems. Only 20% of the waste produced in Angola is reintegrated into the economic system, with metal being the most valued waste due to its high market value and the large volume consumed. The provinces of Luanda, Benguela, Bié, Huambo, and Huíla are the regions that most effectively reuse and treat the waste they produce. This activity is carried out by environmental defense associations, waste picker cooperatives, and recycling companies.

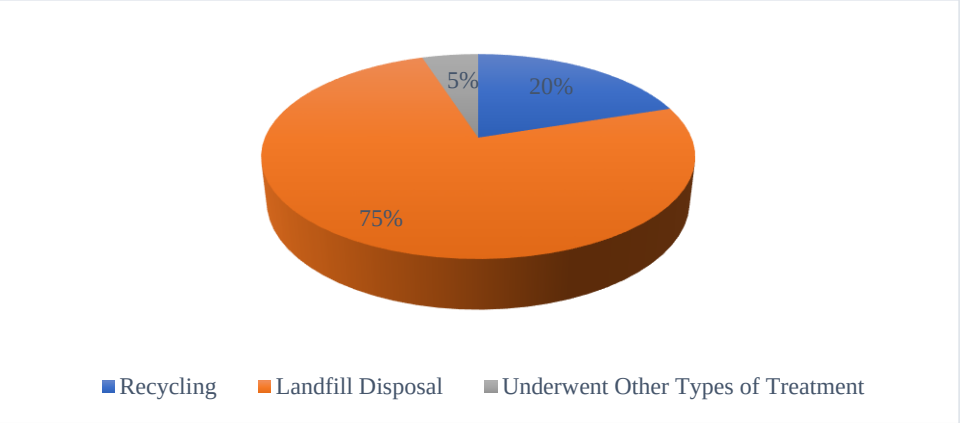

Figure 1: Waste Treatment and Final Disposal in Angola.
Source: Agência Nacional de Residuos, 2023.

César and Neto (2007, p. 19) "describe the importance of a well-structured reverse logistics system that seeks to coexist harmoniously with the environment. This approach provides the company with greater efficiency in its production processes and, instead of being a cost, it presents an opportunity to reduce expenses and add value to the brand within the society in which it operates."

Similarly, Mueller (2005) describes reverse logistics as a tool for creating sustainable production and consumption. For this, the industry must develop methods for collecting its waste and techniques for reusing it in the production of new products. These processes should be viewed as opportunities to reduce costs, decrease the use of non-renewable natural resources, reduce time in processes, and minimize environmental impacts, thereby increasing efficiency and productivity. Consequently, many companies are heavily investing in their reverse logistics, as it not only contributes to the positive image of their brands in the consumer society but also meets legal requirements and supports environmental issues and new markets (Faria & Santos, 2020).

2.1 Public Waste Management Policies in Angola

In Angola, the formulation of a legal framework that globally and precisely defines collective and individual responsibilities in the face of the complex environmental and ecological issues that concern everyone is seen as the first step to be taken, alongside other measures, to implement the environmental policy that the State is responsible for establishing. In this context, in 1998, the Environmental Framework Law (lei nº. 5/98 de 19 de Junho) was created, which defines the basic concepts and principles of environmental protection, preservation, and conservation, the promotion of quality of life, and the rational use of natural resources. Considering the characteristics and importance of the oil industry in Angola's economy, in 2000, the Environmental Protection Regulation for Oil Activities (Decreto nº. 39/00 de 10 de Outubro) was approved to ensure its preservation, particularly regarding health, water, soil, subsoil, air, flora and fauna, ecosystems, landscape, and atmosphere. Considering cultural, archaeological, and aesthetic values, it is therefore important to establish rules and procedures to ensure that waste is treated, removed, and disposed of in a manner that prevents or minimizes harm to human health and the environment. In 2005, the Regulation on Waste Management, Removal, and Disposal was approved (Decreto Executivo nº. 8/05 de 5 de

Janeiro), which sets the rules and procedures for the management, removal, and disposal of waste to be implemented by the operator and other oil companies to ensure the prevention or minimization of damage to human health and the environment. With the need to regulate the right of participation and intervention of environmental advocacy associations in environmental management, the Environmental Protection Associations Law was created in 2006 (lei nº. 3/06, de 18 de Janeiro).

Considering that environmental auditing is a procedure aimed at monitoring and evaluating studies for decision-making related to the reduction and mitigation of environmental risks and allowing for ongoing control of polluting activities, Decreto nº. 1/10 de 13 de Janeiro was approved in 2010.

In 2012, the Regulation on Waste Management was approved (Decreto Presidencial nº. 190/12 de 24 de Agosto), which sets general rules regarding the production, land or underground disposal, discharge into water or air, treatment, collection, storage, and transportation of any waste, except for radioactive or specially regulated waste, in order to prevent or minimize negative impacts on human health and the environment, while establishing rules for the reduction, reuse, recycling, recovery, and elimination of waste. That same year, the Strategic Plan for Urban Waste Management was also approved (Decreto Presidencial nº. 196/12 de 30 de Agosto), which established a new philosophy for waste management in Angola, providing essential support to the country's sustainable development process. Considering that meeting the targets set for the proper management of urban waste as an essential public service requires in-depth efforts at the provincial level, the Provincial Urban Waste Management Action Plan was approved in 2013 (Decreto Executivo nº. 234/13 de 18 de Julho). Aware of the dangers posed by construction and demolition waste due to its heterogeneous composition with varying sizes and types, and recognizing the constraints related to technical solutions for the recovery of construction and demolition waste, including sorting and suitable locations for final disposal units, the Legal Regime on the Management of Construction and Demolition Waste was approved in 2013 (Decreto Executivo nº. 17/13 de 22 de Janeiro), which sets the rules for the management of waste resulting from construction or demolition of buildings or landslides, including its prevention and reuse, as well as collection, transport, storage, sorting, treatment, recovery, and disposal operations.

In 2014, the Regulation on the Management of Hospital and Healthcare Waste was approved (Decreto Presidencial nº. 160/14 de 18 Junho). That same year, recognizing the need to ensure national implementation of waste management policy, and considering that waste management should adhere to principles applicable to the prevention of waste production, reuse, recycling, recovery, and disposal, the Organic Statute of the National Waste Agency was approved (Decreto Presidencial nº. 181/14 de 28 de Julho).

Recognizing the legality of forms for the registration of companies operating in the areas of waste, water treatment, and wastewater treatment, the Regulation on the Process of Registration and Licensing of Companies Engaged in Waste, Water, and Wastewater Treatment Activities was approved in 2015 (Decreto Executivo nº. 24/15 de 29 Janeiro).

With the recent and growing emergence of urban clusters with very specific characteristics, such as centralities, urban developments, and similar areas, local administrative bodies are required to provide essential and costly public services, imposing serious challenges, particularly in managing and monitoring solid waste collection and treatment models. To foster a cleaner and healthier environment and contribute to improving the quality of life for the population, the Legal Regime of the Cleaning Services Tax was approved in 2016 (Decreto Presidencial nº. 107/16 de 20 de Maio).

Aware of the risks that waste and its transboundary movements pose to human health and the environment, and convinced that States should internally adopt measures to establish mechanisms for operational and administrative control concerning the transfer of waste within

the national territory and abroad, recognizing the limited capacity of developing countries, especially African ones, to manage various types of waste, the Regulation on the Transfer of Waste for Reuse, Recycling, and Recovery was approved in 2018 (Decreto Presidencial nº. 265/18 de 15 de Novembro).

Recognizing the importance of licensing waste disposal operations in landfills, the Legal Regime of Landfills was only approved in 2019 (Decreto Presidencial nº. 203/19 de 25 de Junho), which establishes the legal regime for waste disposal in landfills, including the requirements for designing, constructing, operating, closing, and post-closure of landfills, as well as specific technical characteristics for each class of landfills.

In addition to public waste management policies, the Angolan state has various international agreements and treaties ratified. In 1991, Angola ratified the Convention Concerning the Protection of the World Cultural and Natural Heritage, which states that countries must recognize the obligation to ensure the identification, protection, conservation, enhancement, and transmission to future generations of cultural and natural heritage located within their territories.

In 2000, Angola ratified the Vienna Convention for the Protection of the Ozone Layer. That same year, Angola ratified the Convention on Climate Change, which led to the Kyoto Protocol of 1997, incorporating commitments by industrialized countries to reduce their emissions of certain greenhouse gases responsible for global warming. Angola also ratified key declarations, conventions, and resolutions for environmental sustainability, notably the Millennium Declaration and the Millennium Development Goals, with a focus on Goal 7 concerning environmental sustainability.

In 2001, to create a system for combating and preventing pollution and incidents involving hydrocarbons, Angola ratified the International Convention on Cooperation and Combating Pollution by Hydrocarbons.

In 2005, Angola ratified the Stockholm Convention on Persistent Organic Pollutants (POPs), which provides the basis for eliminating the production, use, import, export of 12 priority POPs, as well as their safe handling and disposal or reduction of unintended releases of certain POPs into the environment.

In 2016, Angola ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Resolução nº. 29/16 de 25 de Julho). In the same year, Angola ratified the Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes in Africa (Resolução nº. 34/16 de 1 de Agosto).

In recent years, Angola has been a signatory to various international environmental conventions and protocols, from which it has developed national plans and strategies (Mosaiko, 2023). In addition to these international protocols, Angola is a member of the Southern Africa Development Community (SADC) and has ratified various protocols within the SADC framework.

In recent years, there has been a nearly revolutionary transformation in waste management in Angola. However, despite the undeniable progress made, much remains to be done to achieve the established objectives. Meanwhile, it is the state's responsibility, first and foremost, to define environmental policies that align with this new global awareness, aiming not only to renew or properly utilize available natural resources, thus ensuring sustainable development, but also to continually improve the quality of life for people.

2.2 Reverse Logistics of Electrical and Electronic Waste: Reality or Utopia in Angola?

Most cities in Angola and around the world face serious problems related to waste generation and a lack of knowledge about alternatives for the final disposal of urban solid waste, causing significant disruptions to the population and the environment. Waste is defined as substances or objects that the holder discards or has the intention or legal obligation to discard,

which have hazardous characteristics such as being flammable, explosive, corrosive, toxic, infectious, or radioactive, or any other characteristics that pose a danger to human life or health and the environment (Decreto Presidencial nº. 190/12 de 24 de Agosto). Waste management involves all feasible procedures aimed at ensuring environmentally safe, sustainable, and rational management of waste, considering the need for reduction, recycling, and reuse, including separation, collection, transportation, storage, treatment, recovery, and disposal of waste, as well as the subsequent protection of disposal sites to safeguard human health and the environment from harmful effects (Decreto Presidencial nº. 190/12 de 24 de Agosto).

In parallel, the Portuguese Environment Agency (APA, 2020) defines waste management as the set of technical, administrative, and financial activities necessary for the disposal, collection, transportation, treatment, recovery, and disposal of waste, including the planning and oversight of these operations, as well as monitoring final disposal sites after their closure. Therefore, it is crucial that waste is properly separated and classified at the source to ensure that its final destination is the most appropriate and least harmful to human health and the environment.

Correct classification, characterization, and treatment of waste become fundamental for a new management approach that incorporates sustainability principles, problem resolution, and transformation of vulnerabilities faced by affected groups. Thus, good management of solid waste is considered an important way to prevent environmental pollution and improve the quality of life of the population (Bitencourt et al., 2013).

Waste management in Angola is based on the Strategic Waste Management Plan (PESGRU). Each province develops its Provincial Urban Waste Management Plan (PAPGRU), which must align with PESGRU and be submitted for approval to the National Waste Agency (Decreto Presidencial nº. 196/12 de 30 de Agosto; Decreto Executivo nº. 234/13 de 18 de Julho). Waste management in Angola is the responsibility of provincial governments, while the National Waste Agency is tasked with implementing national policy (Decreto Presidencial nº. 181/14 de 28 de Julho).

The rapid growth in the use of Electrical and Electronic Equipment (EEE) worldwide has led to a significant increase in the amount of waste produced globally. More sophisticated devices are being discarded, and fierce competition drives companies to produce the next, best, thinnest, and smartest products. As the demand for these devices rises, their lifespan decreases. It is estimated that more than 50 million tons of e-waste are produced annually (UN News, 2019b), and the vast majority of this waste is placed in regular trash, incinerated, or even dumped openly into the environment, causing severe environmental damage (Baldé et al., 2017; Oliveira et al., 2017, cited by Costa & Gonçalves, 2020).

According to the 2020 Global E-Waste Monitor report, discarded electronic waste worldwide increased by 21% in just five years (Forti, 2021). Based on information available from surveys conducted under PESGRU, there is a projection that links waste production to population and economic power. Based on these calculations, it is estimated that the waste production rate in Angola is around 0.46 kg per capita per day, equivalent to an annual production of approximately 3.5 million tons (Decreto Presidencial nº. 196/12 de 30 de Agosto). Currently, the country has an estimated annual production of 25 million tons, with an average daily production of 0.75 kilograms of waste per inhabitant (Agência Nacional de Resíduos, 2023).

Despite the rapid growth in the use of Electrical and Electronic Equipment (EEE) worldwide causing a significant increase in the amount of waste produced globally, as noted by UN News, the amount of e-waste produced in Angola does not seem to be highlighted in the reports from the National Waste Agency. However, according to Global E-Waste reports, Angola discarded over 125 tons of e-waste in 2019, corresponding to 4.2 kg per capita (Forti et al., 2020, p. 70), and it is unknown how much of this amount was recycled. According to the

International Labour Organization, only 20% of so-called e-waste is formally recycled, even though it is valued at over USD 62 billion (UN News, 2019a).

Although Angola has made significant strides in its environmental legal framework and there are international legal norms applicable to waste management (EU Directives) that establish specific requirements for waste from certain end-of-life consumer goods, including e-waste, the management of e-waste in Angola is still not a reality. However, it is imperative to establish management rules and define goals and objectives so that economic operators in Angola make the necessary adjustments to internalize new requirements in their activities and participate in the reverse process of products (Decreto Presidencial nº. 196/12 de 30 de Agosto). Waste is one of the most complex problems of modern society, with its growth, parallel to economic development, and the inherent difficulties in its management taking on significant importance in social policy (Decreto Presidencial nº. 196/12 de 30 de Agosto). In this sense, it is crucial to dissociate economic growth from material consumption and waste production by reintroducing end-of-life materials into the economic system through the recovery of waste as secondary raw materials that replace natural resources (Decreto Presidencial nº. 196/12 de 30 de Agosto).

The United Nations published an environmental report estimating the growth of global e-waste generation at a rate of 40 million tons per year, highlighting the increasing need for reverse logistics to meet this growing demand (United Nations Environment Programme [UNEP], 2010). On the other hand, the dynamization of the waste recovery sector significantly contributes to economic development and the improvement of living conditions, without compromising the supply of goods to future generations.

With the increase in the consumption of Electrical and Electronic Equipment (EEE) and the rapid pace at which these items become obsolete and unused, the quantity of product discards has also increased. However, the reverse logistics of companies in Angola have largely failed to keep pace with this increase in a structured manner, leading to a growing number of discards in inappropriate locations—either in nature or by overloading landfills with materials that could be reused to generate income and benefit the environment. If e-waste is not correctly returned to the production cycle or properly disposed of, it becomes harmful to the environment, as its decomposition can take decades or even centuries to be fully absorbed by nature.

Incorrect disposal of these wastes not only negatively impacts the environment but also represents a significant economic waste, as recycled e-waste "can be converted into raw materials for different industries, avoiding the extraction of limited natural resources" (Green Electron, 2021, p. 4). Reverse logistics should be seen as a viable path to promote the return of these devices to the production cycle, creating safe job opportunities and income for sectors of society that currently handle these wastes without safety, thus avoiding harm to public health and the environment (Costa & Gonçalves, 2020).

3 Methodology

Since this is an in-depth study aimed at understanding and describing post-consumer reverse logistics of electronic equipment in Angola, it is a case study. Considering the nature of this research and the stated objectives, this investigation simultaneously employs both qualitative and quantitative paradigms, using mixed methods for data collection. This study follows an interpretive perspective of social phenomena, aiming to understand the main obstacles preventing the practice of post-consumer reverse logistics in Angola, particularly in the electrical and electronic equipment sector.

The general objective guiding the research is: To understand the main obstacles preventing the practice of post-consumer reverse logistics in Angola, particularly in the electronic equipment sector. The specific objectives are: 1. To understand the attitudes and practices of electronic equipment dealers regarding post-consumer reverse logistics; 2. To characterize post-consumer reverse logistics of electronic equipment; 3. To describe the

management of electronic waste in Angola; 4. To identify post-consumer reverse logistics practices in the electronic equipment sector in Angola; 5. To identify strategies to enhance reverse logistics.

The case study was conducted in Angola. According to the Instituto Nacional de Estatística (INE, 2016), Angola, a country on the southwestern coast of Africa, is considered the fourth largest country in Africa and the largest among Portuguese-speaking African countries. Its territory is bordered to the north and northeast by the Democratic Republic of the Congo, to the east by Zambia, to the south by Namibia, and to the west by the Atlantic Ocean, covering a geographic area of approximately 1,246,700 km². Its current political and administrative division consists of 18 provinces, 162 municipalities, and 559 communes, with a resident population of 25,789,024 characterized by significant ethnic, ethnolinguistic, and multicultural diversity. The study involved 150 economic operators in the EEE sector, 125 male and 25 female, aged between 25 and 65 years, from 10 of Angola's 18 provinces. Accessibility sampling was used.

To understand the attitudes, knowledge, beliefs, feelings, values, and interests of consumers regarding post-consumer reverse logistics of electrical and electronic equipment, a questionnaire was developed for consumers, with both open and closed questions. In constructing the closed questions, a 5-point Likert scale was used in some cases.

To understand and interpret the attitudes and practices of economic operators in electrical and electronic equipment, as well as end consumers in the context of post-consumer reverse logistics, unsystematic observation, also known as unstructured observation, was conducted in some retail establishments in the electrical and electronic equipment sector, in urban areas, suburbs, and informal markets in 4 provinces of Angola, namely Benguela, Huíla, Luanda, and Huambo, due to their significant production volumes, greater waste management challenges, and advanced practices in urban waste management. Microsoft Excel was used for data analysis and graphical presentation.

4 Analysis of Results and Discussion

The level of disagreement among consumers clearly indicates that, despite the investments made in recent years in the context of waste management, there is a need to strengthen the focus on this issue with training and awareness-raising activities about the benefits of proper waste management. According to the PESGRU, this awareness should address all information asymmetries between social classes and regions of the country, as well as address traditions and cultural habits that are not conducive to proper waste management (Decreto Presidencial nº. 196/12 de 30 de Agosto).

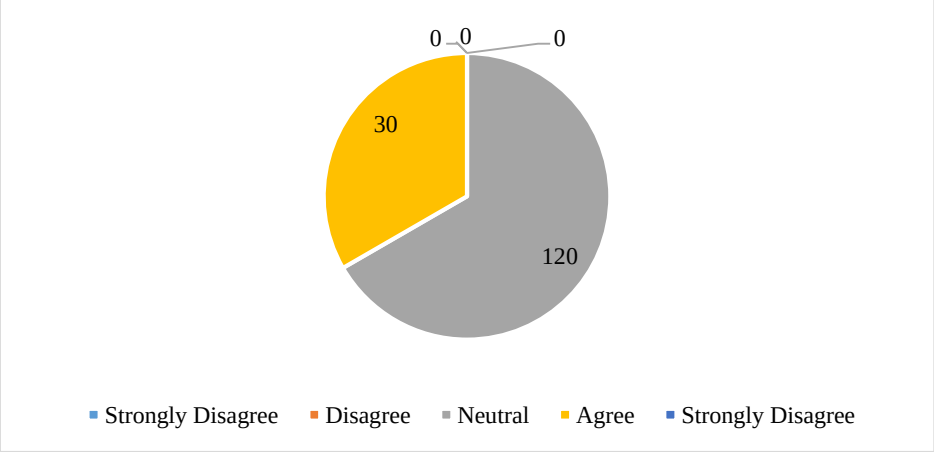

Figure 02: Awareness of the Importance of Reverse Logistics

Reverse logistics has become a major issue for organizations when it is recognized that products returning to companies are becoming crucial aspects in the decision-making process

of management, linking them to the design and development of their supply chains (Lira, Neto & Silva, 2018). Unfortunately, when asked about the importance of reverse logistics, only 30 respondents agreed, while the majority of respondents are unaware of its significance.

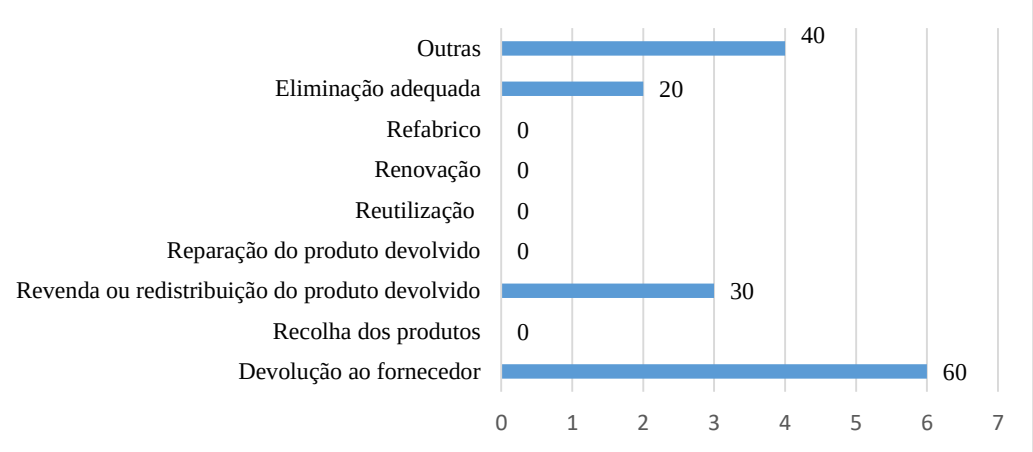

Figure 03: Reverse Logistics Process Conducted by the Company

When asked about the reverse logistics activities conducted by their companies, 60 respondents stated that they return items to the supplier, while 20 participants said they do not dispose of items properly. None of the participants refurbish, renew, reuse, or collect the products. 30 respondents indicated that they resell or redistribute the returned products, and 20 reported that they ensure proper disposal.

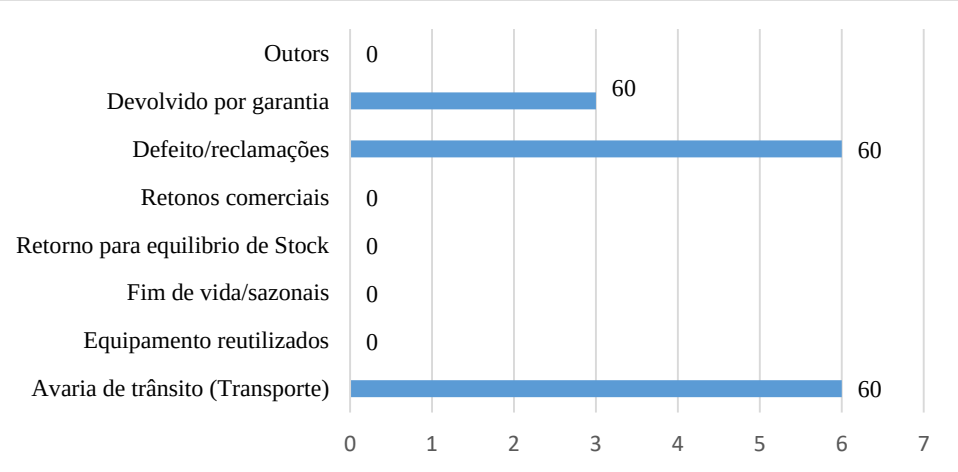

Figure 04: Reasons for Initiating Reverse Logistics

Regarding the main reasons for initiating reverse logistics, 60 participants reported that the primary reason is product damage in transit, 60 responded that the main reason is product return due to defects, and 30 mentioned that the main reason is return under warranty. The promotion of the waste recovery sector significantly contributes to economic development and the improvement of living conditions without compromising the supply of goods for future generations. Reverse logistics plays a fundamental role in a country's sustainable development, as it can adopt a set of measures (reuse, recycling) and appropriate policies that align with human, economic, and environmental needs (Moura, 2006).

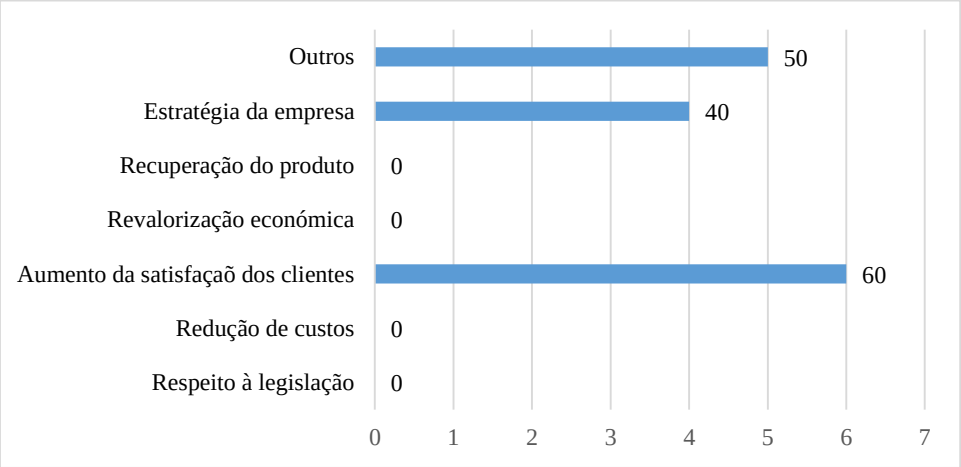

Figure 05: Motivation for Companies to Implement Reverse Logistics

Some of the main reasons for implementing reverse logistics, according to Lacerda (2002), include: environmental concerns, increasing legal requirements regarding company responsibility for their products and environmental awareness, competition, enhancement of companies with good product return policies, and cost reduction. When asked about the main reasons that led their company to adopt or implement reverse logistics, most respondents stated that the primary reason is to increase customer satisfaction. 40 respondents mentioned that it was implemented as a company strategy, and none of the respondents considered product recovery, economic revaluation, or cost reduction as factors.

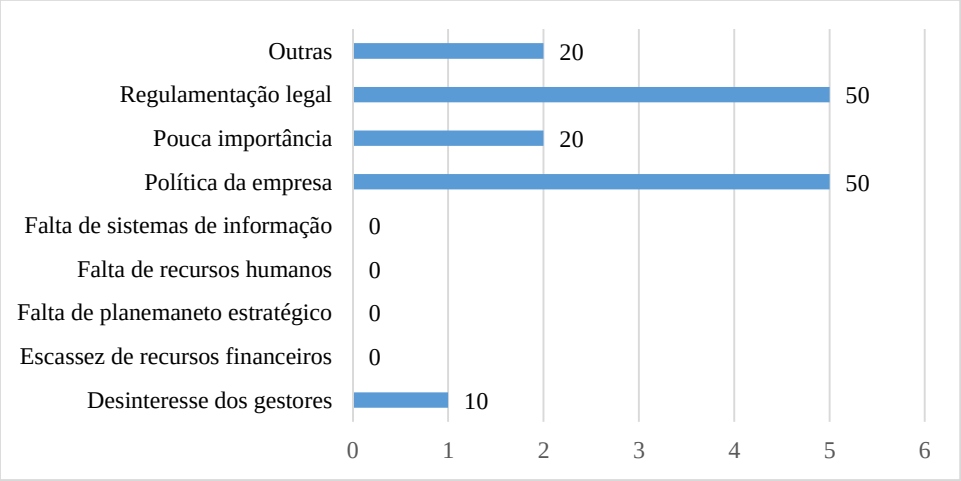

Figure 06: Difficulties Associated with Implementing Reverse Logistics

Regarding the difficulties associated with implementing the reverse logistics process, 50 respondents pointed to a lack of specific regulation, 50 cited a lack of company policy, and 20 participants indicated a lack of interest from companies. These findings align with the difficulties identified by Rogers and Tibben-Lembke (1998, cited by Gonga, 2021), who note that the main challenges in implementing reverse logistics in companies are related to: the low importance given to reverse logistics compared to other business activities; company policy; lack of information systems; competitive reasons; managerial disinterest; financial resource scarcity; lack of human resources; and absence of legal regulations. Concurrently, Machado et al. (2006, cited by Gonga, 2021) state that despite the barriers to implementing reverse logistics, companies' decisions to engage in reverse channels also depend on strategic reasons that provide value and benefits of various kinds—economic, ecological, legal, and corporate image which result in increased competitiveness and cost reduction.

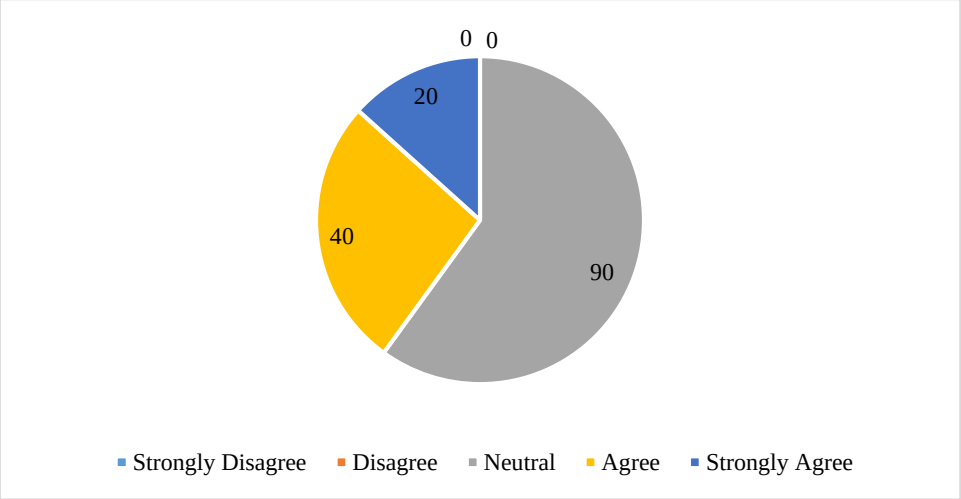

Figure 07: Awareness of Reverse Logistics for Sustainable Development

When asked if reverse logistics is an essential support for the country's sustainable development process, 90 respondents indicated they did not know, 40 respondents agreed, and only 20 fully agreed. In light of this, it is important to emphasize that the promotion of reverse logistics significantly contributes to economic development and the improvement of living conditions without compromising the supply of goods for future generations. Reverse logistics plays a fundamental role in the sustainable development of a country, as it can adopt a range of measures (reuse, recycling, and recovery) and appropriate policies that align with human, economic, and environmental needs (Moura, 2006).

During observations, it was noted that WEEE (Waste Electrical and Electronic Equipment) is deposited in inappropriate areas, such as in containers, landfills, or on public streets with other urban waste. Similar to other African countries, waste management in Angola is highly inadequate, with much of the waste visible in open dumpsites, contaminating water and soil (Ministério da Economia e do Planeamento de Angola, 2021, cited by Mosaiko, 2023). Although the PESGRU outlines that by 2025 all produced waste should be properly treated and landfills dismantled by 2022, waste remains visible in public areas and poses a series of public health problems. The majority of discarded WEEE is placed in general waste, incinerated, or abandoned in the open environment, causing severe environmental damage (Baldé et al., 2017; Oliveira et al., 2017, cited by Costa & Gonçalves, 2020). Specific WEEE collection points were not observed. The installation of recycling points will play a crucial role in selective collection and facilitate oversight.

In some cities, low levels of urban waste production were observed. In the outskirts, high levels of urban waste were noted. Major sources of waste were found around large wholesale and retail food distribution warehouses and public squares, where waste accumulates due to a lack of collection. Other concentration points for waste include drainage ditches and swamps. According to data from the PESGRU surveys, which relate waste production to population and economic power, the national waste production is currently approximately 25 million tons annually, with a daily average of 0.75 kilograms of waste per person.

It is estimated that the percentage of waste collected in Angola during 2022 was as shown in the graph below.

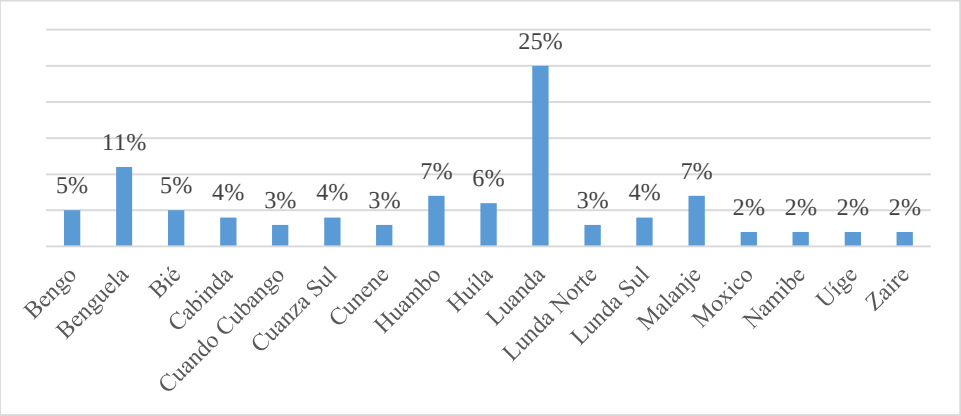

Figure 08: Percentage of Waste Collected by Province in 2022
Source: Agência Nacional de Resíduos, 2023.

According to data from INE, the Province of Luanda, with over 9 million inhabitants, collected approximately 6.3 million tons annually. Luanda accounts for 25% of the waste collected in Angola. The PESGRU proposes a more efficient management of urban waste, identifying four main action areas: expansion and optimization of undifferentiated collection, implementation of treatment, recovery, and disposal models for urban waste, collection and disposal of existing waste liabilities, closure of existing landfills, initiation of selective collection, and structuring of specific waste flows (Mosaiko, 2023, p. 24).

Regarding waste composition, a relevant characteristic, besides organic waste, is the visible amount of inorganic waste such as packaging, plastic bags, glass, metal, and others. Waste pickers collect some organic waste for their consumption, while inorganic waste such as packaging and plastic bags remains at these sites for extended periods. Plastic or glass containers are often collected and sold to the public or informal markets for reuse, such as selling fuel or traditional drinks like Kissangua (a traditional beverage of the Ovimbundu people in southern Angola) and capuca (a typical Angolan alcoholic beverage). This collection is done inadequately. Regarding WEEE, it is quickly collected by pickers and sold in the informal market to repair technicians who reuse spare parts. Informal markets and repair shops for EEE showed a significant amount of WEEE. According to Mosaiko (2023, p. 24), the informal sector, especially waste pickers, plays a crucial role in collecting and sorting materials, which have economic value and can be sold to companies or local traders for reuse. WEEE has become an increasingly important resource for informal workers who recover, repair, refurbish, reuse, adapt, and recycle electrical and electronic equipment, bringing innovative services and products to the market and facilitating a transition to a circular economy (ON News, 2019a).

A lack of oversight and infrastructure was observed, with some peripheries also showing a lack of means and waste collection companies. The International Labour Organization has called for urgent actions to better manage the toxic flood of electrical and electronic waste. According to the Agency, this waste could be transformed into a valuable source of decent work (ON News, 2019a).

Under Article 4 of lei nº. 15/03, de 22 de Julho, Consumer Protection Law, consumers have the right to quality goods and services, information and clarification, product guarantees, and protection in consumer relations. Consumers also have the right to be protected in the manufacture and supply of goods and services and should be compensated for any damages incurred. During observations, it was found that economic operators do not engage in post-consumption reverse logistics. In some establishments, if a good or service is non-compliant, the consumer has the right to request replacement within 30 days for non-durable goods and services, and 90 days for durable goods and services, with a maximum warranty period of one

year, as agreed between the parties, according to Article 13 of lei nº. 15/03, de 22 de Julho, Consumer Protection Law.

5 Conclusions/Final Considerations

WEEE (Waste Electrical and Electronic Equipment) represents one of the most complex issues of modern society, with its growth paralleling economic development and the inherent difficulties in its management becoming a significant social and political issue. Therefore, it is crucial to decouple economic growth from material consumption and waste production by reintroducing end-of-life materials into the economic system, through increased waste valorization as secondary raw materials that replace natural resources.

In this context, it is concluded that the Government of Angola is implementing a program for the reconstruction, capacity building, and expansion of fundamental infrastructure across the country. However, the inadequate management of WEEE continues to be a critical factor, with negative impacts on the environment and public health. Thus, the Strategic Plan for Urban Waste Management (PESGRU) serves as a national reference tool, but unfortunately, many of these plans and strategies have either not been implemented or are in very early stages, facing multiple operational difficulties.

On the other hand, the implementation of PESGRU will help reconcile solving an environmental and public health problem with institutional strengthening and the interests and expectations of various civil society partners, including policymakers, citizens, service users, technicians, economic operators, service providers, media, and associations. Nonetheless, due to its impacts on the environment and public health, WEEE requires a differentiated management strategy based on the waste management hierarchy, prioritizing prevention and reduction, followed by preparation for reuse, recycling, or other forms of valorization, to reduce the amount of waste to be eliminated and contribute to the efficient use of resources and recovery of valuable secondary raw materials. Reverse logistics will significantly contribute to improving population well-being and promoting job creation, aligning with the guiding principles of the Sustainable Development Goals.

Therefore, it is essential to regulate the management of WEEE flows by holding accountable the various stakeholders in the lifecycle of electrical and electronic equipment, including: producers; distributors; consumers; and especially operators directly involved in the collection and treatment of WEEE, with a view to applying the principles of prevention, valorization, and safe disposal, to improve the environmental performance of all operators involved in the lifecycle of EEE.

Reverse logistics for electrical and electronic equipment is a current and highly sensitive topic, and the results of this study may generate unexpected reactions. However, we believe that the knowledge produced from this research will be useful in encouraging the Angolan government to formulate specific legal provisions regarding post-consumption reverse logistics for electrical and electronic equipment.

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