

## Toner Technology Route: A Case Study

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**Keywords**— *electronic waste; technological route; public agency.*

**Abstract**— *The unbridled increase in the generation of solid waste, especially electronic waste, due to its dangerousness, has been worrying the world. The Judiciary, based on shared responsibility, has already been promoting some sustainable practices to improve the environment and society as a whole. The aim of this study is to contribute, with possible improvements in the Solid Waste Technological Route (Toners) in the Thomaz Aquino Forum, an integral unit of the Judiciary of the State of Pernambuco, Brazil, located in the central area of the city of Recife. The methodology was carried out through a bibliographic survey, including qualitative and quantitative research, by data collection, through questionnaires, about the management of the Toner Technological Route of 14 offices, located in the Thomaz Aquino Forum, in order to propose more effective adjustments and adjustments, in addition to expanding information on the importance of knowledge and participation of all in sustainable actions. The study is relevant, given the importance of adequate solid waste management, which make it possible to contribute effectively to the protection of the environment in order to avoid or minimize environmental and institutional degradation, to provide subsidies to propose new actions in updating the next Sustainable Logistics Plan (PLS), in order to achieve its goals and objectives. It was concluded that the Court, although it works positively in the realization of sustainable practices, still demonstrates fragility of some measures from the simplest measures such as information and guidance to the effective improvements, especially in the management of electronic waste and its technological routes.*

### I. INTRODUCTION

In the context of the Third Industrial Revolution, in the mid-twentieth century, society began to experience the development of new products at a faster pace. The possibility of creating more in less times and with fewer human resources - due to technological advances and the consequent automation of processes, generated a relevant impact on the business strategy of large companies and various sectors of the economy.

To increase the revenues of companies, it is noticeable the tendency to reduce the durability of certain industrialized products and the consequent need to replace them more frequently, due to the launch of virtual products, such as software and applications, because it forces the exchange of physical products (hardware) because the old models can not run this new tool. The waste strategy, based on the programmed obsolescence of products (industrial and virtual) has been further leveraged by globalization and technological progress. (ROSSINE, 2017).

Despite being something beneficial for the movement of the economy, this strategy has been harmful to the environment and human health by generating an accumulation of waste, especially of electronic equipment, which contain dangerous substances.

The risk to human health lies mainly through the handling of printer toners, which are one of the most contaminating WEEs, due to the components of the equipment's own housing, composed of plastic, resin and pigments. In addition, the smoke powder contains heavy metals, among them: cadmium, gold, copper, mercury, lead, beryllium, carbon with polymers metal oxides such as manganese and some salts (DOMINGUES, et al., 2016).

It is necessary to turn to the source of production with the knowledge that capital cannot supplant the reality of the destruction of natural resources (FRÁGUAS, 2019).

In Brazil, more than a decade ago, Law 12,305 of 2010 instituted the National Solid Waste Policy (PNRS). However, the absolute volume of waste continued to grow in the following years. According to data from the Solid Waste Overview in Brazil 2020, generation went from 66.7 million tons in 2010 to 79.1 million in 2019, a difference of 12.4 million tons. The same study also says that each Brazilian produces, on average, 379.2 kg per day (BRASIL, 2021).

The National Solid Waste Policy (PNRS) deals with shared responsibility for the product life cycle, reverse logistics, encouraging the creation and development of cooperatives or other forms of association of waste pickers of reusable and recyclable materials. According to the Brazilian Institute of the Environment (IBAMA), states and municipalities can use PNRS instruments to organize reverse logistics chains with less coverage. In such cases, they may expand, but not slow down, the environmental protection measures signed in the sectoral agreements and terms of commitment with greater geographical scope (BRASIL, 2010).

According to IBAMA, the legal entity is obliged to develop hazardous waste management plans, for the identification of technical responsible duly qualified for the preparation, implementation, and monitoring of all stages of the management plan, including control of the final disposal environmentally appropriate to tailings (BRASIL, 2022).

The research is justified by seeking to understand the current waste management system of the Court of Justice of Pernambuco (TJPE), a state agency that updated its Sustainable Logistics Plan (PLS) for the financial year 2021 (PERNAMBUCO, 2016), in order to monitor the achievement of the goals and objectives established by the National Council of Justice (CNJ), where the theme solid waste management, is among the indicators aimed at

rationalizing public spending and reducing its effects on the environment (PERNAMBUCO, 2020). Article 3 of the Resolution of the CNJ deals in its item I, shared responsibility, sustainability actions, and says that this institutional practice should promote ethical behaviors that contribute to the environmental, social, cultural, economic development, as the purpose of improving, simultaneously, the environment and the quality of life of the staff and auxiliary of the judiciary, as well as the local community and society.

Focusing on the objective of this research, the following question arises: does the staff know about the Sustainability Policy within the judiciary? And the managers of each unit, are performing their role adequately to the PNRS and the goals and objectives established in the PLS of the TJPE?

In this same resolution, also in Art. 3, item IV, item IV, it embodies shared contracts: joint acquisition of goods and services that generate less environmental impact, greater social inclusion, consider the cultural dimension of sustainability and economic efficiency, as a scale gain, carried out by public organizations from different sectors or between units of the same public organization, sustainable production and consumption in the country.

## II. METHODOLOGY

The study was carried out in 14 (fourteen) offices of judges, which operate on the 6 (six) floors, of the Thomaz Aquino Forum, considering that there are a total of 23 offices on site, the study conducted a random sample, directed to gabinetes of better accessibility, convenience, in addition to excluding those who are not with full activities, this fact occurs when the incumbent judges are appointed to be the Board of Directors, that is, when they move away to occupy positions of President, Vice-Presidents, Corregedor and Vice-Corregedor or removed by other administrative circumstances.

The said organ is located on Av. Martins de Barros, 593, santo antônio neighborhood, in the city of Recife, capital of the state of Pernambuco, in the central region of Recife.

The city of Recife is in the northeast region of Brazil, bathed by the Atlantic Ocean. The capital of Pernambuco is inserted in the Atlantic Forest Biome, the most threatened forest in Brazil, with only 12.5% of the original area preserved. Recife is the third capital of Brazil with the highest percentage of natural vegetation, according to a study by the SOS Mata Atlântica Foundation and the National Institute of Space Research (INPE).

According to Cheng et al. (2014), the contamination of the biome occurs due to the significant presence of toxic substances present in electronic waste, as is the case of

Toners, the object of the present study.

The exploratory study was initiated by bibliographical research, pertinent to the theme, where it was possible to deepen knowledge for a better analysis, from previous studies, International Agreements, Federal Constitution of 1988, infraconstitutional legislation - such as the National Solid Waste Policy, instituted by Law 12.305/2010 - to Institutional Policies, such as resolution 400/2021 of the CNJ and the current Sustainable Logistics Plan PLS/TJPE 2020/2021.

In a second moment, a descriptive, quali-quantitative survey was conducted, whose survey was using the survey method.

A survey is defined as a research technique that uses the "direct interrogation of people whose behavior you want to know" (GIL, 2008, p.55).

In the case study, the researcher usually uses a variety of data collected at different times, through various sources of information. Its fundamental research techniques are observation and interview. It produces reports that present a more informal, narrative style, illustrated with quotations, examples and descriptions provided by the subjects, and can also use photos, drawings, collages or any other type of material that helps you in the transmission of the case (FABÍOLLA, 2007).

In exploratory stage 2, questionnaires were applied, with the same questions to all interviewees, the questions were opened and closed, directed to each person responsible for the Technological Route of the (Toners), for two weeks in a row, where the researcher went to the field and questioned each of the responsible in each office, in addition to the managers of the sectors involved in the route until its destination.

In addition to the interviews, photographic records were made on site, the printers, and Toners, as well as the packaging where the toners are transported and the material request form, a document by which the input and output of the toners is recorded.

In the last stages, already with the data collected, with the help of Microsoft's Excel program, it was possible to build the graphs, flowcharts, and tables, for a better visualization, understanding and discussion about the results on the management of the WEEe of the Technological Route, in the 14 Offices of the Thomaz Aquino Forum, units that are part of the Judiciary of the State of Pernambuco.

### III. RESULTS AND DISCUSSION

The study made it possible to evaluate several aspects involving the Technological Route of the Thomaz Aquino

Forum, such as the finding that no research had been conducted in this forum in this sense, it was also possible to verify that the institution makes use of the same model of printers. And each of the 14 offices visited, were found between 3 to 6 equipment.

And in relation to the quantity of toners used in the period of 1 year, the result was a total of 41, ranging from 1 to 6 units in each cabinet. The research found that such variation occurs because, in some cabinets, Toners are ordered in a larger amount than necessary, because the surplus is as reserve stock, while other cabinets require toners in the exact amount to replace what was used.

Another factor that contributed to the reduction in the consumption of Toners, has a direct connection with the volume of decisions in the offices, considering that most of them come from the PJE - Electronic Judicial Process, that is, where there is no printing of documents. In this case, decisions, orders, among other expedients, are sent by the system itself, without the need for printing.

An event that also reflected in the reduction of the generation of REE studied, was the Covid-19 Pandemic, when there was a long period of remote work or home office model.

When 64% of the interviewees answered that, when they were dangerous, 36% of the interviewees answered that they knew it was dangerous waste, and 36% of the interviewees answered that they did not know about the possible dangers. It was also observed that during the handling of the cartridges, the employees do not make use of PPEs.

As for the toners' technological route, they are sent to the supply sector and when they receive the new Toners, they also forward, by request form, to the offices. On the other hand, the head of the supply sector, when asked about the route and destination of the toners, replied that the institution already states, in contract, that the manufacturer is responsible for the proper collection and disposal of toners, that is, there is the recent adoption of the reverse logistics practice.

In a research to the Sustainable Logistics Plan, it was confirmed that the disposal of waste from the printing supply is based on logistics agreements formalized between the TJPE and representatives of the manufacturers of cartridges/Toners used by the agency and proved successful with regard to the correct destination. In 2021, the institution registered a collection of 1,272 unusable units.

It is possible to show that there is no standardization in the Toner's Technological Route held at the Thomaz Aquino Forum, because there are currently two Exit Routes: the first, the Toners leave the offices, go to the Administration of the Forum and this is responsible for continuing the route,

forwarding them to the Supply Sector, intended for suppliers. The second route, practiced in 50% of the offices, makes a shorter path, since the Toners are sent directly to the Supply sector, without going through the Forum Administration.

Although the study noted the lack of standardization in the Technological Route, this fact does not lead to the conclusion of poor waste management, however, it is important to realign the Technological Routes so that there is better future planning.

Similar studies, when compared with the results found in the present study, state that the identification of technological routes in analysis of management models makes the system simpler and the assembly of strategies to be studied in decision-making process. It is therefore a path of solutions that involves several dimensions, explores diverse and relevant techniques. (PIMENTEL, 2017)

On reverse logistics, an action already practiced by the TJPE, an integral part of the technological route studied, the case study of (ASSIS, et al, 2015) says that reverse logistics is a tool that aims to revalue everything that is discarded, thus making an ally for sustainability and found that there is still a lot of resistance, both by companies, as for the generating agents, who are generally uneducated and aware of the problems caused by the incorrect disposal of these materials and highlighted the importance of a model to be followed, such as that developed by the Center for Disposal and Reuse of Computer Waste (CEDIR). The model provides for how it is possible to perform the treatment and ensure the sustainable destination of electronic waste and its components.

Also on Reverse Logistics, considering that the present study found that in the 14 Offices, all printers are of the same brand and that the supply sector reported that the manufacturer itself is responsible for reverse logistics, a similar study conducted by (SILVA, 2018) at the Federal University of Paraíba - UFPB, found that manufacturers of toners of brands such as HP, LEXMARK, XEROX and SAMSUNG, through the reverse logistics process, outsource companies for environmentally correct final collection and destination.

The same study also affirms the importance of better disseminating information about the appropriate place of disposal of this type of waste to the academic community, in addition to an awareness to employees and teachers, through environmental education and alerting about risks to health and the environment, in case of destination and incorrect disposal.

#### IV. CONCLUSION

The research analyzed the structure of the current technological route of toner residues generated in the 14 offices of Judges of the Thomaz Aquino Forum and with the results obtained it was possible to corroborate the importance of adequate waste management, especially of the hazardous waste of toners.

The adoption of Reverse Logistics was a recent measure, implemented in the last update of the PLS, however, it was possible to notice that there is a lack of alignment between the various sectors involved in waste management, especially at the study site, regarding the pattern to be followed. Even in one of the answers, the guardians stated that they did not receive any type of guidance or determination to be followed, a relevant fact to be analyzed in the future strategic planning, which demonstrates the feasibility of effecting one of the objectives proposed in the present study.

It is important to point out that the concern around sustainable practices should go beyond goals and institutional duty, a fact that is also noted in the institutional reports, which demonstrates the need for a more preventive action-oriented approach, to avoid both environmental degradation and possible damage to human health.

From this diagnosis on the current Technological Route of Toners in the Thomaz Aquino Forum, it will be possible to subsidize managers in decision-making, when implementing and updating the Sustainable Logistics Plan of the TJPE - 2022/2023, as well as serving as parameters for other public or private bodies, as well as references for future studies of other researchers, including in the same institution.

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