

Contribution to Computer Waste Management: Knowledge of the Regulatory Framework by Industry Stakeholders in Guinea

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Abstract: In African countries, regulations on the management of WTE (Waste from Information Technology Equipment) are non-existent or sometimes insufficient, if they exist. This study shows how to mention waste from information technology equipment in a country that does not have a regulatory legislative framework or organized management channels. A methodological approach based on documentary research and semi-directed interviews was adopted in this work. The results showed that 54.55% of institutional managers are unaware of the existence of regulations for the management of WTE, both at the national and international levels; 72.72% of these managers do not have a specific implementing text for this management; 72.73% of institutions have adopted an acquisition policy based on the needs of workers and 81.82% of institutions store WTE in warehouses. Relations with waste collection SMEs (Small and Midsize Enterprises), especially for IT equipment, are limited for 72.73% of institutions. In terms of improving the capacity to manage WEEE (Waste Electrical and Electronic Equipment), 90.91% of institutions do not offer training or awareness raising. Overall, no significant indicators are in place to assess WEEE management in institutions, which reflects a lack of commitment and awareness among institutional managers. In addition, there are no financial means for ecological and sustainable management. Although 27.27% of managers are aware of the dangers to human health and the environment related to IT equipment, they are often unaware of the harmful consequences of abandoning it in nature.

Key words: Waste, IT equipment, legal frameworks, regulations, informal management.

1. Introduction

The management of IT waste has become problematic in all countries of the world in general and in Africa in particular due to the inadequacy or absence of a rigorous regulatory framework, with a management system dominated by the informal sector.

However, IT waste can have adverse consequences on health and the environment, as highlighted by Baldé et al. [1]. Many countries have difficulty defining waste statistics, because they have differences in the way of reporting data, and also in the definition of products [2]. Others, however, estimate an increase in the amount of

waste over time. Africa, Asia and South America are the regions most affected by the presence of this waste. It turns out that 50% to 80% of the waste from the United States is exported to the Asian and African continents where the cost of recycling is lower [3]. Similarly, in 2019, Europe exported 63 kt of WEEE (Waste Electrical and Electronic Equipment) worldwide and 24% was destined for Africa. In addition, the study shows that 25% of the equipment exported to sub-Saharan Africa is used, including 65% of printers, 61% of monitors and 77% of smartphones are used. In addition, IT waste is exported in the form of humanitarian donations through NGOs (Non-

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Governmental Organizations) and associations of personal effects, or second-hand equipment in working order, which is not always the case in practice, to second-hand markets from rich countries to poor countries [4, 5].

The influx of often unused IT equipment considered waste to developing countries is encouraged by the absence of legislative and regulatory frameworks. Sometimes the texts exist in certain places but they are often insufficient or are not applied. This allows industrialized countries to circumvent the law on the reuse of equipment and promote their exports. Current regulatory provisions and state policies do not allow stopping this illegal trade which is dangerous for the health of the poorest despite the implementation of conventions (Basel and Bamako) on the illegal transfer of hazardous waste, which includes computer equipment [6]. Some African countries are now aware of the dangers inherent in the poor management of electronic waste. The legal framework and infrastructure for sound management are still insufficient in the majority of countries. Only a few countries, such as South Africa, Cameroon, Ghana, Kenya, Madagascar, Nigeria, Uganda and Rwanda, have legislation, policy or national regulation in place on waste from electrical and electronic equipment, as indicated by the World Health Organization report and the study of Prakash et al. [7]. The Basel Convention has been ratified by almost all African countries. However, most have not transposed it into national law in the form of specific legislation for various waste streams.

To date, the ARPT (Postal and Telecommunications Regulatory Authority, 2020) has presented a telephone penetration rate of 111% in the 3rd quarter of 2020 compared to 101% in 2018. Data from the Planning and Statistics Department of the General Directorate of Higher Education show that the computer penetration rate in higher education institutions has reached a percentage of 0.21%. According to the National Agency for Electronic Governance and State

Information Technology, the computer penetration rate is 2.2% per 100 inhabitants [8]. Computer waste is not regulated, only a few orders and service notes on the classification of hazardous waste including some substances contained in computer equipment are mentioned.

WEEE is subject to incineration (50%), storage for probable recycling (30%) and landfill (20%) as a method of disposal. Some methods (incineration and landfill) represent a risk of pollution for the soil, air and water. The level of environmental risk remains high with 75% against 25%.

Other studies have also revealed that WEEE generally contain toxic substances and contribute to environmental pollution. This research aims to determine the level of regulation of WEEE management in Conakry [9].

2. Methodology

A methodological approach based on documentary research and semi-directed interviews was used in this work.

2.1 Data Collection

The first stage of the documentary research took place in the ministerial departments, services and with resource persons in relation to IT equipment and waste management. It made it possible to first obtain documents on waste management policies in general and IT waste management policies in particular, namely: legislative and regulatory texts, activity reports, scientific publications, sectoral programs, strategic plans, etc. Then, information related to companies and stakeholders operating in the field of IT and waste managers in general.

An interview was organized with institutional managers to understand the problem of end-of-life IT equipment waste management, namely: Rectors/General Directors of Higher Education Institutions and Mobile Phone Companies and Internet Access Providers.



Fig. 1 Unrecovered IT equipment.

We discussed the subject of the legal and regulatory framework concerning IT equipment. The institution's public policy, plans and strategies for IT waste management, their level of knowledge on the negative consequences of IT waste, vision, opportunities and recommendations were also discussed. The interviews helped to understand the importance that these institutions give to IT waste management, while identifying the different management methods.

The administration of the interview guides began by contacting the respondents, then requesting an appointment at their convenience. These survey forms were filled out on site by the investigators after a brief presentation of the objectives. The individual interviews followed the same process, except that the institutional managers received a letter with an acknowledgment of receipt. With their permission, the conversations were recorded on a smartphone so that the information was accurate. Field visits and contact with the various IT equipment stakeholders made it possible to test the questionnaires and readjust them.

2.2 Data Analysis and Processing

The data collected during the individual interviews were transcribed individually into Word. Each interview was listened to several times in order to accurately translate the information collected. The themes and sub-themes significant for the restitution of

opinions were included in an analysis grid. Two steps followed the analysis: the first step, called vertical analysis, consists of integrating the interviewer's strong ideas in relation to the question, his point of view and the examples cited to support his opinions. This allowed taking a critical position according to each interview. The second step of the analysis is called horizontal. It allowed comparing the information of the different interviewees according to the questions, which resulted in the overall interpretation with regard to the objectives of this study. Illustrative extracts from the interview are included to support the arguments. The photos in Fig. 1 show the non-valued IT equipment.

3. Results and Discussion

3.1 Existence of Regulations on the Management of WEEE in Guinea

The Guinean regulatory framework does not allow us to understand the concept of waste management of IT equipment, because it is not integrated into the legislation. It only mentions certain chemical substances that enter into their composition. Thus, to date, 54.55% of institutional managers are unaware of the existence of regulations on the management of WEEE, both nationally and internationally. The regulations on the management of WEEE are known by only 18.18% of institutional managers. It should be remembered that our country, Guinea, has adhered to many international

conventions such as the Prague and Basel conventions on cross-border trade in hazardous waste.

Lack of knowledge of the regulatory framework means that 72.72% do not have an implementing text for the management of WEEE. Only one institution has an internal regulatory document as an implementing text, in the form of a procedure manual describing the management of WEEE in general.

The control procedure of some institutions requires them to protect the environment and improve the living environment. Consequently, 27.27% of managers have included this component in their development process. However, it should be remembered that the management of WEEE is not mentioned in their implementation strategies. They are sometimes treated in the same way as other categories of waste or, failing that, stored in places dedicated to this purpose. The documents setting up the environmental protection committees, in accordance with the requirements of their control structure, were considered as implementing texts by 18.18% of institutions. Indeed, it is paradoxical that these texts do not specify the management of waste from IT equipment in any place.

3.2 Missions of the Institution in the Management of WEEE

The management of IT equipment, when not in use, is not mentioned in the strategic development plan of the institutions. It is therefore not considered a priority activity in the field of waste management or environmental protection and HHST (Hygiene, Health and Safety at Work). It is important to emphasize that institutions rather favor the advantages of computer equipment to modernize their administration and education. The management of these, as waste, has never been a concern, given the low rate of one (1) in eleven (11) of what ensures the collection is almost ecological. When purchasing this equipment, we integrate environmental concerns to influence suppliers so that the choice of equipment is made taking into account certain aspects, such as less polluting equipment.

3.3 Social and Environmental Management Plan for Environmental Protection

The social and environmental management plan does not exist. The few institutions (54.55%) that said they had it confused it with their policy document on hygiene and the work environment. This document takes into account the activities of collecting other categories of waste, by dedicated SMEs (Small and Midsize Enterprises), reforestation and other awareness-raising and environmental protection activities. In other institutions, it is not a written document that defines it as such, but rather the activities carried out. Among the activities they carry out, the management of computer waste is never mentioned. In reality, these managers are not aware of the danger of computer equipment waste. A committee responsible for hygiene and environmental preservation was created by two higher education institutions, in accordance with the recommendations of their quality control structure, as an indicator of sustainable development. However, no activity of this committee focuses on the management of computer equipment waste.

The committee will participate in popularizing the actions carried out, supervise our students to provide them with training, raise their awareness and broaden their horizons on this urgent need to preserve the environment. Institutions that have certification in the protection of human health and the preservation of the environment are rare. For example, one (1) out of eleven (11) is certified to the ISO (International Organization for Standardization) standard on HHST and only one is certified to the environmental standard ISO 14001 [10]. Thus, it is the only one that has a certificate and has a division responsible for environmental issues in its entirety, the identification of regulatory compliance texts, the renewal of the certificate and the environmental audit. Consequently, it considers the management of IT equipment throughout its life cycle.

3.4 Management Methods of DEI (Storage Time, Storage Location, Collection Deadline)

Due to the management of DEI, some institutions (81.82%) opt for storing out-of-use equipment in warehouses. Thus, they are beginning to worry about the future of DEI, because said storage locations are almost full. Other management methods are used, such as the repair of some equipment (27.27%), the reform of personnel (18.18%), the use of components for students' practical work. The most polluting and hazardous waste is landfilling, like other categories of waste, with the presence of chemical substances.

All these methods are carried out informally, as indicated by those responsible for the management of IT equipment, which are usually the IT departments in some institutions and the hardware/logistics departments in others. The institutions do not consider these activities as priorities in the field of waste management or environmental protection and HHST [11].

Despite this state, only one company considers environmental concerns related to WEEE throughout their life cycle. As management methods, it uses maintenance to extend the life and the reform of equipment to employees after depreciation. It has a contract with an SME specialized in the collection of WEEE, in which the treatment and recovery of this waste is provided. Unfortunately, the implementation of this article remains unapplied, due to the difficulties of transferring hazardous waste, especially from developing countries to developed ones.

3.5 Relations with Collection SMEs

Relations between institutions and waste collection SMEs are generally limited to a contract for the collection of other categories of waste, except for IT equipment (72.73%). Sometimes, all waste is collected, including DEI. Consequently, 90.91% of institutional managers are unaware of the existence of SMEs specialized in the collection and treatment of IT equipment waste. However, 27.27% of managers have

DEI collected by individuals from the informal sector [12]. Storing unused IT equipment in warehouses is the management method most used by most institutions and these warehouses are almost full.

3.6 Training, Information and Awareness Policies

The operational action plan does not provide for training of staff on the dangers related to IT equipment, not only during the use phase, but also at the end of its life, as stated by 90.91% of institutions. However, 18.18% organize training sessions for their staff extended to other people on topics related to environmental protection in general. On the other hand, in their Corporate Social Responsibility component, 27.27% of institutions provide financial and material assistance to NGOs, to organize awareness days on hygiene of the living environment and environmental protection and sanitation. In addition, the only multinational institution, having a contract with a local service provider for the collection of its DEI, has a training, information and awareness plan. Thus, training activities for employees and partner service providers are organized. The establishment of a hygiene committee in two institutions, at the request of their quality control structure, is considered as their institutional policy to preserve the environment in general, but this document does not make any special mention of DEI.

3.7 Indicators to Measure the Achievement of Significant Results

The indicator to measure the achievement of significant results in the management of IT equipment waste is not achieved or does not exist in any institution. Obviously, even the institution that has a service provider specialized in the management of these types of waste does not present an indicator. The certificate of destruction or recovery of this waste is an indicator to measure their ecologically rational management. However, there is no indicator to date, because the DEI is always stored on the service provider's site. This

shows that the laws for transferring hazardous waste must be followed if the destination is from Africa to the West. This text is circumvented, if it is the other way around.

The storage of unused IT equipment in stores is the only visible indicator. The dumping of DEI (18.18%) and the collection by individuals in the informal sector (27.27%) are indicators that pollute the environment and affect the health of the population, especially due to toxic substances.

3.8 Current Weaknesses in IT Waste Management

In particular, the management of DEI is insufficient, especially at the institutional level, because there is no information on the management policy. Regarding the skills of human resources in training, awareness-raising and information, there is a lack of managerial spirit among institutional managers. For the economy, there are no financial means that allow for ecological and sustainable management. Some institutional managers believe that only the State can take measures through a legislative and regulatory framework to ensure better ecological management of DEI.

Despite some efforts, such as the storage and collection of DEI by individuals, ecologically sustainable management is not sufficient, because these stores must necessarily fill up. The SME specializing in the collection and processing of WEEE will be able to transfer them to other countries for their processing and recovery, or do them on site, in the event of national regulations. In addition, if users are informed and made aware of the requirements for collecting WEEE, this will gradually reduce institutional shortcomings in the management of WEEE.

3.9 Policies for the Acquisition of IT Equipment (EI)

Most institutions define the acquisition of IT equipment as an activity that is not described in a document. However 72.73% of institutions have adopted the following policy: request for equipment needs expressed by the worker and addressed to the

institutional manager, who directs him to the IT or hardware/logistics department to define the characteristics of said equipment. Then, the file is forwarded to the financial affairs department which handles the purchase.

The institution's EI acquisition policy is based first on donations made by Guinean and foreign companies, then, by purchasing said equipment by the institution according to the needs expressed by the services. However, 27.27% have a procedure manual in which the conditions, deadlines and characteristics of the computer equipment are described for their acquisition. Thus, these institutions are not equipped with second-hand equipment, but rather with new equipment. RI06 "Everything we do is planned according to our training. The document exists in the form of a service note."

3.10 Negative Effects of IEDs on Human Health and the Environment

The dangers of IT equipment on human health and the environment are known by 27.27% of institutional managers. However, they are unaware of the harmful effects that this can have when the equipment is thrown away in nature. Indeed, 63.64% of respondents are aware that poor management of IEDs can cause health and environmental effects due to the toxic substances they contain, as well as pollution of receiving environments (soil, water, air). Institutional managers, despite their level of knowledge on the impacts of IEDs (90.91%), do not propose any provisions for the ecological and sustainable management of IEDs. It is therefore time to sound the alarm, in order to draw the attention of our users in our African countries and, more particularly in Guinea, to these possible ecological threats, given the increased proliferation of said equipment.

4. Discussions

In order to implement the Basel Convention, measures are taken by the Ministries of the Budget, through the National Customs and the one in charge of

the Environment. Thus, a program of registration, inspection, verification, collection, as well as the reception of the ecotax on electrical, electronic and pneumatic equipment exported to the Republic of Guinea, has been set up and has been in force since February 1, 2020. So far, all the importers surveyed are unaware of these provisions. However, for professional users, at least two (2) out of eleven (11), are aware of environmental standards and have ISO certification on Hygiene, Health and Safety at Work (HSST and ISO 140001) [13]. Regarding the management of DEI, it is noted that 54.55% of institutional managers are unaware of it both nationally and internationally. Today, the most effective environmental protection practices recommend that companies be certified by certain standards, in order to enable them to adopt responsible behaviors [14]. Obviously, this practice is unknown to all users, with the exception of those who have evolved in multinational spheres.

The implementation of joint orders on imports and the payment of the eco-fee is not effective. But, also, the implementing texts and monitoring of laws in Guinea remain in the embryonic state. The existence of regulatory texts does not mean their implementation, application, appropriation or popularization in the current context, that is to say, not applied. The studies of Baldé et al. [1] confirmed that this action was justified and argue that texts were sometimes piled up by inadequacies and non-applications.

We are witnessing an awareness, which is manifested by the establishment of certain provisions, although they are not applied or transposed into the national legislation of the Republic of Guinea. Indeed, the absence of this legislative framework demonstrates that the concept of waste management of IT equipment is far from being considered by the various actors, in case it is not yet considered a national priority. However, some African countries, such as: South Africa, Cameroon, Ghana, Kenya, Madagascar, Nigeria, Uganda and Rwanda, have national regulations on WEEE, as highlighted by Refs. [16, 17]. Environmental

standards also include the collection, treatment of metals and toxic substances, as well as the routing to controlled landfills of the remains of non-recovered materials, as indicated by Ankit and al., (2021) [18]. However, the only company that collects WEEE by a specialized SME cannot treat them properly. This can be explained by the absence of recycling units in Guinea and the difficulty of cross-border transfer of hazardous waste to countries of origin.

Although SMEs are not authorized to collect all types of waste, many of them collect WEEE (75%). Even if these SMEs operate in the formal sector, they do not respect the clauses of the service contract, which only authorizes them to collect household waste. If they are able to do so, it means that the population considers waste from IT equipment as household waste and treats it as such. Indeed, 80% of collectors stated that WEEE is mixed with household waste. Whether it is the recyclers/repairers or the collectors, it is the components with market values that are recycled. The other parts of the IT equipment are always thrown away with household waste [19].

Computer equipment is all found mixed with household waste, as reported by collectors. It is either in good condition (repairable) or defective (unrepairable). It is sometimes found in part, i.e. a few pieces of equipment or the complete equipment with all the elements, but which do not work. This corroborates with the low repair rate (30%), but also recycling (5.6%) of some components with market value [20].

5. Conclusion

In addition, waste management is governed by legal texts such as: laws, decrees and orders whose applications are lacking in most African countries, particularly in Guinea. Laws and regulations are not necessary when they are not implemented on the ground. However, when, in a state governed by the rule of law, we try to organize or support effective and systematic control, state services always remain bound, if there is no appropriate legal system. This is why it is

important to produce legal texts that govern waste management locally; because this allows us to see the inadequacy, or even the non-existence, of specific provisions for managing this waste.

This work highlights the shortcomings in the application of international texts which, even if they are ratified, are not truly transposed and integrated into national legal systems. Guinea only has general texts that apply to all categories of waste. Regarding collection systems, the specificity of electronic waste in general and computer waste in particular is not taken into account. The absence of centers to collect, sort and treat them, leaves the country in situations as serious as they are inextricable. Currently, the decontamination of sites and materials is out of reach and the voice of those who denounce this fool's market is stifled.

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