



(RESEARCH ARTICLE)



Characteristics and management of scrap metal waste in Cotonou in the Republic of Benin

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World Journal of Advanced Research and Reviews, 2021, 12(02), 006–018

Publication history: Received on 11 September 2021; revised on 28 October 2021; accepted on 30 October 2021

Article DOI: <https://doi.org/10.30574/wjarr.2021.12.2.0528>

Abstract

The development of new technology leads to the consumption of new equipment which finally becomes hazardous waste and difficult to manage. This is what was observed in the city of Cotonou in the Republic of Benin which motivated the initiative of this study, the main objective of which is to describe the mode of management of these types of waste. The data collected concerns the types of electrical and electronic equipment used by professional users and households, as well as their conditions at acquisition and their lifespans. The data were collected from households, professional users and waste pickers. After the collection, the data were entered in the Microsoft Excel 2013 spreadsheet for the analysis and then the calculations of the means, the frequencies and the production of the graphs were carried out with the SPSS 21 software. It has been revealed that among professional users, universities and administrations are major producers of scrap metal, where respectively 30% and 16% of scrap metal was recovered. According to information gathered from these players, 79% of their equipment purchases took place on the local market. At household level, radios, televisions, telephones and refrigerators are the most widely used equipment. Like other electronic and computer equipment, the households surveyed also use computers, printers, DVD players, video players, landline and portable telephones, electronic gadgets, cameras and refrigerators. At the end of its life, 66% of the households surveyed throw their equipment in the trash cans like household waste. This discarded waste is collected by the waste pickers. Among the scrap metal recovered from the latter, motorcycle and car wrecks, television sets are the most popular with respectively 16%, 15% and 14%. Next are refrigerators for 13%, batteries for 12%, followed by electronic and computer devices.

Keywords: Scrap metal waste; Management; Cotonou Benin; Characteristics

1. Introduction

The progress made in the field of new technologies and their usefulness in economic activities is no longer in dispute. But urbanization and the development of new technologies are contributing to the exponential increase in waste [1]. The production of waste is inherent in human activities, whether domestic, agricultural, industrial or commercial. But, in Africa, as everywhere else, it is only with the urban fact that it truly becomes a public issue [2]. The diversity of scrap metal and its growth is prompting a reaction from the international community. The UNEP, in its report entitled "Recycling - from E - Waste to Resources", drafted within the framework of the initiative StEP (Solving the E-Waste Problem), specifies on average a linear increase for personal computers (OP), TVs and refrigerators, while sales and stocks of mobile phones have grown exponentially in recent years in the eleven (11) countries studied. This results in a significant production of scrap metal which could have serious environmental consequences [3]. Today people live on a planet that is increasingly polluted. Metals, plastics, rubbish, pieces of bottles, waste electrical and electronic equipment, etc., are the lot of household waste that clogs bins, streets, gutters, transit depots, open spaces, swamps, urban perimeters, fields and are breeding grounds for large green flies, mosquitoes, termites, rats and cockroaches [4].

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The solution to household waste management has been easier to establish as selective sorting which applies to each individual and on a much larger scale. But there is waste that is not only dangerous for the environment but also for humans. Among all types of waste, given the risk they represent for both the environment and human health, scrap metal waste deserves special attention because it is sometimes overflowing with radioactive waste [5]. Radioactive materials are used in many sectors of our societies such as agriculture, medical research, health care, the production of medical isotopes or in certain specialized industries. Indeed, many sectors have to use the properties of radioactivity in their activities or are confronted with its presence [6].

Benin is not spared by the presence of this waste. Indeed, the development of economic, industrial and administrative activities in Benin generates a significant amount of scrap metal waste. But no specific measures are taken for the effective management of this hazardous waste.

In the city of Cotonou, there are several sites of scrap metal waste traffic. Many expatriates such as Nigerians, Indians and more and more Beninese engage in trafficking in scrap metal which is an income-generating activity.

2. Material framework and study methods

2.1. Study framework

Covering an area of 79 km² and a total population of 679,012 inhabitants, the commune of Cotonou is located on the coastal strip which stretches between Lake Nokoué and the Atlantic Ocean, made up of alluvial sands of about five maximum height meters". Cotonou is bounded to the north by the municipality of Sô-Ava and Lake Nokoué, to the south by the Atlantic Ocean, to the east by the municipality of Sèmè-kpodji and to the west by that of Abomey-Calavi (figure 1).

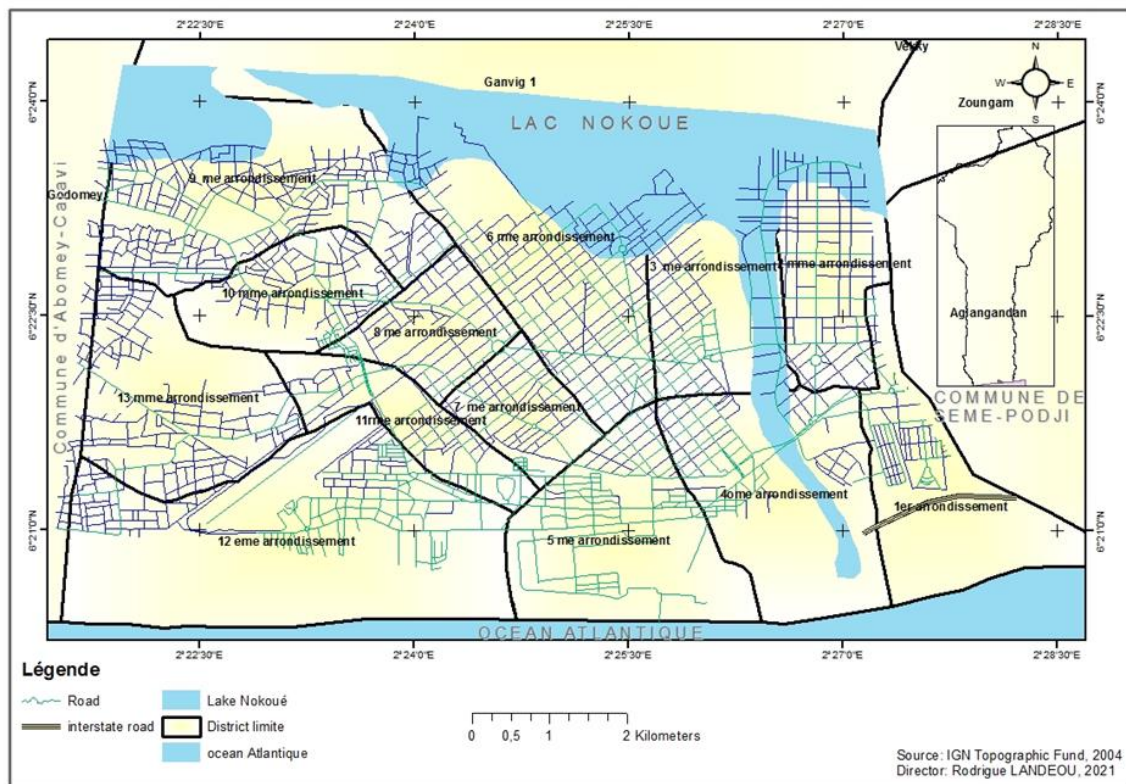


Figure 1 Geographical location of the city of Cotonou

West of Cotonou are the Autonomous Port and the International Airport which make the city the most important gateway to and from Benin, while the East has a vast industrial zone".

2.2. Study materials and methods

2.2.1. Type of study

This is a descriptive and cross-sectional study that took place from March to June 2021. It aims to describe the management methods of scrap metal waste in the city of Cotonou in Benin.

2.2.2. Study populations

In the context of this study, the primary targets consist of all the players in the scrap metal waste sector. These are households, professional users, importers, distributors, sorters, recyclers, and waste pickers. The politico-administrative authorities are seen as secondary targets.

2.2.3. Study data

The data collected within the framework of this research are those relating to the types of scrap metal waste collected and stored at the storage sites, the sources of the scrap metal waste and the volumes of each type of waste stored per year.

2.2.4. Data collection techniques and tools

The research was carried out along the following three axes: documentary research, interview survey and direct observation.

Documentary research

It concerns the documentary research which has enabled a compilation of information available in reports and studies on the management of solid waste in general and scrap metal waste in particular. Articles and comments posted on the Internet are also among the main sources of documentation used, as are DEA and thesis papers on the subject. This research made it possible to synthesize knowledge on the subject. Documents on waste management in Cotonou such as, legislative and regulatory texts relating to hygiene and sanitation, and environmental protection were also consulted nationally and internationally.

Field work

Regarding field surveys. They took place in three phases:

The first phase to make a multidimensional inventory of scrap metal waste in Cotonou. The surveys concerned the 13 districts of the city of Cotonou. All players in the scrap metal waste sector have been affected. These are households, professional users, importers, distributors, sorters, recyclers and waste collectors.

The second phase involves the inventory of scrap equipment to determine its condition, retention sites and its intended use. It consisted of administering the questionnaire to the different target groups.

The third was devoted to the survey on the method of recovery and management of scrap metal waste at the level of Cotonou reclaimers and recyclers by administering the questionnaire to the two target groups, which are reclaimers and recyclers.

Direct observation

According to Massonat (1987), "direct observation is a process of knowledge serving multiple purposes which is part of a global human project to describe and understand his environment and the events that take place there." . This method was used to collect qualitative data in addition to the interviews. The aim is to collect data on the basis of observations made in the field regarding the methods of managing scrap metal waste.

2.2.5. Data processing and analysis of results

The processing of the data and the analysis of the results constitute the last part of the methodological approach used in this study.

After the data was collected, they were entered in the Excel 2013 spreadsheet. The data was processed under SPSS for the calculation of averages, frequencies and the production of some graphs.

3. Results and discussion

3.1. Professional users

This part first presents the general characteristics of professional users of equipment, which at the end of its life becomes scrap metal, then describes their equipment and finally examines their knowledge of the impact of scrap metal on the environment and their concerns. The future of equipment. According to the nomenclature used, users in the professional sector include private companies, banks, consulting firms, audiovisual and radio communication bodies (specialists in digital and analogue information processing), research institutes, non-governmental organizations, public companies, the various ministries and attached directorates, national agencies, local authority management structures (prefectures, police stations, town halls), etc., the training and education sector which constitutes a potential market where requests for increasingly strong in electronic and computer equipment are recorded. In this market, we also identify the wide range of university students, professionals from research laboratories, schools and training institutes.

Thus, to better understand the use made of equipment which at the end of its life becomes scrap metal waste, this study looked at the sectors of activity of the users. Figure 2 shows the results of the survey carried out.

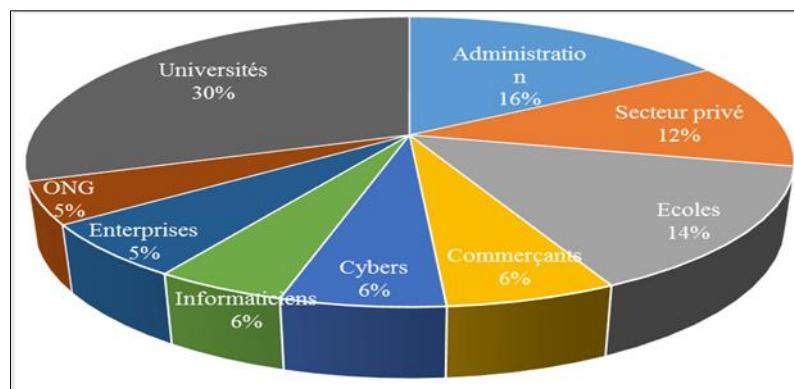


Figure 2 Distribution of professional users of new technology equipment by sector of activity; (Source: Fieldwork, Cotonou, Landéou, 2021)

It emerges from the analysis of Figure 2 that 9 major users of equipment which at the end of its life becomes scrap metal have been identified. According to their distribution, 30% of equipment which at the end of its life becomes scrap metal comes from universities, 16% comes from the administration, respectively 14% and 12% are used by schools and private companies, traders, cyber cafes IT specialists, companies and NGOs use between 5 and 6% of this equipment.

3.1.1. Places of acquisition of equipment by professional users

The places where equipment was purchased were also the subject of this study. Data on where equipment was purchased shows that 79% of purchases were made in the local market. However, the acquisition in this market does not mean the presence of manufacturers in Beninese territory. The equipment of professional users in question here is either imported directly or supplied by direct suppliers located in the national territory. Taken one by one, more than 21% of the various equipment available to professional users is imported directly from abroad.

3.1.2. Condition of equipment acquisition and existence of manufacturers' labels

To better assess the quantities of scrap metal produced each year in a given environment, it is important to know the condition of the equipment when it is purchased. Figure 3 shows the distribution of equipment according to their states during acknowledgments.

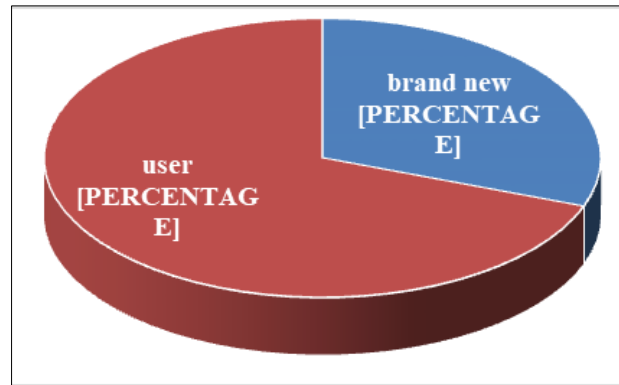


Figure 3 Distribution of equipment according to their states during acquisition; (Source: Fieldwork, Cotonou, Landéou, 2021)

As shown in Figure 3, the condition of equipment upon acquisition is as follows: 69% of professional users' equipment is acquired after first use, 31% is new equipment. The acquisition of equipment by professional users is done through several means: those who have the means and a large order do so directly from the manufacturers in 3.1% of cases, the majority of cases (71.3%) are address to authorized distributors and 25.6% have other methods. It should be noted that, in most cases, the condition of the equipment at the time of acquisition defines its usage times.

3.1.3. Usage time

The usage time of the equipment at the user level determines the frequency of its renewals and the frequency of the production of scrap metal. So, to estimate the amount of scrap metal waste received by the storage sites in the city of Cotonou, the users surveyed were asked how long their equipment was used. The results of the survey work are presented in Figure 4.

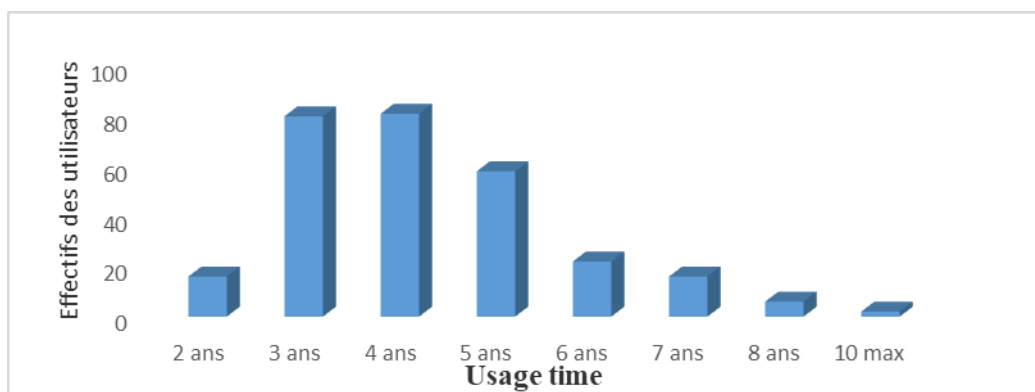


Figure 4 Distribution of users according to equipment usage time; (Source: Fieldwork, Cotonou, Landéou, 2021)

From the analysis of Figure 4, it appears that the majority (83%) of users use their equipment for a period of between 2 and 5 years at most. Only 17% of users surveyed use their equipment for a period of between 6 and 10 years at most. This proves a very high need for equipment renewal, and contributes to the strong proliferation of scrap metal waste in the city of Cotonou.

3.1.4. Fate of end-of-life equipment for users

The uses that users make of end-of-life equipment and their impact on the environment and the health of populations is a major concern in the context of this study, given the physical and chemical components that make up this equipment. This is why this study is interested in the fate of the equipment they use and which at the end of their life becomes scrap metal waste. The results of the user survey work are shown in Figure 5.

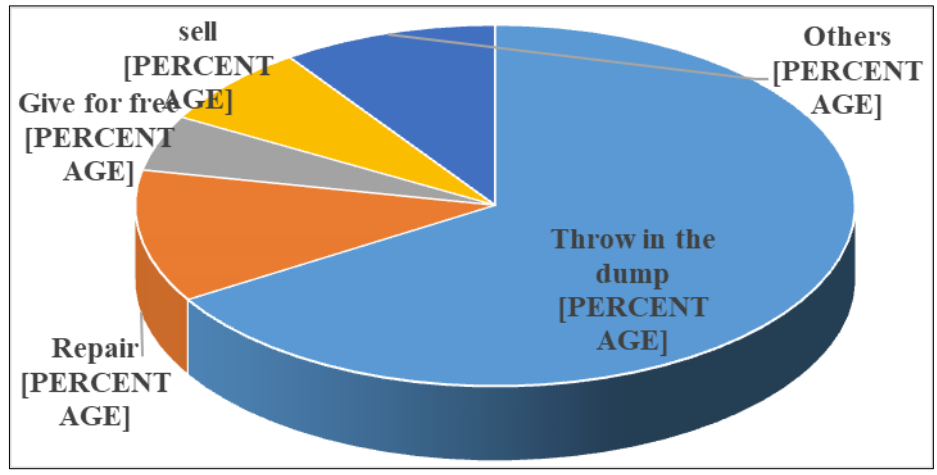


Figure 5 Distribution of users according to the uses of end-of-life equipment; (Source: Fieldwork, Cotonou, Landéou, 2021)

As shown in Figure 5, in the majority of cases (66%), end-of-life equipment is thrown into landfills and constitutes scrap metal waste. This high proportion of cases of rejection of end-of-life equipment by users is due to their conditions at the time of acquisition. For most of the users surveyed, the equipment is acquired after its first use. Thus, after some time of use, this equipment is depreciated and no longer requires repair. This forces users to throw them on landfills. In addition, the socioeconomic conditions of a poor country like Benin and the skill of Beninese technicians have meant that, when equipment breaks down or is no longer usable, professional users seek the expertise of repairers in 12% cases. But there are many other practices such as offering them (5.0%) to waste pickers or any other interested person, starting with staff when it comes to businesses. The resale of their unusable equipment is also practiced by 7% of these surveyed users.

3.1.5. Fate of end-of-life equipment

The fate of end-of-life equipment should be a major concern for users, who should not mix it with solid household waste. Thus, equipment at the end of its life should undergo special treatment. This is not always the case with all users. But what do they do with this hazardous waste if we know that there is no process or treatment system available to the populations? It is to answer this question that this study looked at how end-of-life equipment is managed by users. To this end, it was first a question of ensuring that users are aware of the consequences of end-of-life equipment on the environment and the health of populations. The results of the survey work are illustrated in Figure 6.

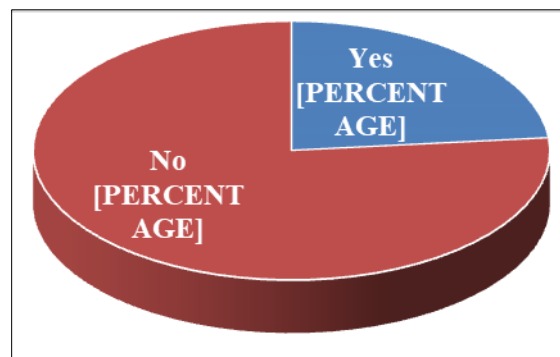


Figure 6 Distribution of users according to knowledge of the effects of end-of-life equipment on the environment and the health of populations; (Source: Fieldwork, Cotonou, Landéou, 2021)

The analysis of Figure 7 shows that only 23% of users are aware of the consequences of the waste that the equipment they use at the end of its life has on the environment and the health of populations. The rest (77%) have no knowledge of the damage that the mismanagement of this hazardous waste can cause on the environment and the health of populations and mix it with other types of waste. The danger that scrap metal waste represents for the environment and the health of populations is better known by users who are in the education system (universities and training schools), because 83.1% of users who know the impacts of these waste is in universities and training centers. Thus, a

good awareness-raising policy, starting with the school environment, could constitute a basis for education in the management of this new type of waste.

3.1.6. Waste management systems from end-of-life equipment

Better management of scrap metal waste from equipment at the end of its life spares the environment from the consequences that this hazardous waste can generate and guarantees a better state of health for the populations. To ensure ecological management of scrap metal waste at user level, this study looked at the scrap metal waste management system (Table 1).

Table 1 Scrap metal waste management system at user level

| Scrap Metal Waste Management Systems | Yes | No |
|---------------------------------------|------|------|
| Do you have a repair service | 55.9 | 43.9 |
| Do you have a recycling system | 15.9 | 84.1 |
| Do you have an approved company | 12.8 | 86.9 |
| Existence of waste management service | 3.8 | 96.2 |

Source: Fieldwork, Cotonou, Landéou, 2021

The analysis in Table I shows that very few companies (only around 15.9% of the sample) have implemented a recycling system. Among those who have done so, we find in the first place the administrations and the universities. This seems logical as universities, institutes and vocational schools in computer science are very busy. Second, cyber cafes do self-maintenance and self-maintenance to reduce the operating expenses of their business. There is a significant difference between the scrap metal waste management systems ($P = 0.04$; dof = 3).

3.1.7. Waste recovery methods from end-of-life equipment

The recovery of waste in general contributes to reducing the quantity of waste and also limits waste pollution on the environment and the health of populations. Instead of being a nuisance, waste can be a resource in the economy's production chain. It is in this context that this study is concerned with the recovery methods used by users of scrap metal waste from their equipment at the end of its life. The results of the survey work are illustrated in Figure 7.

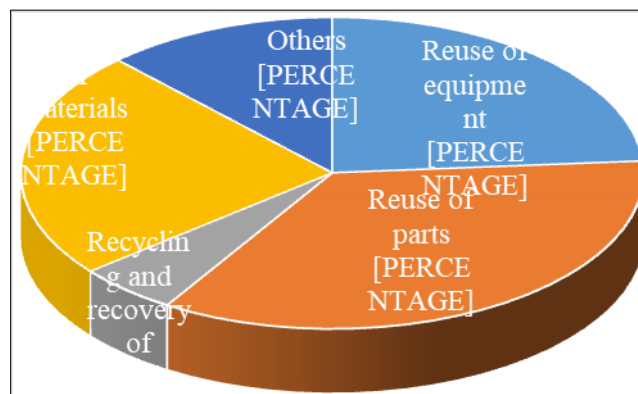


Figure 7 Breakdown of users according to the waste recovery method for end-of-life equipment; (Source: Fieldwork, Cotonou, Landéou, 2021)

Depending on the condition of the equipment, professional users provide the appropriate treatments, thus 35% reuse parts, 24 % recycle equipment to increase performance. The reuse of entire equipment is done by 24% of respondents and 12% make other uses, while 5% recycle and recover materials.

3.1.8. Methods of preventing the hazards associated with scrap metal

The degradation of the environment by scrap metal waste is obvious to the professional users surveyed, as some of them claim to be aware of this danger. To assess the willingness to fight against the dangers of scrap metal, professional

users were asked about their possible commitments. The information collected from this survey is presented in Figure 8.

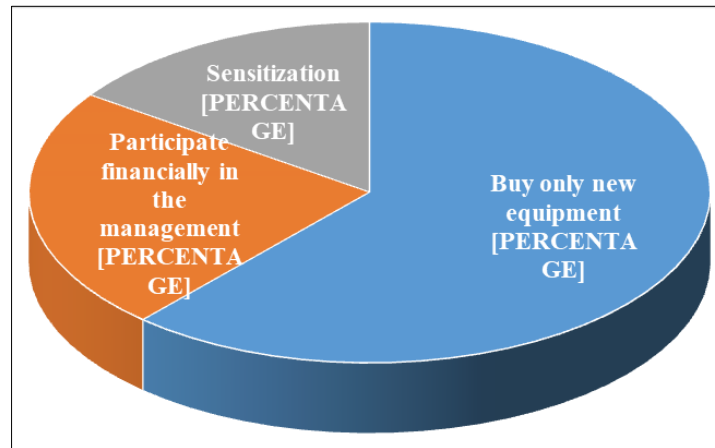


Figure 8 Distribution of users according to the method of preventing hazards related to waste from end-of-life equipment; (Source: Fieldwork, Cotonou, Landéou, 2021)

Among the means of prevention proposed, the exclusive purchase of new equipment which would offer a longer lifespan was adopted by 62% of the professional users surveyed. For 23%, the preference goes to a financial participation in the management of hazardous waste, in accordance with the polluter pays principle. But for the others (15%), awareness would be the most appropriate choice. Each of these three solutions taken individually could give satisfactory results, but a combination of the three would undoubtedly give much more chance to an effective management of scrap metal waste.

3.2. Households

The information collected from the heads of households concerns the socio-health and economic aspects relating to scrap metal waste and its management. The survey was carried out in towns of Cotonou. It covered a sample of 1559 households or concessions, chosen at random. It was aimed in particular at heads of household, in some cases any manager as long as he was able to make decisions in the concession or household. The main focus is therefore on income providers and / or expenditure executors.

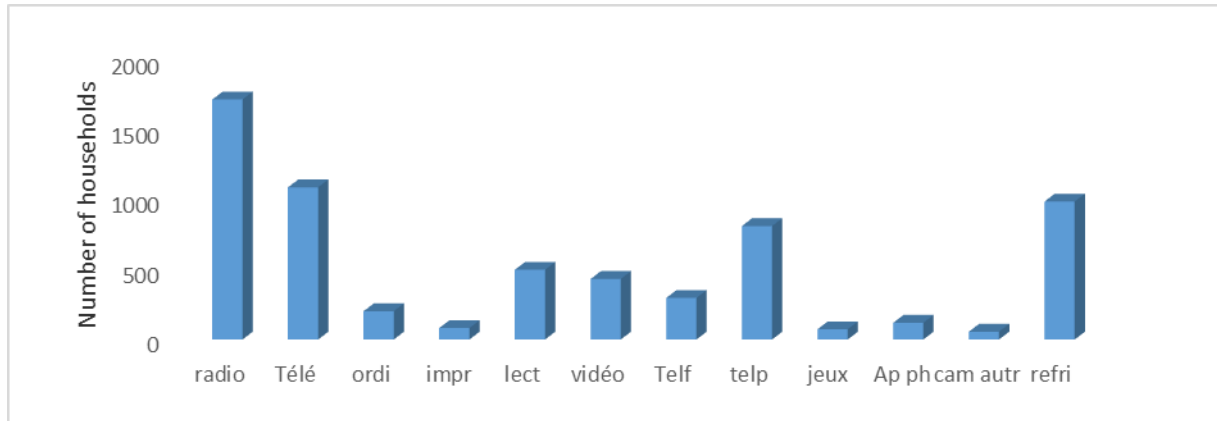
3.2.1. Availability of electronic and computer equipment in households

Electronic or computer equipment is mostly the material used in households, which at the end of its life becomes difficult to manage scrap metal waste. To assess the quantity and characteristics of scrap metal waste collected and stored at storage sites, this study looked at the electronic and computer equipment available to households. The results of the survey work show that almost half of the people surveyed (48%) have electronic and computer equipment in their households. 33% say they have electronic equipment only in their households and 10% have computer equipment only. Only 9% of the households surveyed have no electronic and computer equipment in their breasts. So, we can expect a high rate of production of scrap metal waste which will be collected and stored on site.

3.2.2. Distribution of electronic and computer equipment owned by households

To better estimate the characteristics of scrap metal waste collected and stored, this study investigated the types of electronic and computer equipment available to households. The results of this study are presented in figure 9.

As shown in Figure 9, radios, televisions, telephones and refrigerators are the most widely used equipment in households. Like other electronic and computer equipment, the households surveyed also use computers, printers, DVD players, video players, landlines and laptops, electronic gadgets, cameras, refrigerators, etc.



Télé = television, ordi = computer, impr = printer, lect = DVD player, video = video player, telef = landline telephone, telp = cell phone, games = electronic gadget, ap ph = camera, cam = camera, refri = refrigerator

Figure 9 Distribution of households according to the types of electronic and computer equipment owned; (Source: Fieldwork, Cotonou, Landéou, 2021)

3.2.3. States of equipment during acquisition

The usage time of the equipment depends on its condition at the time of acquisition. Most of the equipment used by households does not have a long useful life, if it is not purchased new, and is scrap metal. At the end of the survey work on the condition of the equipment during the acquisition, it was revealed that the majority (74%) of the electronic and computer equipment used by households is second-hand equipment. Only 26% of this equipment is purchased new. This high use of second-hand electronic and computer equipment needs to be accompanied by an effective policy for the management and treatment of scrap metal waste.

3.2.4. Scrap Metal Waste Management Methods at the Household Level

The majority of the households in the study environment use second-hand electronic and computer equipment, which after some time of use experiences repeated failures and abandoned. Sometimes, with the evolution of technology, some households frequently renew their equipment to meet modern standards. Suddenly, they abandon the old equipment which becomes waste.

How do households get rid of this waste? It is to answer this question that this study has focused on the method of managing scrap metal waste at the household level. The results of the household survey work are shown in Figure 10.

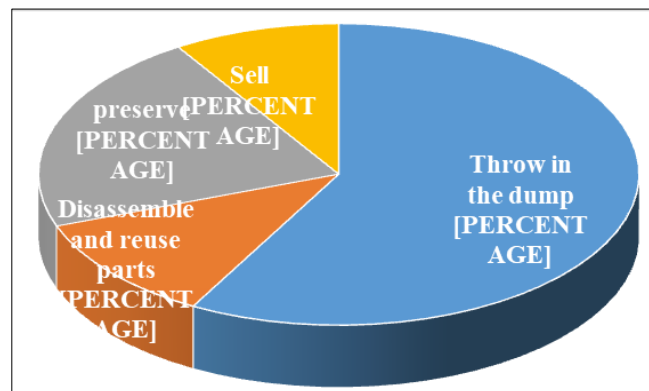


Figure 10 Distribution of households according to the scrap metal waste management method; (Source: Fieldwork, Cotonou, Landéou, 2021)

The management of waste from electronic and electrical equipment at the end of its life by households has many facets which consist in selling, keeping, throwing away and dismantling the equipment. Among all these alternatives, households first tend to throw away broken down equipment, depending on their condition, even if they can be repaired (58%), while those who wish to keep them represent only 22% of households. For equipment that has broken down and cannot be repaired, 11% prefer to dismantle it and reuse the parts. As for equipment in operation, 9% of owners

who want to part with it choose to sell it. Of those households whose preference is to sell the equipment, 37% want to sell it in second-hand markets, 53% to waste pickers and 10% to other buyers.

3.2.5. Households knowledge of the effects of scrap metal waste on the environment and health

Good waste management starts with making households aware of the effects that this waste could have on the environment and human health. Thus, knowledge of the consequences of scrap metal waste on the environment and health is of paramount importance for households for better management of these types of waste. This is what justifies the motivation of this study, which investigated whether the households surveyed were aware of the consequences of scrap metal waste on the environment. The results of the survey work showed that the effects of scrap metal waste on the environment are known differently in all categories of the Cotonou population. Indeed, the majority of respondents (78%) claim to have no knowledge of the impacts of scrap metal waste on the environment and health.

3.3. Collectors

The recovery is done both on items already dismantled as on broken or whole items. In Cotonou, as in the big cities of Benin, the recovery activity supports many people. In addition, this is a sector where there is a strong representation of foreigners. The number of waste pickers varies greatly from one site to another. Their activities consist in acquiring scrap metal to dismantle it, break it and recover materials with a market value.

3.3.1. Types of scrap metal recovered

To facilitate the characterization of the scrap metal waste stored on the sites, the recovery agents were informed of the types of scrap metal waste they collect from households and professional users. The results of this survey work are presented in Figure 11.

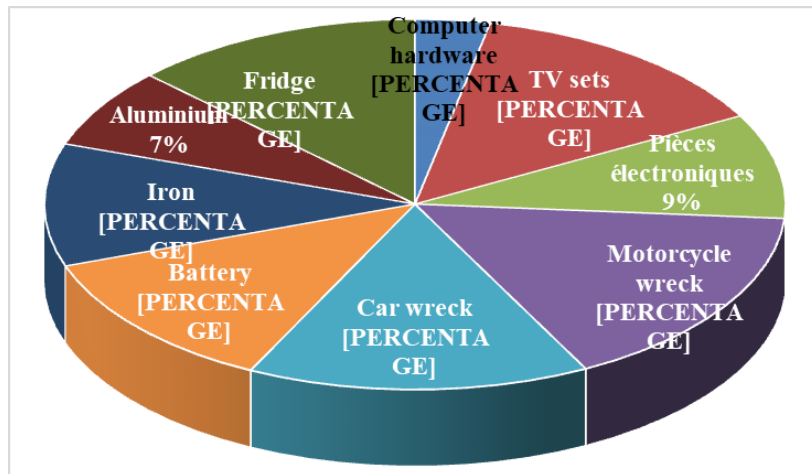


Figure 11 Types of scrap metal waste collected from households by waste pickers; (Source: Fieldwork, Cotonou, Landéou, 2021)

As shown in Figure 12, among the scrap metal recovered from motorcycle and car wrecks, television sets are the most popular with 16%, 15% and 14% respectively. Next are refrigerators for 13%, batteries for 12%, followed by electronic and computer devices. During the recovery certain extracted elements are more popular than the others according to the knowledge of the recoverer. Thus 41% of waste pickers seek lead, 20.8% seek aluminum, 15.8% prefer screens, and 11% seek iron. We also note on the storage sites, railway equipment, metal structural elements, ship scrap

As criteria for preference of types of waste, 21.3% cite ease of marketing, 18% refer to availability, 13.7% refer to cost, and 10.9% find their lifespan to be appreciable.

3.3.2. Advice from waste pickers on the risks associated with scrap metal

It is easy to indulge in an informal activity without realizing the risks. Collecting scrap metal waste is an activity that exposes collecting agents to health risks, given the dangerousness of the physical and chemical components of these types of waste. Figure 13 shows the assessments of the waste pickers, collected, within the framework of this study on the risks associated with their activities.

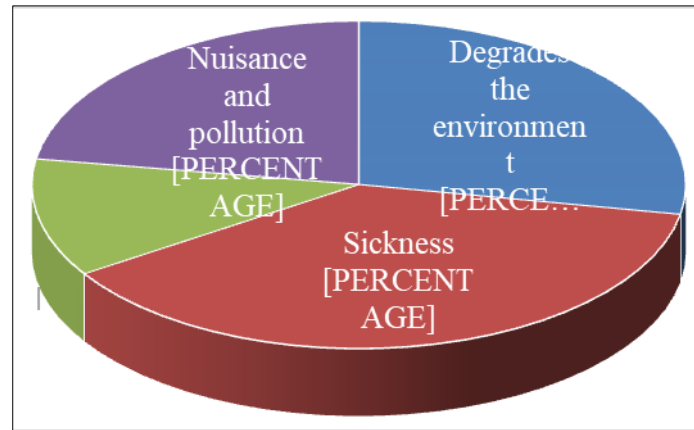


Figure 12 Assessment of waste pickers on the risks associated with scrap metal; (Source: Fieldwork, Cotonou, Landéou, 2021)

For 38% of waste pickers, illnesses are the first risks, followed by environmental degradation (28%), nuisance and pollution (22%), injuries (12%). Thus, faced with the risks, 33.9% of waste pickers express a need for bags as work tools, 17.5% for work clothes and knives, 12.6% for safety shoes and 13.3% for more suitable machines. .

Among waste pickers, 54.6% cite plastics as the most dangerous components of scrap metal. Heavy metals and glasses are cited by 18.6% and 13.7% respectively. The knowledge of waste pickers on the toxic nature of the waste seems to be low. Indeed, among them 36.60% are aware of this toxicity and 63.4% are unaware of it. Diseases caused by waste are tetanus for 67.2% of the diseases mentioned by the waste pickers surveyed. Cancer is mentioned by 32.8% of respondents. For 35% of respondents, tuberculosis is caused by waste. Finally, 27.3% say that scrap metal waste is responsible for other ailments. To alleviate these various diseases, 49.2% of waste pickers find it necessary to treat scrap metal waste, against 3.3% who think it is not necessary.

4. Discussion

In view of the various results obtained within the framework of this study, it should be noted that the knowledge of the dangers of scrap metal waste on the environment and health by professional users is 93.75%. As for households, 69% of respondents know that scrap metal waste can degrade the environment, against 31% who do not know. To get rid of this very harmful waste, 66.91% of the households surveyed agree to the incorporation of the cost of treating scrap metal waste in the purchase price of the items against 33.08% and 67.46% of the households surveyed are for the payment at the cost of environmental prevention of human and animal health if the price is reduced to 500f CFA. However, 65, 12% of households are in favor of setting a tariff of 1000 CFA francs for each piece of equipment at the end of its life, against 34.87%. These results are comparable to those found by Diop and Thioune (2014) [7] in Senegal and Benin. The amount of machines and electronic devices used in Benin is increasing year by year. This trend is confirmed by Ouatarra et al. (2005) [8] in Mali and Senegal it is 26.25% in recent years Rochat et al. (2008) [9], Diop and Thioune, (2014) [7]. It should be noted that at this level no difference between new devices and second-hand devices has been made. No organization for the recovery and recycling of scrap metal waste, but non-formal structures are starting to be put in place. Those who dispose of this waste provide them with various types of treatment. This analysis is shared by Ouatarra and Kanouté (2005) [8] and Yomé (2011) [10] in Mali. In the context of the recovery of scrap metal, there are preferences

in terms of materials sought: 24 % say they seek out lead in scrap metal, 4 % seek aluminum, 24 % screen content, 20% other materials and 8% seek other metals. According to "Reporter sans frontières, 2008" in Ghana, it is copper which is sought first, in France it is gold which is sought after, according to Laviolle (2007) [11] in France. In Japan, rare earths are sought after according to Steiner (2012). The collected items are traded to Europe. According to the survey 63.63% of waste pickers have supplier partners and 36.36% do not.

There are several scenarios in relation to the recovery of scrap metal. Recyclers use certain parts in good condition to repair other broken down equipment (memory card, sound card, CD player or USB port) in computer equipment. According to the investigation work most of the failures are noticed in the displays for the screens and motherboards for the microprocessors. There are electronic and computer equipment collectors who go door to door to collect end-of-life equipment which will be sold to lessees who carry out the dismantling. They remove the parts that interest them

and get rid of the rest. The collected items are traded to Europe. This result is similar to that of “Reporters without Borders, 2008” in Ghana and Bondolfi (2007) [12] in Switzerland. Even if the scrap metal waste sector is not organized in Benin, it is active, 75.86% of recyclers and salvagers claim to have suppliers and 72.41% say they have customers for recycled equipment. These results are similar to those of Coulibaly (2010) [13] in Mali. As for sorting, it takes place at the transit depot and in the trash by individuals. Some for plastic parts, others for iron and other metals such as aluminum and tin contained in various devices. Even if the respondents do not give their exact turnover, it is an activity that maintains the actors. More efficient management of scrap metal could generate more income for players in the sector when we know that they are unaware of the presence of precious metals such as gold in equipment. The quantities of scrap metal waste are increasing in Benin given demand and purchasing power, but also the existing quantity which has become obsolete and which does not know any form of recycling, 23.54% of the equipment is used or Out of order. In Ghana in 2009, investigators found that about 70% of all scrap metal imports consisted of used electronic and computer equipment waste; 30% of imported second-hand equipment was estimated not to work (and therefore to be electronic waste), Steiner (2012) [14].

The origin of electronic equipment is diverse: 51.51% comes from Europe, 27.27% of equipment originates from the USA, and only 21.21% of equipment comes from Asia. These results are comparable with those of Bioaddict (2012) [15].

5. Conclusion

Scrap metal waste is hazardous waste for humans and the environment and requires specific management. But in Benin, their management is problematic. The present study carried out with three major players in scrap metal such as professional users, households and waste pickers revealed that several types of electrical and electronic equipment are used in the city of Cotonou. The majority of this equipment is not acquired in new condition and after a few years depreciates and becomes waste, the management of which is problematic. Recovery from users, dismantling and incineration are the management methods operated in the city of Cotonou. These management methods lead to the accidental spillage of substances dangerous for the environment and the health of populations. It is therefore urgent to find an adequate solution to the management of these types of waste for the protection of the environment and to guarantee the well-being of the populations.

Compliance with ethical standards

Acknowledgments

We thank all those who contributed to the writing of this manuscript. In particular, we would like to thank those involved in the management of scrap metal (households, professional users, collectors of scrap metal) who accepted to participate in this research.

Disclosure of conflict of interest

The writing of this manuscript is without conflict of interest. Each of the authors contributed to the success of this manuscript.

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