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# Activities of Recovery and Valorisation of Non-Organic Degradable Waste in the City of Porto-Novo in Benin: Strength and Weaknesses

**Brice Saturnin DANSOU* et[1], Léocadie ODOULAMI[2]**

[1]Laboratoire Pierre PAGNEY, Climat, Eau, Ecosystème et Développement LACEEDE)/DGAT/FLASH/ Université d'Abomey-Calavi (UAC). 03BP :1122 Cotonou, République du Bénin (Afrique de l'Ouest)
[2]Laboratoire Pierre PAGNEY, Climat, Eau, Ecosystème et Développement LACEEDE)/DGAT/FLASH/ Université d'Abomey-Calavi (UAC). 03BP :1122 Cotonou, République du Bénin (Afrique de l'Ouest)

**Abstract:** ***In the city of Porto-Novo, recovery and recovery channels have multiplied greatly favoring a broad integration of urban populations in the waste business. This study has analyzed the strengths and weaknesses of the recovery and recovery of non-biodegradable waste in the city of Porto-Novo. Socio-economic data are collected from twenty (20) waste pickers (given the nomadic nature of the waste pickers), ten resellers and five users of the completely selected recycling products in Porto-Novo. They are supplemented by information from interviews with 44 resource persons, observations and documentation. The descriptive statistics, the documentary analysis and the triangulation technique made it possible to analyze the results obtained. In Porto-Novo, the recovery sector is controlled at 87% by West African nationals against only 13% of Beninese. This activity enabled 82% of respondents to overcome the surrounding unemployment and generate a monthly "salary" of about 37,500 CFA francs / month. Metal waste, plastic waste and pneumatic waste are the most recovered and recovered. Given the scale of this activity, it is important that accompanying measures are taken.***

**Keywords:** Benin, city of Porto-Novo, recovery and recovery activity, non bio degradable waste

## 1. Introduction

The economic crisis that began at the end of the 1980 has led to an increase in the scale of unemployment in the big cities of Benin and Porto-Novo in particular. This has led to a boom in the informal sector as city dwellers have used their imaginative resources to cope with the crisis. As in Ouagadougou (Meine Pieter, 1986), Yaoundé (Zoa, 1995) or Cotonou (Dossou-Yovo, 2013), it is not uncommon to meet in Porto-Novo many inventors of small trades scrutinizing the needs of everyday life, to respond with strategies to survive.

Among the informal activities that have emerged since the early 1990, there is the business of waste recovery and recycling. This activity took place as the crisis worsened, and the waste itself offered many new opportunities and sources of income for many actors.

The city of Porto-Novo is located between 6 ° 26 'and 6 ° 31' north latitude and between 2° 34' and 2°40' east longitude. It is located in south-eastern Benin 32 km from Cotonou and is bounded on the north by the communes of Akpro-Missérété, Avrankou and Adjarra, in the south by the commune of Sèmè-Kpodji, in the East by the municipality of Adjarra and to the West by the municipality of Aguégué. The city is composed of five boroughs and covers an area of 5274 hectares (Vigninou, 2010).

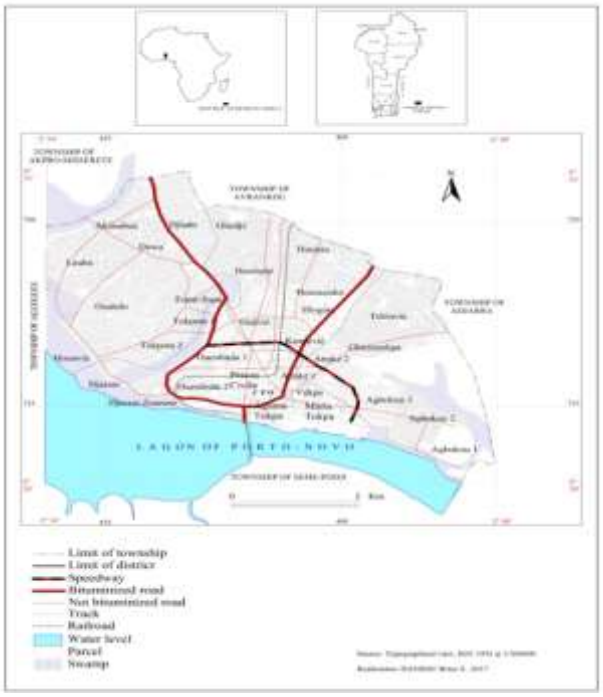

**Figure 1:** shows the geographical location of the city of Porto-Novo to carry out the study, a methodology was developed

## 2. Materials and Methods

To carry out this study, the socio-economic data are collected from twenty (20) waste pickers (given the nomadic nature of the waste pickers), ten resellers and five users of the recycling products selected in an exhaustive manner in Porto-Novo. These data are then supplemented by interviews with 42 resource persons and observations to learn about certain aspects of the problem that investigations can not

reveal. The descriptive statistics, the documentary analysis and the triangulation technique made it possible to analyze the results obtained.
The results obtained are as follows.

## 3. Results and discussion

### 3.1 Actors of waste recovery in Porto-Novo

#### 3.1.1 Geographical origin of the collectors and reason for choosing the activity

Recovery has become a fairly important waste recovery sector in all continents. The number of people working in this field is estimated at 15-25 million worldwide, with China being the largest country with the largest number of waste pickers, at 10 million (Ilo, 2012). Classified as a small informal urban job (Gbinlo, 2010), recovery took hold in the 1990s especially in Porto-Novo. Whether in Cotonou (Lawson, 2008, Gbinlo, 2010) or in Libreville (Ada, 2006), informal waste recovery has become a full-fledged economic activity enabling many people to the basic needs of their families (food, health, education).

The geographical origin of waste pickers is characterized by ethnic diversity with a preponderance of immigrants as shown in figure 2.

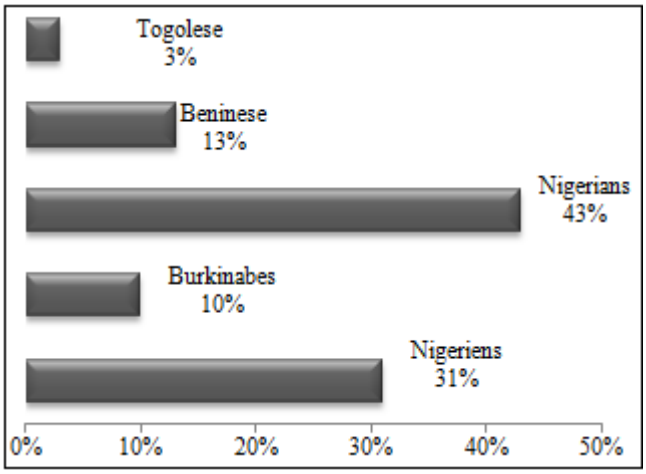


**Figure 2:** Geographical origin of the collectors surveyed
**Source**: Field Investigations, February 2017

The figure 2 shows the provenance of the collectors surveyed in the city of Porto-Novo. It shows that the recovery channel is controlled at 87% by West African nationals including 31% from Niger, 10% from Burkina Faso, 43% from Nigeria and 3% from Togo against only 13% of Beninese origin.

In addition, the information gathered from the president of the association of waste pickers indicate that the association is created since 2000, but tries without success to make recognize the profession of the recovery near the administrative and municipal authorities of the city of Porto-Novo. It has about 50 members, and is a place for meetings, discussion, mutual aid and mediation in case of disputes between waste pickers. The recovery activity is structured around three major poles or sectors. This is the scrap metal or metal sector which represents 65.4%, the plastics sector which represents 24.6% and the clothing sector (clothes and shoes) which represents 10%.

According to the president of the association of the recuperators, the scrap metals are more solicited because of the presence of the Chinese and the Indians in the sector. Since 2006, they have been buying ferrous waste at a good price. Suddenly, everyone is interested in this category of waste. Sometimes, there are even many intermediaries who work for the Chinese and who come to buy from the collectors to sell to the Chinese.

According to the results of the surveys carried out with a sample of recuperators, they work every day, between 6 am and 6 pm and each one looks for a specific type of waste. In addition, the choice of recovery as a trade, by one or the other, is motivated by various reasons, as shown in figure 3.

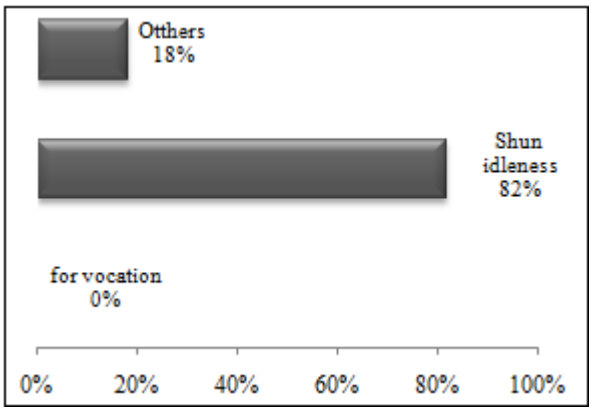


**Figure 3:** Reason for the choice of the waste recovery profession
**Source**: Field Investigations, February 2017

Because of the company's representation of waste collectors, seen as "sub-men", and the profession itself, seen as a form of begging, none of the respondents admitted to performing this activity by vocation. On the other hand, 82% of the recuperators questioned chose to exercise this profession by necessity and to mitigate the ambient unemployment. It appears that the recuperators are young men struck by underemployment, chronic in Porto-Novo. It is also adults who have not had the chance to go to school and who, because of the misery in which they vegetate at the family level, engage in this activity that allows them to escape the vice, boredom, and need. Among the other reasons (18%) of the choice of the profession of recuperator, the following remarks were collected in the field:

- "*I am looking for money to finance my studies because I am a student in the fourth year and I have no more support*";
- "*I work here to feed my family because the job of vulcanizer I learned does not work properly*."

Contrary to popular belief that tries to make believe that the profession of recuperator is reserved only to illiterates or those who could not emerge at school, these answers prove that this activity also welcomes students that other categories of people looking for ways to finance their needs (study, family responsibilities, etc.). The reasons that lead people to informal recuperation in Porto-Novo and as some authors have also stated (Furedy, 1993, Merino, 2010, Medina,

2007) are essentially economic in order to meet their basic needs and above all the imperative need to live and survive in the city where the acquisition of bread is a daily struggle.

**3.1.2 Informal waste recovery in Porto-Novo**

In the cities of sub-Saharan Africa, the sectors of waste development, ranging from recovery to recycling through reuse, have greatly multiplied favoring a broad integration of urban populations in the waste trades. In Porto-Novo, this figure is rising rapidly but remains difficult to evaluate. The actors are largely dispersed and work in isolation. According to field data, at least 200 informal waste workers can be estimated in the city of Porto-Novo. Workers do not need training, skills, or capital to undertake their activities. The industry is generally characterized by labor-intensive production methods and the small scale of different activities (Becker Flodman, 2004).

Informal Recovery (IR) remains a field of activity neglected by the public authorities and poorly known by the population. However, a simple, unprejudiced observation reveals the important role played by informal waste pickers in environmental terms. On the social level, the reason for the existence of the IR is first of all pecuniary. Informal waste pickers are primarily interested in waste with a high market value and easy to market. In Porto-Novo, the missing data do not allow to quantify the gain perceived by the municipality. But in cities like Lusaka, Lima, Cairo, and Pune, where informal waste pickers collect door-to-door or in the garbage cans of households, RI generates a net profit of $ 177.6 million to about 73,000 people and provides $ 52.2 million savings to municipal authorities (Scheinberg, 2010).

Despite the benefits socioeconomic and environmental recovery brings to the informal recovery, it also causes inconvenience. Informal recuperators in Porto-Novo are very poorly or poorly equipped (lack of gloves, boots, nose caches, safety shoes, adapted clothing, etc.) and use a summary material (simple sticks for the search, wheelbarrows and carts with human traction for transportation, non-compliant containers for storing recovered items, etc.). These working conditions expose them to risks when they come into contact with offensive objects, while their incomes are still modest.

**3.1.3 Average daily income of waste pickers**

Recovery is an activity that provides the recuperator with hard work and professional income that allow him to improve his living conditions. 67% of the interviewed collectors have a daily income of between 1000 and 1500 CFA francs, 22% have a daily income between 1500 and 2000 CFA francs, 8% of the collectors encountered manage to make a daily income of between 500 and and 1000 F CFA while 3% make a daily recipe of between 2000 and 2500 F CFA. Considering 1250 F CFA as basic income, a recuperator devoted to work can easily total a monthly "salary" of about 37 500 CFA corresponding to 30 days of work. This sum is very close to the SMIG in Benin which is 40 000 F CFA. This activity is more profitable in Cameroon where Tchikoua (2010) showed that a diligent and professional recuperator can easily add up to a monthly "salary" of about 60 000 F CFA, which is double the Minimum Interprofessional Growth Salary (SMIC).

According to 100% of recuperators, the job of recuperator is one that nourishes his man. However, there is no official data on the functioning, actors, structuring, networks and socio-economic participation of this sector in the life of the community. The authorities would benefit from being a little more attentive to sectors such as recovery, which, although currently in the informal sector, still employs many young people, and in turn feeds many families. The structuring and careful monitoring of the recovery sector would make it possible to employ more people, and could be a source of revenue for the municipality.

**3.2 Main recovered waste in the city of Porto-Novo**

This section presents the types of waste recovered in the city of Porto-Novo.

**3.2.1. Some sub-sectors of waste recovery**

Two possibilities of recovery are offered to the waste when they are not oriented towards a final discharge (controlled or not). It involves material recovery (reuse, reuse recycling) and energy recovery.

**3.2.1.1. Valorisation of metallic waste**

In Porto-Novo, the crafts of recovery and recycling is fairly developed and takes place mostly in an informal setting ... There are other sub value chains for metals including tinplate, foundry, and salvage and sale in the state.

Tinsmithing and foundry: Tinsmithing transforms objects such as cans, bottle caps, etc ... into various objects such as lanterns, gutters, popotes. It also offers services among which there is: the repair of tinplate containers (seals, basins), the manufacture of gutters.

As for the foundry, it most often transforms aluminum and sometimes zinc, bronze and other metals product often used in domestic work (pot, ladle, pots, pans, ...). It offers repair services for old pans and the manufacture of certain motorcycle parts. More and more, it produces new imitation products such as "gearboxes", motorcycle clutch cages (plate 1).


**Plate 1**: Artisanal furnaces (a) and pots (b) made from recycled metals in Porto-Novo
**Shooting**: Dansou, April, 2017

Plate 1 presents various kitchen objects that are made with recycled metal objects. Tinsmithing and foundry are activities carried out by many young people in Porto-Novo. To make the pots, the materials used by craftsmen come

from aluminum waste (old sheets, hulls of household appliances, car bodies, etc.). Suppliers are households and informal waste pickers. The price per kilogram of secondary material varies from 400 to 700 FCFA. The production units are 90% made of temporary materials and use a variety of tools according to their means. Pots from recycled objects are reintroduced on the market by wholesalers sourcing from manufacturers. The prices are between 1500 FCFA and 30000 FCFA or more depending on the capacity of the utensil. These products, which are in high demand, are 95% used in households.

The production of cooking pots is the most successful informal recycling activity. Despite the success of this activity, it does not lack shortcomings. These are exposure to respiratory diseases, lack of safety equipment, risk of burns, high injuries and the permanent risk of fire. Recovery and sale in the state: the sale of used irons is booming in the city of Porto-Novo. In general, young people with rickshaws are storming households, garbage dumps and garages in search of used irons that have become valuable items. They pick up these objects on the dumps or buy them and then send them to regrouping sites (plate 2).


**Plate 2:** Scrap yard at Tokpota (a) and Atakè (b) in Porto-Novo
**Shooting**: Dansou, March 2017

Plate 2 shows a scrap assembly site located at Atakè and Topkota. This site includes a workforce of about 25 people. These are hierarchical, collector on deposit or door to door, sorters and resellers who sometimes export the materials to Nigeria or sell them to Chinese, Indians or their intermediaries. This is the case of metals that are processed in the metallurgical industry and used plastic shoes that are reintroduced into the plastics industries or reworked in shoe manufacturing units.

In the city of Porto-Novo, there were five scrap metal gathering sites with a workforce averaging 20 people. In 2002, nearly 12 kg of metal waste was brought back per day by each collector (Dorrier-Apprill *et al.* 2002). Nowadays, considering the increase of the population and the diversification of the economic activities in general and the craft trades in particular, about 18 kg of metallic objects are brought back by day and by collector or 360 kg per day for a site. In one week, approximately 2520 kg of metallic object are recovered at each site, ie approximately 12600 kg per week for the five sites.
The main items recovered and their market value in local markets are shown in table I.

**Table I:** Ferrous Metals Prices in february 2017

| Designation | Price in Porto-Novo (FCFA / kg) |
|---|---|
| Iron wastes | 75 |
| Unburned copper | 2200 |
| Aluminum | 350 |
| Bronze | 600 |
| Lead | 150 |
| Zinc | 150 |
| Used batteries | 200 |

**Source**: Field investigation, 2017

Table I shows that the sale prices of some ferrous objects. These prices are indicative because, according to informal pickers, they can fluctuate depending on market demand. The collectors admit to finding their account in this field of activities but do not really like it. For this reason, 80% of the actors interviewed want the reorganization of the sector to contribute significantly to the development of the city of Porto-Novo. This implies the establishment of platform actors in the recovery-local authorities to equip actors with the means to create local businesses capable of transforming recycled objects on site instead of exporting them.

**3.2.1.2 Recovery of plastic waste and glasses**
Plastic waste and glass recycling activities have grown considerably in recent decades.

**Commercialization of plastic waste, a means of fighting against poverty**
The difficult economic context facing several households in the city has favored the development of a new economic activity: that of the sale of plastic waste. The change in the perception of waste has given it an economic value (Maystre, 1994). Waste becomes a profitable asset and promotes the development of an income-generating activity. In practice, collectors recover used plastic waste: bags, buckets, plates, basins, shoes, etc. (plate 3) for resale.

(a) (b)

**Plate 3:** Various plastic waste collected by townspeople and stored in Foun foun Tokpa (a) and Kandévié (b), **Shooting**: Dansou, February 2017

Plate 3 shows stocks of plastic objects collected at dumps in the city of Porto-Novo. The selling price is on average 250 F CFA / kg. This activity, in addition to being ecological, is economically profitable for collectors because it allows many of them to be able to support themselves with the money obtained. This recovery action practiced largely by low-income populations or poor children is, however, risky. People who sort garbage in garbage cans or dumps expose themselves to cutting sharps, infections, insect bites or animal bites. Once these sorters have a certain amount, they sell them to the buyers of waste according to the state of wear and cleanliness.

This experience is quite improved in Burkina Faso (Ouédraogo, 2015). As part of the implementation of the national strategy to reduce plastic waste in Burkina Faso, the government of Burkina Faso launched in May 2014, a vast campaign of purchase of plastic waste Kilogram. This remuneration (125 francs / kg) motivated several people to get involved in the collection of these used objects. This activity enabled several of them to be able to provide for themselves with the money obtained and to collect large volumes of waste and especially plastic bags (Ouédraogo, 2015). This operation allowed to collect in one day 5 tons of plastic waste in Dakola and 3 tons in Koubri. This activity also generated about 1,000,000 CFA francs for the collectors of these two localities.

This experience can be applied in Benin in general and particularly in the city of Porto-Novo. The collected plastic waste can be used as raw material for structures such as the AGRIPLAS plastic recycling center of the NGO DECAM-Bethesda.

Apart from the commercialization of plastic objects by private individuals, there is the NGO "Qui dit mieux" which has been famous in the valorization of plastic bags.

**Transformation of plastic bags by the NGO "Who says better"**

The NGO "Qui dit mieux" was founded in 1980 and started its plastic bag recycling activities in the city of Porto-Novo since 1997. This valorization is reflected in the production of various objects such as bags, dolls and other objects (plate 4).

(a) (b) (c)

**Plate 4**: Dolls (a), food nets (b) and handbags (c) made by the NGO " Qui dit mieux " in the city of Porto-Novo
**Source**: http://courantsdefemmes.free.fr accessed on August 9, 2017 at 15h

The board 4 presents some objects (dolls for the children, nets of provisions and bags with hands) resulting from the valorization of the plastic bags by the NGO "Qui dit mieux" in the city of Porto-Novo. The NGO makes a doll with 50 bags or a handbag with 300 bags. The making of a provision net consumes 80 large bags and 25 small bags. By cons, making a backpack consumes about 300 large bags. The average monthly turnover of the NGO is estimated at 2000000 FCFA (lapost.fr of 23 January 2012). According to a former employee of the NGO met, the organization is struggling to sell its products in Benin and the sub-region due to lack of financial support. Despite these difficulties, the NGO's efforts had been rewarded with the United Nations Prize for Poverty Reduction and Environmental

Protection that the NGO president received in 2002 (http: // currantsdefemmes. free.fr). But the death of the president of the NGO as well as the persistence of financial difficulties led to the cessation of activities. The involvement of local authorities in the resumption of this activity is essential because it contributes to the improvement of the living environment and the creation of jobs.

**Commercialization of plastic bottles and glass bottles**

In the city of Porto-Novo, plastic bottles are most often recovered and sold for reuse. They are displayed in markets, shops or at home (plate 5).

a b

**Plate 5:** Plastic bottles recovered and put up for sale at the Ouando market

**Shooting**: Dansou, February 2017

Plate 5 shows the plastics recovered and ready to be reused. Once empty, the plastic bottles are either sold for free to the collectors or sold between 10 F CFA and 25 F CFA per unit (depending on its condition and capacity). They are then washed and sold between 25 and 50 F CFA per unit in the trade. These recovered objects come back to life and are used in the conservation of oil or detergents (liquid soap, cresyl), food products (crushed pepper, spices, peanut oil, red oil, fruit juice, etc.).

When it comes to glass bottles, recovery is also booming. According to Dossou-Yovo (2013), this is probably due to the fact that Benin does not have a glass production plant. In Porto-Novo, the recovered glass bottles are returned to clean for use. They are sold to collectors called "*Gohoto*" between 20 F CFA and 50 F CFA per unit (depending on its condition and capacity). They are then washed and sold between 50 F CFA and 150 F CFA unit in the trade. A " *Gohoto* " that buys an average of 60 bottles at 50 F CFA per unit and resells them at 75 F CFA per unit makes a profit of 1500 F CFA. The price of objects seems very low, but the turnover of the workers shows a fairly dynamic economic sector. This activity is therefore a source of income and employment for those who invest in it. It does not require basic training and can be practiced with a small capital.

Notwithstanding the economic interest of this activity, the use of products from the recovery of waste is also to be monitored more closely. This is particularly the case of the conditions for the reintroduction of packaging and other bottles recovered commercially. Some previously used to condition chemicals or toxic are directly put back into the trade after a simple "washing", posing certain risks for consumers including beverages and other food products packaged in these containers.

The dangers associated with the informal trade in containers and other bottles are real, particularly with the risk of contact poisoning of food products with containers that have previously been used as containers for chemical and / or toxic (pesticide) products. These are bottles containing bleach, cans or drums of pesticides and reused motor oil cans that are indeed sometimes reused to package various drinks and liquids (palm or peanut oil). , milk ...).

**3.2.1.3 Valorisation of pneumatic waste**

Pneumatic waste: The recovered pneumatic waste is the tubes used for the manufacture of drawers and bicycle turnbuckles sold respectively at 800 F CFA and 300 F CFA per unit. These objects are commonly used in households. Tires are also used in restaurants to serve as a table (photo 2) or used to make joints and to delimit a space. They are also used in the manufacture of shoes (photo 1).

**Photo 1:** Shoe manufacturing workshop from pneumatic waste and used shoes in Agbokou

**Photo 2:** Barrels and tires used as a table at the amusement park " Le Légendaire " in Porto-Novo
**Shooting**: Dansou, February 2017

Photos 1 and 2 respectively show the forms of recovery of pneumatic waste in the city of Porto-Novo. The manufacturing workshop (photo 1) employs five workers and manufactures a wide range of sandals from pneumatic waste collected from landfills and households. The selling prices of the shoes vary between 1000 F CFA and 3000 F CFA per unit. About five shoes worth 1500 CFA each are sold per day, a monthly gain of 225 000 CFA francs.

Although these are rarely encountered experiences in Porto-Novo, they deserve to be accompanied and multiplied because they help to clean up the living environment. In addition, they can be a source of revenue for the town hall because currently this activity escapes the tax. Pneumatic waste is also used in restaurants where they are used as furniture (photo 2). This ongoing experience in this amusement park can be extended in homes and especially in gardens. This will significantly reduce this type of waste.

The tire recycling business is facing a number of problems. These include the lack of work equipment and the lack of locations in the markets to practice in good conditions. The resolution of this problem will allow the increase of the tax revenues of the municipality through the payment of market places and taxes.

## 4. Conclusion

Waste management is a fundamental issue for the city of Porto-Novo. Apart from its ecological stake, it releases an economic and social stake with the creation of jobs and the realization of various activities. These many activities, however informal, actually convert waste into a resource of high market value. However, these activities remain insufficient because only a few categories of waste are taken into account. It is urgent that accompanying measures be taken to strengthen the achievements of the various stakeholders in the recovery and recovery of waste in Porto-Novo. There is also a need to introduce a taxable tax on producers of non-biodegradable and / or hazardous waste. To make the environmental tax enforceable and legally binding, it is necessary that the bill on plastic bags that is in the National Assembly include, if it was not yet, the Ecotaxe dimension in the legal and regulatory texts of Benin.

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