

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 10, October 2019

Economic and Sociodemographic Aspects of Household Solid Waste Management within the Cities of Cotonou and Porto – Novo

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ABSTRACT: The study aims at providing a better understanding of economic and sociodemographic determinants of sanitary practices within the city of Cotonou and Porto – Novo. The probabilistic method and the random choice technique are adopted for the selection of the sample in proportion to the size of the structures on the basis of some criteria.

The size of the sample is determined according to the Schwartz method. In order to identify the determinants, the data collected on demographic and socioeconomic features were submitted to the multinomial logit model through the SAS software to identify the determining factors. To appreciate the weight of some determining factors of the household solid waste management in Cotonou and Porto – Novo, the General Linear Model procedure (Proc GLM) of the Statistical Analysis System software version 9.2 (SAS v 9.2) was used for statistical analyzes.

The analysis reveals, the households size, the profession of households heads, the incomes of the household, the nature of construction equipment, particularly households whose houses are built of hard (Brick and cement) and habitats made with Oil palm branches are the main factors that determine the ability of households to properly manage their solid waste ($p < 0.05$ to $p < 0.001$). Also, we note that the analysis of variance reveals that the size of households vary very significantly ($P < 0.05$ to $P < 0.0001$) from one municipality to another. Thus, we find that there is a positive and very significant correlation between household income and household size ($r = 0.090$, $P < 0.01$) and then a negative and very highly significant correlation between the income of households and the household solid waste collection ($r = -0.178$, $P < 0.001$).

KEYWORDS: Aspect, waste, management, Cotonou, Porto-Novo, Benin.

I. INTRODUCTION

Since the 20th century the world population has been growing steadily. It increased fourfold from 1.6 billion in 1990 to 6.4 billions in 1997 [5]. According to a United Nations projection, the global population will reach more than 8 billions in 2025 with 6.8 billions in developing countries. Also, more than half of the global population will live in the city. This population growth in developing countries is one of the main sources of sanitation problems.

The sanitation issue is therefore a major challenge in the world's great cities, but specifically in city in high growth rates in developing countries [4]. As a result, many cities in developing countries face serious hygiene and sanitation challenges due to rapid population growth and lack of adequate infrastructures. A rapid and unplanned urbanization process is generally accompanied by recurrent sanitation problems linked to rapid accumulation of waste in urban areas

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[4]. This accumulation of filth in the cities concerns both solid waste and liquid waste. It is justified according to [16] by the social and economic changes that most African cities have undergone since the 1960s. This situation is so worrying that everywhere in African cities, the existing literature echoes real cities garbage.

Given the inability to control urban dynamics and meet the massive social demand due to the gradual bankruptcy of state supervision systems, African cities pose daunting problems in water services management, hygiene, collection, household waste management, transportation, wastewater management, education, access to health care, etc. However, the limited resources of African states do not allow the public authorities to make investments in line with the demand for urban services that requires proper management of the sanitation issue [16].

The rate of urbanization in Benin, shifted from 26.5% in 1979 to 38.9% in 2002 and 43.50% in 2013 [8]. This growth of cities in Benin caused enormous sanitation issues, especially in the management of household solid waste (MSW). The production of solid waste in 1998 was 342,000 tons, of which 60% for the city of Cotonou. In 2011, the city produced about 708 tons of household waste per day [18]. Today this production is 3889.5 tons per day. However, according to the officials of the Direction of Technical Services (DST) of Cotonou Town hall, the capacity of removal of waste from the town hall does not exceed 100,000 tons per year. This creates a deficit of more than 40,000 tons in kidnapping. So, about 41,966.75 tons of DSM are squandered every year in the city. Also, in the city of Porto-Novo, 151.40 tons of DSM are produced daily or 55261 tons per year. The large amount of waste produced is due to the spectacular and almost exponential population growth experienced by cities with growth rates close to double the global average [9].

Urban management, which should be one of the biggest concerns of decentralized communities, is still poorly taken into account in local development policies. This is the main reason for the sanitation problems encountered in the cities of Cotonou and Porto-Novo in Benin. The fundamental objective of this research is to contribute to a better knowledge of the socio-demographic and economic determinants of sanitation practices in Cotonou and Porto-Novo.

II. STUDY ENVIRONMENT

This study focuses on the two cities with special status of southern Benin, Cotonou and Porto – Novo. Here, emphasis will be laid on the presentation of the geographical situation of each of these cities. The city of Cotonou is situated between the parallels 6 ° 21 and 6 ° 24 of north latitude and between 2 ° 22 and 2 ° 30 of east longitude. It is bounded on the north by Nokoué lake, on the south by the Atlantic Ocean, on the west by the communes of Ouidah and Abomey-Calavi, and on the east by the municipality of Sèmè-Podji (Figure 1). [11].



Figure 1: Geographical situation of Cotonou

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The commune of Porto – Novo is located in southern Benin at 30 Km from Cotonou.

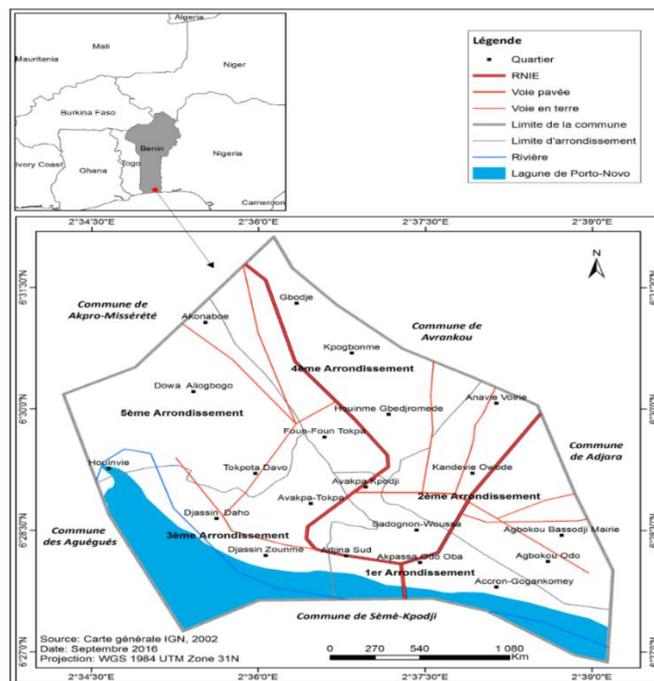


Figure 2: Geographical situation of Porto-Novo

The city of Porto-Novo is located between 6 ° 30 north latitude and 3 ° 30 east longitude. It is limited:

- in the north by the communes of Akpro-Misséréte, Avrankou and 'Adjarra;
- in the south by the municipality of Sèmè-kpodji;
- in the East by the municipality of Adjarra;
- in the West by the municipality of Aguégué.

III. MATERIALS AND METHODS

The data collected analysis method is based on tools, materials, technology, data processing and analysis.

3.1 Collection tools

The information collection tools are interview.

3.1.1 Data collections equipment

The data collection equipment are:

- A motorbike for field trips;
- A Cannon Brand camera

3.1.2 Collected data

- The collected data are quantitative and qualitative. They relate to:
- Knowledge and practice data on household solid waste management;
- Data on the modes of elimination of solid waste management;

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Data on solid waste management storage modes;
Solid waste management evacuation data;
Data on pre-collection structures;
Socio-demographic data (marital status, number of children, size of households, level of education, occupation, ethnicity, type of dwelling, equipment);
Data on the economic conditions of households (household income, daily expenses).

3.1.3 Data collection technique

To collect reliable data on household waste management policies in the cities of Cotonou, two techniques were used: Literature searches, Survey.

The data were collected through a survey of households selected by random and simple sampling in the cities of Cotonou and Porto-Novo. The total number N of individuals selected for the survey is determined using the method of [15].

3.2 Data analysis

Field-collected data has been compiled, ordered, captured, and represented in the form of figures or tables so that they are informative in order to draw conclusions.

To analyze the socio-demographic and economic determinants of mismanagement of household solid waste, data collected on socio-economic and demographic characteristics were subjected to the multinomial logit model according to [17] using SAS software to identify factors. In this model, the dependent variable is multinomial. The specification of the empirical model or reduced form is as follows [17], 2012): $Y_i = f(X_1, X_2, \dots, X_6)$ Where Y_i , dependent polychotomous variable is the income level of the households surveyed and X_1 to X_6 , are the explanatory variables (the economic and socio-demographic factors). In order to appreciate the weight of certain determining factors of household solid waste management in the cities of Cotonou and Porto-Novo, the General Linear Model procedure (Proc GLM) of Statistic Analysis System software version 9.2 (SAS v. 9.2) was used for statistical analysis. These analyzes essentially consisted of one-way analysis of variance, namely districts or communes. The mean values were then compared with each other using the Student Newman-Keuls test at the 5% threshold (probability level).

IV. RESULTS

4.1. Household sociodemographic characteristics in Cotonou and Porto – Novo

The socio-demographic characteristics of households take into account the ages of household heads, household size, educational level, occupational category, and residence status.

4.2 Households heads ages

In Benin and more generally in Africa, local perceptions of phenomena and practices are highly influenced by the habits and customs, themselves dependent on socio-cultural groups. As a result, the subjects were grouped according to three age categories (Young = 1 to 50 years old, adult = 50 to 70 years old, old = 70 years old and over) and sex.

Tableau II: Distribution by ages in households in Cotonou and Porto-Nov

| Age range | Numbers | Frequence in % |
|-------------------|---------|----------------|
| 18 to 50 years | 912 | 85, 79 |
| 50 ans à 70 years | 77 | 7, 24 |
| 70 ans and over | 74 | 6,96 |
| Total | 1063 | 100,0 |

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The table II shows that about 86% of the household heads surveyed in the cities of Cotonou and Porto-Novo are young, and their ages range from 18 to 50 years; 7.24% are in the 50 to 70 year age group and 6.96% have ages between 70 and over. These are adults. It should then be studied in Cotonou and Porto-Novo, if there is a significant difference between the communes as regards the age of the heads of household.

Table III presents the age-based analysis of variance results for heads of households.

Table III: Age variance of household heads.

| Commune | Source of variation | Degree of liberty | Fischer's value Âge |
|------------|---------------------|-------------------|------------------------|
| Cotonou | District | 10 | 3,05 *** (0,0009) |
| Porto-Novo | District | 04 | 18,20 *** (0,0001) |
| | Commune | 01 | 6,16** (0,002) |

ns : P > 0,05 ; * : P < 0,05 ; ** : P < 0,01 ; *** : P < 0,001.

The analysis of variance shows that in the commune of Cotonou, there is a very significant difference (P < 0.01 to P < 0.0001) between the districts as regards the age of the heads of household while in Porto-Novo, the age of household heads vary very significantly (P < 0.0001).

In general, analysis of variance reveals that the age of heads of households vary very significantly (P < 0.05 to P < 0.0001) from one commune to another. The Student Newman-Keuls test shows in each commune, the districts in which the heads of household are older. For this purpose, Table IV presents the results of the Student Newman-Keuls test relating to the difference between the ages in districts within the communes.

Table IV: Difference between ages in district and municipality

| Commune | District | Age |
|------------|----------|------------------|
| Cotonou | 1st | 31,22 ± 1,23 a |
| | 2nd | 34,39 ± 1,48a |
| | 4th | 35,65 ± 1,71 a |
| | 5 th | 36,72 ± 3,06 a |
| | 6 th | 37,54 ± 090 a |
| | 7th | 33,97 ± 1,83 a |
| | 9 th | 31,23 ± 1,35 a |
| | 10 th | 35,18 ± 1,66 a |
| | 11th | 35,51 ± 2,12 a |
| | 12th | 32,43 ± 0,98 a |
| | 13th | 37,63 ± 1,28 a |
| | Average | 34,58 ± 044 A |
| Porto-Novo | 1st | 28,96 ± 1,35 c b |
| | 2nd | 31,03 ± 0,54 c b |
| | 3rd | 32,94 ± 1,52 b |
| | 4th | 40,02 ± 1,71 a |
| | 5 th | 27,02 ± 0,98 c |
| | Average | 31,91 ± 0,65 B |

The averages followed by the same alphabetic letter of the same character and for the same factor are not significantly different (P > 0.05) according to the Student Newman-Keuls test.

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Table IV shows that in Porto-Novo, the oldest heads of households are found in the fourth district of the municipality. The Student Newman-Keuls test, shows that in the city of Cotonou the household heads are very old.

4.1.1 Size of the households

In the cities of Cotonou and Porto-Novo the size of households varies from one household to another and from one district to another. Table V reveals the survey results.

Table V: Households size in Cotonou and Porto – Novo

| Household size | Number | Frequence(%) |
|----------------|--------|--------------|
| 1 | 149 | 14,01 |
| 2 | 87 | 8,18 |
| 3 | 114 | 10,72 |
| 4 | 141 | 13,26 |
| 5 | 260 | 24,46 |
| 6 | 168 | 15,80 |
| 7 | 48 | 4,52 |
| 8 | 45 | 4,23 |
| 9 | 18 | 1,69 |
| 10 | 33 | 3,10 |
| Total | 1063 | 100,0 |

The analysis in Table V shows that beyond the difference observed in the age of heads of households, we also note that the size of households varies from one household to another.

Also, it varies from one person to ten people per household. In the cities of Cotonou and Porto-Novo, for example, 24.46% of the surveyed households are 5 members, 15.80% are 6 members, 14% are one member, 13.26 % have size 4 members, 10,72% have size 3 members, 8,18% have size 2 members, 4,52% have size 7 members, 4,23% have size 8 members, 3.10% have a size of 10 members. It should be noted that there are households whose size is very high (six, seven, eight nine or ten members). This finding calls for a notion of cleanliness in households. Thus, an analysis of variance linked to the size of the households made it possible to better apprehend the situation in the cities of Cotonou and Porto-Novo.

Table VI: Households size variance

| Commune | Source of variation | Degree of liberty | Fisher's value Household size |
|------------|---------------------|-------------------|-------------------------------|
| Cotonou | District | 10 | 1,42ns (0,17) |
| Porto-Novo | District | 04 | 10,64 *** (0,0001) |
| | Commune | 01 | 6,16** (0,002) |

ns : P >0,05 ; * : P < 0,05 ; ** : P <0,01 ; *** : P < 0,001.

Table VI presents the results of analysis of variance related to the size of households in the cities of Cotonou and Porto-Novo.

The analysis of this table shows that in the commune of Cotonou, there is no significant difference (P> 0.05) between the districts in terms of household size. Otherwise, household size remains constant and hardly changes. However, analysis of variance (Table VI) shows that there is a very significant difference (P <0.0001) between the districts in terms of household size in the city of Porto-Novo.

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In general, we note that the size of households varies very significantly ($P < 0.05$ to $P < 0.0001$) from one commune to another in the cities of Cotonou and Porto-Novo. It is important to see the inequalities between household sizes in the districts of the cities of Cotonou and Porto-Novo.

4.1.2 Education level of heads of households

The level of education is an important factor in the hygiene of the living environment. In the context of this study, data collection revealed that in the cities of Cotonou and Porto-Novo some household heads are educated while others are not. Table VII presents the results of the collection.

Table VII: Household heads level of education and the management of household solid waste in Cotonou and Porto – Novo

| | | Household heads level of education | | | | | Total |
|---|-------|------------------------------------|---------------|---------------|---------------|---------|-------|
| | | Primary(%) | Secondary1(%) | Secondary2(%) | University(%) | None(%) | |
| Suscription to Household solid waste collection service | Yes | 16,4 | 5,4 | 5,9 | 8,2 | 3,5 | 39,3 |
| | No | 20,8 | 11,1 | 11,1 | 10,8 | 6,8 | 60,7 |
| | Total | 37,2 | 16,5 | 17,1 | 19,0 | 10,3 | 100 |

The table shows that 89.8% of the households surveyed are educated. In fact, 37.2% of heads of households reached primary level, 33.6% reached secondary level and 19% reached the level of higher education. In addition, 10.3% never went to school. Then among those educated, we note that 35.8% subscribe to pre-collection structures against 54% in the study environment.

4.1.2 Socio-professional categories and subscription to pre-collection structures

People form several socio-professional categories reside in Cotonou and Porto – Novo.

Table VIII: Socio-professional categories subscribed to pre-collection structures

| Socio-professional categories | Suscribed to household solid waste pre-collection servic | | Total (%) |
|-------------------------------|--|--------|-----------|
| | Yes (%) | No (%) | |
| Agriculture | 1,2 | 3,4 | 4,6 |
| Trade | 17,9 | 24,1 | 42,0 |
| Agri-food processing | 0,7 | 1,0 | 1,7 |
| Logging operation | 0,2 | 0,4 | 0,6 |
| Craftman | 5,1 | 10,5 | 15,7 |
| Civil servant | 5,0 | 11,8 | 16,8 |
| Private emplyee | 5,7 | 4,7 | 10,4 |
| Any activity | 1,9 | 2,5 | 4,4 |
| Transport service | 0,7 | 0,3 | 1,0 |
| Non – declared | 0,9 | 1,9 | 2,8 |
| Total | 39,3 | 60,7 | 100,0 |

Table VIII provides information on the households surveyed who have a income-generating activity and who subscribe or do not to a pre-collection structure.

The table shows that in the cities of Cotonou and Porto-Novo, traders dominate with a frequency of 42% in their wake, come the civil servants of the State (16,8%); craftmen (15.7%) private employees (10.4%), farmers (4.6%), agri-food processors (1.7%), transportation service agents (1 %).

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Thus, 36.5% of surveyed households that have a income-generating activity subscribe to a waste collection service against 56.3%. In fact, 42% of the household heads surveyed are traders and 17.9% subscribe to a pre collection service; 15.7% are craftsmen and 5.1% are subscribers; 16.8% are in public administration and 5% are subscribers; 10.4% are in the private administration and 5.7% are subscribers 4.6% are farmers and 1.2% are subscribers; 4.4% have no activities but about 2% are subscribers and only 1% is in the transport service then 0.7% subscribes.

4.1.3 Residence status and subscription to pre-collection structures

The residence situation in the cities of Cotonou and Porto-Novo differs from one household to another. Table IX presents the data collected.

Tableau IX: Residence situation and subscription to pre-collection structures

| | | Residence situation | | | | Total |
|--|-------|---------------------|----------|-----------------|----------|-------|
| | | Tenant(%) | Owner(%) | Accommodated(%) | Other(%) | |
| Subscribed to household solid waste pre-collection structure | Yes | 23,2 | 4,2 | 10,5 | 1,4 | 39,3 |
| | No | 34,8 | 9,8 | 14,4 | 1,7 | 60,7 |
| | Total | 58,1 | 14,0 | 24,9 | 3,0 | 100 |

The table reveals that in the cities of Cotonou and Porto-Novo, there are basically three types of households. These are tenants, owners and free tenants. The most common are tenants (58.1%), followed by free (24.9%) and home owners (14%). From these results, we note that 23.2% of tenants are subscribers to pre-collection structures and 4.2% of owners are also subscribers against 10.5% of free hosts.

Determinants of household solid waste management in the cities of Cotonou and Porto-Novo

In the cities of Cotonou and Porto-Novo, several factors explain the mismanagement of household solid wastes. This study is a contribution to the knowledge of the socio-economic and demographic determinants involved in the good management of household solid wastes.

Table X: Socio – demographic determinants

| Parameters | Chi-Square | Pr >ChiSq |
|-----------------------------------|------------|-----------|
| Household size | 7,23 | 0,007 |
| Level of education | 2,25 | 0,13 |
| House built with palm tree branch | 12,08 | 0,0005 |
| Nature of construction material | 128,42 | <0,0001 |
| With brick and cement | 52,72 | <0,0001 |
| With backed brick | 19,51 | 0,06 |
| Clay | 5,79 | 0,010 |
| Clay and cement | 5,79 | 0,016 |
| Other constructions | 3,66 | 1,92 |
| Age | 0,0005 | 0,98 |

The analysis of Table X reveals that the size of the households, as well as the nature of the building material, particularly the households whose houses are built in hard (Brick and cement) and the habitats made with palm tree branches, are the Main socio-demographic parameters that determine the ability of households to manage their household solid waste well ($p < 0.05$ to $p < 0.001$).

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4.2 Socio-economic determinants of household solid waste management in the cities of Cotonou and Porto-Novo
The socio-economic determinants are the household capacity to finance the management of the waste they produce in their household. This is analyzed through the Occupation, the daily expenses and their willingness to invest in the management of household solid wastes.

Table XI:Socio-economic determinants

| Determinants | Chi-Square | Pr>ChiSq |
|--|------------|----------|
| Occupation | 10,49 | 0,001 |
| Daily expenses | 9,31 | 0,011 |
| Investment in household solid waste management | 13,42 | 0,0002 |
| Household income | 69,46 | <0,0001 |

Table XI presents the socio-economic determinants related to household solid waste management in the cities of Cotonou and Porto-Novo. It reveals that the occupation of household heads and household incomes ($p < 0.05$ to $p < 0.001$) are the main socio-economic parameters that determine the ability of households to manage their household solid waste. Daily household expenditures ($p > 0.05$) hardly determine the ability to properly manage household waste.

4.3 Correlation of determinants and sanitation practices

To better understand the determinants, it is necessary to correlate them with household solid waste management practices. Table XII presents the correlation results.

Table XII: Socio-professional categories and investment in household solid waste management

| Socio-professional categories | Income enabling to invest in household solid waste management(%) | Income that doesn't allow investing in household solid waste management(%) | Total |
|-------------------------------|--|--|-------|
| Trade | 18,6 | 23,4 | 42,0 |
| Agriculture | 1,7 | 2,9 | 4,6 |
| Agri-food processing | 0,8 | 0,9 | 1,7 |
| Logging operation | 0,3 | 0,3 | 0,6 |
| Craftman | 4,0 | 11,7 | 15,7 |
| Civil servant | 9,5 | 7,3 | 16,8 |
| Private employee | 3,9 | 6,5 | 10,4 |
| Any activity | 1,2 | 3,2 | 4,4 |
| Transport service | 0,3 | 0,7 | 1,0 |
| Non – declared | 0,9 | 1,9 | 2,8 |
| Total | 41,3 | 58,7 | 100 |

Table XII shows that in the cities of Cotonou and Porto-Novo, 41.3% of the different socio-professional categories have an income that allows them to invest in the management of the household waste they produce, while 58.7% of head of household have an income that does not allow them to properly manage solid waste in the household.

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Table XIII: Correlation between determinants.

| Charateristics | Age | Households size | Collection cost |
|--|-----------|-----------------|-----------------|
| Collection cost | 0,094** | 0,062 * | |
| Household income | 0,085 ** | 0,090 ** | -0,178 *** |
| Daily expenses | 0,012 ns | 0,020 ns | -0,004 ns |
| Investment in household solid waste management | -0,018 ns | 0,022 ns | -0,128 *** |

ns : P >0,05 ; * : P < 0,05 ; ** : P<0,01 ; *** : P < 0,001.

The analysis in Table XIII shows that there is a positive and very significant correlation between the age of household heads and the cost of collection ($r = 0.094$, $P < 0.01$). In the cities of Cotonou and Porto-Novo, the cost of collection changes according to the age of the household heads. This justifies the observed correlation between the age and the cost of collecting household solid waste.

Thus, there is a positive and very significant correlation between household income and the age of heads of household ($r = 0.085$, $P < 0.01$). As a result, in South Benin's special-status cities, household income changes with the age of the household heads.

The analysis in the table also shows a positive and significant correlation between the cost of household solid waste collection and household size ($r = 0.062$, $P < 0.05$).

Thus, we find that there is a positive and very significant correlation between household income and household size ($r = 0.090$, $P < 0.01$).

Finally, Table VIII also shows that there is a negative and very highly significant correlation between household income and household solid waste collection ($r = -0.178$, $P < 0.001$).

V. DISCUSSION

1.1 Determinants of household solid waste management practices in the cities of Cotonou and Porto-Novo

In the cities of Cotonou and Porto-Novo, the heads of households are young. This can be explained not only by the fact that all the administrative and academic infrastructures are concentrated in the big cities, but also the young people, in general, are in search of work and settle in the big cities. This complicates the question of the size of households in cities and indirectly the question of production and waste management. However, the results revealed that household size is a determining factor in the management of household solid waste in the cities of Cotonou and Porto-Novo. This result explains that population growth is proportional to the production of household waste. So the larger the size of a household is, the more waste it produces. However, households often do not have the financial and material means to cope very effectively with the management of the waste they produce, especially in a context where the quantity of waste produced is significant. [8] in its studies on the effect of the population of villages and city districts observed that household size is larger in Porto-Novo than in Cotonou.[9], [13] and [18] have shown that population growth accentuates the problems of waste management and that these problems are felt in terms of the amount of waste produced. Their studies then confirm our findings that household size is a function of the amount of waste produced. But, contrary to these studies, [16] justifies the size of households by the level of fertility (or even birth) and mortality. According to him, although these different indicators are related to natalities and mortality exclusively, it is however the latter that determine the composition or recomposition of households. It should be noted that the author did his studies on a rural environment and not on the big cities. His results are then contrary to those of this study.

Also, it is found that other factors determine the mismanagement of household solid waste in Cotonou and Porto-Novo. It is basically the occupation of household heads, household income, the nature of construction equipment including households whose houses are built of hard (brick and cement) and habitats made with palm tree branches. In fact, when

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the head of the household has a profession that pays him better for income, he wants to be in a healthy environment. He appropriates a habitat that secures him and seeks to make it clean especially by investing enough in his immediate environment. It also preserves its health by granting a special stamp to the waste produced. All these factors then determine the good management of household solid waste in Cotonou and Porto-Novo. These results were confirmed by [51] who finds that the mismanagement of garbage in the city is the result of multiple and diverse causes related to habitat characteristics, socio-economic conditions and organization of municipal service. [7] says that the attitude towards waste also depends on the education received (traditional or modern), and by the current practices of the environment but also by the status and the economic situation.

5.2 Determinants Influence and the management of household solid waste in the cities of Cotonou and Porto-Novo

There is a significant correlation between household size, the cost of household solid waste collection, and household income. As a first step, in Cotonou and Porto-Novo, the size of households changes according to the cost of household solid waste collection. Household income also changes according to the size of the household. Here we can understand that, in a household consisting of several persons, the head of the household is assisted by the other members of the household who contribute in one way or another to the total household income. On the other hand, when the size of the household is small, only the head of the household brings his income for the expenses of the household.

These expenditures take into account the management of household solid waste produced in the household. However, the amount of household solid waste produced is proportional to the size of households, so it is understandable that when household solid waste is produced, the cost of collection follows linearly.

Also, there is a negative and very highly significant correlation between household income and solid waste collection. Otherwise, in the cities of Cotonou and Porto-Novo, households whose income is not high do not like to subscribe to pre-collection structures. Thus, we can explain that the more the households do not have a better income, the better they prefer to throw the household solid waste on the piles of garbage. These results were confirmed by [1], who, after conducting a study on the monthly income of household heads of an unsanitary district in Cotonou, concluded that the vast majority of the population has a monthly income that does not allow them to afford the enormous expenses that requires the qualitative improvement of their frame of life. It is understandable then that the qualitative improvement of the household solid waste management requires the mobilization of a minimum of financial resources especially for the pre-collection of household solid waste produced. Some heads of households in the cities of Cotonou and Porto-Novo, whose income does not allow them to cope effectively with the pre-collection of the waste they produce, simply throw them into the nature. This prevailing practice in these Communes has been noted by [14], [18], [2], [6], [10] and [3]. For these authors, such a behavior exposes the population to aesthetic pollution. In the cities of Cotonou and Porto-Novo, garbage is deposited on spaces that are not yet occupied and often give rise to the formation of small piles that serve as a place of comfort for some households. [4], in the same vein, emphasized that the unsanitary conditions created by garbage dumps provide easy access to human waste. This behavior contributes to the olfactory pollution that reigns in Cotonou and Porto-Novo. [12], in a study done in the city of Kinshasa in 2010 noted that households throw their garbage on the streets, in streams, in ravines and in the bush. He pointed out that this way of eliminating waste promotes the proliferation of garbage that is gaining more and more space in avenues and is a breeding ground for pathogens. It also pollutes the water and degrades the soil [5]. He also pointed out that this way of managing household waste contributes to soil and groundwater pollution.

VI. CONCLUSION

Household solid waste management faces many technical, organizational and financial difficulties in Benin's major cities. In the cities of Cotonou and Porto-Novo, solid household waste ends up in landfill and becomes a nuisance vector. Several factors explain this mismanagement of DSM. The results of this research show that household

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 8, Issue 10, October 2019

demographic and economic factors influence this management. These determinants have a significant impact on improving the quality of life of the populations of the cities of Cotonou and Porto-Novo.

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