





EXTERNALITY EFFECTS OF SACHET AND PLASTIC BOTTLED WATER CONSUMPTION ON THE ENVIRONMENT: EVIDENCE FROM BENIN CITY AND OKADA IN NIGERIA

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ABSTRACT

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This paper examines the public perception of the externality effects of sachet and plastic bottled water consumption in Benin City and Okada. The methodology applied to source for data involved both the qualitative and quantitative analysis, through the use of questionnaires with well-structured questions and informal personal interviews. 320 respondents were then selected from the four local government areas of Oredo, Egor, Ikpoba-Okha and Ovia North East that make up Benin City and Okada. The results of the study as indicated by majority of the various respondents revealed the absence of tap water supply. The wastes from sachet and plastic bottles constitute danger to our environment by blocking the water ways and hindering the draining system, depositing debris in the affected rivers, thereby creating negative externalities to our environment. The study also showed that the perennial flooding in Benin City and Okada could be associated with indiscriminate disposal of empty sachets and plastic bottles. The study recommends the following; local government authorities should try to provide waste bins in every street and these should be managed and monitored by their authorized agents. Private firms that are involved in sachet and plastic bottled water production should be encouraged to establish recycling plants that can recycle plastic wastes into other useful materials in line with renewable energy mandate. Government should properly enforce the laws against indiscriminate disposal of wastes, where offenders are punished in order to maintain proper disposal of wastes in Benin City and the entire states of the Federation.

Contribution/Originality: This study contributes in the existing literature on environment climate change action on the SDGs. The paper's primary contribution is finding that wastes from sachet and plastic bottles constitute danger to our environment by blocking the water ways and hindering the draining system, depositing debris in the affected rivers.

1. INTRODUCTION

Among the Sustainable Development Goals (SDGs) is the goal to ensure healthy environment and access to clean water by 2030. Nigeria as a developing society is facing serious challenge of flooding and access to healthy environment and potable water supply in almost all communities, whether urban, semi-urban or rural settlements. According to the United Nations declaration, access to water supply by a larger population of developing countries

will fast-track the reduction of poverty and thereby improve the quality of life of the people. The Nigerian government is making frantic effort to improve water supply by engaging in the construction of several multi-functional dams across the country. The state and local governments have equally keyed into the Improved Water Supply Model (IWSM) developed by the federal government. There appears a paradigm shift in the water supply chain in the country with the private sector coming on board to complement the efforts of the various tiers of government.

The involvement of the Organized Private Sector (OPS) in the provision of water to the people has led to a new twist in the management of materials used in packaging water such as sachets and plastic bottles. Every nook and cranny in most cities in Nigeria is totally littered with sachet water nylon, also called in the Nigerian local parlance as “pure waste sachet” and plastic bottles. This has become a serious source of worry to many environmentalists and health conscious individuals. With the increasing growing demand for packaged water and with the need to reduce water-borne diseases such as guinea worm, cholera and diarrhoea, there will be a corresponding increase in environment-related challenges such as flooding, blocked water channels and drains. All these combine to cause pollution which invariably results in negative externality. The indiscriminate disposal of sachet water nylon and bottled water across many cities in Nigeria has resulted in the increasing rate of flooding in most Nigerian cities. Though we may not totally attribute the flood of 2012 that sacked over 17 states in Nigeria to blocked water ways, but there is largely a contributing factor to the perennial flooding in many cities, including Benin City.

According to [Edoga *et al.* \(2008\)](#) over 70 percent of Nigerians drink at least sachet water per day resulting in over 50 to 60 million used water-sachets disposed daily across the country. [Babatunde and Biala \(2010\)](#) posited that the packaging of sachet water is made of non-biodegradable synthetic polythene, which does not decay, de-compose or corrode, and which when burnt, produces oxides of carbon, nitrogen and sulphur and serious harm is inflicted on man and the environment. They pointed out that the release of the oxides is due to the petro chemical composition of polythene, out of which the packaging is made. The environmental degradation occasioned by this indiscriminate disposal of this non-biodegradable materials for packaging water results on the long-run to such economic consequences as flooding, use of scarce resources to manage avoidable natural disasters, and sometimes loss of both human capital and man-hour. According to [Adewumi \(2006\)](#) the economic and environmental impacts of this plastic waste is increasing significantly as they clog domestic sewage systems, choking water chains, threatening aquatic life in receiving water systems, often causing soil degradation, reducing biodiversity and the aesthetic quality of most Nigerian cities. [Adenuga *et al.* \(2006\)](#) posited that waste associated with packaged water and sachet could precipitate epidemics and national health crises. The externality effects of such unwholesome disposal of water cans and sachets are highly unquantifiable and sometimes, it cannot be measured. Millions of Naira is spent by the various tiers of government to enhance sanitary conditions of most Nigerian cities. The National Emergency Management Agency (NEMA), a parastatal of the federal government, saddled with the responsibility of providing relief materials to affected persons, spend billions of naira annually in providing succour to displaced persons, no thanks to blocked drains occasioned by wastes and sachet nylons. There is hardly any measure put in place to mitigate and internalize the effects of externality, particularly in developing economies. There is no appropriate legislation that will ensure that bottled and sachet water producers pay special tax that will address such issues. These are the main focus of this paper.

Other parts of this paper are organized into four sections. Section two contains review of relevant literature, while section three will discuss the theoretical framework; Section four is the methodology applied and analysis of results. Finally, section five contains recommendations and conclusion.

2. MATERIALS AND METHODS

Packaged water became highly visible in Nigeria in the early 1990s. This was as a result of growing middle class population who no longer found satisfaction in drinking tap water. Also, at this period, there was huge water

scarcity in most urban cities in Nigeria. The quest for development in most cities including Benin City resulted in the destruction of most pipes meant for potable water supply due to road construction. According to [Gbadegesin and Olorunfemi \(2007\)](#) the rate of increase of the country's total water supply for industrial, agricultural and domestic uses was 1.0 percent while the population growth rate was 2.8 percent. This indicated that the population would be larger than the available water supply, the result of which is scarcity of water supply.

According to some recent studies, [Schweizer and Annoh \(1996\)](#); [Archer \(1997\)](#); [Maconachie \(2008\)](#); [Adamu \(2009\)](#); [Idiata et al. \(2013\)](#) and [Ayisi and Kumi \(2018\)](#) there is a negative relationship between inadequate disposal of waste associated with bottled water and human health. In other words, avoidable environmental and health hazards are highly correlated with indiscriminate disposal of sachet nylon from packaged water and bottled water waste.

[Akunyili \(2003\)](#) opined that the inability of the government to steadfastly and deliberately provide adequate potable water for the growing Nigerian population led to the proliferation of questionable packaged water production units across the various states in the federation, including Edo State. Apart from the fact that most sachet and bottled water are produced in unhygienic conditions due to inactive regulatory agencies, there is also the absence of legal framework that will guide the operation of these manufacturing outfits. Akunyili further noted that the provision of water that is not only safe, but tasteless, odourless and clean in appearance is top priority in any country that cares for good health and poverty reduction towards sustainable economic development. Though sachet water was introduced into the Nigerian market in 1990s, its regulation by the National Agency for Food and Drug Administration and Control (NAFDAC) started in 2001.

[Ababio \(2005\)](#) noted that externalities arising from unwholesome disposal of sachets and plastic bottles can constitute a kind of atmospheric pollution; which affects both the areas where the pollution is generated as well as other surrounding environment. It thereby increases the burden to the consumers.

2.1. Externalities Associated with Plastic Bottled and Sachet Water

According to a popular axiom, "if you refuse to take care of the environment, the environment will take care of you". The earth and the environment are to complement human existence. When the environment is adequately taken care of, avoidable health hazards can be prevented. According to [Babatunde and Biala \(2010\)](#) the externalities associated with the disposal of used water-sachets and plastic bottled wastes are of three dimensions; viz: air pollution, land pollution and water pollution. The indiscriminate disposal of sachet water waste constitutes land pollution, because when it rains, these waste that litter the environment are washed into water channels, thereby blocking drainages and therefore constituting water pollution. Air pollution arises when attempt is made to burn the waste associated with sachet and plastic- bottled water. The non-biodegradable nature of synthetic polythene often makes some consumers to attempt burning waste associated with sachets and plastic-bottled water. The waste when burnt constitutes air-pollution.

Edo State Environmental Protection Agency (ESEPA) in collaboration with the State Ministry of Environmental and Public Utilities (MEPU) have embarked on series of campaigns on public awareness relating to indiscriminate and unwholesome disposal of waste linked to non-biodegradable materials like nylon. The campaign is not yielding minimal result as many claims that such an enlightenment campaign is not directed at the ultimate consumers of sachet and bottled water.

Benin City is made up of three urban local governments namely: Oredo, Ikpoba-Okha and Egor while Okada is located in Ovia North East Local Government Area. These are the most populated local government areas in Edo State. With increasing population and high level of poverty, many settlers in these communities like the highly vulnerable-poverty group (the women) engage in one trade or the other that is waste-generating, such as the sale of sachet and bottled water. The compartmentalization of these council areas into zones for waste collection has not even helped matters. Whenever it rains, these non-biodegradable wastes (sachet water nylon and plastic-bottled

water) litter the streets of Benin City; water channels are blocked resulting in heavy flooding in most areas, and most importantly individual houses and roads built with tax payers' money are destroyed.

According to [Nurnberger \(1999\)](#) non-biodegradable waste when buried at dumping sites has the tendency of polluting ground water. Since most people at the urban centers due to the failure of the government, now depend on borehole water, such wastes do pollute the underground table water, thereby resulting in serious health hazards.

The only measure that ensures efficiency in the consumption and production of these sachet and plastic bottled water is to internalize the associated externalities. This can be done either through the imposition of tax at the producing units; or alternatively, government could reduce the in-take of sachet and bottled water through adequate provision of potable drinking water to consumers. When this is done, consumption of sachet and bottled water will considerably reduce, and consequently, a reduction in pollution associated with non-biodegradable waste. In this same vein, flooding that is hitherto linked to sachet and plastic bottled water is equally reduced to the barest minimum, and scarce resources that would have been used in replacing destroyed infrastructure would be diverted into other areas begging for government attention. The releases of hazardous emissions from incineration of Municipal Solid Waste (MSW) also create negative externalities. Combustion at 22 percent efficiency can generate 600kwh of electricity with less CO_2 emissions as compared to coal plants. However, gases released from decomposition processes from plastics present in municipal solid waste include cyclic chlorinated hydrocarbons which are believed to be toxic. [Andrady \(2003\)](#) noted that the release of hydrogen chloride and dioxins from incineration can be very toxic to humans and animal species alike. The corrosive fumes released into the atmosphere from plastic combustion can also increase acidity levels of the environment. A potential effect from such emissions is the generation of acid rain.

An approach in reducing the effect of pollution to the barest minimum is the one suggested by [Babatunde and Biala \(2010\)](#). According to them, a company producing packaged product could be legislatively mandated to recycle the waste generated through their production activities. Alternatively, these industries could be taxed with a view of internalizing the externalities. This approach is often called the plastic polluter pay (PPP) which was inherent in the pigovian tax introduced by Arthur Cecil Pigou, a renowned classical economist to internalize externalities. This was alluded to by [Babatunde and Biala \(2010\)](#) in their empirical report, which they referred to as Deposit Refund System (DRS). The effectiveness of this however as acknowledged by even the developers depends on the ability to fix the taxes that will be equal to the marginal social cost (MSC) of the goods and services involved. This also requires the knowledge of the price elasticity of the product.

In countries like Uganda for instance, outright ban was the measure adopted to reduce such externalities arising from the packaging of products that apply non-biodegradable materials. One extreme consequence of this measure is the loss of jobs in the industry where such packaged products are dominant. The chain of poverty is therefore elongated. Adopting this measure in Nigeria will be counter-productive in an economy ridden with several social unrest ranging from criminality, kidnapping, insurgency, pipeline vandalism and crude oil theft.

2.2. Welfare Distribution Effects of Pollution

[Jhingan \(2003\)](#) identifies two main changes in social welfare; such as: those, which benefit all or at least one person through trading and those; which benefit at least one person at the expense of the other through conflict. Making provision for externalities through taxes and subsidies is a major justification for welfare. The existence of externalities increases the welfare of someone and decreases the welfare of others, and since changes in both directions are unlikely to be absolutely equal, externalities affect changes in general welfare.

Externalities are costs or benefits of market transactions not reflected in prices. When an externality prevails, a third party other than the buyers or sellers of an item is affected by its production and consumption. The benefits or cost accruing to the third party are not considered by either buyers or sellers of an item whose production or use results in an externality. Negative externalities also called external costs are costs to third parties other than the

buyers or the sellers of an item not reflected in the market place. This also occurs when the prices of goods or services do not reflect the full marginal social costs. For example, the consumption of sachets and bottled water improve the welfare of the consumers and reduces the welfare of the non-consuming public through damage done to their health and environment, by the disposal of wastes associated with sachets and plastic bottled water. According to him, social welfare is a function of the quantities of products consumed by each member of society.

Virtually all internalizing measures have the tendency to raise the price of the polluter's production. Pollution is the result of an absence of price for some certain scarce environmental resources, and economists thus prescribe the introduction of surrogate prices in the form of taxes charges or prices paid for pollution permits, to provide the necessary succour to economize on the use of these resources (Cropper and Oates, 1992). They opined that if polluters are forced to take into account the social costs of their actions, their products will tend to become more expensive. The price increase is worth it or desirable from an efficiency point of view. If not prices, then the consequent profits would give incorrect signals as regards the full cost of production whether Marginal Private Costs (MPC) or Marginal Social Cost (MSC).

There is the need to consider the economic implications of justifying the increase in the price of the commodity that has pollution effect. This is where the issue of equity and efficiency come into play in analyzing the problem of externality. The disagreement state is when it comes to who should bear the cost of pollution control. Should it be the producers or consumers of sachet and bottled water? It was concluded that one of the crucial propositions of the consensus of the 1960's is that the questions of inability for externalities cannot be properly settled by consideration of the equity involved. Matters of equity cannot be established prior without detailed examination of the welfare level of each agent involved in the alternative problems. To evaluate the distributional implications of reducing pollution, we need to know the demand patterns of the goods produced by the polluting firm (Rosen, 1999). The Pareto Optimality Criterion (POC) states that general welfare is said to increase or decrease if at least one person is made better off (or worse off) without a change in status of others. The social welfare is maximized when it is not possible to make any one better off without making anyone else worse off.

2.3. Theoretical Framework

This study is captured within the framework of Extraordinary Theory and Pigovian Tax Theory. Externalities are costs or benefits not transmitted through prices and are incurred by a third party who was not involved in the transaction causing either these costs or benefits. According to Pigou (1932) the externality theory argues that the value of any commodity or transaction should be made up of the economic and social costs but most times the market price of these goods and services are computed using only the economic cost. A Pigovian tax is a corrective tax applied to a market activity that generates negative externalities. The tax should be equal to the social cost and is intended to correct the market outcome. In the presence of negative externalities, the social cost of a market activity is not covered by the private cost of the activity. In such a case, the market outcome is back to efficiency. The Pigovian tax model was criticized on the ground of its difficulty in measuring social cost as a means of correcting the effect of externality (Baumol, 1972) the reciprocal cost problem from Coase (1960) the political problem from Thompson and Batchelder (1974) signals a minor departure from the Pigovian corrective tax mechanism.

According to Rosen (1999) the externality theory only suggests reduction of pollution to optimal level, which is not zero level. Zero level implies no production of the goods that generates pollution. The theory is so indicated because the society needs those goods though they generate externalities. The externality theory explains that even if the cost of an externality or pollution control is placed on the producer in the form of tax or the consumer in the form of subsidy, that is if the polluter is made to pay for the pollution or compensate for externality, the amount of pollution will not fall to zero. Pollution will fall to zero only if the production or output level of the externality-generating goods falls to zero.

The following assumptions are put in place to make the analysis amenable to reality, firstly, it is assumed that pollution is a manifestation of waste emissions (E); secondly, production function is taken to be a function of a vector of conventional inputs. Waste emissions are treated as another factor of production, since attempts to cut back on waste emissions will involve cost.

2.4. Methodology and Sources of Data

The study adopted both the qualitative and quantitative methods. Questionnaire with well-structured questions and informal personal interviews were used to source for data. The qualitative analysis was used to address the general objective, which is to examine the Public perception of the externality effects of sachet/plastic bottled water consumption on the environment. In carrying out the research we delude into the remote and immediate causes of externality problems and their effects on man and his environment using Benin City and Okada as a case study.

In order to ascertain the usefulness of our research in terms of its quantitative applications, a non-parametric test based on chi square was used to justify if our selected factors had significant effects on sachet/plastic bottle water consumption which led to some negative externality on man and his environment.

Cross tabulation, proportions and percentages were also adopted to analyze the qualitative descriptive data. The questionnaires used were distributed to consumers of sachet/plastic bottle water who reside at the three local government areas that make up Benin City (Oredo, Egor and Ikpoba Okha) and Okada. Three hundred (320) respondents were administered the questionnaire. The main instrument for this research assignment paper was questionnaire; a pre-tested pilot study was done in Igbinedion University, Okada and Benson Idahosa University, Ugbor campus in order to test for its validity and reliability. This was done in order to ascertain its validity and reliability in our environment.

3. ANALYSIS OF RESULTS AND DISCUSSION

Table-1. Statistics of responses.

Area	Respondents	Bore Hole Supply for Drinking	Sachet & Bottled water	Central Waste Disposal	Self-Waste Disposal	Recycling of waste	Waste as Pollutant
Oredo	80	16	64	30	50	NIL	68
Igor	80	20	60	25	55	NIL	60
Ikpoba Okhai	80	18	62	27	53	NIL	62
Ovia N'East	80	26	50	5	75	NIL	66
Total	320	80 (25%)	240 (75%)	87 (27%)	233 (73%)		256 (80%)

The various results obtained from our questionnaire are summarized as shown in Table 1 above. The summary, of the results are presented as follows: we had 140 men and 180 female respondents, 80 from Egor, 80 from Oredo, 80 from Ikpoba-Okha and 80 from Ovia North-East local government areas to make up our 320 respondents. The source of water in the homes/neighborhood in the four local government areas is borehole water. 240 had borehole in their homes and 80 had no borehole, in terms of drinking water preference, 25% preferred borehole water while 75% preferred sachet/plastic bottle water. This was also shown in respect to the safest source of water, most respondents preferred sachet/plastic bottle water.

Due to the absence of tap water most people preferred sachet/plastic bottle water which led to increase in demand for sachet/plastic bottle water consumption in Benin City.

Most respondents, about 80% agreed that the production and consumption of sachet/plastic bottle water pose a lot of danger to our environment. They also agreed that the empty sachets/plastic bottles water can litter our environment and block our water drains.

80 percent of the respondents agreed that the empty sachet/plastic bottles constitute about 60% - 80% of debris that are accumulated in Ikpoba and Ogba rivers.

53.3% of the respondents agreed that consumer wastes in beaches, highways, parks, and markets create a negative externality for tourists.

Almost all the respondents agreed that there is no recycling plant in their environment for empty sachets/plastic bottle waste. The respondents also agreed that the management of waste disposal is not effective. About 66.7 percent of the respondents believed that the perennial flooding in Benin City is caused by indiscriminate disposal of empty sachets/plastic bottles in our environment.

Finally, the law against indiscriminate disposal of waste is not very effective in their environment. From our chi square results, the null hypotheses is that the daily intake of sachet water is low, was rejected since our calculated value (224) is greater than the table value of (5.99) at the 5% level of significance and 2% degree of freedom, which led us to accept the alternative hypothesis. Hence we agreed that the daily intake of sachet/plastic bottled water is high in Benin City.

The second null hypothesis which states that the production and consumption of sachet/plastic- bottled water does pose danger to our environment was rejected since our calculated value (108) is greater than the table value (3.84) at the 5% level of significant and 1 degree of freedom which made us to accept the alternative hypothesis that the production and consumption of sachet/plastic- bottled water pose a lot of danger to our environment.

The third null hypothesis states that empty sachets/plastic-bottles cannot decay was rejected since our calculated figure of 33.333 was found to be greater than the table value of 3.84 at the 5% level of significance and 1 degree of freedom, which led to the acceptance of the alternative hypothesis.

The fourth null hypothesis states that the burning of empty sachets/plastic bottles creates a negative externality to our environment was rejected since our calculated value (56) was found to be greater than the table value of 5.99 at the 5 percent level of significant and 2 degree of freedom which made us to accept the alternative hypothesis.

Finally, the last null hypothesis states that the perennial flooding in Benin City is not caused by indiscriminate disposal of empty sachets/plastic- bottles, this was rejected since our calculated chi square value of 33.3 is greater than the table value of 3.84 at the 5% level of significant which made us to accept the alternative hypothesis that states that the perennial flooding in Benin City is caused by indiscriminate disposal of empty sachets/plastic bottles.

3.1. Policy Implications

This paper crucially examined the externality effects of sachet/plastic bottle water consumption on the environment using Benin City as a case study. Thus from the various results in our analysis; we observed the following:

- That there is a total absence of tap water supply in Benin City which made the residents to depend solely on either borehole water or sachet/plastic bottled water.
- Most residents of Benin City preferred sachet and plastic bottled water as the safest source of drinking water, thereby increasing the demand for sachet/plastic bottled water.
- Waste from the consumption of sachet and plastic bottle litter our environment and help to block our water drains, as they constitute about 60%-80% of debris that are accumulated in rivers around Benin City- based on the fact that most residents in Benin City agreed that perennial flooding is caused by indiscriminate disposal of these empty sachets and plastic bottles.
- The absence of any recycling plants in Benin City that can help reduce the waste from the environment.

- The disposal of plastic sachets and plastic bottles creates a serious aesthetic problem, in urbanized areas of the world; the chemical stability of plastic prevents plastic waste from decomposing into the environment (soil) at a rate comparable to the rate of waste generation, thus plastic waste accumulation in urban centers creates negative externalities on the environment.
- The release of hazardous emissions from incineration of sachets and plastic bottles waste creates negative externalities which are believed to be toxic to men and animals. The corrosive fumes released into the atmosphere from sachets/plastic bottles and other forms of plastic combustion can also increase acidity levels of the environment.

4. RECOMMENDATIONS AND CONCLUSION

From our study we have been able to establish that the consumption of sachet/plastic bottled water creates some negative externalities in our environment. Based on our findings we therefore recommend the following ways as means of reducing sachet/plastic bottles waste from our environment.

The local government authorities should try to provide waste bins in every street which should be managed and monitored by their agents.

Government and private institutions should be encouraged to establish recycling plants that can recycle plastic waste into useful materials while those who collect these plastic wastes should be paid reasonably in order to ensure that the recycling plants are effective in their operations.

The producer of sachet/plastic bottled water should be involved in the management of plastic waste in their area of distribution. The producers of sachet/plastic bottled water should also be encouraged to establish their own recycling plants. These producers should also be made to pay a special tax that will help internalize the effect of externalities and waste generated by their activities.

- The government should properly enforce the laws against indiscriminate disposal of waste, where offenders are punished in order to maintain proper disposal of waste.
- People should be discouraged from burning plastic waste in order to avoid the harmful effects of the chemicals of plastic waste that are toxic to both man and its environment.

In order to effectively reduced the consumption of sachet/plastic bottle waste that constitute waste to our environment, the government should provide safe and clean water by improving the supply of water through the tap system. From our empirical results, it is obvious that wastes arising from sachet and plastic-bottled water consumption have some harmful consequences on the health of the people living in Benin City and its environment. Regulatory and legislative framework should be strengthened with a view of ensuring that the environment becomes more conducive for habitation.

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