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Spatial Distribution of Service Stations and Access to Fuel in the Municipality of Bohicon in Benin

QUENUM Comlan Irene Eustache Zokpenou

Territory Planning, Environment and Development Laboratory Sustainable (LATED)

University of Abomey Calavi (UAC)

Abstract – The mobility of people and things is a necessity in the life of populations. It generates various modes of movement. Also fuel consumption becomes an obligation for the proper functioning of the machines. The availability of fuel and its accessibility arises in the municipality of Bohicon . The objective of this research is to evaluate access to fuel, in particular gasoline from service stations in this municipality.

The methodological approach used consisted in carrying out enough documentary research followed by various field work using different tools and materials such as survey questionnaires, interview guides, a notepad and a GPS. This is followed by the processing of the data collected and then the presentation of the results using Word, Excel and QGis;

A total of 24 service stations and 10 points of sale in the municipality as well as to understand the behavior consumers. However, it is noted the unbalanced distribution of the various service stations and points of sale. Also it is noted that there are only 18% of consumers who get their gasoline at the service station against 82% who prefer adulterated gasoline for various reasons although they are aware of the quality of that of service stations. Hence the need to revise the policies of this sector and a proposal for a development plan for service stations for an upgrade of sector of Petroleum Products Storage and Distribution Infrastructures (ISDPP).

Keywords – Municipality of Bohicon , Disparity, Planning, Service stations, Access, Fuel

INTRODUCTION

States due to the increase in population are visibly confronted with several socio-economic difficulties in this case that of the distribution of service stations and the shortage of fuel in service stations or the dilapidation of existing ones. Faced with this state of affairs, the equitable installation of new service stations or the renovation of existing ones would make it possible to cover the population's demand for gasoline. But, despite the multitude of oil companies on the market, it is clear that the informal market has completely supplanted the official market to the point of functioning as a regulatory instrument (PS AOUTCHEME et al , 2014 , *p.13*) and its distribution chain is remarkably majority. In Africa, more specifically in Benin, this emergence has been observed following the economic crisis of the 1980s which undermined the oil sector. This development of the "parallel" market for petroleum products has gone through three major stages in its evolution. First, a primary phase (1980-1990) which is characterized by an embryonic development of the traffic and a weak enthusiasm of the consumers for the gasoline of contraband, commonly called " *kpayo* " . Next comes the traffic expansion stage, which extends from 1990 to 2000. This phase is marked by a context of labor market crisis following voluntary departures and the freezing of recruitment in the civil service. It was also at this time that smuggling lost its artisanal aspect, one might say, to become organized commercially. Finally, after the 2000s, the spectacular growth in traffic coincided with the general decline in the purchasing power of many Beninese and the frequent shortages of fuel in service stations (A. DIAKITE, 2016, p.18-19) .

Corresponding Author: QUENUM Comlan Irene Eustache Zokpenou

The informal sector takes advantage of the failure of the formal sector in the distribution of gasoline to attract its customers and retain them, which allows it to grow day by day. The price difference between the sale of gasoline by the two sectors and the lack of marketing and strategic policy of the formal sector are elements that increase competitiveness in the Beninese market (GN HOUNDJAKO, 2019, p.5) . Also, in order to meet their needs, not finding a job and given the proliferation of means of travel, many people in general in Benin and in particular in the Commune of Bohicon, who embark on the activity of sale of gasoline fraudulently imported from Nigeria. Indeed, Bohicon is located in the department of zou 130 km north of Cotonou. But in recent years, with the rapid demographic growth, it is nowadays faced with many problems hindering its development (KS MAGBONDE, 2020, p.3) . However, despite the various measures taken by the State, traders remain repeat offenders and consumers continue to consume the adulterated gasoline installed on the edges of the city's public roads. They offer a wonderful trilogy every day that promotes and encourages consumers to always come to them, even if the price goes up slightly, it's good price-proximity-speed, qualities that you don't find in stations. -approved services (GN HOUNDJAKO *et al* , 2019, p.5). It is these situations that led to the adoption of this subject in order to contribute to the improvement of access to service stations in the Commune of Bohicon. This therefore raises the following question How do the people get their fuel in the Commune of Bohicon?

The objective of this research is to analyze the modes of access to fuel in the Commune of Bohicon.

I. METHODOLOGICAL APPROACH

It presents the nature and source of the data used, the method of collection and finally the processing of the data and analysis of the results.

1.1 Nature and source of the data used

Several types of data were used to carry out this research. These are the nature and source of the data used below:

- The number of service stations in the Commune of Bohicon
- The number of consumers according to the type of machine
- The number of consumers by type of gasoline used
- The number of consumers by type and volume of gasoline used on average for a week
- Number of sellers by type and volume of gasoline sold
- The number of consumers by reason of preference of the type of gasoline
- The number of consumers by type of gasoline due to the difficulties encountered
- The number of consumers according to their opinions on the difference in gasoline quality
- The number of consumers according to their preferences of the purchase price of gasoline at the service station
- The opinion of individuals on the effect of good coverage at service stations
- The opinion of consumers on the difference in quality between species
- Geo-referenced data of the service stations of the Commune of Bohicon

1.2 Field work

❖ **Target group and sample size**

For this research, four target categories were identified and investigated.

The research target is made up of politico-administrative authorities, pump attendants/service station managers, adulterated tradesmen and consumers.

Thus, the choice of individuals is based on the following criteria:

- Be in one of the boroughs of the Commune for at least 10 years;
- Be at least 20 years old;

- Use a rolling means requiring fuel (petrol).

In the case of this research, the investigation unit is a person with rolling stock and the size of the sample consists of 198 individuals chosen according to established criteria and randomly in the Commune of Bohicon. This sample is then distributed arbitrarily in favor of each category and all the districts as shown in Table I.

Table I: Summary of actors interviewed

Categories of actors	Gas station attendants/managers	adulterated traders	Consumers	Political-administrative authorities
Workforce	36	42	115	5

Source: Summary of preparatory work for the survey, April 2022

Table I presents the distribution of the number of individuals surveyed according to their categories in all the districts of the Commune of Bohicon.

❖ **Data Collection Materials and Tools**

The materials used are:

- The QGis software for creating maps;

-The Locus maps application for geo-referencing .

Several tools were used to collect data. It is :

-An observation grid,

-Questionnaires and interview guides for various categories of individuals in order to collect the information needed to carry out our work.

❖ **Data collection technique**

It consisted of apprehending the field through direct observation following an observation grid, administering a questionnaire to individuals in the categories selected in the commune of Bohicon and getting closer to the various resource structures in the commune of Bohicon and Cotonou. The process used is the counting of response numbers by category and then the calculation of the percentage.

1.3 Data processing and analysis of results

Our investigations allowed us to collect data whose manual processing was mainly based on the counting of survey sheets and observation guides. Thus, after data processing, Word and Excel software were used to produce tables and graphs and Q-Gis for the maps.

II. GEOGRAPHICAL AND ADMINISTRATIVE SITUATION

The Municipality of Bohicon is located in the center of Benin, in the department of Zou, 130 km from Cotonou. It is located between 6°55' and 7°08' North latitude, 1°58' and 2°24' East longitude. It has an area of 139 km2 and is limited:

- To the North by the Municipality of Djidja ,

- To the south by the Municipality of ZOGBODOMEY,

- To the east by the Municipality of ZA KPOTA and

- To the West by the Communes of ABOMEY and AGBANGNIZOUN.

The Commune of BOHICON is subdivided into 10 administrative districts and 66 districts and villages. The districts of Bohicon 1 and Bohicon 2 constitute the urban districts. The other peripheral districts are growing (Mairie de BOHICON, 2017, p.11).

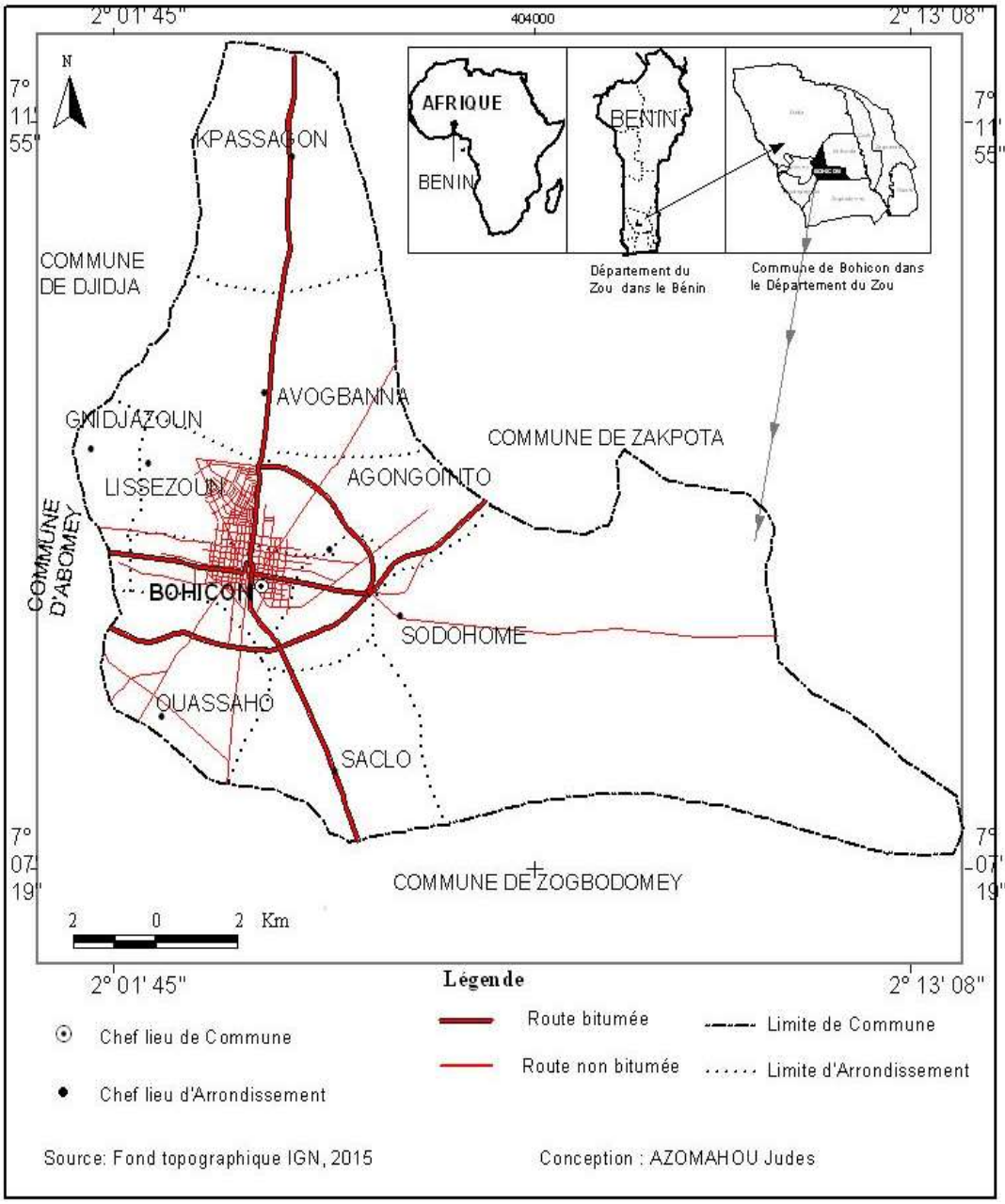

Figure 1: Geographical location of the Municipality of Bohicon

III. Results And Discussion

3.1 Inventory of service stations and spatial distribution of service stations

The table below shows the number and status of service stations by district in the Commune of Bohicon.

Table II: Number and status of service stations by district

	ARRONDISSEMENT										
	GNIDJAZOUN	SACLO	LISSEZUN	AGONGOINTO	AVOGBANNAN	OUASSAHO	PASSAGON	SODOHOME	BOHICON I	BOHICON II	TOTAL
WORKFORCE OF EXISTING SERVICE STATIONS	**2**	**3**	**1**	**2**	**9**	**0**	**6**	**3**	**2**	**5**	**33**
WORKFORCE OF ACTIVE SERVICE STATIONS	**1**	**3**	**1**	**2**	**9**	**0**	**4**	**3**	**1**	**0**	**24**
WORKFORCE OF INACTIVE SERVICE STATIONS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**5**	**6**
EMPLOYEES OF SERVICE STATIONS UNDER CONSTRUCTION	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**3**

Source: Summary of fieldwork, April 2022

Table II shows the number and condition of service stations by district. These are the workforce of existing service stations, the workforce of active service stations, the workforce of inactive service stations, the workforce of service stations under construction.

From this table it can be seen that:

- There are 2 existing service stations in GNIDJAZOUN, 1 of which is active and 1 is under construction.
- There are 3 existing gas stations in SACLO that are active.
- There is 1 existing gas station in LISSEZOUN which is active.
- There are 2 existing gas stations in AGONGOINTO which are active.
- There are 9 existing gas stations in AVOGBANNAN that are active.
- There is no existing service station in OUASSAHO.
- There are 6 existing service stations in PASSAGON, 4 of which are active and 2 are under construction.
- There are 3 existing service stations in SODOHOME that are active.
- There are 2 existing service stations at BOHICON I including 1 active and 1 inactive.
- There are 5 existing gas stations at BOHICON II which are inactive.

The analysis therefore reveals that the Municipality of Bohicon currently has 24 operational service stations and 3 others under construction, still distributed unevenly by borough with a distance of 250 meters, mostly measurable, between two service stations in general. There is therefore an inequality in the distribution policy of service stations.

With the development of the automobile and the creation of new roads, service stations largely integrated the Commune. Depending on the data available and for an objective analysis of the latter, a grouping by district of the service stations of the municipality was made.

The spatial distribution of these service stations is shown in Figure 2.

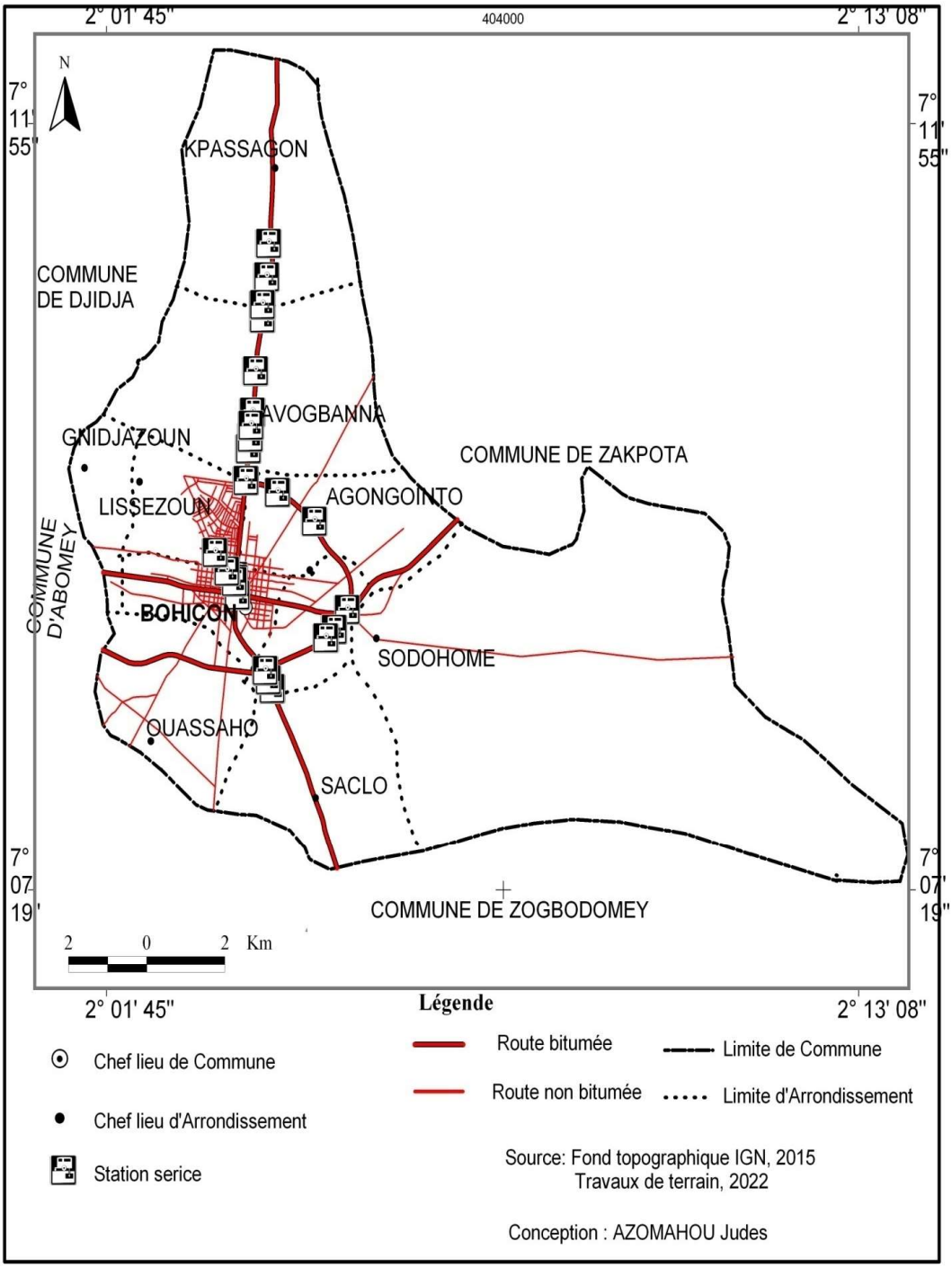

Figure 2: Spatial distribution of service stations in the Commune of Bohicon

From the analysis of Figure 2 , we see that all the service stations are geographically well established. However, not all the districts of the Commune of Bohicon have at least one service station. This is the case of the district of Ouassaho whose populations are forced to resort to adulterated gasoline or to the service stations of the districts which border it since its roads are

under construction. Also it appears that the service stations are more concentrated on the Inter-State Road No. 2 especially at the level of the district of Avogbannan . Most of the districts of the Commune of Bohicon do not have good ISDPP coverage.

3.2 Mode of access

It presents formal and informal access, supply problems, then suggestions and perspectives which highlight the proposals regarding the location of service stations, the proposals regarding the development of service stations, the proposals in relation to service station services and proposals in relation to oil sector management and regulation policies (Figure 3).

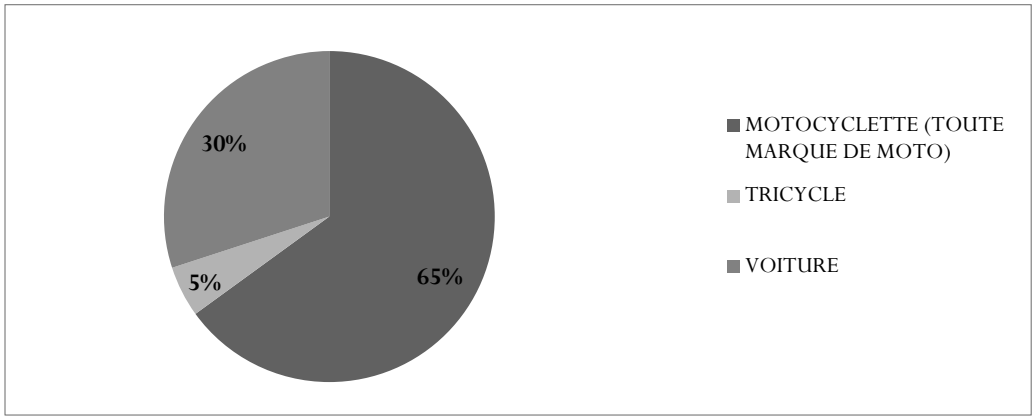

Figure 3: Number of consumers by type of machine

Source: Summary of fieldwork, April 2022

Figure 3 presents the number of consumers according to the type of vehicle, namely motorcycles, tricycles and cars.

From the analysis of this figure, it emerges that 5% of the individuals surveyed are tricyclists, 30% are car drivers and 65% are motorcyclists. The analysis shows that motorcyclists have the dominant percentage because they are the most encountered, accessible and more or less available with car drivers. On the other hand, tricyclists are very rarely encountered. Figure 4 presents consumers by type of gasoline.

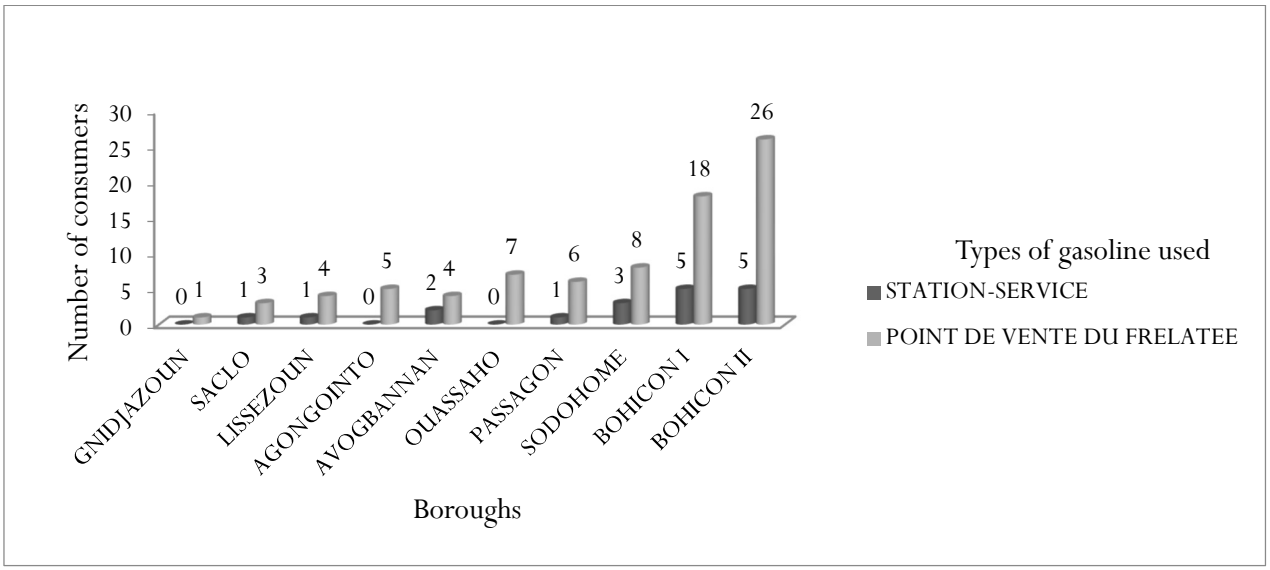

Figure 4:Number of consumers by type of gasoline used

Source: Summary of fieldwork, April 2022

Figure 4 shows the number of consumers by type of gasoline used, namely gasoline from service stations and adulterated gasoline.

From this figure, it can be seen that:

- Only 1% of consumers get their gasoline supplies at adulterated sales outlets in GNIDJAZOUN.
- 1% of consumers obtain their supplies of gasoline at the level of adulterated sales outlets compared to 3% who obtain their supplies from service stations in SACLO.
- 1% of consumers get their fuel at the level of adulterated sales outlets against 4% who get their supplies from service stations in LISSEZOUN.
- Only 5% of consumers get their gasoline supplies at the adulterated points of sale in AGONGOINTO.
- 2% of consumers get their fuel at the level of adulterated sales outlets against 4% who get their supplies from service stations in AVOGBANNAN.
- Only 7% of consumers get their gasoline supplies from adulterated outlets in OUASSAHO.
- 1% of consumers get their gasoline from adulterated sales outlets, compared to 6% who get their gasoline from PASSAGON service stations.
- 3% of consumers obtain their gasoline at the level of adulterated points of sale against 8% who obtain their supplies from service stations in SODOHOME.
- 5% of consumers obtain their supplies of gasoline at the level of adulterated sales outlets against 18% who obtain their supplies from service stations at BOHICON I.
- 5% of consumers obtain their supplies of gasoline at the level of adulterated sales outlets against 26% who obtain their supplies from service stations at BOHICON II.

From the analysis of this figure, it appears that 18% of consumers obtain their supplies of gasoline from pump attendants/service station managers compared to 82% who obtain their supplies from adulterated traders in the Commune of Bohicon. This state of affairs does not encourage and therefore does not benefit the private promoters of service stations, unlike the sellers of adulterated products who largely benefit from it. Plate 1 presents the various petrol stations and a few points of sale in the Commune of Bohicon.

Photo 1: Benin Petro service station (AVOGBANNAN)

Photo 2: SOMAYAF gas station (AGONGOINTO)

Photo 3 Petrolum gas station (ZAKPO)

Photo 4: Vendor of adulterated gasoline (ZAKPO)

Photo 5: Seller of adulterated gasoline (AGONGOINTO)

Shooting **:** Judes AZOMAHOU, April 2022

Figure 5 illustrates the volume of fuel used by consumers.

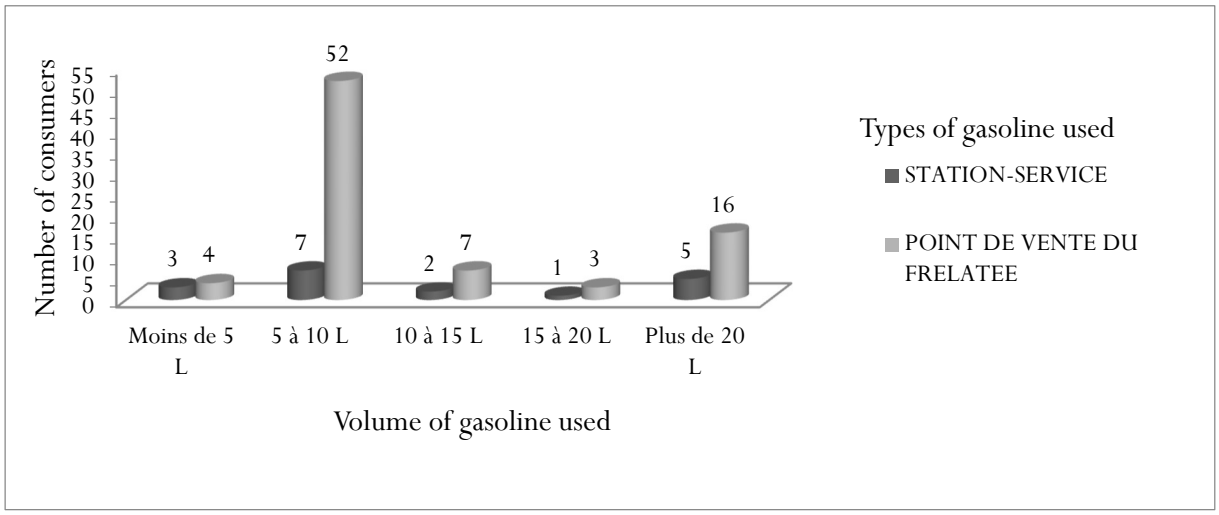

Figure 5 : Number of consumers by type and volume of gasoline used on average per week

Source: Summary of fieldwork, April 2022

Figure 5 presents the number of consumers by type and volume of gasoline used on average per week. These are gasoline from service stations, adulterated gasoline and volumes that are: Less than 5L, 5 to 10L, 10 to 15L, 15 to 20L and More than 20L.

From the analysis of this figure, it appears that:

- 3% of petrol station consumers and 4% of adulterated petrol consumers use less than 5 liters on average per week.
- 7% of consumers of gasoline from service stations and 52% of those of adulterated gasoline use between 5 and 10 liters on average per week.
- 2% of consumers of gasoline from service stations and 7% of those of adulterated gasoline use between 10 to 15 liters on average per week.
- 1% of consumers of gasoline from service stations and 3% of those of adulterated gasoline use between 15 and 20 liters on average per week.
- 5% of consumers of gasoline from service stations and 16% of those of adulterated gasoline use more than 20 liters on average per week.

The analysis shows that consumption is dominant on the side of adulterated gasoline and especially between volumes of 5 to 10L in particular for motorcyclists and tricyclists then that of More than 20L for car drivers.

With the growth of the vehicle fleet, both service stations and points of sale sell large volumes of fuel, which is illustrated in Figure 6.

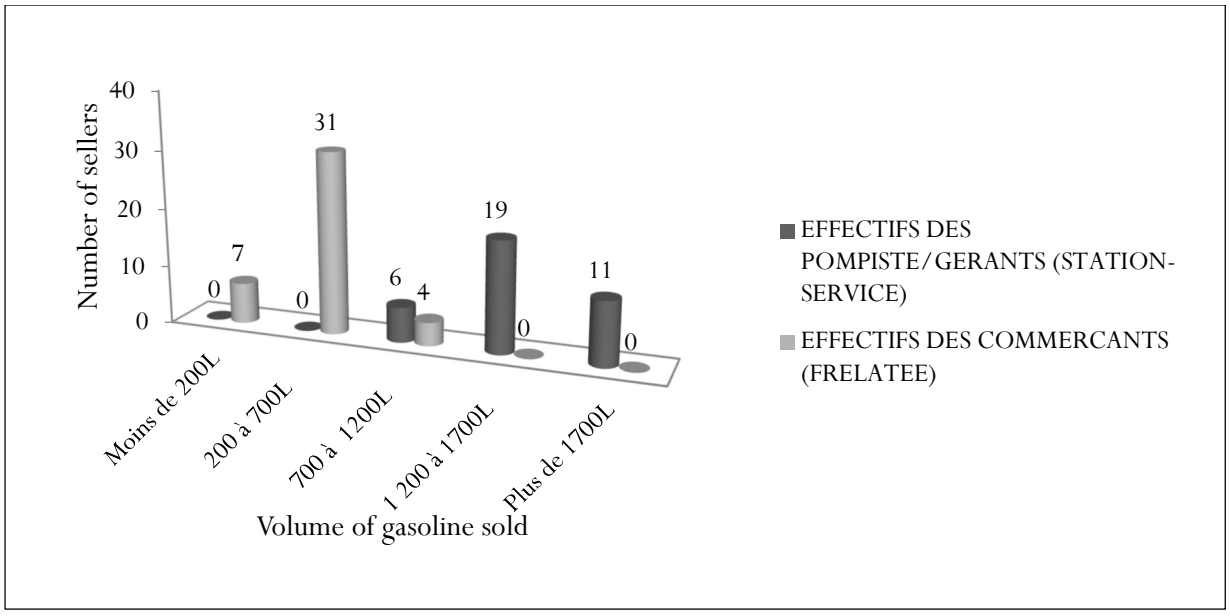

Figure 6: Number of sellers by type and volume of gasoline sold on average per week

Source: Summary of fieldwork, April 2022

Figure 6 presents the number of sellers by type and volume of gasoline sold on average per week. These are gasoline from service stations, adulterated gasoline and volumes that are: Less than 200L, 200 to 700L, 700 to 1,200L, 1,200 to 1,700L and More than 1,700L.

From the analysis of this figure, it appears that:

- None of the pump attendants/service station managers sell less than 200 liters of gasoline on average per week, while 16.67% of adulterated traders sell it.
- None of the pump attendants/service station managers sell between 200 and 700 liters of gasoline on average per week, while 73.81% of adulterated traders sell it.
- 16.67% of pump attendants/service station managers sell between 700 and 1,200 liters of gasoline on average per week, while only 9.52% of adulterated traders sell it.
- 52.78% of pump attendants/service station managers sell between 1,200 and 1,700 liters of gasoline on average per week, while none of the adulterated traders sell any.
- 30.55% of pump attendants/service station managers sell between more than 1,700 liters of gasoline on average per week, while none of the adulterated traders sell any.

The analysis reveals that adulterated gasoline is more sold between the volumes of 200 to 700L in particular because of motorcyclists and tricyclists compared to gasoline from service stations which is more sold between the volume of 1,200 to 1,700L in favor of car drivers.

With these volumes marketed, consumer perceptions vary according to the place of supply.

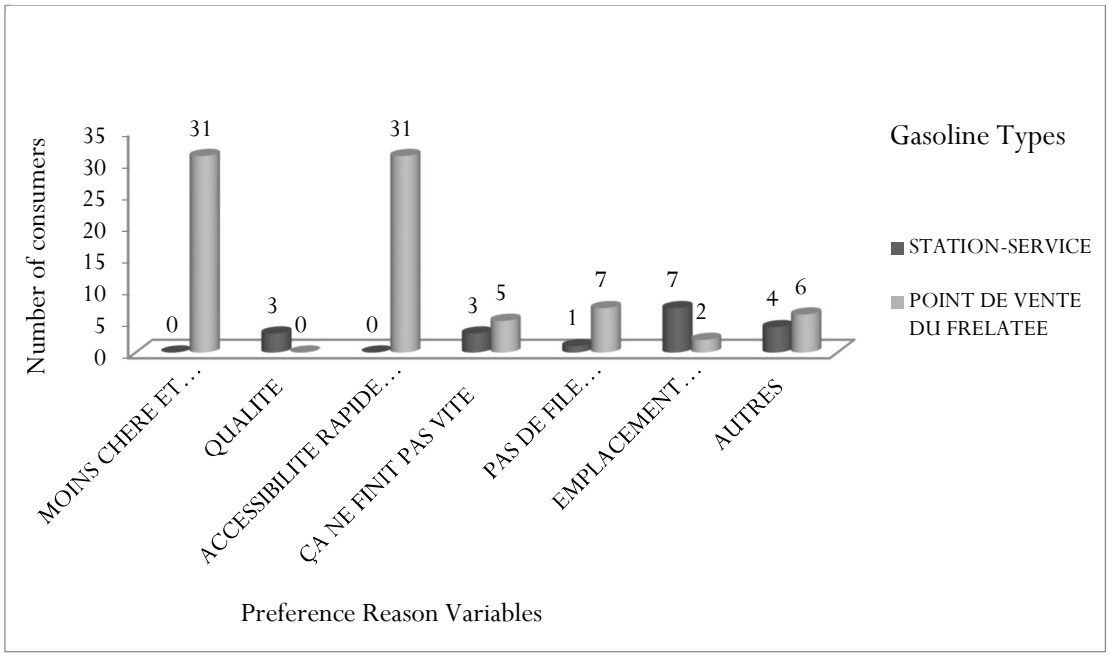

Figure 7: Number of consumers by reasons for preferring the type of gasoline used

Source: Summary of fieldwork, April 2022

Figure 7 presents the number of consumers by reason for preferring the type of gasoline used. It's about gas station gasoline, adulterated gasoline, and the reasons why: cheaper and always available, quality, fast accessibility and always available, it doesn't end quickly, no queues and quick accessibility, adequate locations, and others.

From the analysis of this figure, it appears that:

- Faced with the “cheaper and always available” aspect, only 37.80% of consumers of adulterated gasoline expressed their opinion against 0% of those of gasoline from service stations.
- Faced with the "quality" aspect, only 16.67% of consumers of petrol at service stations expressed their opinion against 0% of those of adulterated petrol.
- Faced with the “quick and always available accessibility” aspect, only 37.80% of consumers of adulterated gasoline expressed their opinion against 0% of those of gasoline from service stations.
- Faced with the aspect “it does not end quickly”, 6.10% of consumers of adulterated gasoline expressed their opinion against 16.67% of those of gasoline from service stations.
- Faced with the aspect of "no queuing and quick accessibility", 8.54% of consumers of adulterated gasoline expressed their opinion against 5.56% of those of gasoline from service stations.
- Faced with the aspect of "adequate locations", 38.88% of consumers of gasoline from service stations expressed their opinion against 2.44% of those of adulterated gasoline.
- Faced with the “other” aspect, 7.32% of consumers of adulterated gasoline expressed their opinion against 22.22% of those of gasoline from service stations.

The analysis indicates that adulterated gasoline is much more preferred by consumers due to its aspects which are: cheaper and always available then quick accessibility and always available unlike gasoline from service stations.

The number of consumers according to their attitudes towards the rise in the price of the gasoline they buy, which are: continue to buy and turn away from it in favor of the less expensive one.

- Only 9% of consumers said they would continue to buy this gasoline.

- Only 91% of consumers said they would turn away from this gasoline in favor of the cheaper one.

The analysis makes it possible to understand that as long as adulterated gasoline is available, accessible and less expensive, they will always prefer it to that of the service station. Also, the few times that consumers flock to service stations are periods of adulterated gasoline stock-outs during which the cost of purchasing adulterated gasoline is remarkably higher than that of station gasoline. -service. This shows that the financial aspect is one of the most important determinants that cause problems for consumers in terms of access to fuel.

3.3 Supply issues

Figure 8 presents the synthesis of the various problems of supplying the populations with fuel.

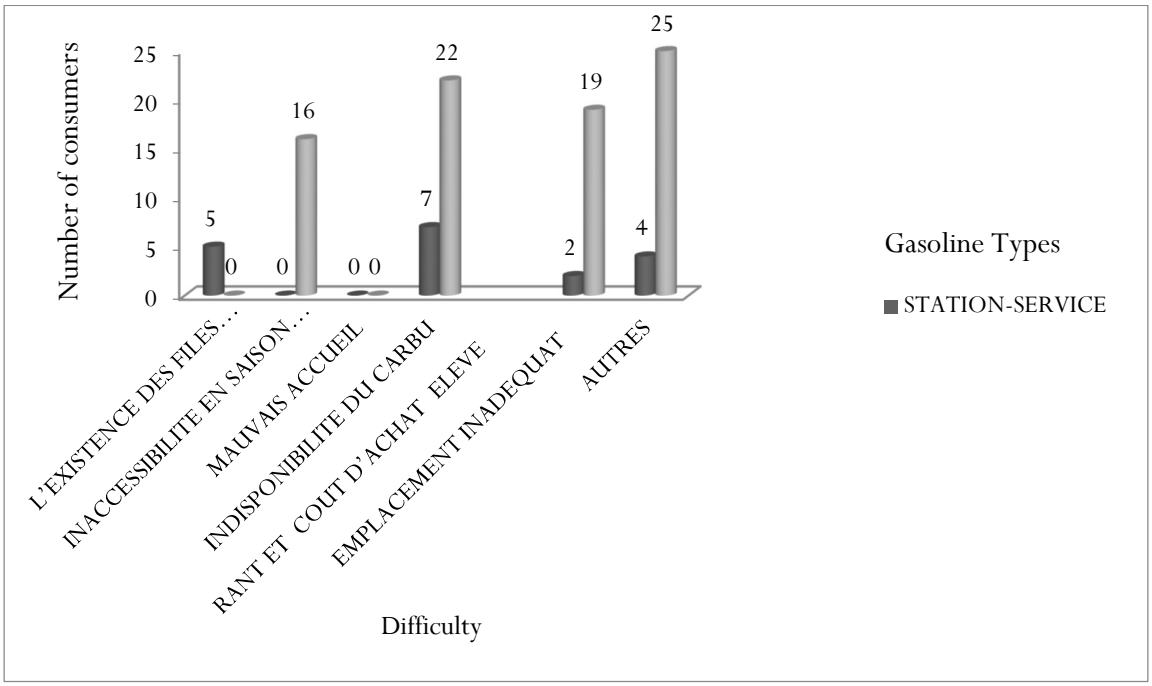

Figure 8: Number of consumers by type of gasoline due to difficulties encountered

Source: Summary of fieldwork, April 2022

Figure 8 presents the number of consumers by type of gasoline due to the difficulties encountered. These are gasoline from service stations, adulterated gasoline and the reasons are: existence of queues, inaccessibility in the rainy season, poor reception, unavailability of fuel and high cost of purchase, location inadequate and others.

From the analysis of this figure, it appears that:

- Faced with the "existence of queues" aspect, only 27.78% of consumers of petrol at service stations expressed their opinion against 0% of those of adulterated petrol.
- Faced with the aspect of "inaccessibility in the rainy season", only 19.51% of consumers of adulterated gasoline expressed their opinion against 0% of those of gasoline from service stations.
- Faced with the "bad reception" aspect, none of the consumers of gasoline from service stations or of adulterated gasoline have spoken.
- Faced with the aspect of "unavailability of fuel and high purchase cost", 26.83% of consumers of adulterated gasoline expressed their opinion against 38.89% of those of gasoline from service stations.
- Faced with the "inadequate location" aspect, 23.17% of consumers of adulterated gasoline expressed their opinion against 11.11% of those of gasoline from service stations.

- Faced with the “other” aspect, 30.49% of consumers of adulterated gasoline expressed their opinion against 22.22% of those of gasoline from service stations.

The analysis shows that the purchase of gasoline at the service station is criticized by consumers mainly because of the difficulties that are: unavailability of fuel and high cost of purchase then existence of queues. It is therefore appropriate to pay particular attention to these points.

3.4 Discussion

The various results of the present research confirm those of the authors of the discussion. Hydrocarbons are important for the growth of a nation because the operation of many and various transport vehicles depends particularly on their uses. Hydrocarbons are therefore of great interest to the economy. Therefore, each State must assign a major place to the oil sector in its development policy. Benin, which has an oil rig but no refinery, until recently exported crude oil and imported petroleum products on world markets (A. DIAKITE, 2016, p.19) because population growth , the he boom in economic activities, the development of industry and transport continually increase the demand for petroleum products (GN HOUNDJAKO *et al* , 2019, p.2).

However, the lack of official points of sale of petroleum products leads to the predominance of the informal sector in certain localities. Therefore, it emerges that despite the no less significant number of operators operating in Benin (PS AOUTCHEME *et al* , 2014, p.39-40) , it is the trade in contraband gasoline that absorbs approximately 95% of the companies in the country and is one of the activities of the Beninese informal sector that is the most difficult to understand, and has heavy impacts on the national economy (VJM KIKI *et al* , 2016, p.4).

The IMF (2012) shows that the prices offered by the informal gasoline sector in Benin are directly related to those prevailing on the official Nigerian gasoline market, which are relatively low because of state subsidies. Nigerian for oil. The Nigerian subsidy strongly promotes competitive prices for smuggled gasoline in Benin. This situation gives fraudulent Beninese importers a competitive price advantage on the gasoline market in Benin because formal Beninese companies are obliged to follow the "truth price" structure (VJM KIKI et al, 2016 , p . 5 **)** .

IV. Conclusion

Through this work, we studied the consumption of the population in gasoline, more precisely the distribution of the service stations and the accessibility to the fuel in the Commune of BOHICON. It is therefore noted that our investigations and the processing of the data collected confirm for the most part our initial hypotheses and allow us to conclude that the populations choose their place of supply of gasoline according to the competitive price, that is to say according to the lowest cost factor, not the highest quality factor. From here, we can note and understand that the disharmony between the number of population and the number of ISDPPs installed accompanied by the high price of gasoline at the gas station are the major problems that promote the amplification of parallel trade gasoline " kpayor " in the Commune.

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