AN APPRAISAL OF PIPELINES AND DEPOTS DISTRIBUTION SYSTEMS OF WHITE PETROLEUM PRODUCTS

(A CASE STUDY OF PPMC KADUNA AREA OFFEICE A SUBSIDIARY OF NNPC)

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(MBA/ADMIN/06282/93/94)

BEING A RESEARCH PROJECT IN PARTIAL FULFILMENT OF THE AWARD OF MASTER OF BUSINESS ADMINISTRATION DEGREE

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DECLEARATION.

I hereby declare that this research project has been written by me. The ideas, opinions, assumptions and errors in this project work therefore remain completely mine.

However, all information not original to this project has been duly acknowledged.

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A Case study of PPMC (Area Office A Subsidiary of NNPC Kaduna).

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DEDICATION

This Project is dedicated to all members of my family and particularly to my Parent, my Wives whose support and understanding have assisted in making the MBA Course a success.

ACKNOWLEDGEMENT

A study of this nature requires guidance and commitment. In the course of this work a number of individuals, many more than I can mention, in one way or the other gave token contribution, which invariable led to the success of the study. To all these people I give appreciation and thanks.

My special and sincere gratitude goes to my able supervisor Mrs. M. Akanet who gave me useful advise, counselling, encouragement and made numerous valuable criticisms and suggestions that made my project a reality. I equally thank my various Lecturers whose guidance contribution immensely assisted towards successful completion of this programme.

This acknowledgement is incomplete without extending my profound gratitude to the entire staff of NNPC Kaduna for their assistance. In this regard, I hereby express thank to Bashir, J; Habibu, M. and My entire family who provided me with most of the data for the project.

I also wish to acknowledge the contributions made by friends through their companionship and encouragement.

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ABSTRACT

Distribution and marketing of petroleum products in Nigeria has always been constrained by a number of problems. To alleviate the problems, the Federal Government established the Pipeline and product Marketing Company Limited as a subsidiary of the Nigerian National Petroleum Corporation (NNPC), which become operational in 1987. Has this company been effective'?.

In an attempt to determine whether the Organisation is effective in distribution and Marketing of Petroleum Products throughout the country, the performance of the company was measured against the set objective.

To measure the performance or otherwise of the company, analysis of petroleum products, produced by our local Refineries and products consumed in the country were made. Also analysis of products lifted by Pipeline from our four domestic Refineries were made. Methods of product transportation and the changes in transportation mode of refinery off-take were assessed. The growth of petroleum products retails outlets before and after the advert of pipeline Network system was also assessed.

The study attempts amongst other things to analyse as succinctly as possible the various factors affecting the products distribution. However, it deals with a

particular brand of products - "the white products". The recommendation and other relevant considerations and suggestions for better performance of the organisation were made.

Based on the analysis, therefore, the company was found to be effective in distribution and marketing of petroleum in Nigeria's.

CHAPTER ONE

1.O INTRODUCTION:

1.1 BACKGROUND OF THE STUDY

The significance of Petroleum Products to the Nigerian economy cannot be over emphasised. Petroleum is the mainstay of the Nigerian economy that provides at most 90% of the country's exchange earnings. Agriculture which served the country so well in the fifties and sixties have been relegated to the background with the discovery of oil in large commercial quantities in the seventies.

The history of oil prospecting and distribution in Nigeria dates back to 1908 when a German Company the Nigerian Bitumen Corporation started exploration in the Ararom area of the present Ondo state this was however interrupted by the outbreak of world war I in 1914.

In 1937, oil prospecting commenced in Nigeria by Shell D' Archy now shell petroleum was awarded the sole right to prospect for petroleum in Nigeria .It was in 1956 that oil was discovered in commercial quantity at Oloibiri in the Niger delta after sinking over #30 million Shell started oil production and export from this oil field in 1958.

In 1961, other companies such as Mobil, Gulf, Agip, Safrap (nowElf) Tenneco and Amoseas (now Texaco/Chevron) has started exploration for oil in the on-shore and off-shore areas of Nigeria.

Oil prospecting that started in 1958 with production rate of 5,100 barrels of crude oil per day saw the quantity doubling the following year and crude oil exports from Nigerian rose to 2.0 million barrels per day in 1972. Nigeria has since grown to be the 7th major producer in the world.

By 1998 it has grown to be the sixth largest producing company in the world.

Petroleum production has a long history in Nigeria which dates back to the period before petroleum refining commenced. Government became more involved in this aspect, when it developed local refineries in the seventies.

Petroleum products were hitherto evacuated from Port Harcourt and Warri refineries by road, rail and sea and this continued up till 1979. This system of distribution made oil tankers travelled from all nooks and corners of the country to supply oil from these two refineries, thus, in the long run became inadequate and there was acute shortage of petroleum products in the country. The additional storage facilities provided by the seven major marketers like Texaco, Agip, National, Mobil, African petroleum and Unipetrol were not giving sufficient products for the country. The problem was caused not because of lack of the

products but because of insufficient and inappropriate distribution network channels.

The federal government in an attempt to tackle this problem, constructing a nation wide petroleum products pipelines network totalling 4950 kilometres, which served as linkage to 30 storage terminals. The pipelines and depots were commissioned between 1979 and 1994/95. In addition the Kaduna refinery was also constructed to tackle the problem of petroleum shortage in order to minimise the risk-involved n the long distance haulage of finished products by roads and rails.

The pipeline networks can be classified into fire categories made up of pipelines sizes ranging in diameter between six and sixteen inches. All these are buried at about one metre below the ground. The network is divided into five systems. Both systems 2A and 2B have Mosimi as the common front, from Warri Via Benin and Ore; system 2A texminates at Mosimi. System 2B runs from Atlas to Mosimi and continued to Iiorin Via Ibadan Depot system 2C transports crude oil from the Gulf oil company's Escravos terminal Via Warri to Kaduna refinery. The system 2D takes off from the Kaduna refinery pipes containing refined products and runs in two directions first to Kano Via Zaria where there is a branch to Gusau and another to Maiduguri Via Jos and Gombe area office depots.

The federal government has in addition to pipelines system through the Nigerian National Petroleum Corporation (NNPC) granted licences to indigenes distributors known as independent marketers, this is to ensure that even people in the rural areas have easy access to petroleum products. Presently has a result of development there are more increase political, technology, social and economic activities in both rural and urban centres that call for the use of petroleum products more than ever before an this increased needs and usage of petroleum products has rendered the distribution system network explained above inadequate. Therefore this study is main to determine a more effective system of distributing petroleum products that will reach every Nigerian at an affordable price and at the right time and place.

1.2 STATEMENT OF THE PROBLEM

Petroleum product distribution in Nigeria is bedevilled by many problems, which has caused a great concern to the federal government and the general public. The demand for petroleum products in the country has been on the increased tremendously over the years. The commercial life and the economic activities of the country solely dependent on a petroleum product that require a steady and uninterrupted supply to all nooks and corners of Nigeria.

The major problem we have that affects our social, economic and other facets development is fuel shortages, which became acute in 1974 and 1975. And this

almost caused total collapse of the Nigerian economy. The federal government took prompt action at this term in order to remove the constraints and bottlenecks in the supply and distribution of petroleum products throughout the country. The government then instituted a judicial commission of enquiry into the problem of these shortages of petroleum products in 1975. This was called the OPUTA Panel of inquiry.

One of the major recommendations issued to the federal government by this commission was increased in the local refining capacity and the establishment of the pipelines and depots distribution systems.

The pipelines network system came into existence between 1997 and 1982 and become one of the major channels of petroleum products distribution to all part of Nigerian parts of Nigeria. The Northern part of the country is covered with the supply of petroleum product by two out of the five systems currently in operation as already explained above. These are the 2c and 2D pipeline network systems, coupled with tanker lifting system.

Inspite of the adoption of this system, the problem of petroleum products shortages have persisted in Kaduna state in particular and other parts of the country in general. And this is the most singular major problem of this research

study, to determine a more effective system of distribution of petroleum products in other to minimize or stop the shortages in the country.

1.3 OBJECTIVE OF THE STUDY

The objective of this study research is to appraise the pipeline and depots system of distributing petroleum products and access the efficiency and effectiveness of the present system in used and where necessary to recommend more effective and efficient other system of distribution.

1.4 THE SCOPE OF THE STUDY

The study will concentrate on the distribution of white petroleum products such as:

- Premium motor spirit (P.M.S) - Petrol
- Dual purpose Kerosene (D.P.K) - Kerosene
- Automobile Gas oil (A.G.O) - Diesel

The study is limited to Kaduna and Kano depot storage terminals because of term and financial constraints. The period to cover is 1990 to 1997.

1.5 LIMITATION OF THE STUDY

The study is limited by the time span and financial constraints. The sample obtain is consider to represent our adequate research entity, therefore the conclusion

dawn from this sample adequately represents the factors of the system in Kaduna zone.

Petroleum industry occupies a very strategic place in the skim of things in this country, therefore this places some limitations in collection of information in this regard as most information is regarded as confidential, therefore is extremely difficult to extract some basic information from the people concerned.

1.6 SIGNIFICANCE OF THE STUDY

The importance of petroleum products to the notion, business and citizens of Nigerian cannot be over emphasised since it's the raw material around which a chain of commercial activities known petroleum industry involves. Its major some of energy in the world today and has become the bird rock of man progress. It has account for 90% of the nations earning.

Petroleum products are required for wide range of chemicals for the production of fertilizer fibres for manufacturing textiles and numerous other products essential for human existence. Petroleum jelly for body, candle and bitumen for tarred road.

On the other hand the importance of this study could be summary be seen in term of revenue generation, transformation of economy, regular provision of products

to fuel the economy, generation of employment opportunity and the multiplier effect which the oil industry has on the entire economy.

1.7 METHODOLOGY

The method of appraisal come from two sources namely primary and secondary date the primary data emanates from, questionnaires in order to access the contribution of pipelines and depots distribution system in Kaduna area office.

The secondary data which emanates from previous projects, these, annual reports documents from NNPC and PPMC e.t.c.

In the methodological frame work this study and also based on the nature of the topic, both primary and secondary data are sources required.

Primary data is usually the data that is gathered for the first time and this means that it has not been used by anybody. It's first hand information. This data will be obtained using questionnaire, which is a sub-method of survey research method.

The secondary data on the other hand is data collected from the second party and who must have used it for his own purpose but such data may still be very relevant to the problem at hand. That is why it is used in this study. The data is gotten using the following secondary sources, such as previous relevant project, annual

report and documentaries of NNCP as well as annual reports and documentaries of PPMC and other sources.

1.8 DEFINATION OF KEY TERMS

1.9 PETROLEUM.

Petroleum is mixture of hydrocarbon oils obtained below the subsurface in Nigeria, it generally occurs of depth below 1,500 metres.

1.10 WHITE PETROLEUM PRODUCTS.

This is a general name fuel used for light engines. This means all premium liquefied petroleum gas, dual purpose Kerosene, aviation and turbine Kerosene are regarded as white products.

1.1.1 INDEPENDENT OIL MARKETERS

These are wholly owned indigenous oil marketing companies granted operating licences by the government to market petroleum products.

1.12 BRIDGING

This is the movement of products by either road or on rail from one depot or refinery to another.

1.13 STREAMING

Streaming is usually used for a depot or location that has been officially finished and commissioned with loading of trucks.

1.14 DOWN STREAM

This comprises of all the activities from delivery to processing plants. These include refining and subsequent conversion to Petrochemical products, transportation and the marketing of finished products and related auxiliary services.

1.15 UP STREAM

It involves all those activities related to exploration discovery and extraction of oil and gas and their treatment, transportation and delivery to designated export terminals or o processing plants e.g. Refineries etc.

1.16 PHYSICAL DISTRIBUTION

This involves planning and implementing the physical flow of materials and final goods from points of origin to points of use or consumption to meet the needs of the customers at a profit.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION.

Prior to 1979, the pattern of petroleum products movements was done by Batch Sea or coastwise, rails, tanker wagon and road. The use of pipelines in the oil industry in Nigeria was introduced in 1979. The purpose of pipelines and depots network systems in the petroleum industry is to transport large volume of crude oil, gas and refined product, overland, from a fixed centre of production to a fixed centre of consumption.

The depots also store the products before it is being carried away. This study centres on the appraisal of pipelines and depots distribution system of white petroleum products of PPMC Kaduna area office a subsidiary of NNPC. This organisation has the responsibilities of distributing and marketing of petroleum products in Nigeria. To this extent therefore, there is need to have a good understanding on the physical distribution and marketing of petroleum products as well as the problems associated with it in Nigeria. On this account, this chapter attempts to provide a framework of petroleum products distribution and marketing as well as an insight on how other countries have succeeded in handing the supply of petroleum products to this people.

2.1 THE SUPPLY AND MARKETING OF PETROLEUM PRODUCTS IN NIGERIA

The first petroleum product to be marketed in Nigeria was "Sub Flower" Kerosene introduced by Socony vacuum oil company (now Mobil Oil) in 1907. Since then the marketing and distribution of petroleum products was in the hand of foreign oil companies and it was not until the 1970s that government took the decision to be involved in the development of petroleum products marketing.

At the moment there are eight major oil companies operating in Nigeria, namely: Mobil,Total,African Petroleum (Agip, Texaco, National, Unipetro and Elf. Apart from these companies, government through its "independent marketer" encouraged small-scale marketer to be involved in the production and marketing of petroleum product throughout the country.

At the early day of the oil industry in Nigeria, crude oil produced was wholly exported and local needs for the products were met through importation. However, in 1965, a refinery with a processing capacity of 35,000 barrels per day was established in Port Harcourt. The supply of "white products" from this refinery was enough to meet domestic demand and surplus oil was available for export. The processing was subsequently expanded to 60,000 barrels per day to meet increasing domestic demand. However, the economic recovery from the civil war in the early seventies was very rapid resulting in large increase in

demand for the products. The development resulted in acute shortage of petroleum products and government had to enter into offshore processing arrangements to refine Nigeria crude oil in Caracas and Rottersan for re-importation (Amu, 1983) Petroleum products consumption has been growing

In order to avert major crisis from shortages of petroleum products, government took a number of crucial decisions in the mid-seventies. Domestic refining capacity had increased to 260,000 barrels per day with the commissioning of Warri refinery of 100,00 barrels per day capacity in 1978 and the Kaduna refinery of 100,00 barrels per day in 1980. Government in addition constructed 3001 Kilometres of Multi-products and single-product pipelines making a total of 18 petroleum products depots strategically located throughout the country. The low level of liquefied petroleum Gas (LPG) production before the dramatic increase of 1979 was due to the fact that only one refinery owned and managed by the then Nigerian petroleum Refinery Company Limited, Port Harcourt, was in operation. With the expansion of refineries to include Warri and Kaduna Refineries in 1978 and 1980, Liquefied petroleum gas production was increased by more than 100 per cent.

The phenomenal increase in liquefied Petroleum Gas consumption is attributable to rapid increase in Urbanisation following the oil boom and the absent of clear-cut policies on income distribution between the Urban and Rural sectors of the

economy. Urban concentration led to increase in demand in liquefied petroleum Gas and Kerosene as fuel-wood and charcoal prices rose in response to demand pressures and government subsidies.

Nigeria imports petroleum products because the operating capacity of local refineries could not meet the demand. As a result government decided to build another 150,000 barrels per day refinery in Port Harcourt and also increased the capacities of Warri and Kaduna refineries by a process of debottlenecking which brought the total refinery capacity to about 445,000 barrels per day in 1990. Despite this increased refining capacity, the country still imports petroleum products. The Chairman of the National Economic Intelligence Committee (NEIC) Professor Sam Aluko was quoted saying "about $45 million (N36.5 billion) had been spent by Government in fuel importation between January and June this year. This figure is $51 million more than the $400 million budgeted for oil imports for the whole year. The huge imports, inspite of the fact that the combined output of the nations four refineries at 445,000 barrels per day, by far exceeds the 250,000 barrels per day was expected to be used up by the domestic market"3.

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3 Quoted from this Day Newspaper, (Lagos), 1996.

Fuel Imports, 23, July page. 1

2.2 INTERNATIONAL PETROLEUM PRODUCTS DEMAND AND SUPPLY.

The world energy marketing mix is quite difficult to forecast, this is because of the complex nature of various factors that determine their patterns. Certainly, events of the past few years have shown that the market has an unpredictable behavioural pattern and that has often rendered well-articulated projections grossly inaccurate. with regard to petroleum products, demand and supply balance are in general influenced by;

a. Economic factors such as growth rate;

b. Consumer behaviour;

c. Environmental factors and

d. Technical Factors.

The complexity and interplay of these factors in dictating energy requirement and supply make the forecast of future market situation almost impossible. However, analysts believe that world energy and indeed oil consumption will grow continuously but at a low rate in the next 10-15 years. In the highly industrialised countries. Considerable growth in demand is expected in the gasoline and the middle distillate range while the consumption of heating oil is likely to decline. It is also widely believed that rapidly growing economies of the less industrialised

nations of Asia and Africa will have energy demand growth far out pacing those of the organisation of European Community Development countries (O.E.C.D)4 Looking at the supply side of prospective markets United state of America has now sufficient refining capacity to meet her domestic needs while Western Europe has excess of her requirements.

This notwithstanding, many market watchers contend that stringent environmental regulations currently being put in most of these countries will eventually lead to short fall in supply. Some older and marginal refineries are likely to shut down while relatively newer ones would require high level of capital to install equipment needed impossible to fulfil. Moreover, petroleum-producing countries are progressively replacing crude oil sales with products export. This will restrain some United to meet regular standards. It is, of course, becoming increasingly difficult to built new plants in the United States, since permission requirements are practically States and European refineries and make their products less competitive in the market. We are all aware of the market implications and the strong challenges that the creation of an America free-trade zone (being planned by the united states, Mexico, and Canada) will pose. We are, also mindful of the fact that the collapse of the Soviet Union and the Communist block countries would affect oil market dynamics but it can be reasonably assumed that the impact

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[4] See Export oriented refinery and export processing zone. Lecture delivered at a seminar organised by the Calabar Chamber of Commerce and Industry, Calabar. NNPC Public Affairs Publication, 17-18 March 1992. Pg. 8-10

on the petroleum products supply will take some time to manifest.

Regardless of the foregoing Nigeria's export refinery should be able to have a niche in the major market of Organisation of European Community Development (O.E.C.D) countries but more importantly bigger markets will open-up in the growing economies of Asia and Africa where consumption, currently is lagging behind those of Organisation of European Community which is expected to increase significantly.

At home such refineries could be called upon, from time to time, to bridge shortfalls in local supplies.

There is, therefore, considerable assurance of very good prospects for our export refinery but being mindful of the fact that many oil exporting that are mining or already building such refineries are eyeing the same consumer, we should recognise the paramount importance of timely entry into the market.

2.3 ORGANISATION OF PETROLEUM EXPORTING COUNTRIES (O.P.E.C)

Production and Demand.

Bearing in mind that increase in domestic product demand and the advantages of expanding their market share in the inter-national product markets, member countries have been involved in various refining projects during 1991. In Latin

America, Venezuela is currently involved in down stream refinery unit expansion and modernisation. In Africa, Nigeria is reviving its domestic refinery units to full capacity following a series of refineries that have limited the country's potential as a supplier of gas oil and fuel oil to the international product market. Algeria and Libya have a begun to implement a programme to modernise and upgrade their refineries.

In the Middle East, Iran is constructing wholly new refineries at Bander Abbas and Arak and a condense refinery at Bander Taheri, with the completion of its second phase, the capacity of the Abadan refinery has been increased to 297,000 barrels per day. Iraq is also involved in modernising and upgrading its refineries. Kuwait's. Mina Al-Ahmadi, and Mina-Abdullahi refineries have been revived from war damages. Saudi Arabia has also embarked on extensive domestic refinery expansion and upgrading programmes to enhance the output of value-added products, mainly for export. The United Arab Emirates (U.A.E) has also under taken projects to expand and upgrade its domestic refineries. In the Far East, Indonesia has constructed two new refineries for domestic's consumption and export.

Early in the year 1992, Iraq recommissioned its Basrah refinery and this has restored its local refinery capacity to its pre-1990 Middle East crisis level. This total capacity is now excess of the country's domestic requirements (OPEC annual report, 1992) 5.

2..4 PRODUCT DEMAND IN ITALY AND JAPAN.

In Italy, the country's refining capacity amounts to 175 million tons per year, greatly exceeding to domestic demand of petroleum products, which is at present on the order of 100 million tons.

A large part of the refining capacity was build by private national operators who were during this period have giving 50 per cent of this refining capacity thus The first factor, wholly institutional is tied to the fact that a large part of oil activities are normally carried on by a small number of very large companies, in a market characterised by fast growing demand and by heavy competition, these companies have followed a policy objective aimed at guaranteeing in the future their individual market share. The second factor is tied to the noticeable advantages of larger refineries from the standpoint of unit production costs. The maximum size of the plant now operating in Italy is exceeding 15 million tons per year. On the other hand, the yearly increase of domestic demand during 1967-73 periods was equal to about 7 million tons. As s consequence, each individual company has increased its refinery capacity at a growth rate of its product demand. Today there are 33 refineries in Italy with total capacity of 175 million tons per year. Average unit refining capacity is therefore about 5.3 million tons.

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[5] See OPEC' Annual Report, 1992. Pg.23-24

[6] Stiliotti, G. (1975) Origin and Present prospective of ENI as Italy's National Hydrocarbon's Agency. A Lecture delivered at a *seminar on prospect of Arab refinery held Damascus Syria 18-23 October.Stiligiotti (october, 1975) 6*

However, only 17 of these refineries have capacities equal to or greater than the average while some plants have capacities below 2 million tons per year.

The dispersion of the refining activity among large number of plants has not been Japan is working towards diversification of energy sources to remove its dependency on petroleum products. Kuboto (October, 1975) [7] in his paper titled petroleum Refining Industry in Japan, write; "Since the beginning of calendar year 1974 like most other countries in the world, the diversification of energy sources has been strongly advocated, increased use of nuclear energy for electric favourable as well for the development of a rational system of pipelines for transporting products. This of course, is because, pipelines, generally are competitive means of transporting a large amount of products are involved, which obviously can be provided only by large size refineries.

generation and acceleration of import of liquefied Natural Gas (LNG) has been emphasised to alleviate dependency on petroleum. The share of petroleum energy in 1985 in Japan decreased to 63.9% from its 77.6% in 1973, while the shares of nuclear energy and Liquefied Natural Gas increased to 9.6% from 0.6% and to 7.9% from .08% respectively.

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[7] See Kubota, K. (1975) Petroleum Refinery in Japan. Proceedings of the seminar on prospect of Arab refining industry held in Damascus Syria, 18-23 October. For further discussion see the BP Oil Company, (1959). Our Industry The BP Oil Company, London.pg. 201-202.

2.5 PETROLEUM PRODUCTS DISTRIBUTION IN NIGERIA:

Prior to and after Commissioning of Pipelines.

The British Petroleum Oil Company in its book titled "Our industry" (1959) 8, Describes distribution of petroleum products to have completed when the products reach the final consumer. The book further described the organisation of the distribution companies and their distribution process. There are eight of such companies in Nigeria. They include, Mobil, Total, Agip, Texaco, Nlchem. Unipetrol, African Petroleum (AP), and Elf.

Since these Companies are multi-nationals, which have world wide operation, they normally market their products under their own trademarks and brand names. Side by side with activities of these "Major oil markets" is the competition posed by the activities of "independent oil marketers".

The book further asserts that it was usual for products to be refined near oil fields and later transferred to installations strategically located. The above principle though depicts what operates in United
Kingdoms (UK), represent to a large extent what obtains in Nigeria. The book compares products distribution system in UK with that of United States (US) and France.

"This quotation is adapted from Sfiliotti, G. (1975) Origin and present prospective of ENI as Italy's National Hydrocarbon's Agency. A lecture delivered at the seminar on prospects of Arab refining industry held in Damascus, Syria, 18-23 October.

Nigeria, in Contrary to the system of locating oil refineries near oil field in Britain and Italy refining facilities are located away from the oil fields. Sfligiotti in his paper titled, the experience of Ente National Introcarburi (E.N.I) as a national Corporation in the development and expansion of the refining industry in Italy, writes, "this accelerated development of oil refining industry in Italy in that that period can be explained on the basic of the general world trend to locate refining away from the oil fields (resources refineries) and near consumer markets (market refineries) or intermediate areas (intermediate refineries)9".

Such a tendency can be justified on the basis of a number of reasons, mainly of an economic nature, as indicated in the following:-

a. It is economically more convenient to move crude oil rather than the already refined products, larger tankers could be employed, the facilities for oil receiving and movement (ports, rails roads, and pipelines) are less complex and less expensive.

b. Nearness to market allow sitting and structuring of refineries as a function of demand patterns of the individual area to be served.

c. Certain refinery products due to either chemical and physical characteristics or the small amounts involved, cannot easily and economically are transported over long distances.

d. Crude oils of different sources and quantities can be processed in order to tailor refinery production according to the products local demand

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[9] See Schatzi, L.H. 1969. Petroleum in Nigeria. Oxford University Press, Ibadan, pg. 223.

From the monetary point of view, the purchase of these crude by Nigeria instead of middle distillates required for the petrochemicals. Feed, results in currency saving and therefore an important factor for the country with heavily deficiency trade balances.

According to L.H. Schatzi, in his book "Petroleum in Nigeria" published in 1969, the Nigerian Petroleum Refining Company (NPRC) Port Harcourt in 1959 was the result of the agreement reached between the company and the shell B.P. The refinery was constructed between 1962 and 1965. It was commissioned in 1965.

On distribution of petroleum products, Schatzl worked on the regional consumption of petroleum product. He divided the country into three zones in line with individual oil companies' zones of selling operation. Zone one was made up of Lagos, western and Northern region respectively. From his assessment the oil companies distributed 61% of the country's total oil trade in zone one in 1964,zone two disposed of 21.5% in zone three. Schatzl used local concentration of retail outlet within the three zones for determining the regional consumption of petroleum products.

Schatzl discusses the distribution of petroleum products before and after the premier refinery in Port Harcourt in some lengths. His work pointed out that there were two base depots situated in Apapa and Port Harcourt. In addition, there were

intermediate depots in the hinterland. These played an important role in the distribution of products in Nigeria. Individual oil marketing companies owned the storage depots. However, the severe shortages of petroleum products experienced in the country during 1974 and 1975 were attributed to poor distribution network for the products. Storage facilities provided by the individual oil marketing companies were inadequate to hold sufficient stocks for the country's consumption. To solve this problem the government abolished all the storage depots owned by the marketing companies and established seventeen

(17) Storage depots nation wide under PPMC a subsidiary of NNPC. (The depots also store the products but its being carried away. Our studying centres on appraisal of pipelines and depots distribution system's of white petroleum products of PPMC, a subsidiary of NNPC).

Prior to opening of the refining at Port Harcourt about 7% of Nigerian Petroleum Products requirements were distributed from the base depot at Port Harcourt in 1964. Similarly, the depot at Apapa supplied 56.4% of the national demand. The products were transported to the depots in Western and Northern Nigeria by railway and Inland waters.11

With Commissioning of the Port-Harcourt refinery the individual oil companies lift products from it. The companies may choose to deliver to end-user or deliver at their depots.

Schatzl concluded his work with a projection that products would be supplied from Port-Harcourt refinery to all depots in the North. That Jebba and Lokoja would by barger through Niger. He asserts that railway line running Northwards from Port Harcourt will transport 1/6th of the total consumption in future.

Schatzl worked with available data in his time to project the future of products distribution. Perhaps, he underrated the rate of change and development of Nigeria.

The Nigeria economy has increased and is increasing every day. For example, in the period 1975-1980, growth in domestic consumption rose by an average of 19% annually, to reach 250,000 barrels per day in 1984. There is therefore, a need for reliable and effective distribution and marketing system in the country, which is being addressed by this study.

Abubakar (October, 1987)12, in his work, titled the effectiveness of Pipelines and depots system as a solution to petroleum products marketing in Nigeria, assessed the pipelines and depots system as an efficient one. He wrote, "Consumption and distribution of petroleum products (gasoline, Kerosene and diesel gas oil) has increased by an average of 7% when compared with what was distributed between

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[11] Adapted from the works of Schatzl, L.H. (1969) Petroleum in Nigeria. Oxford University press, Ibadan. Pg. 223.

1975 -1979 when pipelines network was yet to be fully operational, if one considers the economic activities of the 70s and downturn of the 80s, a decrease rather than an increase would have been envisaged. On this note, the pipelines and depots system has therefore improved the distribution of petroleum products in the country".

He also found that pipelines off-take of products produces by all the nation's refineries between 1980 -1986 totalled 68% as against 32% moved by other transportation modes. According to him, on this alone pipelines network has been effective method of distribution of petroleum products in the country. He was of the view that without the pipelines system, the incidence of petroleum products shortages would have been wide spread to the extent of crippling the Nigerian economy.

Abubakar, also noted that the petroleum licensed retail outlets throughout the country have been showing increasing trend since 1974. He pointed out that the proliferation of many indigenous filling stations (independent Marketers) would not have been possible without pipelines network and depots system.

However, the fuel scarcity, which the country experienced, recently (from 1993-1994), clearly shows that provision of pipelines network alone is not the only factor to reckon with in ensuring effective petroleum products distribution in the country. Other factors such as smuggling, diversion, hoarding, Illegal bunkering

[1] The quotation in this paragraph is drawn from the works of Abubakar. A (OCT. 1987) The Effectiveness of pipelines and depot system as a solution to petroleum products marketing in Nigeria, 1982-date. Unpublished MBA Project, ABU Zaria, pg.77

etc. of petroleum products play an important role in contributing to the *ineffectiveness in the distribution of petroleum products in Nigeria.*

In his work titled, "Distribution problems and determination of future demand for petroleum products in the Northern states of Nigeria". Isiaku (1982), noted some problems of products distribution related to operations emanating from NNPC to include;

a. Breakdown of loading equipment in the depots and lack of spare parts. Distribution petroleum's and determination of future demands for petroleum products in Northern state of Nigeria. Unpublished MBA project ABU, Zaria.
b. *Disruption of loading operation as a result of tank-truck driver's strikes.*
c. Diversion of products by tankers driver
d. Inadequate programming and planning of trucks by marketers
e. Inadequate retail outlets especially in rural areas.

On the other hand, the severe shortage of petroleum products, in the country during 1975 was attributed to poor distribution network for petroleum products. Shortage facilities provided by the seven petroleum-marketing companies were in adequate to hold sufficient stocks for nations consumption. To solve this problem therefore, the government embarked on the construction of a countrywide petroleum products pipelines network totalling about 3000

[11] The problems of product distribution quoted in this paragraph were discussed in details in the work of Isiaku, M.A. (1982).

kilometres lined to terminals (Depots) in seventeen (17) towns. Four "white products" namely: premium motor spirit (petrol), five star Motor spirit, Dual purpose Kerosene (domestic kerosene), and Automotive Gas Oil (Diesel Oil) are handled by this transportation and storage.

There are five area offices all over the country they are:

Warri, Port Harcourt, Mosimi, Kaduna and Gombe. The Kaduna area office has the following depots at:- Kaduna Kano, Gusau and Suleja. The Kaduna area Office like any other manages the installations, depots, pipelines, pump stations etc. in its area. By far, the depots handle a large proportion of white products sales. However, some special products like Base-Oil, paraffin Wax, Fuel oil, etc. are sold only from the depots at the refineries. As already mentioned above, there are seventeen (17) depots strategically located all over the Country. It is from these depots that the various petroleum products marketers (major and independent) buy stock to dispense to their filling stations.

2.4 PIPELINE AND DEPOTS FACILITIES TO KADUNA PPMC

It is the system 2C pipeline which originates from Warri that transport crude oil to Kaduna refinery the crude oil is pumped from Gulf oil (now Chevron) Company's Escravos terminal to Warri via the Escravos - Warri pipeline which supplies crude oil to Warri refinery. System 2D consists of the pipeline from the Kaduna refinery storage to Kano Depot via Zaria pump station where it branches to Gusau Depot.

Another pipeline Originates from the Kaduna refinery to Maiduguri Depot via Jos and Gombe Depots; each of the pipline ranges from 6 inches to 16 inches.

System 2E runs from Port Harcourt to Maiduguri Depot via Aba and Enugu Depots. The only Depot within the NNPC pipelines system not connected to any other by pipeline is the Calabar Depot. All pipelines are buried about one metre below ground.

In addition to the facilities already mentioned, there are pump stations at Atlas cove, Mosimi, Ibadan, Kaduna, Zaria, Gombe, Warri, Ore, Port-Harcourt and Enugu. On Warri-Kaduna pipeline, there are operating booster pump stations which are located at Auchi, Abuja, Izom, Abudu, Lokoja and Sarkin Pawa (figure3). There are additional Deports located at Suleja, Minna and Yola which were commissioned in 1995.

2.6 METHODS OF PRODUCT TRANSPORTATION.

Four major forms of transportation of petroleum products in Nigeria are rails, road, water vessels, and pipelines systems. Table 2.7 indicated changes in transportation mode of refinery off-take from 1977-1985. As at 1985, 46.79 percent of Nigeria's refinery off-take was through the pipelines systems, while 26,62,25,12 and 1.47 per cents were transported by roads, sea, and rail respectively.

Table 2.7

CHANGES IN TRANSPORTATION MODE OF REFINERY OFFTAKE 1977-1985

YEAR	ROADS		RAIL		SEA		PIPELINES	
	% SHARE	CHANGE OVER PREVIOUS YEAR	% SHARE	CHANGE OVER PREVIOUS YEAR	% SHARE	CHANGE OVER PREVIOUS YEAR	% SHARE	CHANGE OVER PREVIOUS YEAR
1977	39.4		9.4		51.2			
1978	50.2	10.8	6.6	-2.8	43.2	-8	43	
1979	36.9	-13.3	4.4	-2.2	37.2	-6	12.5	-21.5
1980	32.4	-4.5	2.7	-1.7	31.2	-6	33.7	12.2
1981	30.2	-2.1	0.9	-1.8	25.3	-5.9	43.6	9.9
1982	26.2	4	0.9	0	22.8	-2.5	50.1	6.5
1983	28.4	-2.2	0.8	-0.1	22.9	-0.1	47.9	-2.2
1984	23.9	-4.5	1	0.2	22.7	-0.2	52.4	4.5
1985	26.2	2.7	1.47	0.47	25.12	2.42	46.79	-5.6
TOTAL CHANGE 1977-1985		-12.8		-7.93		-26.1		3.8

Source: NNPC ANNUAL PETROLEUM PRODUCTS STATISTICAL BULLETIN 1985

2.7 BILLING AND COLLECTION OF PETROLEUM PRODUCTS SALES:

Billing and collection of petroleum products sales is one of the key aspect of marketing operations is PPMC. This important activity is carried out by various departments in the company. These include supply and distribution departments, sales department and Finance and Accounts Department [4]. The functions of each of these department would be examined.

2.8 SUPPLY AND DISTRIBUTION DEPARTMENT:

Supply and Distribution Department (S&D) is the charged with full responsibility for scheduling physical movement of petroleum products. As the name implies, it collates marketer's product requirement and distribution and schedules supply to meet those requirements. It sets the price for domestically consumed products taking into account governmental regulations. It keeps track and movement of products using information such as stock balance and out turn reports from Depots. At the instance of S&D, products are moved from one storage facility to another. For example, from jetties to Depots using vessels.

2.9 SALES DEPARTMENT:

Sales Department is essentially responsible for sales of all petroleum products for both domestic and international marketers. It negotiates with buyers on destination, quality required and determines the price and mode of payment.

[4] Much in this section is drown from the works of billings and collection, school for PPMC staff, instructors guide, April to June 1990 edition NNPC public affairs publication pg. 1-5.

2.10 FINANCE AND ACCOUNTS DEPARTMENT:

Finance and Accounts Department (FAD) is responsible for all finance accounting matters in PPMC in this respect, it is solely responsible for billing marketers and collecting payments accruing to the corporation. This function is performed by placing billing staff at Depot where the primary documents for billing (invoice) is originated FAD keeps ledgers for all marketers and therefore is in a position to determine and inform management on the level of indebtedness of each marketer.

2.11 INTERFACE BETWEEN SUPPLY AND DISTRIBUTION DEPARTMENT, SALES FINANCE AND ACCOUNTANT DEPARTMENT.

Having mentioned briefly the functions of each of these departments, let us examine the interface between them.

For the purpose of billings and collection, FAD is the collection centre and I will therefore relate the functions of the Departments to it. S&D is linked to FAD through bills of loading for lifting made in barges at jetties which are passed on the FAD together with the out-turn reports. S&D affect this transfer of document after it has checked the transaction for accuracy in quantity, price and destination. Sales department raise involving notes for export and banker sales, which are passed together with bills of lading to FAD for invoicing.

Since each of these units has an impute into what eventually becomes the marketers statement, it is imperative that each and every one of them does so within the minimum stipulated time in order for the marketer to get the statement on time. Timely delivery of products states would enable FAD collect payment of time, which is the ultimate goal of the system.

2.12 THE PROCESS OF BILLING AND COLLECTION:

PPMC Depots basically deal in "White products" which include premium motor spirit (PMS), Dual purpose Kerosene (DPK), and Automotive Gasoline oil (AGO). The exceptions are refinery depots that also deal in special products like Base Oil. Asphalt, Benzene, Wax etc. The refinery depots include Warri, Port-Harcourt, and Kaduna Returns from these depots include invoices, meter tickets, and invoice listing sheets, these are sent by all depots to headquarters. The process is as follows:

1. Sales supervisor prepares meter tickets based on allocation by sales
2. Depot billing staffs raise invoices and are checked by the marketers representative, who collects the original copy 24 hours after the products is lifted.
3. Depot Accountant batches Monday to Sunday invoices on the 8th to 9th day following the fiest day of lifting.

4. Depot Accountant delivers the batch to the area office on the morning of the 10th day.

5. Area office delivers consolidated batches from all these depots within the area to PPMC FAD headquarters, on the 11th day.

6. PPMC FAD, headquarters compiles and relay delay report via a radio message to defaulting area offices/depots, at the end of the day 11.

7. Receiving officer in Lagos despatches the invoices on day 12 to the computer room for processing.

8. The schedule offices (computer) process the depot returns to form part of the consolidated marketers sales report.

2.13 SOURCES OF DISP0UTES BETWEEN PPMC AND MARKETERS:

There are three major sources of disputes between PPMC and Marketers at the depots. These include the following:

a. Over-invoicing or under-invoicing

b. Arithmetic error

c. Volume disputes.

Over-invoicing or Under-invoicing

Over-invoicing or under-invoicing occurs when wrong rates are used to invoice a marketer for example, when domestic rates are used to bill export sale, sales or when bunker lifting are invoiced at export rates or vice versa.

Arithmetic error.

This occurs when there are errors in the arithmetic of volume of products lifted multiplied by its price.

Volume disputes.

This is commonly found in jetty lifting where volume of shore and offshore readings differ. The same applies to the Apapa marketers joint facility where products shared amongst the marketers need to be confirmed by each marketer.

2.14 PROCEDURE FOR DISPUTE RESOLUTION OF DEPOTS:

Disputes are usually resolved at depot level. If there is any discrepancy the marketers representative at the depot or the billing staff would point it out. Thus the billing staff and the sales supervisor will resolve it immediately. In a situation where wrong rates are used to bill a marketer resulting in over or under invoicing, a credit or debit note respectively are issued to the marketer immediately.

This study centre on appraisal of the pipeline of and depots distribution systems of white petroleum products in Kaduna area office. The literature review revealed the role of the company in this aspect and even the distribution it (sales) and production problems encountered by more developed (such as United State, Japan and Italy) which are yet to be witnessed in Nigeria.

It is our intention therefore, to learn from mistakes and experiences of these countries that have been in this business before us. The work attempts to quality the effectiveness of the Company in performing its corporate functions. To do this we weigh the set goal against the performance of the company.

3.0 **INTRODUCTION:** Petroleum production and marketing has a long history in Nigeria which dates back to the period before refining commenced as earlier mentioned. Government becomes more involved in this aspect when it develop local refineries in the seventies.

Petroleum product were hitherto evacuated from Portharcort and Warri refineries by road, rail ad sea, this continued till 1979. This means trucks travelled from all nooks and corners of the country to lift oil from the two refineries. Thus, in the long run became inadequate and there was acute shortage of petroleum product in the country. Even the additional storage by the major oil marketers was insufficient for the nation.

Hence the construction of nationwide petroleum product pipelines by the Federal Government in 1979 totaling 4,550 kilometer which linked to thirty (30) storage terminals. Pipeline depots were also commissioned between 1979 and 1995.

3.1 HISTORICAL BACKGROUND

The Pipeline and petroleum marketing company (PPMC) as a subsidiary of NNPC was incorporated in November, 1998. The emergence of the company was in no way accidental but as a result of pains taking of revotionalizing and

modernization as well as commercializing the activities of the NNPC and it integral parts.

3.1.2 HISTORICAL ANTECEDENT:

By February 1979 following Porthacourt-Aba-Enugu, Makurdi pipeline system, the need to have an organization to operate and manage the system became necessary. A pipeline unit was consequently established. An American Company William International group incorporated (NIG) provided technical backup to the unit.

No doubt, NNPC has a long tradition of an experience in marketing petroleum products. The former product marketing of the commercial division for has long been responsible for distribution and marketing of petroleum product both in domestic and export markets.

Therefore, the merger of both department to the pipeline and products marketing division (PPMD), in 1982, was natural.

In 1985 NNPC was reorganized into sectors. For the first time, well defined corporate objectives emerged. The pipeline and products marketing sector (PPMC) was formed through and the merger of the pipelines operation division (POD) and the product marketing and marine transportation operation division

(PPMTD) PPMS latter metamorphosed into PPMC during the 1988 reorganization.

3.2 OBJECTIVES OF ESTABLISHMENT OF PPMC

OBJECTIVES: the PPMC as a subsidiary of NNPC was set up to provide excellent customer services by transporting crude oil to the refineries and moving white petroleum product to existing and future markets as well as maintained efficient and at low cost through network of pipeline and depots. It is in charged with the execution of the corporation business in its area.

On the other hand its mission is to profitability and efficiently market refined petroleum and petrochemical products in the domestic market as well as in ECOWAS subregion and provide marine services.

3.3. ORGANIZATIONAL STRUCTURE OF PPMC

3.3.1 **THE STRUCTURE:** The company has a ten man board, under the chairmanship of a most economists and management consultant.

The Management team is led by the Managing Director and Executive Directors. One is in charge of operation and the other services respectively.

and the product which are sold at the seventeen (17) depots across the country. The Pipeline are delineated as follows:

System	2A Warri-Benin-Ore- Mosimi (PMS, DPK, AGO)
System	2B Atlas Cove- Mosimi- Ibadan- Ilorin (PMS, DPK, AGO)
System	2C Crude line Warri to Kaduna (Escravos- Kaduna)
System	2D Kaduna Portharcourt - Aba- Enugu- Makurdi (PMS, DPK, AGO)

3.4.3 MAINTENANCE:

In this aspect a there is a new awakening to maintenance culture in the nation; PPMC also mindful of its strategic role in the national economy is in the vanguard of this new awakening. Accordingly, there is a strong maintenance department is to ensure that proper function of all equipment and facilities. Both preventive and corrective maintenance are carried out.

3.4.4. MARINE TRANSPORTATION DEPARTMENT (MTD)

This section handle evacuation of petroleum from refineries through the use of costal tankers. At present it has 16 vessels on line 14 vessels for liquidified products and 2 for L.P.G i.e

Furthermore, it deals with overseas qrunning of the crude storage vesse4l. (Oloibiri) and the product storage vessles (MT TUMA).

The MTD also plays a role inthe importation of supplementary product and crude.

3.4.5 AREA OFFICES

This departments has earlier been fully mentioned and discussed extensively its only pertinent to say that each of this area offices has a manager, material management superintendent, commercial superintendent, Deputy Manager maintenance Deputy Manager Account, Deputy Manager Pipeline and corrosion and tanks, superintendent fire and safety, deputy manager Administration and personnel as well as deputy manager operation.

All the depots in the country are under these area offices, strategically located all over the country. For instance the Kaduna area offices four (4) depots under its that is Kaduna, Kano, Gusau and Suleja as earlier mentioned It is from some of these depots that various petroleum products marketers (Major and independent) buy stock to dispense to their filling stations. It can be observed that the depot is very strategic unit in the distribution chain between the refinery and the product consumer.

In fact most of the independent, marketers are required to pay before being allowed to lift any product from the depots. They are thus referred to as cash

customers. The major marketers on the other hand may lift from PPMC finance and account main office from Abuja, these are the credit customers.

3.4.5 SERVICES DIVISION

The Services division in itself consist of the following:

- Administration and personal APD
- Finance and Accounts FAD
- Data Processing
- Public Affairs
- Planning.

The function of the APD and FAD in Administration and personal the Human Resources Development section is responsible for the career development of every member of staff. They do this by mapping out a training programme for every member of staff and this programme is some times carried out in alliance with the corporate Human Resource development Department. On the other hand in FAD ie. Finance Account Department there a section whose activities must be highlighted to it's the petroleum products sales Accounting section, PPS Accounting keeps records of the sales of all petroleum products and the payment for them. Its also know as "Billing section" As it was described above there 2 types of customers: Cash and carry customers (i.e the independent markers, the other the major marketer. The 1st category are expected to pay before they carry products, Subsequent, the depots forward record of all payments by Such

customers as well as their concomitant lifting to the billing section the Headquarter this procedure differs in respect of credit customers. In this instance the customer is allowed to lift product or request. The depot them raise and invoice on the transaction. A copy of invoice is giving the customer while two copies are suet to the billing section now use its copies to prepare weekly statements of account which are forwarded to the customer to demand to demand payment for the lifting invoice of the customer is expected to pay his bill on receipt of this statement.

THE MARKETING OF ITS PRODUCTS:

3.5.6 COMMERCIAL SERVICES DEPT. (CSD)

The commercial Services department this is the depart that deals with marketing aspect of PPMC it has bear split into to fire sector's for effective performance. These are: Sales, Supply & Distribution, Liquidified Petroleum Gas, Petrochemical & Business Department.

3.5.1 SALES

The sale section is on responsible to all petroleum product in both domestic and international markets. This is especially.

necessary in case of product like: Fuel oil, base oil, paraffin wax, furfural extract and the suitability or other wise of introducing new product. This is in collaboration with plus product that are solo in the export market.

Product Sales are made through Eight major marketer-National, Mobil,Total,AP, ELP, Texaco, Agip, Unipetrol and 500 five hundred independent marketing companies who have numerous dealers all over the country. The products are lifted by marketers trucks at depots nearest their out lets. The purchase these goods at depot/refinery prices sell at the approve pump prices. Product short at the depot is met by bridging from the next depot or from other area at no extra cost to marketers.

3.5.2 BUSINESS DEVELOPMENT (BD)

This section is responsible for monitoring the marketing place (domestic and international) to Asses how any event or activities affect P.P.M.C.'s fortunes. B.D also monitor the performance of the existing products as well as survey the feasibility or other wise of introducing new product. This is in collaboration with refineries and corporate R.A. Again this is a good development as marketing strategy is concern.

3.6.0 THE DISTRIBUTION SYSTEM OF PPMC

3.6.1 SUPPLY & DISTRIBUTION DEPARTMENT

S & D is the section in charge with full responsibility of for scheduling physical movement of petroleum products of PPMC as earlier mentioned. As the name implies, marketer product requirement and distribution are scheduled to meet those requirement. It's set the price for domestically consumer products taking into account governmental regulation. It refineries, supply supplementary products whenever any shortage is anticipated in the supply from local sources arrange bridging between depots when products shortage occur on some part of the country. The supply and distribution department of PPMC also manage petroleum equalization fund.

3.7 GENERAL MARKETING PROBLEM OF PPMC

There is no organization without problem so also the case of PPMC the main problems with this company include the following:-

- Continued encroachment and vandalization of pipeline right of way. PPMC official are usually told by the vandals that the products they obtain from the pipeline belong to them, this is becoming a serious matter to the government too.
- Another problem of great concerned is the incessant break down of refineries, which is another factor to product shortage.

- Shortage of staff is another problem to the PPMC as the government has put embargo for employment lack of adequate office accommodation in the Headquarter to house all PPMC staff less than one roof.
- Partial computer operation also retards the flour of information in the organisation.
- Difficulty experienced in establishing LCS for off shore purchases of critical spare apart and non replacement of retired, terminated or dismissed of staff as stated above which placed heavy burden on available staff.
- Oil spillage is another source of Problem Company in recognition of the future challenges the PPMC has plan to execute some projects that would enhance it operational efficiency. The major projects to be purse are:

i Construction of cabala Jetty

ii PPL maintenance project

iii Construction of the revised PPL phase 3

iv Butanization phase I (ie to boost LPG production unit)

v Bonny export terminal (BET) construction

On the balance however, PPMC through its performance has prove to some extent to be viable venture a source of pride to NNPC and indeed the nation.

- Furthermore, with population of close 100 million people, huge debt service conittincency, industrial capacity under utilization, huge developmental needs and cash strapped economy/ suggest and welcome both indigenous and international capital investment and participation in PPNC as subsiardy of NNPC. To PPMC, this can occur either through leaks or damage to oil pipline or from accident involving tankers road truck or railway cars. Such may lead to contamination of varying areas of shoreline and soil. There exist become other structural problems. The company experiences some bureaucratic delays in taking some marketing actions for example the organization is expected to get corporate approval for some decision approved by its board and with the board limit.

3.8. THE FUTURE PROSPECT OF PPMC

INTERNALLY AND EXTERNALLY

In order to meet the challenges of the dynamic and complex future market the company has to have a in place a long range, strategic master plan till the year 2010. It also has to employ a scenario planning methodology as the world of business is changing daily in order to meet marketing competition successfully within and abroad.

In order to be the leader in business today it has to study its competitor very well and world wide.

THE METHODOLOGY OF THE STUDY

4.0 INTRODUCTION

Research methodology is referred to as a process of scientific inquiry and investigation to validate the existing knowledge and to some extent provide comprehensive and accurate information to management as an aid to rational decision. This chapter therefore, deals with the methods and research processes used to obtain the necessary data for the testing of the hypothesis as well as identify further research areas on Distribution network of PPMC.

4.1 DATA COLLECTION METHODS OF THE SUDY

As earlier mentioned in chapter one, the analytical tools had been used in this research. The importance of this method is to provide a comprehensive over view of the problems of Distribution in PPMC. To achieve this, two types of Data are required, these are primary and secondary data primary data is that which is obtained from original sources to meet a specified need secondary data is that which already exists within company records, or has been published by government, trade association, consulting firm.

4.2 SECONDARY DATA

This is ready-made information from the past records and various PPMC reports (Annual or periodic reports). Secondary sources available for this study are as follows:-

1. Government sources (CBN, OFN and Economic Digest Statistics) These are official documented or published statistical information which cover manufacturing, production, services, distribution and other miscellaneous sectors. The study extracted useful information on holding capacities of NNPC Depots in Cubic metres.

2. **An Examination of the PPMC'S Historical Performance**

Market size is estimated over a specific period and the PPMC'S sales to this market, broken down by product type, compared with past market levels. Among other things such an analysis can be expected to throw light on trends in market size, the trend in company performance, and the trend in product performance. Many of the PPMC sale's figure over the period of the research would provide useful information for this analysis.

3. **Major Oil Marketing Companies and selected Independent Oil Marketers records.**

Distribution of petroleum products requires extensive use of major oil marketing companies and independent marketers. Many records of petroleum products allocation and distributions amongst these companies are kept either in the PPMC

main office or with the companies such records present useful information about the products mostly marketed, the mode of distribution frequency of delivery and distribution problems encountered.

4.3 Primary Data

There are two principal methods of obtaining primary research data by observation, and by survey. The former technique has widest application in consumer research but is also relevant to the depots or refineries in two situations. Its on the spot record of data at each depot. The time priece was used in the processes .

1. Production processes can be observed giving the basic end use understanding which is essential to the refineries researcher the problems of fuel scarcity could be attributed to the failure of the existing machineries and the level of technology and diversion by marketers.

2. Products differential can be observed and thus can give some indication of product range application and in certain cases market share as well as distribution from various depots. As far as product range is concerned there are of course several limits on the information, which can be obtained by observation, but is help to fill gaps in the research's knowledge. On the time piece recorded the arrival time of truck at the depots while the second recorded service time.

4.4 Method for Data Collection

The man technique used to obtain data is the survey method. The survey instrument used to collect data for this research is questionnaire for convenience and better understanding the questionnaire is made up of closed ended and opinionated questions. The questions for the PPMC Staff independent marketers, oil companies and customers are grouped into five major categories as follows:-

4.3.1. Issues revolving around PPMC objective, marketing, strategies and its distribution policies. The essence of this is to solicit information from the management staff their candid view the effective distribution process of system of PPMC.

4.3.2 there are questions relating to PPMC Management and the distribution network of petroleum products. The research examined the planning, organising and co-ordination capabilities of PPMC. The problem of bureaucracy and lukewarm attitude, which may result to inefficiency in the distribution of petroleum products, are also examined.

43.3 Since the major and independent marketers are linked in the distribution system of petroleum products, the study has set questions to seek their views and

opinions and their roles in the distribution of petroleum products. Questions asked include, frequency of delivery, sources of supply, mode of transportation, use of own Or NNPC transport to lift petroleum and distribution problems encountered. The opinions of this group of respondents would enable comparative analysis with that of the PPMC management and some selected customers.

4.3.4. Questionnaire was also framework to solicit opinions form the final consumers who purchased petroleum products. it is well known fact that PPMC made wealth from the sales of the products. The generation of wealth arises from the interaction between the company with its skills, products and resources, and the immediate environment. It is the complex nature of the latter which created the need for this research. The consumers views on products mostly consumed, their satisfaction with the distribution of petroleum products, problems encountered in the consumption of petroleum products and their suggestions on how to improve the distribution problems of petroleum products are solicited though questionnaires meant for the consumers.

43.5 Those statements relating to corrective measures towards an effective and efficient distribution systems are examined through sets of questions. Meant for both management staff of PPMC, oil companies and independent marketers and customers.

4.3 PROCEDURE FOR DATA COLLECTION

4.4.1 Sampling Techniques employed

1. Sample techniques:

For convenience and better assimilation of information, the population of the sample has been drawn from Kaduna metropolis including the PPMC stuff. The probability or random sampling techniques had been used. By this, every member of the sample was randomly selected in order to give all members of the population a chance of being represented. General opinion of the population was thus formed from the sample selected. This sample size technique was selected because it is a true representation of the PPMC management staff, major oil marketing companies, independent oil marketers if petroleum products and the consumers of the PPMC products. This is because the population surveyed was divided into groups based on their operation and its unique characteristics.

4.4 SAMPLING METHOD

4.4.1 Sample size:

The researcher in a bit to curtail the problem of respondents unwillingness to answering question and also to achieve a higher response rate from respondents utilise the following:-

i. At PPMC the following respondents were served with questionnaires

a. The middle management staff of PPMC from different fields:

These included, the maintenance operation department, accounts Department, supplies and Distribution Department and Depot chief of some Depots.

b. Supply and distribution Branch managers and depots sales representatives of the oil marketing companies.

These respondents were particularly sampled for their knowledge of both the primary and secondary distribution system. They are field workers and responsible for the day-to-day operations of their various companies and therefore are familier with the problems of distribution. Another reason for the group is that as middle management staff, they are moiré opt to give honest answers to question posed. With this background twenty (20) questionnaires were administered to these respondents

i. **Major oil marketing companies:**

These are the eight major oil-marketing companies that are involved in the distribution of petroleum products. Two sets of questionnaires were administered to each of these companies.

The manager and one middle staff of these companies were served with the questionnaire. The reasons for these are to examine their operations and sources of supply of petroleum products in PPMC. The total sample size of 18 respondents was earmarked for this group of respondents.

ii. **Independent marketers**

There are many independent marketers registered by PPMC there is no precise ways to have a clear picture of their numbers. W tends to obtain information from the Depot centres and select only ten (10) for our purpose. Most of these independent marketing companies are involved in the distribution of petroleum products across the Northern regions. Their candid opinion on their operations, delivering source of supply and mode of transportation has been examined.

iv. **Consumers**

In order to compete the distribution process it was considered necessary to personally interview some of the consumers of petroleum products. This was to determine the extent to which they are satisfied with the distribution and the source of supply of petroleum products before and after pipeline introduction even though we cannot determine e actual population size of PPMC consumer, we have applied random sampling for fifty (50) of these consumers at various petrol station in Kaduna Metropolis.

4.5 DATA PRESENTTION AND ANALYSIS

For the purpose of analysing the data collected and the testing of the hypothesis mentioned in chapter 5, the percentage methods and cross tables are used. The nature of the questions put forward to the respondents necessitated the use of this method assembling of data has proved to be very difficult Notwithstanding, rating

scale, and tabular layout were used to present the data. The tabular form shows the respondents opinions in number and percentages. The content analysis was implored to examine the behavior of the parameters under study and the content of the data collected.

The secondary data were presented in tables. Each table has a title, the columns and rows as well as source.

VALIDITY AND RELIABILTY

To ensure validity and reliability of the questionnaire used in this study effort were made to ensure that the questions asked relate directly to the topic under investigation. In addition, the observation method has also used for various depots as well as records of information from the source. Its enable the research established if the result would tally with one another, this to some extent will found to tally as earlier mentioned.

CHAPTER FIVE

Data Presentation Analysis and findings:

5.0 Introduction:

Our objective in this research was to determine the efficiency of pipeline and depot system of petroleum products distribution in Kaduna zone. We have defined efficiency as the process of balancing the inputs and out puts of a system. In this regard, we were interested in determining the relationship between the services provided by the system measured by the time spent in the system and the cost involved in setting and maintaining the system.

The analysis centered on the operation of individual depots in the system. This could be regarded as a queuing problem involving a multichannel system. In this system therefore, units arrive randomly and take their place in waiting line if service cannot be obtained immediately. And the service discipline also revolves around a first come first serve criteria. The arrival rate is generally stated as the number of arrivals per unit of time while the service rate depends on the manner in which the servicing facility can handle the incoming demands and is expressed as a rate per unit of time. [1]

[1] Thierauf. R. J and Kiekamp, R. C. Decision Making Through Operations Research, New York, john Iley and Sons, Page 413.

The multichannel queuing theory treats the condition where service stations are in parallel and each element in the waiting line can be served by the same type of service and is equipped essentially with the same facilities.

The first unit in the waiting line enter the first service channel, which becomes available. The system contains service channels in parallel. The other channel in the system operates with a mean service rate of; the state of the system (number of elements at certain moment) can assume one or two values: this is no queue because all arrivals are being serviced (n.c.n.) or a queue is formed because the serviced demand by the arrivals is greater than the capabilities of the service stations in the problem (n.u.)[2]

[2] Schemidth, J.W. and Taylor, R.E. Simulation and And Analysis of "I" Industrial Systems. Homewood Illinois, Richard Irwin Inc. 1970 Page 327.

FIG. 5.1 **FLOW DIAGRAM OF UNITS ENTERING THE SYSTEM**

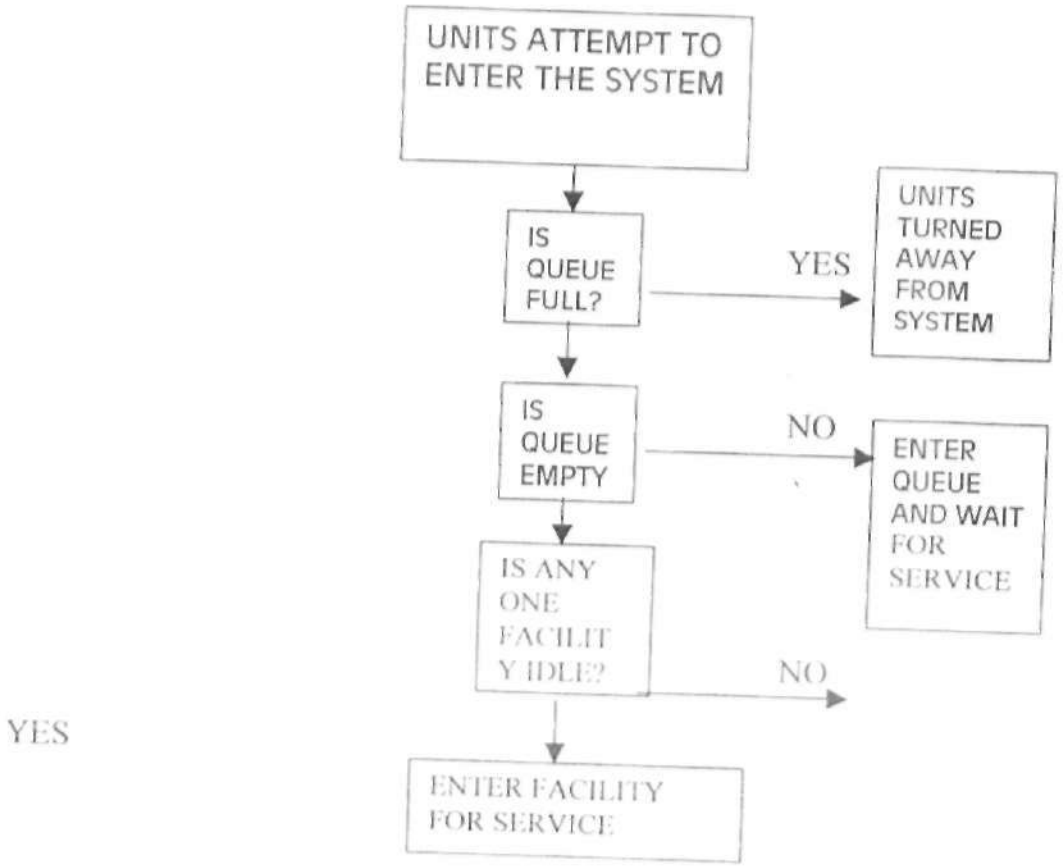
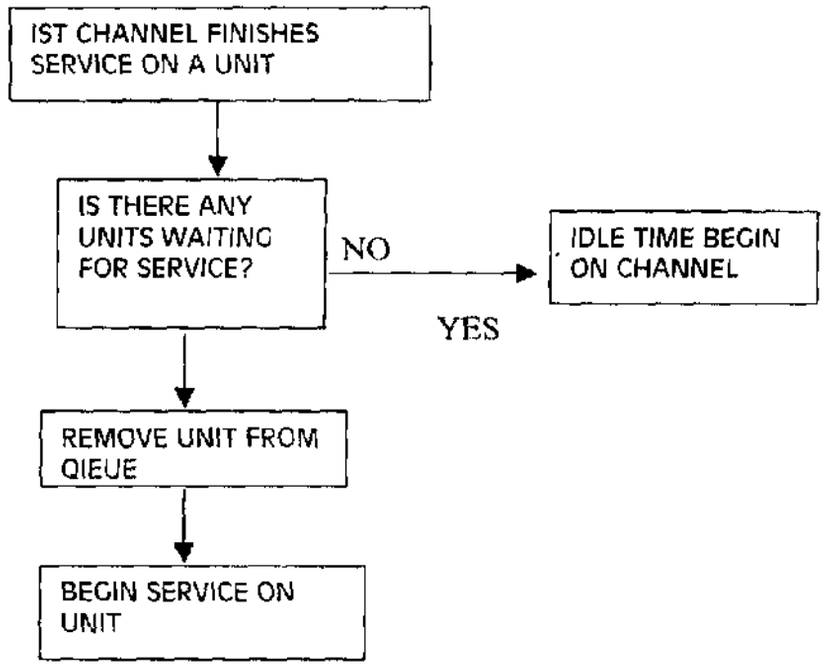


FIG 5.2 **THE FIRST SERVICE**



The system includes the units in the queue, the units being served, and the service facility itself

FIG 5.3 **DECISION GRID FOR FACILITY STATES AFTER SERVICE**

STATES		OUTCOME	
QUEUE NOT EMPTY	QUEUE NOT EMPTY	FACILITY BUSY	FACILITY IDLE
X		X	
	X		X

The facility will be busy after it completes service on a given unit when the queue is not empty, but when the queue it will not be busy.

FIG 5.4 **DECISION GRID UNIT STATES UPON SYSTEM ENTRY**

EVENTS UPON SYSTEM ENTRY BY A UNIT OUT COMES TO THE UNITS

	Queue not all	Queue empty	All N channel busy	At least one channel	Enter queue	Enter first available channel	Leave system
x							x
	x				x		
		x	x		x		
		x		x		x	

The figure illustrate that a unit can entered for immediate service only when queue is empty and at least one channel is idle in the system entry. If any other condition exit, the unit will enter and leave the system or enter the queue to wait for service, if more than one channel is available when the unit is ready to enter service .the unit will enter the first available channel. This implies that no preference

relationship exit between channels and the choice is rather a random one as long as no prior arrangement is made.

We have in the above discussion presented a brief framework upon which the system under consideration operates. Next, we shall make an attempt at discussing the method is the monte carlo simulation.

Simulation is useful in solving business problem where many values of the variables are not known or partly known in advance and there is no easy way to find these values. Simulation can therefore be define to be the action of performing experiment on a mode of a given system. Where system is defined as a collection of entities which act and interact together toward the accomplishment of some logical end. 3 Some of the advantage of using simulation in this regard includes:

(1) The model of a system, once constructed, may be employed as often as desired to analysis different situations.

(2) Simulation methods are handy for analysing proposed systems in which information is sketchy at best.

(3) Usually data for further analysis can be obtained from simulation model much more cheaply than from the real world system.

(4) Simulation methods are often easier to apply than pure analytic methods and hence can be employed by many more individuals.

5.5 THE MONTE CARLO SIMULATION APPROACH

This is attributed to the work of two great physicists at the los Alamos scientific Laboratory, Von Nevmann and U1am.

Basically, the Monte cattalo methods is a simulation technique in which statistical distribution functions are created by using a series of random numbers that is, instead of drawing sample from a real population, they are obtained from a theoretical counterpart of the actual process therefore involves interpreting random number and defining it to mean a particular variable state and its effect on the system fore a time period. Another s

State is defined for the next period of time and its related

3 schmidt, J. W. and Taylors, R. E. (Ibid) page 3335.

4 Thierauf, R. J. and Klekamp, (Ibid) page 449.

Effects are determined. This process of assuming a state and it's effect successive time is repeated for mary periods. The general procedures followed in Monte Carlo simulation, which we shall adopt in this study, include:

1. Determining the distribution of time between arrival and service time.
   Converting the frequency distribution to cumulative frequency distribution.
2. Assingning an appropriate set of random number to represent each value or range of value of the stochastic variable.
3. Conducting the simulation experiment by means of random sampling.

5.6 DATA PRESENTATION

How the data was collected!

The scope of the project under model once covered Kaduna Depot and Kano Depots. In each of these depots, the operation basically consists of the loading of petroleum produce on trucks or tankers that report daily at the terminus. The research got data trough observation and oral interview at the various depots. The data collected for this study falls into two classes the first class consisted of data on the inter arrival time of trucks at each of the depots and their frequencies. The second category consisted of the service time distribution.

The methodology used for collecting these data was the observation method as earlier mention. This involved on- the spot recording of data at each depot. Two timepieces were used in the 5 Buffs, B. S. Modern production and operations management. New York John Willey and sons. 1980 page 612.process. one time piece recorded the arrival time of trucks at the depots, will the second time piece recorded the service time.

These timepieces were number t and t2. T contained records on the time until the nest arrival to the system occurs. the other clock, t2 contained the time until service is completed on the unit in the service channel. The actual time values placed into these time pieces initially are general because we know both the distribution of inter arrival time as well as the distribution of service time. Hence

when a unit arrives at the system, all that is done is to generate an inter arrival time for the nest arrival and place this value in the proper column. Similarly, when a given unit enters the service channel we will generate its service time from the distribution of service time as reflected in our process generator and place this value in the proper column

For the propose of this project, we made certain assumptions in collecting the data for the analysis. These include:

1. Data on the arrival time of trucks at each depot on daily basic was collected for a period of ten hours. That is, we assumed that affective arrival starts at 6. 00 a.m and ends at 4. 00 p.m. daily. Similarly, the service facility was assumed to operate for a period of eight hours daily. That is, the loading operations start daily at 8. 00a.m and ends at 4.00 p.m.

1. We had assumed that each truck loaded at each of the depot has an average capacity of 30,000 litres of any of the products.

   Premium motor spirit (PMS)

   Automobile Gas oil (AGO)

   Dual purpose kerosene (DPK)

2. We had also assumed that only and produces were lifted from Kaduna Refinery, while only PMS, AGO and DPK were lifted from Kano and Jos Depot and.

3. Similarly, the data collected was based only on the number of loading arms currently in operation at each of the terminal. Thus there were ten in Kaduna Refinery, six at the Kano Depot and F Five at Jos Depot.

4. Since some sizeable number of trucks arrival at the Depots within the period 4.00p.m to 6.00 a.m. which is outside the scope of our analysis, we have assumed these trucks to have arrived during the first hours of our study. The actual data collection was carried out in all the seven days of a week since the depots operate on a seven – day a week schedule. An average was then calculated for both the arrival and service time distributions for the purpose of the analysis.

Table 5.7 Arrival Time Distribution: Kaduna Depot

PERIOD	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7
6 am- 7.00a.m	50	48	55	64	67	73	58
7 am- 8.a.m.	26	24	20	24	19	19	22
8 am- 9a.m	24	20	21	14	15	13	17
9a.m-10a.m	19	16	14	17	7	8	5
10a.m-11a.m	10	11	12	6	9	10	9
11a.m-12aNoon	8	6	5	11	3	7	7
12Noon11p.m	5	-	2	4	-	-	7
1p.m-2p.m	6	3	-	3	4	3	3
2p.m-3p.m	2	-	1	6	3	4	2
3p.m-4p.m	-	-	1	4	1	2	-
TOTAL:	150	120	131	153	128	139	141

Table 5.8 Arrival Time Distribution: Kano Depot.

PERIOD	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7
6 am –7a.m.	30	29	36	32	25	25	31
7am –8a.m	15	17	16	18	15	10	11
8am – 9a.m.	10	12	13	20	12	10	11
9am – 10a.m.	8	9	11	12	7	11	6
10am– 11a.m5	5	7	6	9	8	5	9
11am–12Noon	2	4	8	6	5	4	8
12Noon–1p.m.	2	2	4	1	5	5	5
1 p.m –2p.m.	5	3	-	2	6	3	1
2p.m – 3 p.m.	4	2	3	-	3	-	4
3p.m – 4p.m.	-	3	1	2	4		4
TOTAL	81	89	98	92	90	76	88

The same type of information was collected for the service time at the two terminals. Both classes of information were then averaged to get one set of information for the analysis. The figuares are based on minutes from zero hour to the last hour. That is the first hour, 6.00 a.m. was represented by 60 minutes.

5.9 DATA ANALYSIS MONTE CARLO SIMULATION

As we had started above, and some subsequent sections of this chapter, the actual Monte Carlo simulation center around the inter arrival time of units to the system, the number of occurrences within the inter arrival time frequency and the cumulating frequencies of both the arrival and service time distribution. The Monte Carlo simulation for this research project therefore started with the determination of the cumulative frequency the various time distributions at each of the terminals. This is presented in the tables below.

Table 5.10

Interarrival Time of Trucks and the Frequency Distribution at the three Distribution

(A) **Kaduna Depot** **Terminals (Given in Minutes)**

International	60 mins	120 mins.	180 mins	240 mins.	300 mins	360 mins.	420 mins	480 mins	540 mins	600 mins.
Frequency	59	22	18	14	10	8	3	3	3	1
Cumulative Frequency	59	18	99	113	123	131	134	137	140	141

$\frac{141}{100} = 1.4$

(B) **Kano Depot:**

International Time	60 mins	120 mins	180 mins	240 mins.	300 mins	360 mins.	420 mins.	480 mins	540 mins	600 mins.
Frequency	30	14	11	9	7	5	4	3	2	3
Cumulative	30	44	55	64	71	76	80	83	85	88

$\frac{88}{100} = 0.88$

The above information was then plotted in a graph with the cumulation frqwuency on the y –axis and the international time on the x-axis for each of the distribution terminals. This is show 5.5 and 5.6 Kaduna and Kano Depot respectively. The

service time and the frequency was also tabulated in the same way as the interarrival time. This is show in table 6.5 below for all the two units.

Service Time and the Frequency Distribution

At the two Distribution Terminals (Given) in Minutes

A. K aduna Depot

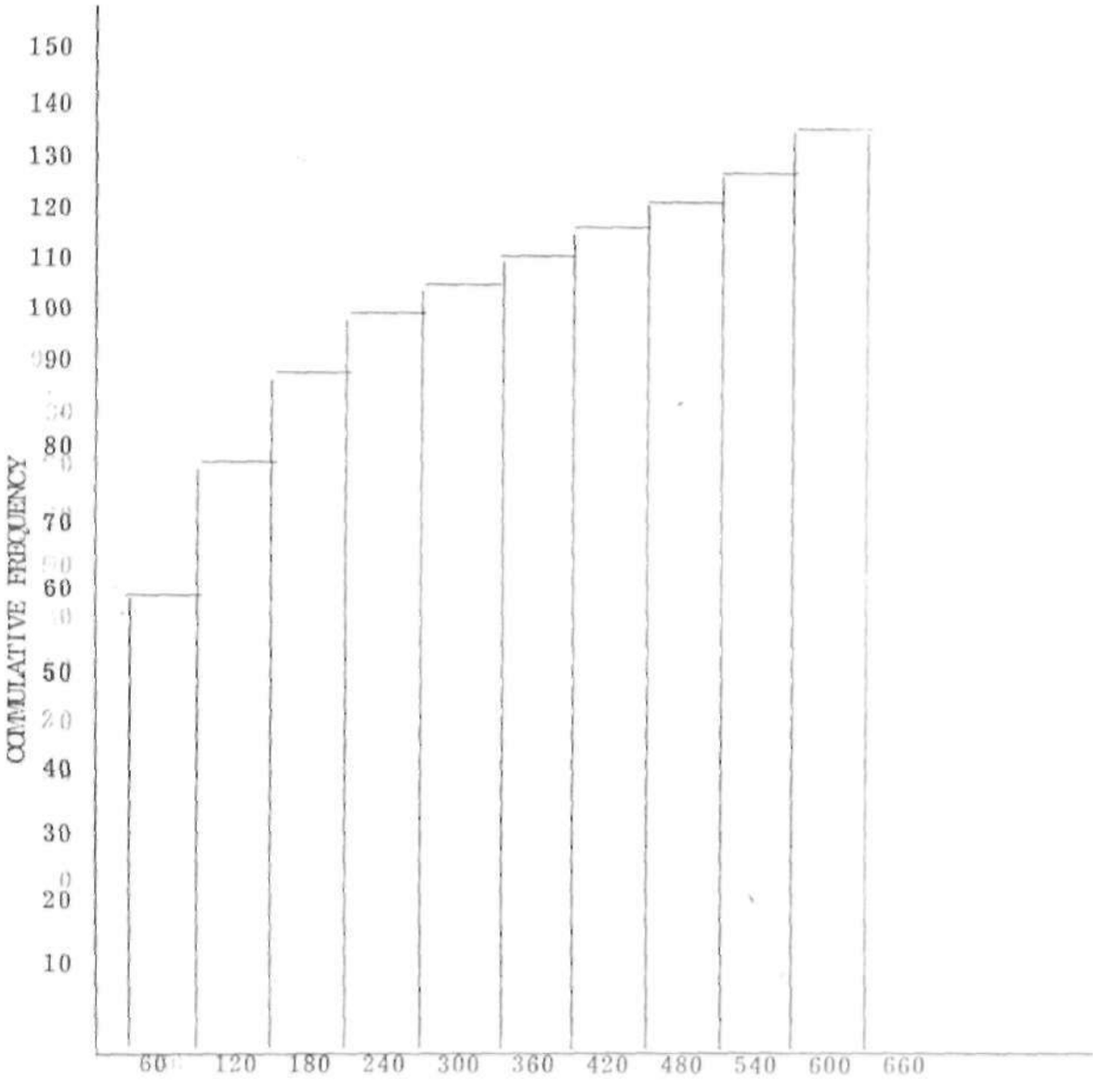
Service Time	60 mins.	120 mins	180 mins.	240 mins.	300 mins.	360 mins.	420 mins.	480 mins.	540 mins.	600 mins.
Frequency	-	-	18	20	19	20	17	18	20	20
Cumulation Frequency	-	-	18	38	57	77	94	112	132	152

$\frac{152}{100} = 1.5$

Service Time	60 mins.	120 mins.	180 mins.	240 mins.	300 mins.	360 mins.	420 mins.	480 mins	540 mins.	600 mins.
Frequency	-	-	10	12	12	11	11	10	12	12
Cumulative Frequency	-	-	10	22	34	45	56	66	78	90

$\frac{90}{100} = 0.9$

5.11 CUMULATIVE ARRIVAL TIME DISTRIBUTION KADUNA REFINERY



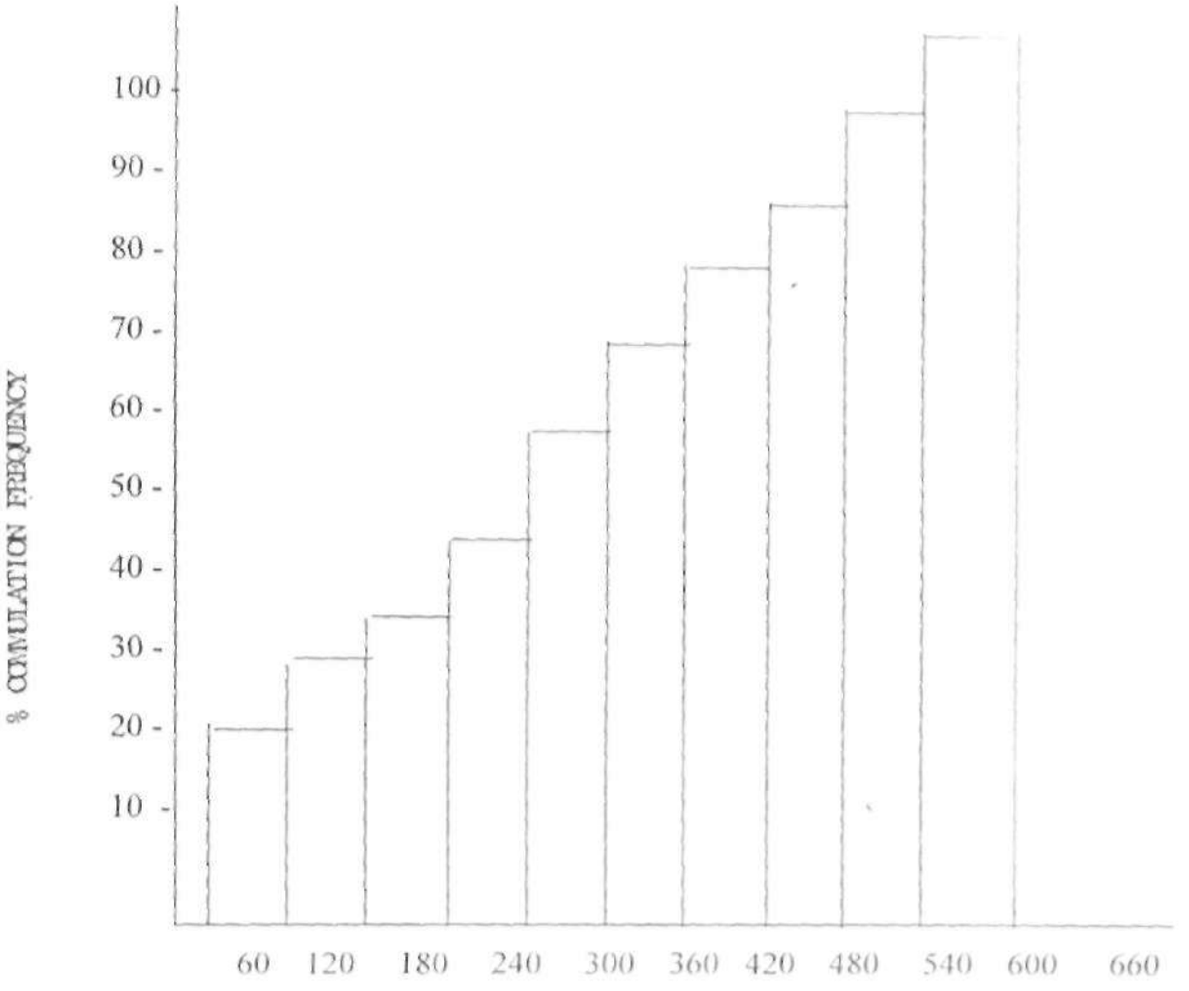
INTERARRIVAL TIME (MINUTES)

Arrival (mins.)	60	120	180	240	300	360	420	480	540	600
Frequency	59	22	18	14	10	8	3	3	3	1
C. frequency	59	81	99	113	123	131	134	137	140	141

5.12

CUMULATION ARRIVAL TIME DISTRBUTION

KANO DEPOT



INTERNATIONAL TIME (MINUTES)

ARRIVAL(mins.)	60	120	180	240	300	360	420	480	540	600
FREQUENCY	30	140	11	9	7	5	4	3	2	3
C. FREQUENCY	30	44	55	64	71	76	80	83	85	88

The data above was also plotted on a graph with the cumulative frequency on the –axis and service time on the x-axis. This is shown in figures 5.9.4 and 5.9.5 for Kaduna refinery and Kano Depot respectively.

The actual simulation process started after the distributions have been plotted in the graph. this involved simulation both the inter arrival time and service time individually and then collectively by the selection of random numbers. In this case, a group of thirty random numbers was selected to cover the simulation for a period of one month. This was so because it is believed that whatever conclutions are made as a result of the analysis based on a month period will be sufficient enough to reflect the state of the system.

Table 5.13

SIMULATION OF ARRIVAL TIME

KADUNA DEPOT

	Random Numbers (a)	Y-axis (ax 1.4) (a)	X axis (c) simulated Arrival
1	15	21	10
2	81	113	240
3	92	129	348
4	23	32	20
5	96	134	420
6	20	28	18
7	68	95	108
8	57	80	120
9	70	111	234
10	84	118	270

Table 5.14 THE CO[illegible] [illegible] TIME AND

SERVICE TIME – K[illegible]

	Trucks Arrival	Service Starts	Service ends	Waiting time of trucks	Idle time of machines
1	10	10	208	-	10
2	250	208	718	-	-
3	598	718	1276	120	-
4	618	1276	1510	658	-
5	1038	1510	2092	472	-
6	1056	2094	2316	1038	-
7	1224	2316	2760	1092	-
8	1344	2760	3156	1416	-
9	1578	3156	3624	1578	-
10	1848	3624	4146	1776	-
11	2100	4146	4662	2046	-
12	2238	4662	5082	2424	-
13	2248	5082	5268	2834	-
14	2254	5268	5430	3014	-
15	2602	5430	5088	2828	-
16	2860	5988	5610	3128	-
17	3058	6510	6990	3452	-
18	3334	6990	7518	3656	-
19	3466	7518	7926	4052	-
20	3556	7926	8280	4370	-
21	3628	8280	8622	4652	-
22	3676	8622	8922	5446	-
23	3790	8922	9312	5132	-
24	3988	9212	9792	5324	-
25	4288	9792	10332	5504	-
26	4294	10332	10500	6038	-
27	4322	10500	10752	6178	-
28	4328	10752	10926	6424	-
29	4442	10926	11310	6484	-

30	4694	11310	11826	6616	-
				97.752	52

The three steps followed for Kaduna Refinery is also carried out for Kano Depot.

Table 5.15 **STIMULATION OF ARRIVAL TIME**

KANO DEPOT

	Random Number (a)	Y-axis (ax 0.9) (b)	X-axis (c) Simulated Arrival Time
1	15	14	18
2	81	73	220
3	92	83	480
4	23	21	66
5	96	84	510
6	20	48	30
7	68	61	216
8	57	53	168
9	79	71	300
10	84	76	360
11	82	74	330
12	62	56	192
13	13	12	18
14	08	7	6
15	92	83	480
16	83	75	348
17	74	67	270
18	85	77	372
19	60	64	174
20	49	44	120
21	46	41	114
22	37	33	78
23	56	50	150
24	74	67	270
25	88	79	464
26	09	8	12
27	28	25	48
28	10	9	150
30	82	74	330

- The figure 0.9 is derived by dividing the total cumulative frequency by

$$100 - \frac{90}{100} = 0.9$$

In the same fashion and in the same way as that of the Kaduna distribution terminal, the service time was also simulated using the same set of random numbers.

Table 5.16 **SIMULATION OF SERVICE TIME**

KANO DEPOT

	Random Numbers (a)	Y – axis (ax – 0.9*) (b)	X- axis (c) Simulated Service Time
1	15	14	204
2	81	73	514
3	92	83	570
4	23	21	240
5	96	84	576
6	20	18	228
7	68	62	450
8	57	53	408
9	79	71	510
10	84	76	534
11	82	74	522
12	62	56	420
13	13	12	198
14	08	7	168
15	92	83	570
16	83	75	528
17	74	67	486
18	85	77	534
19	60	54	414
20	49	44	360
21	46	41	342
22	37	33	300
23	56	50	390
24	74	64	486
25	88	79	546
26	09	8	174
27	28	25	252
28	10	9	180
29	55	50	390
30	82	76	522

- The figure 0.9 is derived by dividing the total cumulative frequency by

$$100 - \frac{90}{100} = \frac{0.9}{}$$

The actual simulation process for the depot which involved determining the total waiting time of the trucks and the total idle time of the service facilities was then presented below. This was also based on the simulated inter arrival and service time distributions above.

Table 5.17

THE COMBINED SIMULATED OF ARRIVAL TIME AND SERVICE TIME – KANO DEPOT

	Trucks Arrival	Service Starts	Service Ends	Waiting Time of Trucks	Idle Time of Service Facility
1	18	18	222	-	18
2	348	348	864	-	126
3	828	364	1424	36	-
4	894	1434	1674	540	-
5	1404	1674	2250	370	-
6	1434	2250	2178	816	-
7	1650	2478	2928	828	-
8	1818	2928	2336	1110	-
9	2113	3336	3846	1218	-
10	2478	3846	4380	1368	-
11	2808	4680	4902	1572	-
12	3000	4902	5322	1902	-
13	3018	5322	5520	2304	-
14	3024	5520	5688	2496	-
15	3504	5688	6258	2184	-
16	3852	6258	6786	2406	-
17	4122	6789	7275	2664	-
18	4494	7275	7806	2781	-
19	4668	7806	8220	3138	-
20	4788	8220	8580	3432	-
21	4902	8580	8922	3678	-
22	4980	8922	9222	3942	-
23	5130	9222	9612	4002	-
24	5400	9612	10098	4212	-
25	5864	10098	10644	4234	-
26	5876	10644	10818	4768	-
27	5904	10818	11070	4894	-
28	5936	11070	11250	2134	-
29	6086	11250	11640	514	-
30	6416	11640	12162	5225	-
				77408	144

The last distribution terminal in the research project is the Kano Depot. As in the two cases above, the interarrival time and service time distributions were simulated separately and then jointly, so as to determine the total waiting time of the trucks and the total idle time of service facility for the given period.

5.18 SUMMARY

Total waiting time of trucks:

a. Kaduna Depot - 97752 mins

b. Kano Depot - 77408 mins

Total Idle time of service facility:

a. Kaduna Depot - 52 mins

b. Kano Depot - 144 mins

5.19 DEDUCTION FROM THE ANALYSIS

We have from the simulation experiment above extracted certain information about the efficiency of the distribution system based on a model. Therefore, within the limitations delimitations of the study as mentioned at the beginning of this chapter, certain deductions can be made. This is necessary in order to have a concrete foundation upon which to base our subsequent conclusions and recommendations. The analysis is presented below, starting with the Kaduna Depot followed by Kano Depot.

KADUNA DEPOT

The average number of trucks arriving at the Kaduna Depot for the purposes of products evacuation was put at 138[6] (Table 5.1). We have also assumed these arrivals to occur between 6.00 a.m. to 4.00 p., covering a time period of 10 hours. Therefore, the total cumulative arrival time covered by the arrival process can be calculated thus, 138 x 600 minutes (10 hours)

- 82800 minutes per day

And since our simulation was for a period of 30 days, the total cumulative time for this period is:

82800 x 30 days

= 2484000 minutes or 41400 hours.

Therefore, the total waiting time of trucks for the simulated period expressed as a percentage of the total cumulative time covered by the arrival

$$- \quad \frac{97752 \times 100}{2484000} = 3.94$$

[6] The number is the average of the data collected for seven working days – 150+128+131+153+128+130+142 = 138

Similarly, the average number of trucks being serviced at the Kaduna Depot was 152 trucks per day. The service time is assumed to fall between 8.00 a.m. and 4.00

p.m. daily which is about 8 hours. Therefore, the total idle time of the service facility (52 minutes) expressed as a percentage of the above cumulative time.

$$= \frac{52 \times 100}{2188800}$$

$$= \underline{0.0024\%}$$

Lastly, we can express the total cumulative service time as a percentage of the total cumulative arrival time to determine the extent to which the service facilities can accommodate the arrivals at the loading terminal.

$$\frac{2188800}{2484000} \times 100$$

$$= \underline{88.12\%}$$

KANO DEPOT

The average number of trucks arriving at this Depot is 87[7] (Table 5.2). The arrival time also coverall a period of 10 hours. Therefore, the total cumulative arrival time at the depot per day:

- 87 x 600 minutes (10 hours)

[7] The number is the average of the date collected for seven working day – 81 + 89 + 98 + 92 + 90 + 88 = 87

= 52200 minutes.

This when multiplied by the 30 days covered in the simulation experiment will give us the total cumulative arrival time for the period of simulation.

$$52200 \times 30 \text{ days}$$

$$= \underline{1566000 \text{ minutes}} \text{ or } 26100 \text{ hours}$$

The total waiting time of the trucks (77408 minutes) from the simulation experiment can then be expressed as a percentage of the total cumulative arrival time

$$= \frac{77048 \times 100}{1566000}$$

$$= \underline{4.94\%}$$

For the service time, the average number of trucks being serviced at the Depot is 90 trucks per day and the total service time is assumed to be 8 hours per day. (8.00 a.m. to 4.00 p.m.) on the average. So the total cumulative service time = 90 x 480 minutes (8 hours)

$$\underline{43200 \text{ minutes}}$$

And when multiplied by 3 days, we'll get the total cumulative service time for the period of simulation.

$$= \quad 43200 \text{ x } 30 \text{ days}$$

$$= \quad \underline{1296000 \text{ minutes}} \text{ or } 21600 \text{ hours}$$

The total idle time of the service facility (96 minutes) expressed as a percentage of the total cumulative service time

$$= \quad \frac{96 \text{ x } 100}{1296000}$$

$$= \quad \underline{0.0074\%}$$

This means not much time is wasted unnecessarily. Total cumulative service time expressed as a percentage of the total cumulative arrival time.

$$= \quad \frac{1296000 \text{ x } 100}{1566000}$$

$$= \quad 82.76\%$$

This is total cumulative service as a cumulative arrivals time. This shows that it's efficient and effective.

5.20 DATA PRESENTATION FOR MODEL TWO

In the second mode of analysis in this research project, a short structured questionnaire was administered on some petroleum products retail outlets,

commonly known as filling or service stations within the scope of study, that is within Kaduna, Zaria, Kano and Jos.

The sample size of respondents was randomly chosen. This choice was partly determined by the purpose of the study, the similar nature of the population, which consist of petroleum products retail outlets. The choice was also determined by the nature of method of data collection (Questionnaire) and the time constraint.

In this particular situation, area sampling was adopted. This is a form of cluster sampling, which pertains to primary sampling of geographical areas. The primary is selected randomly, that is once selected, and all further sampling is restricted to the area chosen in the first stage [9]. For this reason therefore, we have classified our geographical areas into four and data was collected based on this classification. Area I covered Kaduna and its surroundings, Area II consisted of Zaria and its surroundings Area III include Kano metropolitan area and the surroundings. Again the rationable for this limitation in scope lied with the time and financial constraints and also because these areas contain the largest concentration of the research entities of our study.

It is pertinent at this point to indicate the assumptions and limitations of this particular model of analysis. One of the basic assumption in this model was that all the research entities (retail outlets) reconsidered on the same wave length; thus,

[9]Green, P.E and Tull, S.T. Reserch for marketing decision enflewood cliffs, New Jerser, Prentice Hall Inc. 1970 page 253

there was no discrimination as regards the nature, ownership or the time of establishment of these retail outlets. And also that the response from each of these entities was given an independent status.

However, in conducting the research based on this model, we have certain problems which had constituted limitations on the study. One of such problem was in the area of collecting basic data or information on the subject matter. It is important to note that the study could not get an exact inventory of the number of these retail outlets currently in operation within the area from either the Inspectorate Division of the NNPC or the Oil Marketing Companies. This had limited the process of determining the sample size selection.

The data collected for this model as stated above was based on a structured questionnaire. This questionnaire was administered on a total sample size (64) retail outlets for all the areas under study. (In Area I, which consisted of Kaduna, the sample size was 26. The sample size in Area II which covered Zaria was 8 Area III consisting of Kano was 30.)

All the retail outlets were given the same questionnaire and one week was specified with which the response was expected. After the time period specified has passed, the following were the responses collected as shown below:

Area	Sample Size	Response	Percentage
Area I	26	15	58%
Area II	8	5	63%
Area III	30	20	67%
	64	40	63%

Statement of Hypothesis

The Hypothesis to be tested is:- "The pipeline and Depot system is an efficient mode of petroleum products Distribution in PMC Kaduna area office". Therefore, the structured

Questionnaire is geared towards collecting the following classes of data:

1. The source of supply of petroleum products in each of the retail outlets before and after the introduction of the pipeline and depots network.
2. The time between placing an order and taking delivery of the order.
3. The performance rating of the petroleum products distribution system in general.
4. The performance rating of the pipelines and depot system of distribution.

The Rejection or Acceptance of the Hypothesis set forth above as determined by an analysis and exploration of the fats collected from the respondents under the above classification.

Test of Hypothesis:

The data analysis under this model followed the pattern Specified above. That is, data was collected under three Categories. Under the first categorizations it indicates the source of supply to the outlets before and after the introduction of pipelines and depot system of petroleum distribution is determine. The essence was to determining what percentage of this outlets patronized this new channel of distribution at present and compare it with other systems in existence before the pipeline systems.

Table 5.21 **SUMMARY**

	Before the Pipeline	**Patronizer**	**%**	**After the pipeline**	**Partronizer**	**%**
Area1A	Directly from oil Marrketing Company13	13	87	Directly from oil Marketing Coy.	3	20
B	Directly from independence marketers	Nil	Nil	Directly from independence marketers	2	13
C	Directly from petroleum products delears	1	6.67	Directly from petroleum products delears	Nil	Nil
D	Directly from NNPC Depots	Nil	Nil	Directly from NNPC Depots	9	60
E	Other sources	1	6.67	Other sources	1	6.67
	Total	**15**	**100**		**15**	**100**
Area 2 A	As A in area 1	4	80	As A in area 1	1	20
B	As in area 1	Nil	Nil	As in area 1	1	20
C	As in area 1	Nil	Nil	As in area 1	Nil	Nil
D	As in area 1	Nil	Nil	As in area 1	3	60
E	As in area 1	1	20	As in area 1	Nil	Nil
	Total	**5**	**100**		**5**	**100**
Area 3 A	As in area 1	17	85	As in area 1	4	20

B	As in area 1	Nil	Nil	As in area 1	2	10
C	As in area 1	1	5	As in area 1	Nil	Nil
D	As in area 1	Nil	Nil	As in area 1	13	65
E	As in area 1	2	10	As in area 1	1	5
	Total	**20**	**100**		**20**	**100**

Table 5.22 **SUMMARY**

	Before the Pipeline	**Patronizer**	**%**	**After the pipeline**	**Partronizer**	**%**
Area 1A	Directly from oil Marketing Company13	34	68	Directly from oil Marketing Coy.	8	16
B	Directly from independence marketers	Nil	Nil	Directly from independence marketers	5	10
C	Directly from petroleum products delears	2	4	Directly from petroleum products delears	Nil	Nil
D	Directly from NNPC Depots	Nil	Nil	Directly from NNPC Depots	25	50
E	Other sources	4	8	Other sources	2	4
	Total	40	80	As A in area 1	40	80
B	As in area 1	Nil	Nil	As in area 1	1	20
C	As in area 1	Nil	Nil	As in area 1	Nil	Nil
D	As in area 1	Nil	Nil	As in area 1	3	60
E	As in area 1	1	20	As in area 1	Nil	Nil
	Total	**5**	**100**		**5**	**100**

The conclusion to be drawn from the above categories is that prior to the establishment of the pipelines and Depot system of petroleum products distribution, 42% of the retail outlets received their products from the various

depots of the seven oil marketing companies scattered throughout the country. However, with the establishment of this new distribution, majority of these outlets 67% received their products directly from the various NNPC Depots, which were all connected with the Kaduna Depots. With this also, a new source of supply, namely, the indigenous independent marketers has developed rapidly, accounting for about 10% The oil marketing companies still played prominent role in the distribution process, accounting for about 16%. This has to great extent shown that it better to use the pipeline in distribution petroleum in production according to the analysis. In the second categorization, data is collected on the time between placing an order and the receipt of that order. The result or response received is as follows: -

2.23 TIME BETWEEN MAKING AN ORDER AND THE RECEIPT OF THE OTHER.

Area I	(a)	Less than three days	5 (33%)
	(b)	Exactly three days	2 (13%)
	(c)	More than three days	8 (53%)
			15(100%)
Area II	(a)	Less than three days	1 (20%)
	(b)	Exactly three days	1 (20%)
	(c)	More than three days	3 (60%)
			5(100%)
Area III	(a)	Less than three days	6 (30%)

(b) Exactly three days 3 (15%)

(c) More than three days 11 (955%)

20 (100%)

SUMMARY: (a) Less than three days 15(12)(24%)

(b) Exactly three days (6) (12%)

(c) More than three days (22) (44%)

40 (80%)

The objective here was to determine the period involved in the distribution process vis-à-vis, the storage capacity of the various filling stations. On the average, the capacity is suppose to last for about three days, assuming that the volume a shortage will occur at these filling stations. From the analysis, about 44% of the respondents received their others after three days, 12% at exactly three days and 24% in less than three days.

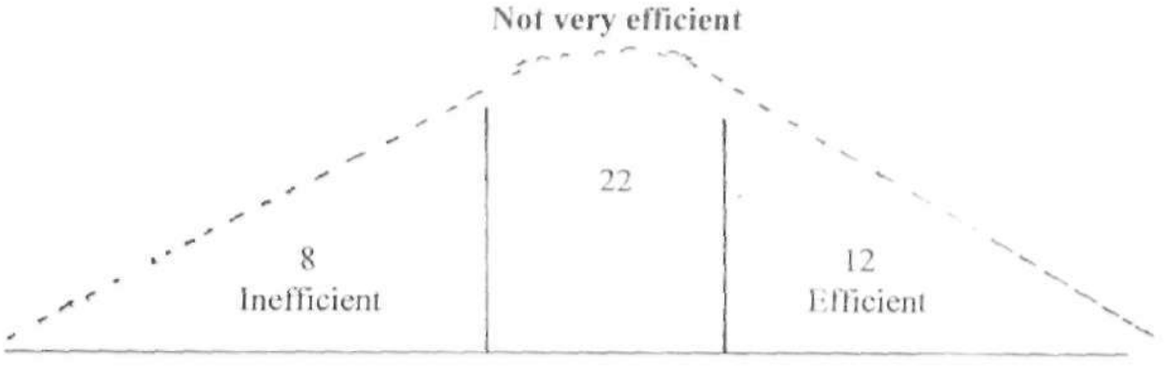
Based on the above response, and the other categorization that has to do with the performance rating by the respondents of the distribution system in general, the efficiency of the system could be assessed. The response pattern is as follows:-

AREA	EFFICIENT	NOT VERY EFFICISENT	INEFICISENT	TOTAL
Area I N1	5	8	2	15
Area II N2	1	3	1	5
Area III N3	6	11	33	20
TOTAL N1 + N2 + N3 +	12	22	6	40

N1, N2, N3, = Number of positive respondents

N1, + N2 + N3 + = Total positive respondents

This information could than be represented in the form of a normal distribution curve.



The assumption is that the area under a normal distribution curve = 80%

Therefore 40 = 80%

Area representing inefficient as response is represented as follows:

$\frac{80}{40} \times 6 = 12\%$

Area representing not very efficient as response but within the range of efficient represents as follows: $\frac{80}{40} \times 22 = 44\%$

Area representing efficient as response as follows: $\frac{80}{40} \times 12 = 24\%$

12% + 44% + 24% = 80%

Test – Inefficiency + Not very efficient = 12% + 44% = 56%

This particular percentage is more than that representing the system being efficient. This is because as its indicated on the curve 12% of the respondents

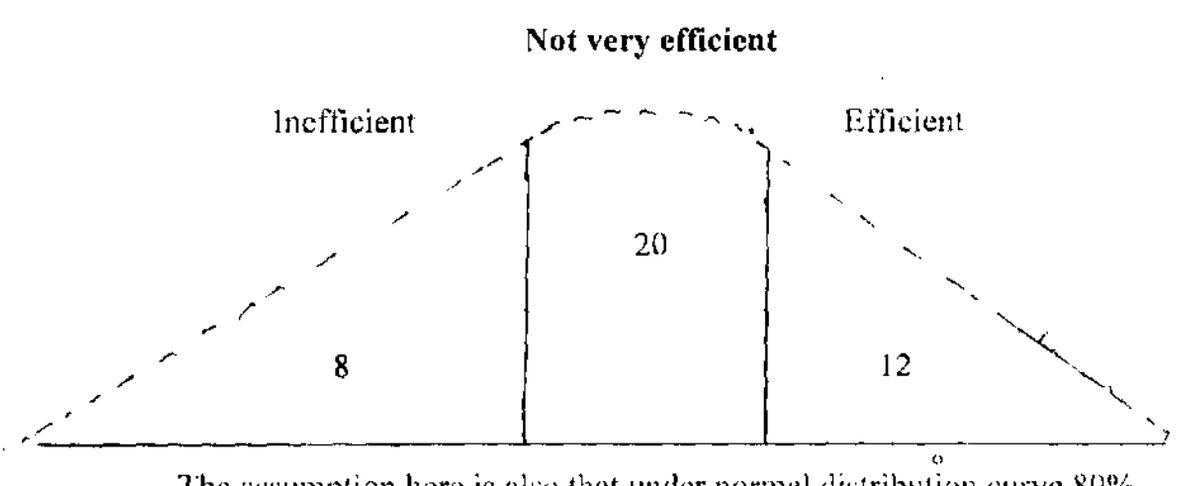
believe the system as efficient and 44% within the normal curve is also aliened to efficient but not very much thus make up 45% performance of the pipeline and depot system itself. The response pattern is as follows:

AREA	EFFICIENT	NOT VERY EFFICIENT	IN EFFICIENT	TOTAL
AREA I N1	8	3	4	15
AREA II N2	3	1	1	5
AREA III N3	9	4	7	20
TOTAL N1 +N2 +N3	20	8	12	40

N1, N2, N3, = Number of positive respondents.

N1 + N2 + N3 total positive respondents.

The above information is then represented in the form of a normal distribution



The assumption here is also that under normal distribution curve 80%

Therefore 40 =80% and the area could be represented by $\frac{80}{40}$ x 8 = 40%=16%

The area representing efficient as response is represented by $\frac{80}{}$ x 20 = 40%

the area representing efficient as response is represented by $\frac{80}{40} \times 12 = 24\%$

16% + 24% + 40% = 80%

By this response therefore, majority of the respondent 40% believed that the pipeline and depot system of petroleum products was not very efficient. While 16% and 24% of the total believed that the system was inefficient and efficient respectively.

Similarly, about 54% believed that the whole distribution system is not very efficient and 12% are of the opinion that the system was inefficient and efficient respectively. From the above analysis therefore, it should be noted that even though in both the two cases, a majority of the respondents believed that the system is not very efficient, and therefore the idea rejected, the percentage of those who believed the system was efficient is greater than that of those who thought it was not efficient. Therefore, the hypothesis cannot be totally rejected under this model. In conclusion one can say the study revealed that prior to the establishment of P.P.M.C in 1987, the total domestic petroleum, products consumption was approximately 5.8 million metric tones. By 1989, the nation consumed about 8.7 million metric tones. As at 1991, PPMC processed approximately 12.7 metric tones of crude oil. The company sold about 12.3 million metric tones of products in 1990. This was 41.7 per cent higher than what was realized in 1989. The cumulative products sales, for 1991 was approximately

13 million metric tones. Products output from the local refineries in 1991 and 1994 show a decreasing trend in the quantity of products produced by the refineries. For example, production of premium motor sprit (PMS or Petrol) fell by 38 per cent to 1,859,966 thousand litres. Dual Purpose Kerosene (DPK or household kerosene) fell by 4.2 per cent to 466,824 thousand litres. While Automobile Gas Oil (AGO or diesel oil) fell by 28.4 percent In 1994.

This trend confirms the fact that over years the rate of petroleum products consumption in the country has been on the increase. However, the products output in each of the years show that the refineries were operating at far below installed capacities.

However, despite that shortfall of products produced by the refineries no one could doubt the fact that NNPC has been effective in distribution of the petroleum products in the country. This is obvious in view of the increasing trend in quantity of products produced and distributed by the company over the years. Also the petroleum licensed filling stations through out the country have been showing increasing trend after the establishing of PPMC. The study revealed that the proliferation of many indigenous and major marketing retail out lets would not have been possible with out adequate petroleum products supply by the PPMC, supply through exploration as well as by the government especially with incessant breakdown of refinery. It was also found out that pipelines off-take of products by

all the Nations four refineries between 1980-86 totaled 68 percent as against 32 percent.

Inspite of these achievements NNPC is constraint by a number of problems. These included, the unscheduled shut down of the refineries which limits products availability, inefficient monitoring of field operations (depot, pump stations and filling stations), smuggling of the products out of the country, hoarding of the products by the marketers and bureaucratic delays in taking actions and replacement of imported spare parts for repairs. For example, the company is expected to get corporate approval for some decisions approved by its boards.

A factor of increasing importance in the petroleum distribution is the role of road tanker drivers. The mere threat of an industrial action by the drivers may result for a "run"on the retail outlets, thus, creating real or artificial shortage and scarcity. Diversion of products by the drivers was also identified as a contributing factor to the problems of petroleum products shortages in the country. Consequently when products were sold illegally along the city streets and country roads. Vandalization of pipeline by dissatisfied community is also another factor leading to shortage of fuel.

CHAPTER SIX

SUMMARY , CONCLUSION AND RECOMMENDATION

6.0 SUMMARY

Pipelines and Products Marketing Company (PPMC) is an arm of the corporate NNPC that is actually responsible for marketing and distribution of petroleum products through out the country. The company was established in 1987. Over years one wonders how well the company has been performing. Out of academic curiosity and evaluation of how the company has been performing since it was established, a plan was set out to conduct the following study. (the role of Nigeria National Petroleum Corporation (NNPC) in distribution and marketing petroleum products in Nigeria. A case study of Pipeline and Product Marketing Company (PPMC) Limited a subsidiary of NNPC).

In an attempt to measure how the company performed over the years the study centered more on the depots to get products the quantities supplied to the domestic market and to what extent consumer patronize the pipelines. This work also identified the causes of the effectiveness or otherwise of the organization and provide more recommendations; areas of further study have also been identified and suggested.

6.1 RECOMMENDATIONS

The fact that the organization has been effective to some extent does not mean that it has no problems. However, if the recommendations listed in this chapter are considered, then the performance of the company would improve tremendously. The recommendations offered are:

1. Rehabilitation of the refineries:

The efficiency of the existing refineries need to be improved and it is necessary that their number and capacities be increased. Bureaucracy in taking some management decisions especially in releasing funds for purchase of important spare parts for refining plants maintenance should be minimized so that work could be carried out without delay. Also it is important that the Petroleum Trust Fund (PTF) should set aside certain percentage of money from the products sales for the maintenance of the refineries and other NNPC installations.

2. Provision of additional storage facilities:

NNPC should construct additional storage depots in strategic locations and extend the pipeline system to interconnect all the refineries and to cover areas that are yet to be reached by the system.

3. Provision of additional road tanker for the transportation of petroleum products:

NNPC should acquire adequate road tankers. This would strengthened the petroleum products road haulage system, to be able to respond quickly and

effectively in times of emergencies, examples, when the tanker drivers embark on strike actions.

4. Manufacturing of spare parts from the local source:

NNPC should look into the possibility of manufacturing spare parts in conjunction with indigenous industries such ass Defence Industries Corporation, Nigerian Tin Mining, Steel Rolling Mills etc. this will reduce the huge amount of money being spent on importation of spare parts and hiring of foreign firms for the maintenance of our refineries.

5. Establishment of appropriate price for petroleum products:

The government should establish an appropriate prices for petroleum products. This will help to make smuggling in attractive. The government should also appeal to the patriotic instincts of Nigerians to refrain from acts that could cause or aggravate the shortage of petroleum products.

6. Private sector participation in petroleum refining:

The government should encourage individuals and private sectors to participate in the petroleum refining in order to boost petroleum product production in the country. So far the government has already approved the construction of two private refineries Qua and brass refineries, located at Ibeno and Brass in Akwa Ibom and Rivers states respectively.

7. Effective monitoring of petroleum products distribution:

NNPC is not responsible for distribution of petroleum products to the consumer. The petroleum marketers and transporters are solely responsible for products

distribution to retail outlets. They could divert or hoard. Also the petrol filling stations could decide not to sell, according David West:

"There are all sorts of improprieties in Oil industry of Nigeria. This is documented. There is mis-management of oil. There is fiddling. There is smuggling. There is illegal bunkering. Our oil industry is not well policed. We have all the official modalities of marketing but then there is a lot of other marketing outside of the official channels, which is not controlled.[3]

Therefore, the petroleum inspectorate and other government agencies responsible for the regulating and monitoring of petroleum products distribution in the country should be strengthened so that they could perform their responsibilities and effectively.

6.2 CONCLUSSION

In conclusion the study as earlier mentioned try to control the pipeline and depots distribution system of petroleum products in Kaduna area office. This study revealed the role of the company (NNPC) in this aspect and even the distribution and production problems encountered by more developed countries. Such as Japan, USA and Italy.

NNPC the mother of PPMC undoubtedly have short term plans and long term strategies for distribution and marketing of petroleum products in adequate

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[3] This quotation is drawn from AED, African Economic Digest, April 1984 edition.

quantities, but lack of adequate planning, forecasting of field operations, uncoordinated management information system, outright sabotage manifested in mysteries fire out breaks in refining plants, products tapping along pipeline by dissatisfied citizens and more significantly corruption are some of the key problems militating against the effectiveness of the organization. Finally, one must point out that if all the recommendations stated in this chapter are implemented and facilities required for the production of petroleum products are made available it would improve the supply and distribution system and this may eliminate or minimize the petroleum products shortage and scarcity.

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