

# Critical Review Of Petrol Station Management System With Emphasis On The Advantages If Digitalized In Nigeria

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**Abstract**—This review is meant to solve the problem of fraud in the company, missing files and documents, time wasting due to manual processing, inaccuracy, insecurity and poor storage. In recent times, most fields of human endeavour have benefited immensely from the services offered by the computer system; petrol station is not left out. The problem of fraud among staff, unauthorized access to secret documents and data, mismanagement of company's petroleum products and diversion of petroleum products necessitated the development of this project. It has the need for proper information management system. The right to privacy and secrecy towards reducing fraud and cash mismanagement are not left out in this research work. More importantly, the system monitors the operation/activities of all the attendants. This research also takes a critical look at the automation of a petrol retailing station, with a view to building an enterprise solution that will enable the monitoring of the petroleum products, with emphasis on retailing, using a web based application written with PHP/MYSQL, java and HTML languages. This research attempts to track sales per product. The implementation and test running of the new system was carried out to conclusively summarize and make recommendations on the system.

**Keywords**—*Management System, Unauthorized Access*

The need to reduce oil spillage and economic waste associated with it, together with its escalating harms on agricultural produce promoted the siting of petrol stations. The loss of lives and properties associated with fuel fire outbreak in uncoordinated and unauthorized petrol selling is also increasing concern to both government and the general public.

In view of the aforementioned havocs, the government decided to put a barn on the sales of petroleum products especially petrol in gallons and tanks and, to enable the government safeguard the lives and properties of her citizens, reduce the cost of petrol, increase the availability and maintain a standard throughout her territory. The difference in modus operandi constitutes a big problem for the major distributors who have to ensure that the retailing stations effectively disburse their allocation and still maintain the corporate image of the oil companies and at the same, maximizing the profit of both parties. To ensure maximum profitability of the major distributor in the industry, they have to ensure that the retailing station not only has a wide reach for marketing their products, but they market those products effectively and be fully accountable. This has led them to provide transportation services for the conveyance of the products from the depots to the respective filling stations. Oluleye O. (2014).

Another move by the distributors to ensure that the retailing stations have a higher advantage is by branding the respective stations. As such, a franchise operator for a major distributor takes on the name of the dealer to ensure that customer identifies with the brand of the companies. Hence, petrol station is a government recognized selling point for petrol products to users. The introduction of petrol stations has in no small measure helped the growth of the economy. Bunkering, smuggling, spillage and possible fire out breaks have being tremendously reduced to an appreciable level thus encouraging healthy competition. Kupolokun F. (2006).

The malpractices observed in managing an organization where money in form of cash, passes through many hands before getting to the final destination (highest in command) are at least reduced if not eliminated if this system is adopted. It is worthy to highlight here that this system helps to guide the

manager on what to do and how to do it, achieving maximum sanitation and transparency in the corporation, while increasing the team spirit in the workers through bonus incentives and allowances made available to them. The increasing need for planning and expansion of business to allow for maximized profit, using information system cannot be over emphasized. With the aid of this system, the man at the helm of affairs can easily slot bonus to workers, calculate the quantity of products sold, pay salary/wage to his staff, keep accurate record of staff personal data, know the status of the workers whether retrenched, suspended or working. He can also generate reports of interest and, above all, enhance the security of data available to the firm; retrieval, addition and modification of records, among other things are made possible.

Management Information System is one of the major tools available to business managers for achieving operational excellence, developing new products and services, improving decision making, and achieving competitive advantages. In the petroleum industry, especially in the midstream and downstream sector, management information system will streamline the business operations. Effective network systems for better connectivity, better IT infrastructure for effective data handling, software for data analysis and future sales projections, efficient Enterprise Resource Planning (ERPs) will bring about the organizations competitive advantage. Take instances from around the globe in the oil and gas sector, it will show players who have made a difference in their business methodology by applying Management Information Systems.

Organizations like MASTERS ENERGY, SURGUTNEFTE GAS, and CONOIL have added these technology features and reaped enormous benefits with respect to exploration and production, resource optimization and sales maximization, which are the main goals of an organization operating in the Oil and Gas sector. Mbam, B. C. E (2002).

#### **Literature Review**

A filling station, gas station or petrol station is an establishment that sells fuel and lubricants usually gasoline (petrol) or diesel fuel. Some stations carry fuels like liquefied petroleum gas (LPG), natural gas, or kerosene. In recent times, filling stations have added shops to their primary business and convenience stores are now a familiar sight alongside pumps. Olohunlambe G.A (2006).

The term "gas station" is mostly particular to the United State and Canada, where petrol is known as "gas" or "gasoline". Elsewhere in the English-speaking world the form "petrol station", "petrol pump", or the old fashioned term "petrol garage" is used. In the United Kingdom, the single noun "Garage" is still commonly used even though the station being referred to may have no services/maintenance facilities which would justify this description. In Nigeria, the term "petrol station" or "filling station" is used.

#### **History of Petroleum Sector in Nigeria**

The extraction and drilling of petroleum in Nigeria is the largest industry and main generator of GDP in the West African nation, which is also the continent's most populous. Since the British discovered oil in the Niger Delta in the late 1950's, the oil industry has been marred by political and economic strife largely due to a long history of corrupt military regimes and complicit multinational corporations, notable Royal Dutch shell. Despite this, it was not until the early 1990s that the situation was given international attention, particularly following the murder by the Nigerian state of playwright and activist Ken Saro-Wiwa, provoking the immediate suspension of Nigeria from the Commonwealth of Nations. Nigeria has since been recognized by the international community and the firms in operation there as a major concern with regards to human right and environmental degradation. There is a growing culture of impunity throughout the country, as perpetrators of violent crimes against civilians are rarely prosecuted or even investigated. The Nigerian government, oil companies and oil dependent western countries have been slow to implement reforms aimed at aiding a desperately underdeveloped area and remediating the unsustainable environmental degradation that petroleum extraction has brought. Heeks (1998).

#### **Deregulation of Petroleum Sector in Nigeria**

The dismantling of the administered pricing mechanism means that oil companies are free to take independent decisions based on import party and market forces in pricing of petroleum products rather than being governed by the dictates of the government. The public sector oil companies have also to face a competitive marketing environment.

#### **Advantages of Deregulation of the Petroleum Sector**

The deregulation of the petroleum sector would make our petroleum prices far more competitive both locally and internationally. There would be better value for money. Smuggling would be discouraged as those who have perfected the business of smuggling our scarce products for financial gains would not find it any more economically gainful. Government need not to spend extra money policing the country's border, or sleeping with one eye open.

More so, the deregulation of petroleum products would most certainly reduce the man-hours lost in queuing for fuel, diesel or kerosene at our filling stations all over the country. Those who are abroad may find it difficult to understand this. An average working class Nigerian, who intends to do the right thing by buying directly from the stations instead of the black market, spends not less than three to five hours queuing for fuel. For how long would this continue? It is even getting worse day by day. Sometime in the past, there was this report that drivers in Lagos state had gone on strike because of the fuel scarcity and this led to the crippling of economic activities in the Lagos metropolis. It is indeed a very sad commentary on us as a nation that a country so blessed with petroleum resources is

unable to manage it in a sustainable manner for the benefit of even its present generation.

### **NNPC Overview**

The Nigerian National Petroleum Corporation (NNPC) was established on April 1, 1977, under the statutory instrument-Decree No.33 of same year by a merger of Nigerian National Oil Corporation, NOC, with its operational functions and the Federal Ministry of Mines & Power with its regulatory responsibilities. This decree established NNPC, a public organization that would, on behalf of Government, adequately manage all government interests in the Nigerian Oil industry. In addition to this, its exploration activities, the Corporation was given powers and operational interests in refining, petrochemicals and products transportation as well as marketing. Between 1978 and 1989, NNPC constructed refineries in Warri, Kaduna and Port Harcourt and took over the 35,000-barrel Shell refinery established in Port Harcourt in 1965. Since its formation, NNPC has had various aims in the petroleum industry critical among them are the regulation of foreign and local oil producing firms, advancing technology transfer, developing local content and indigenous participation in the industry. Wootton. R. (1993).

The performance of the company in terms of developing technical expertise in the exploration and production sector still lags other OPEC National Oil Companies and its partners while operational setbacks impedes the full potential of the Nigerian refineries making the oil producing nation also a fuel importing nation. This may be partially due to the government's early stand favoring maximizing oil revenues from producers and improving Nigeria's standing in the international market while delving little into the exploration and production aspect of the industry. Nwokeji. G. (2007).

### **History and Criticism**

According to Olohunlambe G. A. (2006), the NNPC before 1977 was called the Nigerian National Oil Corporation which was established in 1971 and started operations in 1973. The then NNOC can be described as a leading state enterprise and a mold of public sector bourgeoisie. In the early 1970s, within the NNOC emerged a technical and nationalistic oriented junior and mid level managers with degrees earned in local and foreign universities who sought more accommodation of Nigerian interests challenging the perceived influence of some foreign multinationals within the senior management level. This position later became more prominent in the oil industry towards the later part of the 1970s.

A wave of economic nationalization during the 1970s led the NNPC, serving as a government holding company to acquire interest in some multinational oil companies. By 1973, it had acquired 35% interest in ELF (then Safrap), BP/Shell and a 33% in Agip. Later in 1975, it acquire a 55% interest in oil producing companies, this was followed by further nationalization statute in the petroleum marketing sector and an increase to 60% of NNPC's interest in

oil producing companies and the purchase of all the equity interest of BP in Nigeria.

In 1977, NNOC which was subordinate to the ministry in charge of Petroleum was merged with the ministry of Petroleum Resources to form the Nigerian National Petroleum Corporation. The authority of the new enterprise in operations and policy was enlarged including administering pricing and marketing policies in the petroleum industry, collecting revenues, and monitoring the operations of oil producing companies.

Despite NNPC's large equity holdings, state policy and operational setbacks has been a problem in some of the firm's allied industries. At various points in time, the petrochemical complex built at a huge cost suffered from operational inefficiencies while a lack of state policy concerning natural gas led to the flaring of most of the associated gas by NNPC's partners. During the Nigerian second republic, the report of the Judicial Tribunal of Inquiry into Crude Oil Sales lamented though an absence of deliberate fraud, the company showed widespread insufficient oversight in monitoring production sites, pipeline and storage facilities, ports and terminals while large quantities of oil were siphoned off by various oil industry interests without proper accounting. A rationalization exercise began after the submission of the report and a decentralized corporation was created originally with 9 subsidiary companies. Wootton. R. (1993).

Before now, petrol stations have suffered many forms of loses as a result of damaged/lost records and data. Fund has at one time or the other being diverted by the sales personnel without the management attention. Enormous time and energy were spent on data reporting and report generations for official use and documentation purpose. Records if edited look so rough, dirty and boring to read. The storage space remained demandingly big and more demanding. Chibuzor (2011).

### **Information Management System**

According to Engr. Mbam B.C.E, information can be defined as "the process of generating, transiting, receiving, storing and retrieving of symbols". Hence information is the collection and organization of pieces of data in a meaningful form to broaden the knowledge of whomever that will make use of the document.

Richard Heeks (1998) in his work explained management information system as a system that uses formalized procedures to provide reports which assist the managerial monitoring and control of organizational functions, resources or other responsibilities. Management Information Systems encompass a broad and complex topic. To make this topic more manageable, boundaries will be defined. First, because of the vast number of activities relating to Management Information Systems, a total review is not possible. Those discussed here is only a partial sampling of activities, reflecting the author's viewpoint of the more common and interesting developments. Likewise where there were multiple effects in a similar area of development, only selected ones will be used

to illustrate concepts. This is not to imply one effort is more important than another.

Secondly, there are several frameworks that can be used to define and describe Management Information Systems. More than one will be used to discuss important concepts. Because more than one is used, it indicates the difficulty in capturing the key concepts of what is a Management Information System. Indeed, what is viewed as an effective and useful Management Information System is one environment may not be of use or value in another.

Before discussing Management Information Systems, some tested concepts should be reviewed. Davis, G. B. (1974), offers a commonly used concept in his distinction between data and information. Davis defined data as raw facts, figures, objects, etc. Information is used to make decisions. To transform data into information, processing is needed and it must be done while considering the context of a decision. We are often awash in data but lacking good information.

However, the success achieved in supplying information to decision makers is highly variable. Barabba (1994), expanded this concept by also adding inference, knowledge and wisdom in his modification of Haeckel's hierarchy which places wisdom at the highest level and data at the lowest. As one move up the hierarchy, the value is increased and volume decreased. Thus, as one acquires knowledge and wisdom the decision making process is refined. Management Information Systems attempt to address all levels of Haeckel's hierarchy as well as converting data into information for the decision maker. As both Barabba and Haeckel argue, however, just supplying more data and information may actually be making the decision making process more difficult. Emphasis should be placed on increasing the value of information by moving up Haeckel's hierarchy.

Another important concept from Davis G. B. and Olsen, M. H. (1984), is the value of information. They noted that "in general, the value of information is the value of the change in decision behavior caused by the information, less the cost of the information." This statement implies that information is normally not a free good. Furthermore, if it does not change decisions to the better, it may have no value. Many assume that investing in a "better" Management Information System is a sound economic decision. Since it is possible that the better system may not change decisions or the cost of implementing the better system is high compared to the actual realized benefits, it could be a bad investment. Also, since before the investment is made, it is hard to predict the benefits and costs of the better system, the investment should be viewed as one with risk associated with it.

Another approach for describing information systems is that proposed by Harsh and colleagues. They defined information as one of four types and all these types are important component of a Management Information System. Furthermore, the various types build upon and interact with each other.

A common starting level is Descriptive information. This information portrays the "what is" condition of a business, and it describes the state of the business at a specified point in time. Descriptive information is very important to the business manager, because without it, many problems would not be identified. Descriptive information includes a variety of types of information including financial results, production records, test results, product marketing, and maintenance records. Descriptive information can also be used as inputs to secure other needed types of information. For example, "what is" information is needed for supplying restraints in analyzing farm adjustment alternatives. It can also be used to identify problems other than the "what is" condition. Descriptive information is necessary but not completely sufficient in identifying and addressing farm management problems.

The second type of information is diagnostic information. This information portrays this "what is wrong" condition, where "what is wrong" is measured as the disparity between "what is" and "what ought to be." This assessment of how things are versus how they should be (a fact-value conflict) is probably our most common management problem. Diagnostic information has two major uses. It can first be used to define problems that develop in the business. Are production levels too low? Is the rate earned on investment too low? These types of question cannot be answered with descriptive information alone (such as with financial and production records). A manager may often be well supplied with facts about his business, yet be unable to recognize this type of problem. The manager must provide norms or standards which, when compared with the facts for a particular business, will reveal an area of concern. Once a problem has been identified, a manager may choose an appropriate course of action for dealing the problem (including doing nothing). Corrective measures may be taken so as to better achieve the manager's goals. Several pitfalls are involved for managers in obtaining diagnostic information. Adequate, reliable, descriptive information must be available along with appropriate norms or standards for particular business situations. Information is inadequate for problem solving if it does not fully describe both "what is" and "what ought to be."

As description is concerned with "what is" and diagnostics is "what is wrong," prediction is concerned with "what if...?" Predictive information is generated from an analysis of possible future events and is exceedingly valuable with "desirable" outcomes. With predictive information, one either defines problems or avoids problems in advance. Prediction also assists in analysis. When a problem is identified, a manager will analyze the situation and specify at least one alternative (including doing nothing) to deal with the problem. Predictive information is needed by managers to reduce the risk and uncertainty concerning technology, prices, climate, institutions, and human relationships affecting the business. Such information is vital in formulating production plans and

examining related financial impacts. Predictive information takes many forms. What are the expected prices next year? What yields are anticipated? How much capital will be required to upgrade production technologies? What would be the difference in expected returns in switching from a livestock farm to a cropping farm? Management has long used various budgeting techniques, simulation models, and other tools to evaluate expected changes in the business. Without detracting from the importance of problem identification and analysis in management, the crux of management tasks is decision making. For every problem a manager faces, there is a "right" course of action. However, the rightness of a decision can seldom, if ever, be measured in absolute terms. The choice is conditionally right, depending upon a farm manager's knowledge, assumptions, and conditions he wishes to impose on the decision. Prescriptive information is directed toward answering the "what should be done" question. Provision of this information requires the utilization of the predictive information. Predictive information by itself is not adequate for decision making. An evaluation of the predicted outcomes together with the goals and values of the manager provides that basis for making a decision. For example, suppose that a manager is considering changing marketing alternative. The new alternative being considered has higher "predicted" returns but also has higher risks and requires more management monitoring. The decision as to whether to change plans depends upon the manager's evaluation of the worth of additional income versus the commitment of additional time and higher risk. Thus, the goals and values of a petrol station manager will ultimately enter into any decision.

### System Analysis

This system will process all the data keyed in by the manager daily and will produce report for the day. The system is user friendly as the user/manager has to enter the day, month and the year of the transaction before searching or entering the data. The system has a good graphical user interface. This research provides many functions as needed in a management system in a petrol station. Below is the list of functions provided in this system:

- Consolidated reports on fuel inventory, sales, cost, profit.
- Inventory Management
- Received Management
- Reconciliation management
- Cash Lodgment Management

A typical petrol retailing station receives products from its major operator in tank loads. On receipt, the following procedures occur (assuming the station receives a shipment for DPK- otherwise known as Dual Purpose Kerosene):

1. The received product is transferred into the underground tanks and subsequently measured. The measured amount is indicated and cross checked with the amount reported in the tanker.

2. All pumps for a particular product (in this case, DPK) are linked to the main underground tank.
3. Each staff assigned to the sale of DPK is allocated with a respective pump on their shifts duty. This is because most filling stations operate two shifts- morning and evening.
4. Before the commencement of sales for the particular shift, the current reading of the pump is measured and logged.
5. At the close of shift, the reading for the pump is taken and correlated with the reading taken before the shift to compute the amount of liter sold.
6. The staff calculates the amount sold with relation to the amount of liter sold and handovers. The excess amount of sales is left for the staff to keep.
7. Staff allowances are calculated based on performance per day, for example, a staff might be given a target of 2000 liter to sell in a shift. Achieving this target earns the staff bonus in addition for the allowance for attendance.
8. Problems in operation usually occur in
  - a. Computation of staff allowances, as it is prone to errors and delays in computation.
  - b. Fraud is a common incident because, in most cases, the earnings for the days are kept in the office till the following morning or until it can be transferred to the bank.
  - c. Due to manual recording, sometimes pump readings are adjusted before the change of shift allowing for some lapses in reading, thereby leading to fraud.
  - d. Inadequate correlation of sales between retailing stations and headquarters because of the manual mode of data entry.

**System Methodology:** There are different system development methodologies. Each is unique because of its emphasis on process versus data and focus it places on each Software Development Life Cycle (SDLC). It is usually based on some technical views. The purpose of this methodology is to:

- Formalize the requirement elicitation process to reduce the chances of misunderstanding the requirement.
- introduce the best practice techniques to the analysis and design process.

In this case, the structured system analysis and design methodology is adopted.

Structured System Analysis and Design Methodology adopts a prescriptive approach to information systems in that it specifies in advance the modules, stages and task which have to be carried out, the deliverable to be produced and furthermore, the techniques used in producing the deliverables.

**Parallel Development:** this methodology attempts to address the long time interval between the analysis phase and the delivery of the system. A general design for the entire system is performed and then the project is divided into series of distinct subprojects as shown in the main menu interface in figure 1 below.



Fig. 1. Pms daily sales form.

**Implementation:** The following piece of codes are part of the codes used in implementing the form in figure 1 above.

```
function fill() {var txt8 = document.getElementById("TextBox8").value-0; var txt9 = document.getElementById("TextBox9").value-0; document.getElementById("TextBox10").value = txt9 - txt8; if(txt8 > txt9){alert("Opening Sale can not be Greater than Closing Sale");} function fill1() {var txt10 = document.getElementById("TextBox10").value-0; var txt11 = document.getElementById("TextBox11").value-0; document.getElementById("TextBox12").value = txt10 * txt11; if(txt10==""){alert("Closing Sale and Opening Sale must be entered");}}
```

```
<tr valign="baseline">
<td align="left" nowrap="nowrap"><strong>Rate:</strong></td>
```

```
<td><input type="text" name="rates" id=TextBox11
onchange="fill1()" value="" size="32" /></td>
```

```
</tr>
<tr valign="baseline">
<td align="left" nowrap="nowrap"><strong>Amount:</strong></td>
```

```
<td><input type="text" name="amount" id=TextBox12
readonly="readonly" value="" size="32" /></td>
```

```
</tr>
<tr valign="baseline">
<td align="left" nowrap="nowrap"><strong>Remark:</strong></td>
```

```
<td><input type="text" name="remark" value=""
size="32" /></td>
```

```
</tr>
<tr valign="baseline">
<td align="left" nowrap="nowrap"><strong>Day:</strong></td>
```

```
<td><label for="day_of_sale"></label>
<select name="day_of_sale" id="day_of_sale">
```

```
<option value="1">1</option>
<option value="2">2</option>
```

```
</select></td>
</tr>
```

```
<tr valign="baseline">
<td align="left" nowrap="nowrap"><strong>Month:</strong></td>
```

```
<td><label for="month_of_sale"></label>
<select name="month_of_sale" id="month_of_sale">
```

```
<option value="1">1</option>
<option value="2">2</option>
```

```
<option value="3">3</option>
<option value="4">4</option>
```

```
<option value="4">4</option>
</select></td>
```

```
</tr>
<tr valign="baseline">
```

```
<td nowrap="nowrap" align="left"><strong>Year:</strong></td>
<td><input name="year_of_sale" type="text" value="<?php echo date("Y");?>" size="32" readonly="readonly" /></td>
</tr>
<tr valign="baseline">
<td nowrap="nowrap" align="right">&nbsp;</td>
<td align="center"><label for="select"></label>
<input type="submit" value="Add" class="art-button" /></td>
</tr>
</table>
<input type="hidden" name="MM_insert" value="form1" />
</form></center></p>
```

**Conclusion:** it is high time in Nigeria our Petrol Station get computerized to enhance the activities in the retail station, and link the different sectors involved in petrol production and distribution. This research develops a model for implementing web base digital petrol station in Nigeria that will help to automate a petrol retailing station, with a view to building an enterprise solution that will enable the monitoring of the petroleum products, with emphasis on retailing, using a web based application written with PHP/MYSQL, java and HTML languages. The application track product sales per products, helps to monitors staff activities and host of other things as can see in the interface of the application shown in figure above.

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