INFLUENCE OF REACTIVE MAINTENANCE AT RETAIL OUTLETS ON SALES VOLUME: A CASE OF TOTAL KENYA LTD

BY:

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DECLARATION

I declare that this research project report is my original work and that it has not been presented in any other university or institution for academic credit.

Signature ..... **Date** 9/8/2011

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L50/60553/10

Declaration by the Supervisor

This research project report has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This study is dedicated to my son Mayian, daughters Judy and Graca and to my beloved wife Annette.

ACKNOWLEGEMENT

My deepest gratitude is to the Lord for giving me the knowledge, strength and capability to carry out this research project, hallowed is His name. I am sincerely grateful to my supervisor Dr.Peter A M Mwaura for his guidance and assistance in undertaking this research project. Further many thanks go to all Total service contractors and station managers who despite their busy schedules dedicated their time to respond to my questionnaire. Finally I thank my wife Annette for her moral support and encouragement through out the entire period of my study.

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ABBREVIATIONS AND ACRONYMS

AGO: Diesel

CODO: Company owned Dealer operated

DODO: Dealer owned dealer operated

ERC: Energy regulatory Commission

ERP: Energy resource planning

IK: Kerosene

KPC: Kenya Pipeline Company

LPG: liquefied Petroleum gas

NOCK: National oil cooperation of Kenya

PIEA: Petroleum Institute of East Africa

PIS: Petroleum Industrial Services

PMS: Premium petrol

RMS: Regular petrol

TKL: Total Kenya Limited

WO: Work orders.

WR: Work request.

"Territory Manager." Marketing Personnel in charge of sales per given region.

"Nature of repair". Refers to Mechanical, Civil and Electrical repairs.

"Equipment." The three major machines found at the petrol stations: Compressors, Dispensing Pumps and generators

"Bulk sale" means sale of petroleum products other than retail sales

"Dealer" means any person, firm or company, who carries on, directly or otherwise, the business of storage, distribution and sale of petroleum products in bulk or retail

"Depot" means any premises approved or licensed by the energy regulatory Authority.

"Oil marketing companies" means any person, firm or company engaged in sale of Petroleum products to dealers or consumers in bulk or retail;

"Petroleum products" means crude oil or any product manufactured out of crude oil or from another petroleum product including Aviation Turbine Oil, Motor Spirit, High Speed Diesel, Liquefied Petroleum Gas, Superior Kerosene Oil, Naphtha and Solvent or any derivative.

"Retail outlet" means service/filling station in which one or more dispensing pumps have been provided for retail sale of Motor Spirit and / or High Speed Diesel or an LPG distributorship or a Kerosene dealership.

"Young Dealer". A non financial dealer who is supplied products by the company and sells on their behalf.

"Response Time." This the time when breakdown is reported at the customer care to the time the problem is sorted out.

"Call." This refers to report of breakdown to customer care at total Kenya Head office.

"Work orders". These are calls sent to fixed contracted contractors

"Work request." These are calls sent to non fixed contracted contractors

"Minimint". This is the maintenance system that is used by the customer care and Maintenance team to input calls and reports for the breakdowns

ABSTRACT

The main purpose of this study was to examine how reactive maintenance influences the sales volume at the Total Kenya limited retail outlets. The objectives were to find how response to reported breakdown. frequency of breakdown on particular equipment, nature of repair and quality of contracted contractors in various regions affect sales volume

The study adopted a case study of Total Kenya limited and the target population of 164 retail outlets managers and dealers. The sample size of 65 retail outlets managers and dealers and two equipment contracted companies were drawn from the target population of 165 retail outlets managers and dealers. Out of the targeted 65 respondents, 55 responded while 10 were unable to return back the questionnaires. Both the two contractors responded.

Primary and secondary data using questionnaires and equipment maintenance software reports respectively were used. Descriptive tables, regression analysis and correlation coefficients were used to analyse the data.

The study established that longer response time lead to low sales volume while generators and compressors frequency of breakdown did not have as much effect as pumps which showed significant reduction in volume with high breakdown reports. Areas with technicians with higher qualification and experience registered lower frequency of reported breakdowns hence better sales volume. Correlation coefficients showed strong positive correlation between the parameter testing reactive maintenance and sales volume.

CHAPTER ONE: INTRODUCTION

1.1 Background information

Generally production activities in the manufacturing and marketing of finished products are dependent on the machine efficiency and availability to produce the required or the designed quantity and quality of the products. Customer satisfaction is key to any business survival, consistency and reliability plays a major role in the current competitive market and this is what brings differentiation in the marketing of petroleum products in Kenya where the prices are regulated and all Marketers sell at almost same prices. External and internal challenges to realisation of the business goals must be dealt with to ensure the business stay on the profit making path. For realisation of higher production, the people, machines and general management of the activities are key to the overall success of these organisations all must be balanced for the success of the organisation.

1.1.1: Market Shares for various Marketers in the Kenya

There are over 15 major Oil marketers in Kenya and their market share is based on the volumes of fuel pushed within a given period. In the month of March, 2011, Total Kenya was the leader at 23.4% followed by KenolKobil at 22.8% of the total Kenyan market share. For one to remain on top in the list, then they must ensure they push large volumes of fuel which is dependent on the availability of the equipment at the retail outlets.

Maintenance of equipment used in these sectors is carried out either by directly employed personnel of the organisations or contractors out sourced on pre a greed terms. The contribution of Technical and engineering services department in the marketing of the petroleum products at the service stations is of great importance when looking at the

equipment availability at retail outlets. The department coordinates the repairs with various contractors contracted by the company to carry out equipment maintenance. It is believed within this sector that equipment availability is key to realisation of the set sales targets when the other distribution and availability of the products at the outlets are addressed. If maintenance expenditure is viewed as the necessary premium to be paid for reliability insurance, then it follows that all maintenance activity should be directed towards maximum returns on that investment, i.e. improved reliability. Rarely is that found to be the focus. Usually the emphasis is on returning the machine to service as quickly as possible without any serious consideration of reliability improvement while the opportunity is presented.

The study tried to look at various parameters which may affect the availability of equipments at the retail outlets to ensure stations meet their set sales target; various equipments breakdown at the station, time taken to address the breakdowns, the technicians out sourced to carry out the maintenance and response to calls on equipment breakdown were looked at and the findings of the report documented in the following chapters.

1.2 Statement of the Problem

Reactive maintenance is one of the many types of maintenance to equipment carried out in the retail outlets. This approach majorly is response to breakdown once it has happen. To ensure availability of the production equipment at the retail outlets, time to respond to the breakdown is important since the longer the delay the higher the un availability of the equipment to produce as planned.

Many engineers and researchers have written and published their findings on various issues in the field of equipment maintenance. They have recognized the importance of equipment maintenance in ensuring a safe working environment, reduction of production costs and improved product quality; reactive maintenance and safety incidents (Christer,1999) said that when equipment are not well maintained there exist higher number of accidents. Today's challenges in equipment maintenance (Franzier, 2002) also wrote and concluded that maintenance cost Money. Franzier further argues that developing special method for maintenance of critical equipment improves maintenance quality and reduction of operation cost. He then concluded by suggesting that combination of preventive and reactive based maintenance is suited for critical equipment".

Although most studies recognize the significance of the two major approaches to equipment maintenance but few have related reactive maintenance to sales volume. Many researches have documented on the merits of preventive and demerits of reactive approaches to maintenance in manufacturing industries with little documentation on how to approach reactive maintenance since equipment failure is eminent in the production set up.

The few studies done on reactive are not conclusive since they majorly focus on cost and safety implications of reactive maintenance with minimal relation on its contribution to production volumes. This study examined effects of reactive maintenance on sales volume for Total Kenya retail outlets.

1.3 Purpose of the Study

The main purpose of this study was to examine how reactive maintenance influences the sales volume at the Total Kenya limited retail outlets

1.4 Objectives of the Study

Maintenance in retail outlets could be affected by a number of variables which many not be studied by this research. this study will base its scope on the below four objectives.

1. To evaluate how time taken to respond to reported maintenance issues affect the sales volume.

2. To establish the effect of frequency of breakdowns on a particular equipment on the sales volume.

3. To evaluate the extent to which nature of repair affects the sales volume

4. To establish the relationship on quality of outsourced contractors on sales volume

1.5 Research Questions

This study will try to answer the following questions with a view to address their contribution on the volume of sales.

1. What is the effect of response time on sales volume?

2. How does frequency of breakdown on Compressor, Generator and dispensing Pumps affects the Sales Volume?

3. What is the effect of nature of Mechanical, Civil and Electrical repair at the station affects the sales volume?.

4. What is the relationship between quality of outsourced contractors and the volume of sales?

1.6 Significance of the study

This research adds to the existing body of knowledge effects of equipment maintenance in manufacturing, production and marketing of products. Many researchers and engineers have carried research on equipment maintenance and their relation to production efficiencies and concluded there exist a relationship. Although there has been a lot of documentation on how equipment maintenance affects production, the findings from this research will help the Oil marketers come up with the best value approach to retail outlets maintenance.

Maintenance of equipment at retail outlets (stations) is necessary for all the Oil marketing companies since this is the point of sale for most of the petroleum products. The efficiency of the operations at the station depends much on the availability of the equipment to dispense the products.

The findings will provide Total Kenya managers within the marketing and maintenance to appreciate the importance of focusing specific action plans so as to have the critical equipment available most of the time for production. The results will enhance management of assets within the retail outlets and further improvement of services at the customer point so as to improve efficiency and therefore be able to retain market leadership.

Other oil firms will have a strong background based on the findings to measure their performance and factors that contribute to improved volumes at the retail outlets and address the challenges to availability of equipment at the retail outlets

1.7 Delimitation of the study

Most of the targeted population had internet connection and mobile phones, making sending questionnaires and communication possible hence enhanced the response.The reminders were frequently sent to respondents which reminded them of the need to respond.

1.8 Limitation of the study

Due to time, large number of retail outlets and financial factors this study was limited to Total Kenya 65 petrol stations managers or dealers geographically spread throughout Kenya and the three equipment maintenance contractors. It captured Mechanical, Electrical and Civil engineering maintenance within the stations. The equipment in question were; Dispensing pumps, Air Compressors, Generators, Buildings and Forecourt. Due to time factor and geographical spread of the service stations, this study based its scope on Total Kenya service stations. The other Marketers service stations are equally located within these regions and the findings of this report could be useful to the other marketers.

1.9 Definition of terms

Reactive maintenance-This is a type of equipment repair carried out to correct the failure on the equipment or replace component ones it has broken down.

Sales volume- Fuel sold in Million Litres.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This study addressed the area of equipment maintenance and focused on a type of maintenance known as reactive maintenance and how it affects the sales volume in oil marketing retail outlets. The literature review sampled works that addressed maintenance of infrastructure and equipment in the production, manufacturing and oil marketing Industries and also the effects of maintenance on efficiency, safety, production and sales volumes.The factors that influence the effectiveness of carrying out the reactive maintenanance such as time,nature of repair,the equipment type and the contractors involved in the carrying out the reactive maintenance were looked at.It also tried to evaluate the current maintenance practices and their contribution to production effeciencies and the emerging gaps in an attempt by other researchers to address the equipment maintenance topic.

2.2 Sales Volume

The volume of fuel sold is used as the measure of gauging how particular Marketer is positioned in the market.Large volumes reveals higher margins since the prices are controlled and all Marketers almost sell at similar prices.The table2.1 below outlines the volumes of petroleum products sold beetween the period 2004 to 2011 in Metric tonnes while table2.2 shows the market share for the various oil Marketers in Kenya for the period ending March 2011.

Table 2.1:Kenya Petroleum Sales in Metric Tonnes

	YEAR							
Products	2004	2005	2006	2007	2008	2009	2010	Jan – March, 2011
Avgas	2,462	2,763	2,752	2,999	3,380	2,007	2,672	560
Jet A-1	675,930	710,670	751,927	808,363	705,705	740,211	747,841	211,216
Premium	376,034	383,267	429,900	438,545	417,794	542,856	633,397	162,395
Regular	86,453	81,258	79,056	73,241	61,033	55,158	56,953	13,835
Kerosene	305,825	389,607	364,234	329,853	285,003	374,945	323,441	75,277
Gas Oil	948,066	1,052,581	1,221,373	1,370,126	1,429,838	1,675,577	1,583,718	390,766
Industrial Diesel	30,787	29,623	45,292	47,007	30,344	23,897	26,570	8,607
Fuel Oils	472,107	586,661	713,702	674,809	600,999	590,944	570,232	165,751
LPG*	41,884	48,827	64,639	74,017	78,030	59,773	63,779	15,193
Bitumen*	8,262	11,650	14,634	16,677	17,733	12,405	7,761	3,665
Lubricants	36,508	30,965	39,336	33,074	32,675	26,514	30,970	10,061
Greases*	604	1,206	3,775	3,130	2,431	1,429	1,069	142
TOTAL	2,984,922	3,329,078	3,730,620	3,871,841	3,664,965	4,105,715	4,048,404	1,057,468

Source: PIEA, March 2011

Table2.2: Market shares for various Marketers in Kenya.

January - March 2011	
COMPANY	Market share%
TOTAL	23.4
KENOLKOBIL	22.8
SHELL	17.9
LIBYAOIL	11.8
NOCK	5.2
GAPCO	4.4
HASS	1.8
GULF	1.8
HASHI	1.8
GALANA	1.4
BAKRI	1.4
ENGEN	0.8
OILCOM	0.7
RIVAPET	0.6
FOSSIL	0.5
Others	3.7
Total	100

Source: PIEA, March 2011

2.3 Reactive maintenance

In 2002 K. Guadette described Maintenance and repair as fixing any sort of mechanical, or electrical device should it become out of order or broken. It also includes performing routine actions which keep the device in working order or prevent trouble from arising. Retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions.

Mobley (2009) defined maintenance operations and concluded it could be categorised by whether the product remains the property of the customer, this is when a service is being offered, or whether the product is bought by the reprocessing organisation and sold to any customer wishing to make the purchase. The former of these represents a closed loop supply chain and usually has the scope of maintenance, repair or overhaul of the product. The latter of the categorizations is an open loop supply chain and is typified by refurbishment and remanufacture.

British Standard Glossary of terms (3811:1993) defined maintenance as: the combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function. Activities of maintenance function could be either repair or replacement activities, which are necessary for an item to reach its acceptable productivity condition

Staller, senior maintenance consultant in Britain (2006) describes maintenance as; "a series of tasks and company policies that, if followed, improve and keep business profits as high as possible" he further suggested the following three general guidelines;

Maintain the production equipment and plant utility systems equipment as close to brand new condition as possible and have all equipment ready to start up and run with no unplanned shutdowns.

Maintain the production equipment and plant utility systems equipment in the best possible operating condition for the purpose of producing quality manufactured goods while the machines are in service.

Complete all Preventive and Predictive Maintenance work on a regularly scheduled basis without exceeding the "Point of Diminishing Returns on Investment" for the labour, tools and materials required to perform the work.

Piotrowk (2001) said that the need for maintenance is predicated on actual or impending failure, ideally maintenance is performed to keep equipment and systems running efficiently for at least design life of the component(s). As such, the practical operation of a component is time-based function.

Maintenance practices encompassing preventive and predictive elements can extend this period. The wear-out period is characterized by a rapid increasing failure rate with time. In most cases this period encompasses the normal distribution of design life failures.

In reference to these definitions of Guadette, Staller, Piotrowk and British standards Glossary all brings out the relationship between maintenance and the efficiency of the equipment. They all recognize the importance of keeping equipment maintained to realize its full designed output. It is in this context this research tries to evaluate if the sales volume in the Oil Marketing Retail outlets has any correlation with maintenance of

equipment.Edward W Deming says to managers in his famous warning. "Your business is perfectly designed to give you the results that you get." Poor equipment reliability is the result of choosing to use business and engineering processes that have inherently wide variation. These processes are statistically incapable of delivering the required performance with certainty, and so equipment failure is a normal outcome of their use and must be regularly expected hence failure is designed into the business.

2.3.1 Maintenance Types

Many organizations today are overcoming their state of complacency and are responding to meet increased challenges in being effective and efficient. It is in this context that James Youmans (2011), categorized maintenance into two types:

(a) Preventive maintenance, where equipment is maintained before break down occurs. This type of maintenance is documented to have many different variations and it is believed to be the best approach to maintenance.

(b) Reactive or Corrective maintenance, where equipment is maintained after break down..This maintenance is often most expensive because worn equipment can damage other parts and cause multiple damage.

2.3.2Response time on Preventive Maintenance

Preventive maintenance can be defined as follows: Actions performed on a time or machine-run-based schedule that detect, preclude, or mitigate degradation of a component or system with the aim of sustaining or extending its useful life through controlling degradation to an acceptable level. Piotrowk (2001), preventive maintenance

as cleaning, inspection, oiling and re-tightening of the equipment done to retain the healthy condition of equipment and prevent failure through the prevention of deterioration by periodic inspection or equipment condition diagnosis. He further divided it into periodic maintenance and predictive maintenance. Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance.

Recent studies have shown that Preventive maintenance is effective in preventing age related failures of the equipment. For random failure patterns which amount to 80% of the failure patterns, reactive and part replacement proves to be effective. With most failures being in random failure pattern which calls for responding to the failure to bring back the equipment into use.

2.3.3 Response time on Reactive Maintenance

American's Operations and Maintenance best practices Guide (Release 3.05.5) defines, reactive maintenance as basically the "run it till it breaks" maintenance mode. No actions or efforts are taken to maintain the equipment as the designer originally intended to ensure design life is reached. The guide breaks down the average maintenance program as follows: >55% Reactive, 31% Preventive, 12% Predictive and 2% others.

If More than 55% of maintenance resources and activities of an average facility are still reactive. Advantages to reactive maintenance can be viewed as a double-edged sword. If we are dealing with new equipment, we can expect minimal incidents of failure. If our maintenance program is purely reactive, we will not expend manpower or incur capital cost until something breaks. Since we do not see any associated maintenance cost, we

could view this period as saving money. The downside is during the time we believe we are saving maintenance and capital cost: we are really spending more Money than we would have under a different maintenance approach. We are spending more money associated with capital cost because, while waiting for the equipment to break, we are shortening the life of the equipment resulting in more frequent replacement. We may incur cost upon failure of the primary device associated with its failure causing the failure of a secondary device. This is an increased cost we would not have experienced if our maintenance program was more proactive. The labour cost associated with repair will probably be higher than normal because the failure will most likely require more extensive repairs than would have been required if the piece of equipment had not been run to failure. The above demerits and its huge use in the equipment maintenance make it a point of interest for this study. If more than 55% of maintenance is reactive, then its contribution to sales volume could be significant.

Boone (2008) wrote and gave out an account of equipment losses as:

- Equipment failure losses
- Setup and adjustment losses
- Idle and minor stoppage losses
- Reduced speed losses
- Defects in process
- Defects in products or rework losses

He further justified his statement in the below mathematical equation on how production (sales Volume) is affected by the equipment.

Overall Equipment Effectiveness (OEE) = Availability x Performance Efficiency x Rate of Quality product

In conclusion he says; "Research that evaluates the various decisions in equipment maintenance development will help to drive maintenance investments to improve equipment productivity. Academics need to lead the efforts to improve equipment maintenance management Practices to ensure higher productivity".

Boone recognizes the role played by equipment availability for production. He said; productivity is dependent on the availability of the machine or equipment to produce the designed output. He further documented and said that the output of equipment is a factor of its availability to perform the task. This approach is close to the one that was adopted by this study in regards to the research objectives and the questions the research aim to address.

Rome, Halconsuth (1999), defined reactive maintenance as to mean that people waits until equipment fails and repair it. Such a thing could be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

Reactive maintenance (also known as corrective maintenance) involves all unscheduled actions performed as a result of system or product failure. Basically, it is an attempt to restore the system/product to a specified condition. The spectrum of activities within this

level are (1) failure identification, (2) localization and isolation, (3) disassembly, (4) item removal and replacement or repair in place, (5) reassembly, and (6) checkout and condition verification. This approach is mainly a response to machine breakdowns and is the most common approach at the retail outlets. Many manufacturers are still in a reactive mode of operation and their main objective is to ship the end product. If their manufacturing equipment breaks down, they fix it as quickly as possible and then run it until it breaks down again. This is an extremely unreliable process and is not the best way to maximize the useful life span of one's assets. It leaves machine tools in a state of poor repair and can cause the production of out-of-tolerance parts and scrap. Because of its unpredictable nature it can easily cause disruptions to the production process Brown,(2012)

2.3 Trend in Reactive maintenance to equipment

Laskiewicz, Mike(2005) identified two major trends in the development of maintenance management research and listed them as;(1) emerging developments and advances in maintenance technology, information and decision technology, and maintenance methods; and (2) the linking of maintenance to quality and production improvement strategies and the use of maintenance as a competitive strategy.

The first major trend has to do with the impact of artificial intelligence techniques, such as expert systems and neural networks, on the formation of maintenance knowledge in industrial organizations. There is a diverse application of expert systems within the maintenance area and may not be of interest for this study

The second major trend is typified by the emergence of total productive maintenance, which must be incorporated into the firm's strategy. In the quest for world-class manufacturing, many industries are appreciating the need for efficient maintenance systems that have been effectively integrated with corporate strategy. It is vital that maintenance management becomes integrated with corporate strategy to ensure equipment availability, quality products, on-time deliveries, and competitive pricing.

He then concluded, "Maintenance will continue to be a major area of concern for manufacturers and other forms of business. A study of some seventy manufacturing plants found that over 50 percent of the maintenance work performed by these firms was reactive (run to failure, emergency breakdown). The balance of maintenance work was preventive or period based (25 percent), predictive or condition based (15 percent), and proactive or root-caused based (10 percent)". A strong correlation has been found to exist between manufacturing cost reduction and preventive/predictive maintenance. Mike Laskiewicz did a study for over five-year period for group of companies in Canada and found that productivity improvements correlated strongly with a number of variables, one of which was preventive/predictive maintenance.

Mike Laskiewicz recommended that organizations recognize maintenance as a key department that needs to be well managed. In addition, the maintenance department should be led by a strong-minded individual who is a good motivator, technically competent, experienced and familiar with advanced industry practices and complexities of equipment in use.

Du Pont Corporation (1980) carried out a study of the effectiveness of the maintenance operations in their large number of plants. Maintenance operations and came up with graphical representation their findings known "**Bathtub Curve**". This was presumed applicable to All Machines and described reactive maintenance into three identifiable phases within the Bathtub Curve;

(a) **Running In**, also known as the **Infant Mortality,** phase. This recognises the premature failure of components and is often seen in plant in the first few days or weeks after overhaul.

(b) **Normal Operating Life** phase. This shows a relatively constant probability of failure. Failures within this phase are usually referred to as **Random.**

(c) **Wear Out** phase. There is an increasing probability of component failure between equal and successive time intervals. Somewhere within this phase the failure rate would become unacceptable and widespread maintenance would be carried out, usually of an intrusive nature, on equipment still in its "normal operating life". In the mid- into the following two categories; Reactive and Planned maintenance.

They also identified the characteristics of these operations and concluded that Companies with truly effective maintenance and high reliability operations are very few and most maintenance are reactive in nature.

Rome, Halconsuth (1999) additionally found that in the move from **'Reactive'** to **'Planned'** the value gained when all two strategies were integrated or coordinated together was greater than the sum of the parts – in other words, doing predictive and preventative maintenance is most successful in lifting reliability when they are planned and scheduled. In conclusion the study

found out that many organisation the Predictive, or Condition Monitoring, component is still not well integrated. Reactive 83.5% Planning and preventive at 6.5 % .This conclusion supports why the project was worth concentrating on reactive maintenance which is the widely practiced mode of repair and its contribution could be significant to realisation of production volumes.

Rushton (1990) documented that downtime can influence profit more than occasional production increases, and downtime occurs on a regular basis equipment needs constant maintenance work. Parts need lubrication, components need to be replaced, electrical problems need to be repaired and any other number of problems addressed. Any repair work the maintenance department does to equipment will result in downtime, will take away from production and will cost money. These maintenance costs cannot be avoided. However, they can be minimized through proper maintenance practices.

2.4 Conceptual framework

The conceptual framework that guided this study is constructed from four independent variables; response time to maintenance calls, frequency of breakdowns on a given equipment, the nature of repair required and the quality of maintenance technicians. The Geographical location of stations in Kenya, specification for replaceable parts, number of other marketers served by the same outsourced maintenance contractor as intervening, moderating and extraneous variables for the dependent variable volumes of sales.

Figure 1: Conceptual Framework

2.7 Summary

This chapter looked at the background of maintenance, definitions in various contexts in relation to productivity and efficiency. It also looked at various types of maintenance that are widely adopted in various sectors of manufacturing and production. The evaluation of each and their documented influence in the industry. Reactive which is the subject of study is addressed in depth and reasons for the choice discussed. The various researchers findings were studied and their conclusions based on the field being studied outlined. The variable; independent, intervening and dependent conceptualized to create the desired relationship

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This section delineates the research design, methods of data collection and methods of data analysis.This study was a desciptive survey and used questionnaires and record analysis to collect data from the service station and minimint reports from the customer care records.

The study sought to obtain data on equipment breakdown calls, response to calls and frequency of breakdowns on particular equipment and how that data relates to volume of sales at the service station. According to Kothani (1990) a case study has a unique strength of its ability to deal with a full variety of evidence, including documents, artifacts, interviews and observation. This is because it involves a careful and complete examination of a social unit, institution, family, cultural group or an entire community and embraces depth of a study. The case study was chosen because the objectives of the study required an in-depth understanding of the maintenance on marketing of petroleum products.

3.2 Research Design.

The design was mainly descriptive survey and involved a systematic collection of data concerning opinion of dealers or managers and contracted firm directors on maintenance and expected sales volumes. The question asked aimed at testing the main premise while keeping in focus the purpose, objectives and the research questions relating to this study. This design approach helped in establishing the percentage of contribution of various

independent variables on volume of sales. Survey design was the basis for the formulation of empirical research instruments.

According to Mugenda & Mugenda (2003), a survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. According to Kothari (2004), surveys are only concerned with conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident or trends that are developing. The method of data collection happens to be either observation or interviews or questionnaire (Kothari 2004). A cross-sectional survey research involves the use of structured questionnaires and/or statistical surveys to gather data about people and their thoughts and behavior (Cooper 2001).

Survey research is suitable for this research because it helps to explain and explore the existing status of two or more variables at a given point in time. Surveys are also used in collecting data from large populations that are not easy to observe directly.

The study employed quantitative approach. Quantitative study design using questionnaires and data analysis was deemed appropriate for this study because it facilitated the gathering of opinions of the station managers, dealers and contractors on issues of equipment maintenance and their perceived influence on volume of sales and generates reports from the system.

3.3 Target Population

The target population was the 164 Total Kenya service stations dealers and managers, the managing directors of two contracted maintenance firms. These being the people who are involved in the daily sales and maintenance of the equipment at the total Kenya retail outlets and comprised of both female and male managers. These stations were chosen because they were representative of all the other marketers retail outlets which share the same geographical spread and the results of the findings was of importance for these marketers too. Total Kenya being a market leader in network sales and being present in most urban centres will make a good case for the study.

3.4 Sampling procedure

Sample size is derived from Yamane(1997:258)formula for population proportion as shown below;

$$n=N/(1+Ne^2)$$

Where;

N= Target Population

e = Precision error

n = sample size

Therefore if ;

N=164Service stations

P=Population proportion and is 0.5

At 95% Lowest level of confidence and with an error limit of 10%.

$n = 164/\{(1+164(0.1)^2\}$

$= 62.2$

Say 65Service stations.

The representative sample for all the six regions; Nairobi, Nakuru, Mombasa, Western, Eldoret and Mt. Kenya were proportioned acording to the number of outlets and then stratified random sampling was used identify the service stations to be surveyed.The table3.1 show the distribution of samples per region.percentage response against total sample population and the cummulative frequency.

Table 3.1: Geographical Distribution samples and Respondents

Regions	Sample	Number of respondents	Percentage response	Cumulative Percent
Nairobi	17	10	18.2	18.1
Mombasa	10	8	14.5	32.6
Nakuru	12	12	21.8	54.4
Kisumu	13	13	23.6	78.2
Eldoret	13	12	21.8	100
Total	65	55	100	

The questionnaires were sent to 65 station managersand dealers in Nairobi, Nakuru, Mombasa, Western, Eldoret and Mt. Kenya regions and the two contracted firms directors.

3.5 Methods of Data collection

Due to the geographical spread of the sample, data was collected through self-administered questionnaires to the respondents and document content analysis. Follow up was done to ensure the response rate was enhanced as possible. Since the information required involved daily operational issues encountered by the respondents,the data collected was assumed tol give an insight the study seeked to achieve.

3.5.1 Research Instruments

The following two instruments; Self administered questionnaires and record analysis were used to get the required information for this study.Table 3.2 gives a summary of the instrument, respondent and required information.

Primary data was collected by use of both structured and open-ended questions to ensure the information needed from the respondents were captured. The questionnaires were prepared and structured to meet the information needs.The were delivered to the respondents by email and returned after two weeks. There were two different set of questionnaires; one for contractors directors and the other for the station mangers and dealers. The questionnaires were structured in four parts. Part A was used to capture the background information of the respondent, the station or company run and the period they had been with Total Kenya ltd. Part B was used to evaluate the challenges to response to maintenance calls reported as perceived by the respondents and how prompt

the calls are responded to. Part C was used to collect data on the frequency of breakdown on particular equipment and nature of repairs on sales volume as realised by dealers of stations. Part D assessed the challenges of the service providers and their ability to deliver quality services to the stations and also the assessment of the dealers on the contractors ability to service the stations.

The sources of evidence were documents kept by the stations and contractor, maintenance records from Total customer care who receives the call and log them, the monthly sales volumes records, maintenance system information and other internal documents available in the company. The respondents were the dealers, managers and directors of various maintenance contractors. Preliminary notification was given to the respondents and detailed account of why the information was being sort given to them to avoid any misconceptions which might have compromised the findings. Assurance of confidentiality of information was also be given to the respondents.After returning of the questionnaires back,each respondent was individually sent to a note of appreciation including the ones who did not respond.

Table 3.2 Showing Instrument, Respondent and Information required.

Instrument	Respondent	Information to be acquired
Self administered questionnaires	Contractors	-Level of qualification and experience of Technicians. -Other clients served by the contractor -What affects response time on contractors after receiving maintenance calls -No of stations a signed to each Technician -Area a located to each contractor. -Which equipment is frequently reported.
	Dealers/station managers	-How long does it take for a breakdown to be reported to customer care. -Does the reporting system contribute to delay in response time -Which equipment affects sales volume the most -Percentage contribution of equipment breakdown in meeting sales target. -What is the level of service satisfaction from the contractor. -What nature of repair contribute most to your sales volume.

Instrument	Respondent	Information to be acquired
Record analysis		-Litres of fuel sold during the period. -Call logged in time -Call closure time -Frequency of calls on a particular on equipment. -Work requests/orders generated and responded to during the period

3.6 Validity and Reliebilty

Pretesting of the questionnaires was done by pilot sending out the questionnaires to five Nairobi based dealers and contractors to help test the validity and reliebility and to detect any weaknesses before rolling the instrument out to the other areas. The items which were not clear to the respondents were corrected after calling the respondent to confirm their understanding of the questions which were not clear to them. Some questions which did not have input to the objectives were then dropped and the non clear ones re phrased to simplify them.

3.7 Operationalization of variables

The table 3.3 describes how various variables, indcators, what was measured and what was used to get the results. It also describes which method was used to analyse the data.

Table 3.3: Operationilization of variables

Objective	Variable	Indicators	Measurement	Scale	Data Collection Method	Data Analysis
To assess how time taken to respond to reported maintenance issues affect the sales volume	**Independent variable** Response time to maintenance calls	Time taken for the reported breakdown to be sorted out	How does varied response times impact on the sales volumes Does the reporting system contribute to response time Time to respond to Maintenance Calls	Ratio and nominal	Questionnaire Minimint data	SPSS

Objective To establish the effect of frequency of breakdowns on particular equipment on the sales volume.	**Independent variable** Frequency of breakdowns on equipment	**Indicators** No. of times equipment breakdown	**Measurement** Repairs Frequently Reported	**Scale** Ratio and nominal	**Data Collection Method** Questionnaire Minimint data	**Data Analysis**
To assess the extent to which nature of repair affects the sales volume	Nature of repair required	What is to be repaired?	Which equipment is frequently reported?	Ratio and nominal	Questionnaire Minimint data	SPSS
To establish if there is any relationship between quality of contaccted contractors on sales volume	Quality of maintenance technicians	Type of technician training	Level of qualification and experience of Technicians Preference to a Particular Technician Rating of contractor's performance Technicians ability to handle to handle the issues	Ratio and nominal	Questionnaire	SPSS

3.8 Data Analysis

The data collected was edited for accuracy, uniformity, consistency and completeness. For the objective in establishing how time taken to respond to reported maintenance issues affect the sales volume, the data of all responses was tabulated to give an overview of how the 55 service stations reported breakdown on equipment were responded to. The mean response time in days and its percentage contribution to the sales volume for each month was then calculated. All the findings were categorized into the respective perspective for all the attributes studied. The correlation analysis was used to establish the relationship between frequencies of breakdowns on particular equipment on the sales volume for six months studied which is the second objective of this study. This was by establishing the percentage of breakdown reported on particular equipment and its contribution to the period of study sales volume. All the findings were categorized into the respective perspective for all the attributes and Model Goodness of Fit calculated to establish the relationship and the percentage contribution of the attributes to the sales volume in thousand liters.

Table 3.4 Breakdown reported to the Customer Care at the Head Office

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	54	98.2	95.8	95.8
No	1	1.8	4.2	100.0
Total	55	100.0	100.0	

3.8.1 Descriptive tables

The collected data was analyzed using descriptive tables as the main tool. this comprised tabular and numerical representations of the data in terms of percentages and was decided since it gives a quick interpretation of the findings.

3.8.2 Correlation and Regression analysis

In correlation, Model Goodness of Fit was calculated to establish the relationship of the dependent and independent while regression analysis was used to analyze the contribution of various independent variables on the sales volume. By controlling the other variables the study analyzed the contribution of the major variables studied on the sales volume by using regression coefficients to show how specific aspects under study influenced the findings. Regression analysis of the sales volume for all attributes studied was also analysed using regression coefficients to show how specific aspects under study influenced the findings established by use of the computer software SPSS for each perspective category covering all related aspects

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The chapter presents the data analysis, presentation and interpretation of the findings on the influence of reactive maintenance at retail outlets on sales volume. The data collected was collated and reports produced in form of descriptive tables.

4.1: Effect of response time on sales volume

The tables 4.1; breakdown reported at customer care, 4.2; promptness to respond to breakdown, 4.3; response time to breakdown and the effects on daily sales, 4.4: monthly average response to calls and sales volume were used to present the data.

Table 4.1: Breakdown reporting to Customer care

Nature of breakdown	Time to report a breakdown to customer care			
	0 to 2 Hours	3 to 4 Hours	4 to 5 Hours	Over 6 Hours
Mechanical	16.5%	0%	0%	0%
Civil	4.5%	0%	4%	25%
Electrical	33%	8%	5%	4%
Total	54%	8%	9%	29%

The study sought to know the time taken to report a breakdown to the customer care, it was revealed that 16.5% of mechanical breakdown and 33% of electrical breakdowns are reported between 0 to 2 hours; 8% of electrical breakdown was said to take 3 to 4 hours to be reported; 4% and 5% of both civil and electrical breakdowns take between 4 and 5 hours to be reported respectively. This was to help establish how prompt maintenance issues are reported for action at the customer care and to establish if customers promptly reported the breakdowns.

Table 4.2: Promptness to respond to a breakdown

Nature of breakdown	Is response to breakdown promptly addressed?		
	To a great extent	Somewhat	Not at all
Mechanical	14%	20.8%	8%
Civil	2.5%	21%	11.5%
Electrical	8%	10.2%	4%
Total	24.5%	52%	23.5%

Whether the breakdowns were promptly addressed. 52% were of the opinion that the breakdowns were somehow promptly addressed. 24.5% felt the breakdowns were promptly addressed while 23.5% were of the opinion that the breakdowns were not being

Promptly addressed

Table 4.3: Response time to breakdown and effects on daily sales

Nature of breakdown	Response time to a breakdown affects daily sales		
	To a great extent	Somewhat	No effect
Mechanical	33.4%	6%	3.0%
Civil	1%	16.7%	10.7%
Electrical	24%	4.1%	1.1%
Total	58.4%	26.8%	14.8%

The study also sought to establish from the dealers and station managers how they perceive response time to a breakdown affects their sales volume, response to mechanical breakdown was found to be greatly affecting sales volume at 33% while civil and electrical breakdowns were both at 1% and 24% respectively. Overall, response to breakdown was found to greatly affect sales volume at 58.4% based on the feedback.

Table 4.4: Monthly Average Response to calls sales volume

Nature of repair	Month	Mean Time to respond (days)	Sales in(Million Litres)
Mechanical	June	7.25	8.37
	July	6.63	8.96
	August	5.68	10.27
	September	5.3	10.44
	October	3.87	11.24
	November	3.1	9.75
Electrical	June	6.89	8.37
	July	2.88	8.96
	August	6.89	10.27
	September	2.88	10.44
	October	11.91	11.24
	November	6.12	9.75
Civil	June	13.63	8.37
	July	2 9.69	8.96
	August	37.48	10.27
	September	1 4.95	10.44
	October	3 3.66	11.24
	November	23.37	9.75

From table 4.4: the shorter mechanical response time resulted into increase in volumes of fuel. while electrical response time had higher fluctuations with minimal effect on the sales volume. Civil breakdowns registered longer response time with minimal change to the sales volume.

4.2: Effect of frequency of breakdown on sales volume

The tables 4.5,4.6,4.7,and 4.8 describe how frequency of breakdown on particular equipments and the effects on the sales volume.

Table 4.5: Frequency of reported pumps breakdown

	Frequency	Percent	Cumulative Percent
Frequently	46	83.6%	83.6%
Occasionally	9	16.7%	100 %
Not at all	0	0	100.0%
Total	55	100.0%	

The study sought to know the frequency of pumps breakdown for a period of six months. 83.5% felt that there were frequent breakdowns. 16.7% felt that there were occasional pump breakdown while none of the respondents responded on zero breakdown.

Table 4.6 Frequency of reported Compressors breakdown

	Frequency	Percent	Cumulative Percent
Frequently	19	34.6%	34.6%
Occasionally	23	41.8%	76.4%
Not at all	13	23.6%	100.0%
Total	55	100.0%	

On the frequency of compressor breakdowns for six months period of; 41.8% felt that there were frequent breakdowns, 34.6% had their compressor breakdown occasionally and the rest stated 23.6% no breakdowns in the period.

Table 4.7: Frequency of reported Generators breakdown for Six Months

	Frequency	Percentage	Cumulative Percentage
Frequently	13.8	25.0	25.0
Occasionally	20.6	37.5	62.5
Not at all	20.6	37.5	100.0
Total	55	100.0	

The generators breakdown in the six months were at 13.8% frequently, occasionally and not at all registered 20.6% respectively in the period.

Table 4.8: Frequency of Equipment breakdown and sales volume

	Equipment type	Frequency	Sales in (Million Litres)	Average time to resolve
June			8.37	
	compressor	53		8
	Generator	42		6.7
	Pumps	80		5.7
July			8.96	
	compressor	8		2.21
	Generator	12		5.62
	Pumps	74		3.44
August			10.27	
	compressor	9		12.3
	Generator	4		16.21
	Pumps	23		13.49
September			10.44	
	compressor	15		5.25
	Generator	3		7.12
	Pumps	36		3.4
October			11.24	
	compressor	6		5.32
	Generator	11		3.25
	Pumps	47		6.75
November			9.75	
	compressor	7		10.25
	Generator	2		13.2
	Pumps	50		5.75

The table 4.8 shows how the frequency of pumps, compressors and generators breakdown for the period. Pumps registered highest breakdown reports for the entire period. Month

of June had 80 reported breakdowns for the 55 stations studied. Generator had fluctuation of reports from highest of 42 in June and lowest of 2 reports in November. Similarly compressors registered 53 calls in June with remaining month's calls ranging from 6 to 15 calls. The month of June had higher calls with less sales compared to the compared to the entire period. The month of November registered higher calls on pump breakdown with low sales while august to October the breakdown calls were low with improved sales.

4.3: Effect of the nature of breakdown on sales volume

The tables 4.9 and 4.10 describe how nature of breakdown on particular equipments affected the sales volume.

Table4.9: Effects on particular breakdown on sales volume

Nature of breakdown	Breakdown completely stalls operation	
	Yes	No
Mechanical	20.8%	12.5%
Civil	4%	29%
Electrical	25%	8%
Total	49.5%	49.5%

The study sought to study how nature of breakdowns affect the station operations as perceived by the dealers and station managers; Mechanical were seen to have 20.8%. electrical 25% and Civil 4% on stalling of station operations.

Table 4.10 Monthly reported breakdowns

	Number of reported Breakdown			
	Mechanical	Civil	Electrical	Sales in(Million liters)
June	36	5	24	8.37
July	14	10	7	8.96
August	25	13	24	10.27
September	12	5	20	10.44
October	16	11	15	11.24
November	34	12	46	9.75
Total	107	56	136	10.01

Mechanical breakdowns were the highest in the month of June followed by Electrical and Civil respectively. In the month June when Mechanical breakdowns were reported highest, sales were low, similarly in the month of September when sales were higher mechanical breakdowns registered the lowest calls. The months when both Electrical and mechanical calls were highest, the sales drop by significant margins. Civil breakdown reports throughout the period low with not much influence on the sales.

4.4 Relationship on contractors and the maintenance Technicians on sales volume

The following tables4.11, 4.12, 4.13 and 4.14 describe the effect of various contractor Technicians on their areas of operation.

Table 4.11: Assessment of technician's ability to handle breakdowns

	Frequency	Percentage	Cumulative Percent
Poor	10	16.7	16.7
Satisfactory	45	83.3	100.0
Total	55	100.0	

The ability to handle the breakdowns by technicians; 83.3% of the respondents were satisfied by the Technicians' ability. 16.7% felt that Technicians were poor in handling the breakdowns.

Table 4.12: Rating of the contractor services in general

	Frequency	Percentage	Cumulative Percent
Satisfactory	34	62.5%	62.5%
Good	16	29.2%	91.7%
Very good	5	8.3%	100.0%
Total	55	100.0%	

The respondents' ratings of the contractor services in general were: 62.5% recorded satisfactory services while 29.2% rated the services as being good, only 8.3% felt that the services were very good.

Table 4.13: Rating of contractors Capacity.

	Frequency	Percentage	Cumulative Percent
Able	34	62.5	62.5
Partially able	11	20	82.2
Not able	10	17.5	100.0
Total	55	100.0	

The respondents rated the performance of the contractor at 62.5% as capable while those who felt that the contractor's performance was satisfactory were 20%.Not being able to deliver scored 17.5%

Table 4.14: The general contractors' response to maintenance

	Frequency	Percentage	Cumulative Percent
Slow	34	62.5	62.5
Timely	18	33.3	95.8
Fast	3	4.2	100.0
Total	55	100.0	

The 62.5% felt that the contractor's response was slow, 33.3% felt that the response was timely, only 4% felt that they were fast.

4.5 Regression Analysis

The study conducted regression analysis to determine the effect of Pump. Compressor or generator failures, electrical failures and Forecourt. Building repairs on the sales volume in thousand liters. The regression equation was:

SI = β0+ β1 Pump. Compressor or generator failures + β2 Electrical failures + β3 Forecourt, Building repairs + ε

Whereby β_0 is the regression constant. β_1- β_4 are regression coefficients and ε is the regression model error term which indicates its significance.

Table 4.15: Model Goodness of Fit

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.851[a]	.724	.692	.23484	2.169

a. Predictors: (Constant), Pump, Compressor or generator failures, Electrical failures, Forecourt, Building repairs

b. Dependent Variable: sales volume in thousand liters

The study used the table above to establish whether sales volume in thousand liters has a linear dependence on the independent variables. The study established a correlation value of 0.851. This depicts a very good linear dependence between dependent and independent variables. An R-square value of 0.724 was established and adjusted to 0.692. The coefficient of determination depicts that Pump, Compressor or generator failures, Electrical failures and Forecourt. Building repairs brings about 72.4% variations in sales

volume in million liters; 17.6% of variations are brought about by factors not captured in the objectives. Durbin Watson value of 2.169 was established illustrating lack of autocorrelation in the model residuals.

Table 4.16: Regression Coefficients

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	1.448	.560		2.584	.513
Pump, Compressor or generator failures(mechanical)	.191	.058	.313	3.329	.002
Electrical failures	.466	.123	.312	3.779	.024
Forecourt, Building repairs	.233	.077	-.322	-3.016	.004

a. Dependent Variable: sales volume in thousand liters

The regression equation becomes:

Sales volume in thousand liters = $1.448 + 0.191X_1 + 0.466X_2\ 0+0.233X_3$ $p<0.001$

From the above regression model, when the Pump, Compressor or generator failures, Electrical failures, Forecourt, Building repairs have null value; sales volume in thousand liters would be 1.448.

Holding other factors constant, a unit increase Pump, Compressor or generator failures would yield a 0.191 decrease sales volume in thousand liters. A unit increase Electrical failures lead to a 0.466 decrease in sales volume in thousand liters; Forecourt, Building repairs yields 0.233 decreases in sales volume in thousand liters. This shows that Pump, Compressor or generator failures, Electrical failures and Forecourt, Building repairs reduce the sales volume in thousand liters.

CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter is a summary of the findings, discussions, conclusions and recommendations on the influence of reactive maintenance at retail outlets on sales volume.

5.2 Response time on sales volume

The study sought to know the time taken to report a breakdown to the customer care, The results revealed that 16.5% of mechanical breakdown and 33% of electrical breakdowns are reported between 0 to 2 hours; 8% of electrical breakdown was said to take 3 to 4 hours to be reported; 4% and 5% of both civil and electrical breakdowns take between 4 and 5 hours to be reported respectively. This was to help establish how prompt maintenance issues are reported for action at the customer care and to establish if customers promptly reported the breakdowns. The results combined with the responds to maintenance the effect was realized on the monthly sales volume. When the time to respond to the calls was longer the sales declined this showed that the time to respond to reported maintenance issues had a direct link to realization on sales. Since the volume of sales per station is dependent on the equipment availability, when the pumps are down then stations are an able to push the volumes as expected. From the above trend, the volumes sold increased with decreased response time

5.3 Frequency of breakdown on particular equipment on sales volume

The effect of the frequency of pumps breakdown for a period of six months; 83.5% felt that there were frequent breakdowns, 16.7% felt that there were occasional pump breakdown while none of the respondents responded on zero breakdown. The higher the frequency of breakdown on the pumps the diminishing the volumes sold. Hence it can be concluded that the for better realization of sales, the pumps should be availed as shown in the figure 4.2 above, the frequency of pump breakdown affected the budgeted sales for the period. The higher the percentage of breakdowns the bigger the variation in sales volume in million liters. Though the months of September and October registered low breakdowns with higher variance to budget and this was said to have been as a result of

5.4 Nature of repair on sales volume

On how particular equipment breakdown affects the sales volume, the data showed that 20% of mechanical breakdowns, 4% of civil breakdowns and 25% of electrical breakdowns completely stalled the station. In overall, the effects of breakdown as regarding stalling the station stood at 49.5%.This is an indication that the electrical breakdown is key hence should be addressed promptly since its contribution to sales is critical to the station sales stock out at the stations.

5.5 Relationship between quality of outsourced contractors on sales volume

The ability to handle the breakdowns by technicians; 83.3% of the respondents were satisfied by the Technicians' ability, 16.7% felt that Technicians were poor in handling the breakdowns. The regions that registered better sales also had higher scores on the

satisfaction with technicians. Hence it can be concluded that the technician ability to handle breakdowns is also critical to realization of sales.

The regions where the contractor performance were rated low also registered low sales volumes. it will also be critical to ensure the capable contractors are engaged to carry out maintenance so as to have better sales. The respondents rated the performance of the contractor at 62.5% as capable while those who felt that the contractor's performance was satisfactory were 20%.Not being able to deliver scored 17.5%.

From the regression model. when the Pump, Compressor or generator failures, Electrical failures, Forecourt, Building repairs have null value; sales volume in thousand liters would be 1.448. Holding other factors constant, a unit increase Pump, Compressor or generator failures would yield a 0.191 decrease sales volume in million liters. A unit increase Electrical failures lead to a 0.466 decrease in sales volume in thousand liters; Forecourt, Building repairs yields 0.233 decreases in sales volume in thousand liters. This shows that Pump, Compressor or generator failures, Electrical failures and Forecourt, Building repairs reduce the sales volume in million litres.

5.6 Recommendations.

The findings implied that the availability of equipment at the station in good working condition is important for the oil marketers hence it would be recommended that the Marketers ensure minimal time is lost by having response time to reported maintenance captured in the contract with the maintenance contractors as a key deliverable and penalized for lateness to respond. Mechanical breakdowns are attended to promptly to mitigate the huge lose of sales due to equipment being unavailable to the customers.

Enough revenue allocation is required to ensure the equipment is always in good working conditions for higher sales to be realized.

5.7 Conclusions

Various researchers (Yeoman's, (2002), Laskiewicz, Mike (2005) linked maintenance to production efficiencies and concluded it plays a role in the productivity and profitability of organizations.

These findings supports these conclusions by these researchers hence it is evident that reactive maintenance influences the sales of fuel at the retail outlets and would suggest that priority be given to this type of maintenance and enough budget be allocated to ensure down times are reduced to minimum levels to ensure higher productivity.

5.8 Suggestion for further study.

Though the results depicted a trend in the reactive maintenance in relationship to the sales volume, it would be important to look into the other factors such as the availability of the product at the retail outlets, the geographical location of stations which may also have impact on the sales volume.

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Maintenance - strategy, system, definition, school, model, company, hierarchy, disadvantages

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Appendix I: Consent Letter.

Preamble

I am Nick Kuru. A Masters student at Nairobi University. I am carrying out a research on the topic ***"Influence of Reactive Maintenance at retail outlets on sales Volume. A case of Total Kenya ltd".*** You are being requested to be part of this research by answering the questionnaire sent below. Kindly fill-in the questionnaire as objectively as you can. On my part. I promise you absolute confidentiality on whatever information you may provide. The information you provide here, shall be used strictly for this research. I thank you in advance for responding to the request and promptly sending it back.

Research instrument for the following categories of informants:

A: Dealers and Station managers

B: Contractors

QUESTIONNAIRE:

PART A: DEALERS AND STATION MANAGERS.

INSTRUCTIONS:

Answer the questions as appropriate by filling in blank spaces or ticking your choice of answer.

1.What is the name of your station_____

2. Describe the geographical location of the station. ☐ Nairobi ☐ Mombasa

☐ Mt. Kenya ☐ Nakuru ☐ Kisumu ☐ Eldoret

3. What type of contract do you have with Total Kenya

☐ DODO ☐ CODO ☐ NETCO ☐ YOUNG DEALER.

4. How long have you been in this service station _____Years _____Months

5. Tick in the box if the equipment is available at the service station

☐ Generator

☐ Compressor

☐ AGO pumps

☐ PMS pumps

☐ RMS Pumps

☐ IK pumps

6. In the period of the last Six Months have you reported any breakdowns on the listed equipment?

☐ Yes ☐ No

7. If yes, can you state how many times? Tick as appropriate.

Equipment	Once	Twice	More than twice less than five times	More than five less than ten times	Severally
Generator					
Compressor					
AGO pumps					
PMS pumps					
RMS Pumps					
IK pumps					

8. Were all these breakdowns reported to customer care at the head office?

☐ Yes ☐ No

9. If no, give reason. _____

_____

_____

10. Which among the below repairs are frequently reported?

☐ Pump, Compressor and generator failures.

☐ Electrical failures

☐ Forecourt, Building repairs

11. In a scale of 1- 6 rate which equipment failure affects your sales volume the most with 1 having least effect and 6 the most.

☐ Generator

☐ Compressor

☐ AGO pumps

☐ PMS pumps

☐ RMS Pumps

☐ IK pumps

12.Who is your dispensing pumps, compressor and greasing units maintenance contractors?

(a) Petroleum industrial services ☐

(b) Premier agencies ☐

13. How would you rate the contractor's services in general?

☐ Poor ☐ Satisfactory ☐ Good ☐ Very good ☐ Excellent

14. How do you find their response to maintenance calls?

☐ Slow ☐ Timely ☐ Fast

15. What is your assessment on the Technician ability to handle the issues?

☐ Poor ☐ Good ☐ Very good ☐ Excellent

16.Do you have any preference to a particular technician?

☐ Yes ☐ No

17. If yes, what is your reason for the preference?

_____

_____

18. Rate the generator contractor's performance.

☐ Poor ☐ Satisfactory ☐ Good ☐ Very good ☐ Excellent

19. How do you find their response to maintenance calls?

☐ Slow ☐ Timely ☐ Fast

20. What is your assessment on the Technician ability to handle the issues?

☐ Poor ☐ Good ☐ Very good ☐ Excellent

21. What were your sales target and actual sold for the last six Months (March- August, 2011)

Month	Target Volumes in 1000litre	Actual sales in 1000litres
March		
April		
May		
June		
July		
August		

22. What contributed most to meeting or not meeting your target sales volume for the period? _____

Thank you.

QUESTIONNAIRE:

PART B: CONTRACTORS.

INSTRUCTIONS:

Answer the questions as appropriate by filling in blank spaces or ticking your choice of answer.

1. What is the name of your firm? _____

2. How long have long have you worked with total Kenya as a contractor? _____Years

3.Which region to do cover? . Nairobi Mombasa

☐ Mt. Kenya ☐ Nakuru ☐ Kisumu ☐ Eldoret

4.What nature of contract do you have with Total Kenya _____

_____

5. Do you serve other Markrters? ☐ Yes ☐ No

6.If yes how many?_____

7.How do you handle maintenance calls, from when they are received to when the call is closed_____

_____

_____

_____

8. How many technicians do have who are directly responsible for the maintenance

_____

9. Fill in the table below:

	Name of Technician	Level of Technical Education(Diploma,Craft, Artisan)	Years of experience	Region Asigned
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

10. How many Technicians do you have in these regions below?

(a) Nairobi_____

(b) Mt. Kenya_____

(c) Nakuru region_____

(d) Kisumu and Western_____

(e) Eldoret region_____

(f) Mombasa Region_____

11.Do you have any technicalities in responding to the calls? ☐ Yes ☐ No

12.Briefly state if any?

_____

_____

Thank you.