ISO 14001:2004 CERTIFICATION AND OPERATIONAL PERFORMANCE OF KENYA PETROLEUM REFINERIES LIMITED

BY

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DECLARATION

This Project is my original work and has not been submitted for a degree in this or any other university

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DEDICATION

To my family: wife Naomi, son Liam, Mum Esther, brother Mash, Sisters Alice and Dorcas. God bless you all for being the pillar that you are in my life

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ABBREVIATIONS AND ACRONYMS

EMS – Environmental Management System

GATT – General Agreement on Trade and Tariffs

HSE MS – Health, Safety and Environment Management System

ISO – International Organization for Standardization

KBBL – Kilo Barrel

KWh - Kilo Watt Hour

KPRL – Kenya Petroleum Refineries Limited

Ksh – Kenya Shillings

LCA – Life Cycle Assessment

M^3 – Cubic Meter

MT – Metric Tonne

ROA – Return on Assets

SMES – Small and Medium Enterprises

USD – United States Dollar

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ABSTRACT

As businesses become increasingly aware of the significant role that they should play for them to effectively adapt to climate change, a systemic approach achieved through a world class environmental management system (EMS) has been mooted as one way to combat the challenges of the change. This study sought to establish the effect of one such system, ISO 14001 certification, on the operational performance of Kenya Petroleum Refineries Limited, specifically to determine the effect of ISO 14001 certification on operational cost of KPRL, to establish the effect of ISO 14001 certification on safety at KPRL and to determine the effect of ISO 14001 certification on operational efficiency at KPRL. The study was anchored on two theories, the resource based view and the natural resource based view with a longitudinal case study being adopted as the research design where the effect of ISO 14001 on KPRL's operational performance was studied for a period of 36 months pre and post certification. The findings are based on secondary data obtained from KPRL management. The study concluded that proper implementation of the requirements of ISO 14001 EMS standard leads to improvement in the operational performance of an organisation, in terms of operational cost, operational efficiency as well as safety. The study finally recommends that KPRL brands its vehicles, the company logo, bill boards, and sign posts with the words "ISO 14001 Certified Company". This will serve to notify the public of the company's concern about environmental management and as such lead to better corporate image, improved stakeholders confidence as well as improved staff morale. The study also recommends that the standard (ISO 14001 certification) be made compulsory for other oil companies, especially in the oil exploration sector so as to provide an environmental management framework which will help reduce environmental incidents when crude oil production goes full blast in Turkana in the near future.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The world is today faced with an enormous task of curbing emissions of greenhouse gases to the environment so as to slow down the rate of climate change. Similarly, businesses have become increasingly aware of the significant role that they should play for them to effectively adapt to climate change (Nee & Wahid, 2010). According to Chattopadhyay (2001) the potential financial implications of climate change, environmental degradation and pollution on business is receiving increasing attention and recognition all over the world. Moreover, as a result of enhanced awareness and concern of the general populace, combating climate change is becoming both a strategic issue as well as a public relations issue for companies. Harrington and Knight (2001) noted that organizations are now pondering on what the next source of competitive advantage will be for multinational firms. A systemic approach to improved efficiencies realized through a world class environmental management system (EMS) could be the main source of competitive advantage. According to Nee and Wahid (2010), research has proved that full implementation of an effective EMS brings significant improvement in the firm's performance.

This study was anchored on two theories. The resource based view and the natural resource based view. According to the resource based view, a firm's competitive advantage emanates from its organizational capabilities (Voola, Carlson & West, 2004). The resource based view postulates that a firm can only gain competitive advantage through the exploitation of rare, valuable resources which in turn raise barrier to new

entrants as well as limiting imitation. Barney (2001) noted that the ability of a firm to be innovative, the capacity to come up with new, unique products and services is one of the sources of competitive advantage. This gives them an edge over other players. On the other hand, the natural-resource based view postulates that organizations will be constrained by and dependent upon ecosystems (Hart, 1995). The researcher noted that in future, strategy and competitive advantage will be rooted in capabilities that facilitate ecologically sustainable economic venture. Hart (1995) enriched the resource-based view of the firm to incorporate the challenges and opportunities of the biophysical environment.

The petroleum industry, to which Kenya Petroleum Refineries Limited (KPRL) belongs, plays a significant role in the global economy. It is a source of energy as well as supply of feedstock to various consumer goods thus playing a critical and significant role in people's lives (Russo, 2009). On the other hand the industry holds a potential for hazards to the environment in terms of air, soil and water pollution (Zutshi & Sohal, 2004). To mitigate this, Governments have enacted stringent regulations and legislations to safeguard not only the environment but the society at large. This has forced the oil companies to adopt positive environmental strategies which promote policies, processes and activities that do not harm the environment. KPRL has adopted and has been certified in ISO 14001:2004 Environmental Management System as a possible solution to its environmental management needs. This study therefore sought to establish the effect of this certification on the operational performance of the company.

1.1.1 ISO 14001 Environmental Management System Certification

ISO (2002) defined an Environment Management System (EMS) as a system that is involved in the planning, scheduling, implementation, evaluation and monitoring of those activities that are targeted towards improving the environmental performance of an organisation. According to Arimura, Hibiki and Katayama (2008), an effective EMS is one of the most important tools that helps organizations to be more environmentally efficient and proactive. On the other hand, Tibor and Feldman (1996) defined EMS as that component of a management system that supports the implementation, control, review and continual improvement of an environmental policy. It basically requires resources and involves planning, procedures as well as responsibilities.

ISO 14001 is a universally accepted standard that certifies that a firm is determined to continuously reduce the impact its processes, products and operations have on the environment and is continuously monitoring and seeking to identify new techniques and technologies of mitigating that impact further (ISO,2002). It is the standard that is used in the development of an EMS in the International Organization of Standardization's ISO 14000 series. It contains seventeen fundamental elements grouped into five major areas: environmental policy, planning, implementation and operation, checking and corrective action, and management review (Tan, 2005).

Performance metrics are not absolute requirements in the ISO 14001series. The series focuses mainly on commitment to legal compliance, statutory regulations and the implementation of a process for continual improvement (ISO, 1996). ISO 14001 certification has the ability to improve an organization's bottom line through enhanced

environmental performance (Tibor & Feldman, 1996). A well designed environmental management system (EMS) is a tool which aids an organization to accomplish and systematically take charge of its environmental performance. The EMS triggers operational and technical changes that can bring down the cost of production. The requisite condition for continuous improvement in the implementation of an ISO 14001 certified EMS results in a higher efficiency in the utilisation of all inputs, including energy, raw materials, and labour (Chin & Pun, 1999).

1.1.2 Operational Performance

Operations management deals with the efficient and effective production of goods and services through proper utilisation and management of people, processes, technology and other resources (Armistead & Machin, 1997). Operational performance involves the measurement of a firm's processes and resources against prescribed standards or key result areas such as number of environmental incidents, First Aid cases, operational efficiency, waste minimization, productivity, compliance to statutory and regulatory requirements and safety (Aquilano & Chase, 2001).

Managers are involved in making critical decisions that have a bearing on how the organisation will fulfil its mission and vision. To ensure that the decisions made meet the intended objectives and to effectively offer guidance to the organization, Management requires a means of understanding performance in its operations as well as in other levels of the organization, (Barney, 1991). This can be made possible through performance measurement which involves the quantification of organizational units, goods and services. It also includes the assessment of people, processes as well as other business activities. Performance measurements are applied in the evaluation, control and

improvement of a firm's processes as it moves towards the realization of its goals and objectives (Ghalayini& Noble, 1996).

To effectively compete in the global arena, it is imperative that an organisation strives to achieve exceptional performance (Peteraf, 1993). According to Jiangning (2006), operational performance has significant impact on product cost, product quality, cycle time, safety, speed and reliability. Evaluation of this performance through measurement is critical for the organisation to succeed (Aquilano & Chase, 2001). According to Ghiesellini and Thurston (2005) an organization can measure its financial performance, customer satisfaction, market share and organizational safety. Watson et al. (2004) noted that it is also important to measure service and product quality, speed and reliability in service delivery as well as aspects of innovation and learning. Miles and Covin (2000) observed that measurement of environmental quality which involves designing and controlling work processes that are geared towards environmental improvement is also becoming popular in recent times.

Information obtained during performance measurement should be reliable, relevant, timely, complete and easily accessible by interested parties. Moreover, the measurements must be a true representation/reflection of the important factors affecting the productivity of different processes (Tangen, 2005).An organisation can keep truck of its operational performance by assessing different parameters such as financial, customer satisfaction, market share, safety, quality, time, flexibility as well as innovation and learning(Peteraf, 1993). Therefore, management has to concentrate resources available to those parameters of performance that are critical to the firm's success. Continuous improvement of the processes that are involved in the production and delivery of a firm's products and

services will not only enhance their quality but also lead to a reduction in costs, defects rates and increased customer satisfaction (Aquilano & Chase, 2001).

A good performance measure must be realistic and achievable, it should provide a basis for decision making at the point at which they are applied. Some of the operational performance models include Malcolm Baldrige National Quality Award Framework model, Balanced Scorecard, Value Chain Model and the Service-Profit Chain Model (Hillary, 2004).

1.1.3 ISO 14001 Certification and Operational Performance

According to Delmas (2001), certification and implementation of ISO 14001 EMS comes at a cost. The main question that most investors ask is "what is the return on investment?" Ghisellini and Thurston (2005) noted that over and above the environmental impacts of their activities, organisations are also controlled by commercial interests, especially those related to demands from the international consumers.

Rao and Holt (2005) noted that a number of benefits accrue from ISO 14001 certification. Improved market share, increased productivity, reduction in operational cost as well as reduction of risks associated with poor environmental management are some of the key benefits that were noted. Henri and Giasson (2006) observed that an organization can have a competitive edge through its conformance to statutory and regulatory requirements and also through respectful interaction with stakeholders on environmental questions. This competitive edge can result in improved bottom line.

Haklik (1997) observed that if developed and rolled out in the correct way, ISO 14001 EMS is able to bring substantial benefits and rewards to an organization. The researcher

noted that an organisation is likely to realize operational cost savings, conformance to regulations, sound business practice, customer satisfaction, increased access to capital, reduction in insurance premiums and enhanced competitiveness. According to Chattopadhyang (2001) implementation of ISO 14001 can result in cost saving through reduced energy consumption, better raw material management, improved waste handling and management techniques, reversal of environmental impact as well as improved public image.

1.1.4 Kenya Petroleum Refineries Limited

Petroleum is the most important form of modern primary energy not only for Kenya but globally. According to the Kenya Central Bureau of Statistics (2014), petroleum constitutes more than half of the global energy supply and slightly above twenty per cent of Kenya's energy supply. Petroleum accounts for 30% of Kenya's annual imports (which is approximately Kenya shillings 350 billion) and contributes Kenya shillings70 billion in taxes annually.

The petroleum industry is broadly divided into three segments namely: upstream (exploration and production), mid-stream (storage, refining and transportation) and downstream (supply and distribution). The upstream segment primarily involves the processes of exploration, development and production of crude oil and natural gas. The midstream segment involves processes around storage, refining and transportation of the crude oil into consumable oil and gas products. The downstream segment involves the process by which refined products are made available to the consumers through supply and distribution for example at industries and petrol stations. There is a fairly well

developed network of transport pipelines, storage and retail outlets in Kenya today with a multiplicity of players (Kenya Central Bureau of Statistics, 2014).

At inception, the Kenya Petroleum Refineries Limited was owned by Shell and the British Petroleum Company, BP. The main objective of setting up the facility was to make it the main supplier of petroleum products in the East African region. KPRL was incorporated in 1960, under the name East African Oil Refineries Limited. The facility has two refining trains/complexes that were commissioned in 1963 and 1974 respectively (KPRL, 2012).

KPRL is currently a state corporation fully owned by the Government of Kenya (KPRL, 2016). The company was involved in refining business from inception to September 2013. Currently, it is engaged in petroleum terminal business whereby the company offers hospitality services to the Oil Marketing Companies (OMCs) who store their petroleum products in the facility before dispatching to different destinations within the region (KPRL, 2012). KPRL plays a major role in the petroleum supply chain in the country; this is both in refining operations as well as the terminal operations (Petroleum Institute of East Africa, 2015).

On 5th July 2008, KPRL's Health Safety and Environment Management System (HSE MS) was certified to ISO 14001:2004 Environmental Management Standard by Bureau Veritas (K) Ltd. The company has since undergone four surveillance audits and one recertification Audit. The management system remains robust to date (KPRL, 2012). This study sought to establish the effect of this certification on the company's operational performance since implementation.

1.2Research Problem

According to Jiangning (2006), many firms only see ISO 14001 certification as a cost of doing business. Consequently, organizations may only invest the bare minimum to meet the thresholds envisaged in the standard (Tibor & Feldman, 1996). However, there are many potential benefits for those firms that are ready to go beyond compliance threshold. Nee and Wahid (2010) noted that as businesses are strategically realigning themselves in the midst of climate change, EMS certification is becoming increasingly important to both national and multinational firms. Underlying its emergence and acceptance is the argument that improved systems associated with ISO 14001certification enhance the realisation of strategic goals. Additionally, standards such as ISO 14001 have been forecasted to set a superior level of expected environmental performance worldwide, facilitate trade and eliminate trade barriers (Chin, 1999).

The petroleum industry constitutes one of the major pollutants on the globe today. The industry holds a potential for hazards to the environment in terms of air, soil and water pollution (Zutshi & Sohal, 2004). Similarly the safety risks associated with handling of petroleum products are enormous. This has forced Governments to set stringent operational controls so as to safeguard the environment and the general populace. KPRL was chosen because of its significant role in the Kenyan petroleum sector as well as the country's economy. It is East Africa's only refinery which has been operational since 1963 (KPRL, 2012). Moreover, KPRL total tanks capacity constitutes approximately forty per cent of the country's petroleum storage capacity (Petroleum Institute of East Africa, 2015). This makes the company a potential source of environmental hazard in terms of water, air and land pollution. However, the organisation has taken a proactive

initiative and certified its environmental management system to the ISO 14001 standard (in 2008) so as to mitigate any potential environmental impacts that would emanate from its activities (KPRL, 2012).

There is an on-going conversation both in the academia and industry on the strategic role of ISO standards in corporate management. However, in spite of evidence of a positive correlation between EMS certification and improved business performance (Rondinelli, Berry &Vastag, 1997), there is an on-going discourse against investment in EMS. For instance, Walley and Whitehead (1994) observed that there is a negative correlation between environmental investments and stockholder value. Haklik (1997) noted that many firms are investing the bare minimum to meet the immediate regulatory obligations. They seem to have found little incentive for taking a leadership role, as pertains to ISO 14001 certification. This lack of EMS leadership reinforces the before mentioned paradox and sets the stage for the further development of theory. It is worthy to note that a number of studies have been carried out on the effect of ISO 14001 certification on organisational performance, including Tse (2001), Valdez and Chini (2002), Russo and Fouts (1997), Ann, Zailani and Wahid (2006) as well as Rodrigues and Ferreira (2006). However, none of these studies has explored the effect of ISO 14001:2004 certification on the operational performance of a petroleum company.

In Kenya, the number of firms certified in ISO 14001 has increased over the years, from 2 certified organisations in 2000 to 51certified organisations in 2014 (Evolution of ISO 14001 certificates in Kenya, 2014). However there is no evidence of studies that have been carried out to establish whether ISO 14001 certification has any effect on corporate performance and particularly operational performance, this study therefore sought to

close this gap, by answering the question: what is the effect of ISO 14001 certification on the operational performance of KPRL?

1.3Research Objectives

The general objective of this study is to establish the effect of ISO 14001 certification on the operational performance of Kenya Petroleum Refineries Limited. The specific objectives of the study are:

(i) To determine the effect of ISO 14001 certification on operational cost of Kenya Petroleum Refineries Limited

(ii) To establish the effect of ISO 14001 certification on safety at Kenya Petroleum Refineries Limited

(iii) To determine the effect of ISO 14001 certification on operational efficiency at Kenya Petroleum Refineries Limited

1.4 Value of the Study

The study provides learning points to the organisations that are already ISO 14001 certified as well as give insight information and guidance to those that are yet to be certified. This study makes an important contribution to the already existing body of knowledge in the broader field of managing through standards with its findings forming a basis for further research in ISO 14001 management system.

The study provides a feedback to the KPRL management on the contribution of ISO 14001 to the organization's operational performance and as such form a basis for decision making. This is also significant to the certification bodies like SGS and Bureau Veritas by providing information that will help them in improving the ISO standard. The

Government will also benefit from the findings of the study as it will provide a basis for regulatory framework especially on environmental management in the petroleum sector.

Moreover, the study can assist regulatory bodies and policy makers determine whether adoption of ISO 14001 certification should be made mandatory for the benefit of all stakeholders. This is particularly important at this time when the country is set to experience a rapid expansion in the petroleum sector due the discovery of commercial quantities of crude oil in Turkana

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter, literature on ISO 14001 certification has been reviewed. Theories that support this study have also been reviewed and finally the chapter ends by looking at a number of studies that have been done in the area under study.

2.2 Theoretical Literature Review

This study was anchored on two theories, the resource based view which focuses on an organisation's capabilities as being the main reason of its competitive advantage and the natural-resource based view that is centred on the premise that businesses (markets) will be limited by and be reliant on ecosystems.

2.2.1 Resource Based View

The resource based view postulates that organizational capabilities are a source of a firm's competitive advantage (Voola et al., 2004). This means that an organisation's internal capabilities are the key explanation to the differences in its bottom line (Wernefelt, 1984). The theory further claims that the competitive advantage is only sustainable if the internal capabilities cannot be easily duplicated by the competitors and they are also supported by resources (Rumelt, 1984). In this case, the resources should be valuable, rare as well as able to raise barriers to new entrants and imitations (Barney, 1991).

According to Henri and Giasson (2006), when properly implemented, ISO 14001 can give a firm a unique capability leading to competitive advantage thus having significant

effects on its performance, especially operational and business performance. This unique resource has the ability to give special information such as costs of wastes (liquid, solid or gaseous) leaving the firm, audit documentation, information on environmental incidents both within and without the firm (Rumelt, 1984). ISO 14001certification can provide new information that aids in decision making, enhance corporate image, or facilitate entry into markets that require EMS certification (Morrow &Rondinelli, 2002).

2.2.2 Natural-Resource Based View

An upcoming theory is the natural-resource-based view of the firm. The theory is centred on the assertion that organisations will be limited by and be reliant on the natural environment (Hart, 1995). It postulates that in the coming days, an organisation's strategy and competitive edge will depend and be anchored on its ability to promote processes, procedures, goods, services as well as activities that are ecologically sustainable. Hart (1995) enriched the resource-based view to comprise the limitations and opportunities of the ecosystem. This ended up in two generic types of corporate environmental policy. A short term, reactive compliance strategy and a pollution prevention policy which focuses on process innovation as well as source reduction initiative.

The Natural-resource based view is comprised of three interrelated strategies: pollution prevention, product stewardship, and sustainable development. The pollution-prevention strategy seeks to cut emissions through continuous-improvement methods that are anchored on clearly stated environmental goals and objectives rather than being dependent on complex, costly processes to control emissions (Rooney, 1993). On the other hand for an organization to achieve product stewardship, it basically requires that the Life cycle assessment (LCA) be part of its product design and development process

(Kaoliang & Monterey, 1993).this means looking at the product from the raw material suppliers to the end user, ensuring that the environmental impact of the product within its life cycle is mitigated (Smart, 1992).Teamwork among different stakeholders including staff in procurement, process/operations, commercial, business development/ marketing, and environment as well as clients is also critical in ensuring that the environmental impact of the product in question is mitigated (Hunt & Auster, 1990; Post& Altman, 1991).

The sustainable-development strategy focuses on the belief that firms should engage only technologies that have low impact on the environment(Hart, 1995).Hart (1995) argues that a firm's successful pursuit of the sustainable development strategy will be dependent on how well it achieves product stewardship and pollution prevention. Russo (2009) observed that ISO 14001 is the environmental management standard that provides a framework for the realisation of the strategies laid down in Hart (1995) of pollution prevention, product stewardship, and sustainable development. The standard stands out in assisting the organisation in its commitment of reducing the environmental impact of its products and operations while continuously looking for ways of reducing that impact further,

2.3 ISO 14001 Certification

ISO is an International Organization for Standardization that came into being through the effort of technical Committees of different standard bodies in the world. It was formed in 1947, in Switzerland, with the main objective of coming up with an economic, scientific, technological as well as intellectual cooperation among member states. A Technical

Committee was established thirty two years later with a mandate of coming up with a set of guidelines for the standardization of industries in the world (Russo, 2009)

The ISO 14000 series consists of twenty distinct EMS standards designed to assist organisations in setting up management processes that aid them in improving their environmental performance (Babkari, Bennet & Franchetti, 2003). According to Irivier (2004), the ISO 14000 series appeared around the General Agreement on Trade and Tariffs (GATT) negotiations at an environmental Summit held in Rio in 1992. Whilst GATT focuses on the reduction of non-tariff barriers to trade, the Rio Summit concentrated on commitment to global environmental protection (Quality Network, 1996).Babkari et al. (2003) observed that the most significant standard in the ISO 14000 series is ISO 14001 which plays a critical role in EMS development. Russo (2009) further noted that ISO 14001 provides a framework for environmental management through systems, procedures, processes and documentation.

The standard covers a number of aspects in the EMS, including the environmental policy, planning aspect, operations, progress evaluation and/or checking as well as the corrective action loop. Finally the standard looks at Management review as a feedback loop to ascertain whether the objectives set out at the planning phase are being met (Tan, 2005).The standard has been designed in a generic way that can fit in any organisation, size, industry, location and environmental responsibilities not withstanding (Haklik, 1997).

According to Curkovic et al., (1997), ISO 14001 standard provides a framework for the identification and addressing of significant environmental aspects and related impacts of

an organisation's activities, products and services. The researchers concluded that the standard requires that an organization honours its legal obligations and commits itself to continual improvement. Rondinelli and Vastag (2005) also noted that ISO 14001 provides a harmonised standard for managing the company's environmental impacts.

ISO 14001 requires a well-defined structure for implementation and operation. Responsibilities have to be well outlined with training programs in place to enhance competence and awareness among internal and external stakeholders (Rondinelli, Berry &Vastag, 1997). The standard also requires that a communication procedure be in place for both internal and external stakeholders in form of a documentation system. Also required is a procedure for operational control of environmental impacts as well as emergency preparedness and response. A system for checking non-conformance and reporting it, corrective action that includes monitoring and measurements should also be in place (Curkovic et al, 1997). The standard also envisages internal and external audits and reviews through which management assesses and gives a feedback on the adequacy, effectiveness and suitability of the environmental management system at pre-defined intervals to assure continual improvement (Warries, 2004).According to Rukato (2000), ISO 14001 EMS requires a comprehensive record keeping and documentation system which lead to enhanced controls. Improved documentation leads to better environmental management (Henri & Giasson, 2006).

2.4 ISO 14001 and Operational Performance

According to Hart (1995), one way through which organisations can gain competitive advantage and as such improve on their bottom line is by having a corporate environmental strategy. While analysing the Return on Assets (ROA) and profit margins

for ISO 14001 certified and non certified organisations,Watson et al. (2004) found out that there were no significant differences between them across different economic sectors. Jaffe et al.,(1995) on the other hand implied that organisations incur significant costs which in turn reduces their competitive edge when they comply with environmental regulations. Miles and Covin (2000) suggested that organisations with good plans are likely to have a superior ecological reputation from which they can gain a competitive advantage.

Kang (2005) and Prakash (2005) noted that following the requirement for an external audit, ISO 14001 certification could boost an organisation's performance due to the external pressure emanating from the independent professionals. According to Kang (2005) organizations adopt ISO 14001 certification to demonstrate how friendly they are to the environment or as a means of attaining a competitive edge thus improve on market share. Hillary (2004) noted that ISO 14001 certification can affect the organization both in its internal and external affairs. The Author observed that the certification has a positive influence on quality of environmental information , working conditions and safety , quality of training as well as legal compliance.

On the other hand Chin (1999) observed that implementing an ISO 14001 EMS encourages innovation, improved procedures and documentation and enhances strategic overview of environmental responsibility. Hillary (2004) also noted that financial benefits accrue through cost savings emanating from better material utilisation, energy saving initiatives and reduction of waste generated. When properly implemented ISO 14001 certification directly impacts workers in terms of improved motivation, enhanced skills and sense of belonging. It also provides an avenue for dialogue between employees

and their leaders (Zutshi & Sohal,2004). Zeng, Tian and Shi (2005) suggested that ISO 14001 certification can result in enhanced efficiency in internal operations.

2.5 Empirical Literature Review

A number of studies have been carried out to establish the ability of ISO 14001 EMS to deliver value to different organizations in diverse sectors and economies globally. While conducting a study on 26 construction firms in Hong Kong, Tse (2001) identified the major benefits and obstacles associated with implementation of an ISO 14001 EMS. He noted that the firms were able to save money as a result of improved energy efficiency, minimization of quantity of waste generated, improvement in occupational health and lower costs of insurance as well as involving upper management in environmental decisions. On the other hand, the researcher noted that the major obstacles towards the implementation of ISO 14001 EMS includes the absence of a requirement for client support, high costs of implementation, and outsourced systems which cause hitches in managing the EMS.

According to Valdez and Chini (2002), the most notable benefits of implementing ISO 14001 in the construction industry in U.S.A include: enhanced corporate image, better relations with regulators and enhanced competitive edge. In a survey of various construction firms, the researchers noted cases of cost savings that were as a result of process improvements as a benefit of ISO 14001 EMS implementation. Klassen and McLaughlin (1996) observed that the market value of firms was going up upon receipt of environmental awards or positive environmental moves, and in case of environmental incidents or occupational accidents the returns were dipping. While analysing return on assets (ROA) for ISO 14001 certified and non-certified firms, Russo and Fouts (1997)

concluded that a high level of environmental performance is associated with an increase in return.

Ann, Zailani and Wahid (2006) in a survey done on senior Managers of firms in Malaysia, assessing the impact of ISO 14001 certification on the financial performance of their firms found out that while the certification is deemed positively in the environmental circles, it does not translate to profitability, since it does not contribute to the reduction of production cost and time. Moreover, the respondents believed that the cost incurred during the certification process was much higher than the benefits that accrued from the certification.

While evaluating the profitability of ISO 14001 steel companies in Brazil, Rodrigues and Ferreira (2006) concluded that there was a positive correlation between environmental management and the financial performance of the companies. On the other hand Castro (2006) studied the influence of ISO 14001 on the market value of firms in Brazil and concluded that the certification does not have any impact on the market value of these companies.

In a study on the impact of ISO 14001 on emissions performance of 316 electronic facilities, both SMEs and multinational corporations conducted between 1996 and 2001, Russo (2009) observed that organisations that were among the first to adopt ISO 14001 implementation were associated with lower emissions and the longer they were certified the lower the level of emissions from their facilities.

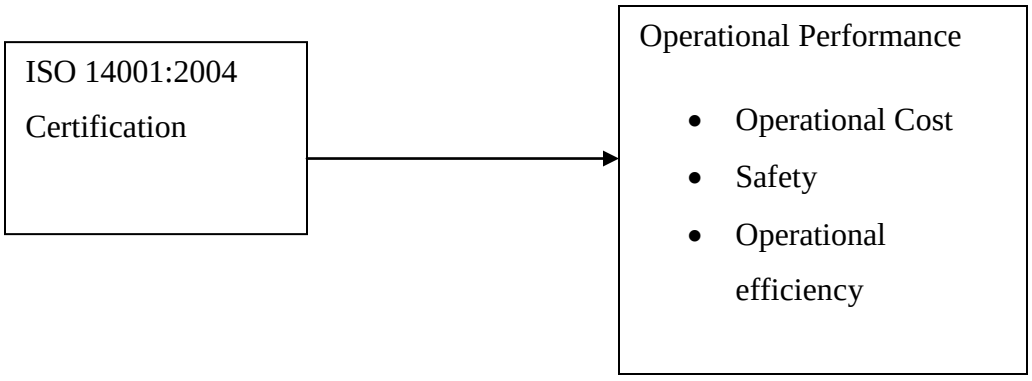
While studying the factors influencing implementation of ISO 14001 Environmental Management System at Allpack Industries Limited in Nairobi, Kairu (2014) noted that

the management admitted that implementation of ISO14001 EMS had earned the company recognition in the industry and that business in terms of customer base had grown by ten per cent since the organisation became accredited. Other benefits that accrued from the certification include; improvement of the company's corporate image and credibility, increased competitiveness, easier access to potential customers as well as waste reduction.

In another study, on a different ISO standard, Mohammed (2014), while studying the effect of ISO 9001:2008 certification on operational performance of Hashi Energy Kenya Limited, found out that there was a significant improvement in all the variables of operational performance under measurement.Specifically, the tanks turnaround factor and percentage of orders processed within time increased from an average of 0.80 and 65.9% to 1.52 and 80.1% respectively after the certification. The study also established that percentage truck turnaround and customer delivery within the selected time increased from an average of 64.9% to 76.3% and 65.9% to 70.6% respectively after certification.

In conclusion, it can be noted that there exist a research gap in terms of the effect of ISO 14001 on operational performance in organizations in Kenya. This study thus sought to close this gap by specifically looking at how ISO 14001 certification has affected operational performance at KPRL

2.6Conceptual Framework



Source: Researcher 2016

The study looked at the effect of ISO 14001:2004 certification on the operational performance of KPRL. Specifically the study assessed how ISO 14001 certification has affected operational cost, safety and operational efficiency of the company. The operational cost aspect was evaluated in terms of cost of electricity, water and fuel over a period of 36 months before and after certification.

The study also looked at the effect of ISO 14001 certification on occupational safety, by assessing the number of environmental incidents as well as First Aid cases in the period under review. Finally the study looked at the effect of the certification on operational efficiency of the company. This specifically looked at the slops quantity generated and the fuel and loss component per unit input for 36 months before and after certification. This means that out of the crude oil charged into the refinery, how much was used as fuel for operations, how much ended up as "waste gas" discharged to the environment. The desire being to convert as much as possible of the crude oil to on-grade finished products.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter highlights the methodology used so as to meet the objective of the study. The applied research design and the data collection and analysis procedures used are also highlighted.

3.2 Research Design

The research adopted a longitudinal case study as the research design where the effect of ISO 14001 on KPRL's operational performance was studied for a period of 36 months pre and post certification. Kothari (2004) recognises that a case study is a powerful form of qualitative analysis that involves a careful and complete observation of a phenomenon. It's a method that drills down to reach the basic causal relations, rather than cast wide. According to Omondi (2008), case studies are excellent tools used to bring out an understanding of complex issues or objects.

3.3 Case Selection

The research was on the Kenya Petroleum Refineries Limited which has been in operations for the last 53 years with the first fifty years operating a refinery where crude oil imported from the Arab world was being processed to produce liquefied petroleum gas (LPG), gasoline (petrol), diesel, kerosene and fuel oil. Currently the company runs as a petroleum terminal where bulk of petroleum products imported into the country is stored before being transported into the hinterland. KPRL had been using internal procedures to manage its environmental issues since inception up to 2008. However, in

2008 the company was certified to the ISO 14001:2004 standard for its environmental management system (EMS). After achieving the ISO certification, no formal review had been carried out to gauge effects of the certification on its operational performance. This case study therefore provided an opportunity to drill down and objectively draw up conclusions on operational performance by the adoption of ISO 14001:2004 EMS.

3.4 Data Collection

Secondary data obtained from KPRL management was used for this study. Data obtained include: operational costs, specifically the cost of electricity, fuel and water for the 36 months pre and post certification, this was obtained from the Finance department. The company's Technology department provided data on plant efficiency, specifically data on quantity of slops generated and the fuel and loss component during the period under study. Finally the Health, Safety and Environment department provided data on safety performance of the organisation within this period. These include number of environmental incidents as well as First Aid cases during the period under review.

3.6 Data Analysis

The collected data was subjected to structural break analysis to confirm whether indeed a structural change had occurred between pre- and post ISO 14001 certification periods. Chow test with the null hypothesis that there was no structural break was used to test the structural break as it is considered the best method for determining and testing unknown break dates (Bai & Perron, 1998).Statistical Product and Service Solutions (SPSS) software was also used as a tool for data analysis and presentation.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the analysis and interpretation of secondary data as obtained from the KPRL records. Data was collected for the 36 months pre and post certification. Analysis was done to determine the effect of ISO 14001 certification on operational cost, operational efficiency and safety at KPRL. Data has been presented in form of tables and graphs and analysed using structural break analysis to determine whether there was indeed a structural change during the period under study.

4.2 General Information

In the data analysis, electricity, water and fuel costs were analysed to determine the effect of ISO 14001 certification on operational cost at KPRL. Similarly, fuel and loss analysis as well as percentage of slops generated were analysed as a measure of operational efficiency while number of First Aid cases and environmental incidents were analysed as a measure of safety at KPRL.

The analysed data was subjected to structural break analysis to ascertain whether there was indeed a structural break between pre and post certification periods. Chow test was used to test the break with the null hypothesis that there was no structural break; this basically applied the F-test where the calculated test statistic was compared with critical values from the F-test tables.

Defining the null hypothesis as H_0 and Alternate hypothesis as H_1, the decision criteria is:

H_0: Null hypothesis, no structural break

H_1: Alternate hypothesis, presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Calculated $F = \frac{(\boldsymbol{RSSC}-(\boldsymbol{RSS1}+\boldsymbol{RSS2})/(\boldsymbol{k})}{(\boldsymbol{RSS1}+\boldsymbol{RSS2})/(\boldsymbol{n}-\boldsymbol{2k})}$

Where,

F= Chow test statistic

RSSC= Residual sum of squares for the entire period

RSS1=Residual sum of squares for pre-certification period

RSS2=Residual sum of squares for post certification period

K= number of parameters in the regression

4.3 Operational Cost

To determine the effect of ISO 14001 certification on operational cost, the cost of electricity, water and fuel were considered per Kilo barrel of crude oil processed for 36 months pre and post certification. The costs were presented in US dollars with an average exchange rate of 77.39 Ksh/USD for the entire period under analysis so as to reduce on the effect of currency fluctuation. Similarly, to reduce on the effect of inflation and price adjustments an average cost per unit of utility consumed was obtained and used for the entire period under analysis.

4.3.1 Cost of Electricity

The cost of electricity represents the average cost of electricity in USD per Kilo barrel of crude oil processed in a month. This was analysed for 36 months before certification and 36 months after certification. Table 4.1 shows the monthly cost of electricity per unit crude processed for both pre and post certification periods.

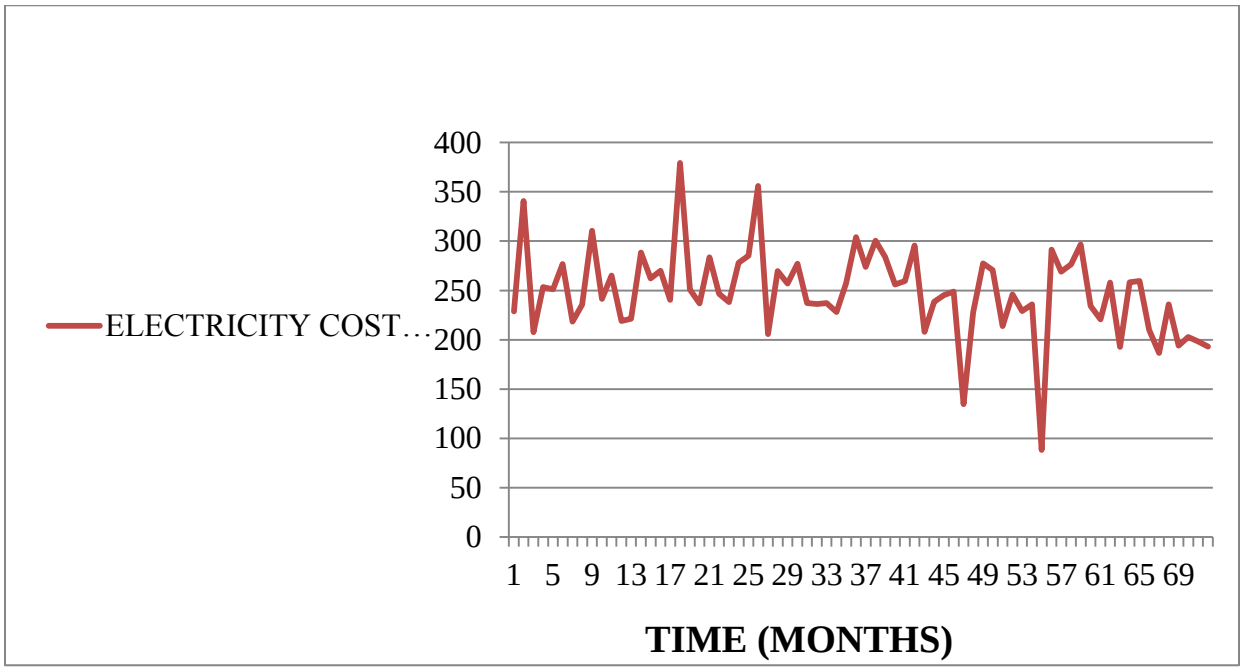
Table 4.1: Monthly Cost of Electricity in USD/KBBL

PRE-CERTIFICATION PERIOD				**POST CERTIFICATION PERIOD**			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	229	221	285	January	274	277	221
February	341	289	356	February	300	271	258
March	208	262	206	March	284	214	193
April	254	270	270	April	256	246	258
May	251	240	257	May	260	229	260
June	277	379	277	June	296	236	210
July	218	251	237	July	208	88	187
August	235	237	236	August	238	291	236
September	311	284	237	September	245	269	194
October	242	246	228	October	249	276	203
November	265	238	257	November	135	296	198
December	219	278	304	December	228	234	193

Source: Research data (2016)

This data is represented graphically as follows:

Figure 4.1: Monthly Cost of Electricity Pre and Post Certification



From the graph, it can be deduced that the cost of electricity per Kilo barrel is reducing post the certification period. This can also be clearly seen from computed means for the two periods which is 261USD/KBBL and 236 USD/KBBL for pre and post certification periods respectively. This shows that the implementation of ISO 14001 certification brought about a reduction in the quantity of electricity being consumed during crude processing.

Subjecting the data to structural break analysis:

H_0: no structural break

H_1: presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 273.692 - 0.685x$

$R^2 = 0.107$

$RSSC = 122178.976$

$df = 70$

$t = 27.505 \qquad (-2.891)$

Regression model for the pre-certification period

$y = 258.079 - 0.156x$

$R^2 = 0.002$

$RSS1 = 54497.977$

$df = 34$

$t = 18.937 \qquad (0.243)$

Regression model for post certification period

$y = 320.495 - 1.543x$

$R^2 = 0.130$

$RSS2 = 62072.407$

$df = 34$

$t = 8.427 \qquad (-2.250)$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (122178.96 - (54497.977 + 62072.407))/2/\left(\frac{54497.977 + 62072.407}{72 - 4}\right)$$

$F = 1.6358$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is accepted. Hence it can be deduced that there was no structural break between the two periods

4.3.2 Cost of Water

The cost of water in USD per Kilo barrel of crude oil processed in a month was analysed for 36 months before certification and 36 months after certification. Table 4.2 shows the monthly cost of water per unit crude processed for both pre and post certification periods.

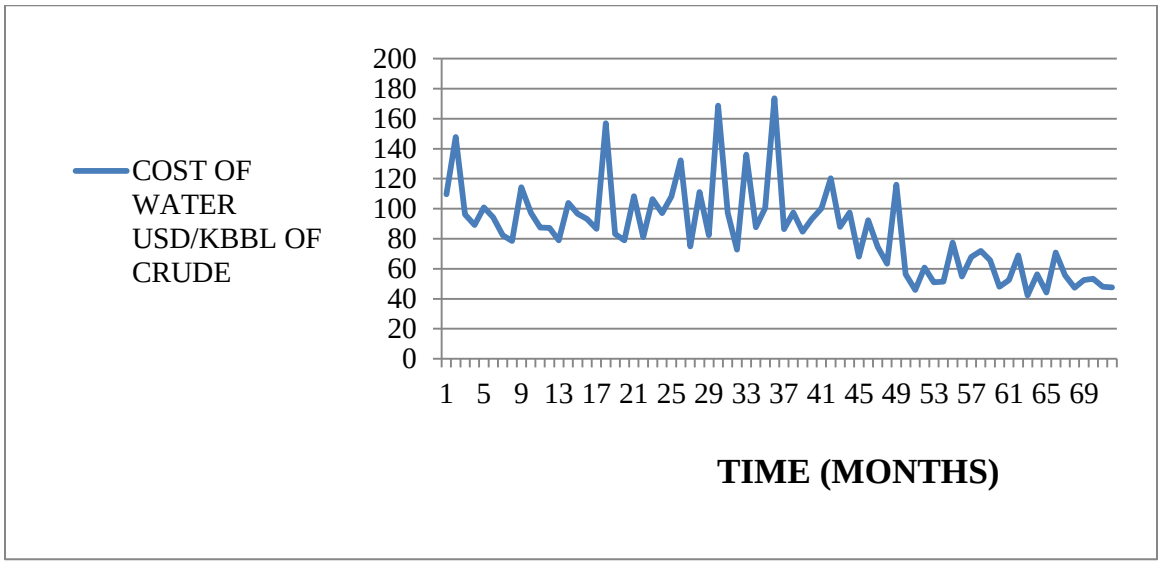
Table 4.2: Monthly Cost of Water in USD/KBBL

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	110	79	108	January	86	116	52
February	148	104	132	February	97	56	69
March	96	97	75	March	85	46	42
April	89	93	111	April	93	61	56
May	101	87	82	May	100	51	44
June	94	157	169	June	120	51	71
July	82	83	97	July	88	77	56
August	78	79	73	August	97	55	47
September	114	108	136	September	68	68	52
October	97	81	88	October	92	72	53
November	87	107	100	November	74	66	48
December	87	97	174	December	63	48	48

Source: Research data (2016)

This data is represented graphically as follows:

Figure 4.2: Monthly Cost of Water Pre and Post Certification



From the graph it can be deduced that there is a sharp decline in the cost of water post the ISO 14001 implementation phase. This can also be noted from the computed means for the two periods, which are USD 103/KBBL and USD 69/KBBL respectively.

Subjecting the data to structural break analysis: where,

H_0: no structural break

H_1: presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 116.143 - 0.835x$

R^2= 0.362

$RSSC = 38201.083$

$df = 70$

$t = 20.874 \qquad (-6.303)$

Regression model for the pre- certification period

$y = 93.773 - 0.487x$

R^2= 0.039

$RSS1 = 22449.790$

$df = 34$

$t = 10.721 \qquad (1.181)$

Regression model for the post- certification period

$y = 148.250 - 1.452x$

R^2= 0.538

$RSS2 = 7123.615$

$df = 34$

$t = 11.506 \qquad (-6.297)$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (38201.083 - (22449.790 + 7123.615)/(2))/(\frac{22449.790 + 7123.615}{72 - 4})$$

$$F = 9.919$$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is rejected. In a nutshell this shows that the regression models for the pre and post certification periods were different hence we can deduce that there was a structural break.

4.3.3 Fuel Cost

The cost of fuel consumed per kilo barrel of crude oil processed was analysed and tabulated in USD per Kilo Barrel. Table 4.3 shows the monthly cost of fuel per unit crude processed for both pre and post certification periods.

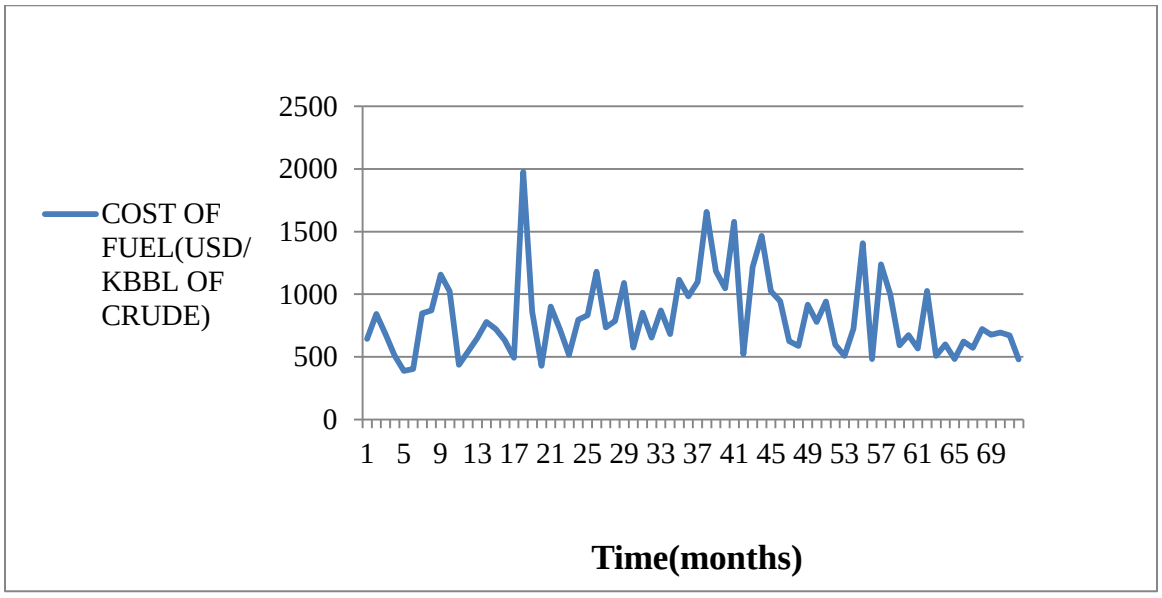
Table 4.3: Monthly Cost of Fuel in USD/KBBL

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	644	648	832	January	1097	916	567
February	842	778	1181	February	1658	779	1026
March	678	722	736	March	1184	941	508
April	511	633	787	April	1047	597	600
May	388	492	1089	May	1578	508	483
June	403	1977	575	June	521	724	623
July	849	859	853	July	1219	1407	572
August	870	428	652	August	1466	483	724
September	1157	901	872	September	1024	1238	677
October	1023	718	681	October	944	1000	695
November	437	517	1115	November	625	592	673
December	544	797	984	December	587	674	481

Source: Research data (2016)

The data is presented graphically as follows:

Figure 4.3: Monthly Cost of Fuel Pre and Post Certification



From the graph it can be inferred that the cost of fuel is slowly decreasing post the 14001 implementation phase. This can also be noted from the computed means for the pre and post implementation periods, which are USD 846/KBBL and USD 783/KBBL respectively.

Subjecting the data to structural break analysis: where,

H_0: No structural break

H_1: Presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 822.227 - 0.224x$

R^2= -0.014

$RSSC = 7028445.118$

$df = 70$

$t = 10.894 \qquad -0.125$

Regression model for the pre certification period

$y = 662.50 + 6.491x$

R^2= 0.053

$RSS1 = 2897425.166$

$df = 34$

$t = 6.667 \qquad 1.386$

Regression model for the post certification period

$y = 1869.006 - 18.78x$

R^2= 0.352

$RSS2 = 2527473.834$

$df = 34$

$t = 7.7701 \qquad -4.293$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$F = (7028445.118 - (2897425.1662527473.834)\ /2)/\ \ (2897425.166+2527473.834)/$ (72-4)

$F = 10.0500$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is rejected. In a nutshell this shows that the regression models for the pre and post certification periods were different hence we can deduce that there was a structural break.

4.4 Operational Efficiency

To determine the effect of ISO 14001 certification on operational efficiency, the percentage of slops produced and refinery fuel and loss were analysed for the period under study.

4.4.1 Slops Quantity Produced

Slops refer to the oil products that do not meet the minimum quality specifications after processing and as such require reprocessing leading to additional cost. In refining, slops is quantified as a percentage of crude oil processed. This was analysed for the 36 months pre certification and 36 months post certification. Table 4.4 shows the monthly slops percentages for both pre and post certification periods.

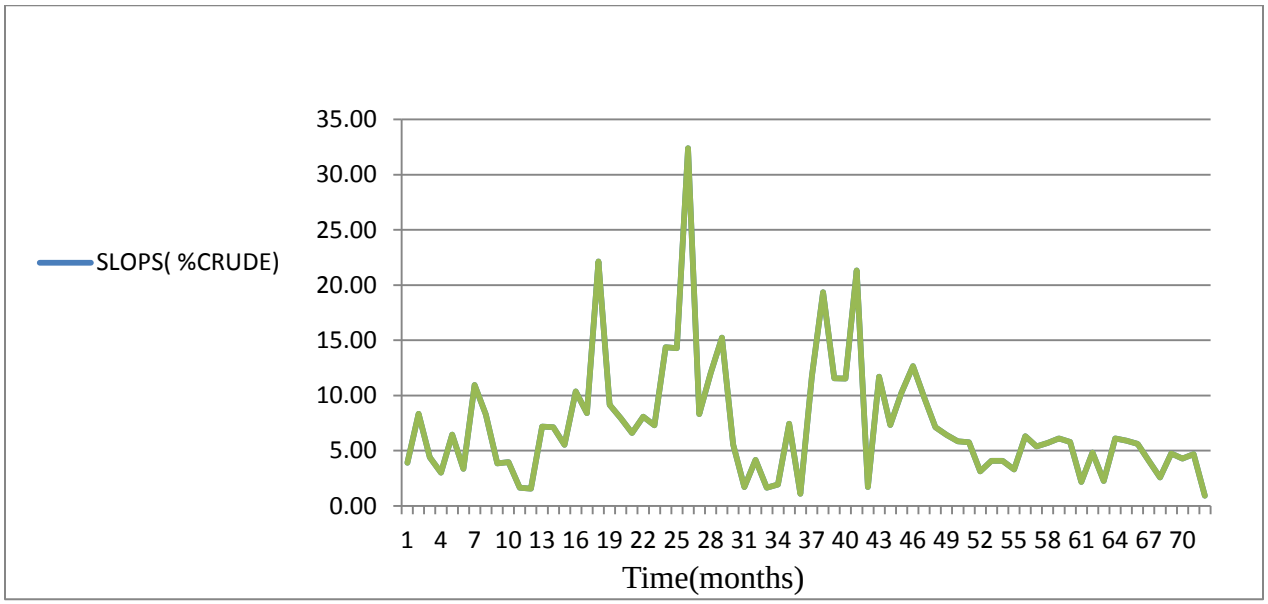
Table 4.4: Monthly Slops Quantity as a Percentage of Crude Processed

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	3.91	7.18	14.28	January	11.73	6.44	2.17
February	8.36	7.12	32.38	February	19.35	5.85	4.85
March	4.41	5.54	8.31	March	11.55	5.76	2.25
April	3.01	10.37	12.06	April	11.54	3.13	6.12
May	6.46	8.40	15.25	May	21.34	4.07	5.92
June	3.36	22.13	5.56	June	1.72	4.07	5.61
July	10.96	9.15	1.72	July	11.70	3.29	4.08
August	8.28	7.95	4.18	August	7.33	6.32	2.59
September	3.84	6.60	1.65	September	10.26	5.40	4.76
October	3.96	8.08	1.94	October	12.67	5.70	4.30
November	1.65	7.30	7.44	November	9.81	6.10	4.69
December	1.57	14.37	1.11	December	7.13	5.8	0.93

Source: Research data (2016)

The data is presented graphically as follows:

Figure 4.4: Monthly Slops Quantity Pre and Post Certification



From the graph it can be deduced that the slops quantity produced was slowly decreasing over time post the certification period. The trend shows a drop of slops quantity to an average of 6.84 % post certification period from 7.77 % before certification. This indeed signifies an improvement in operational efficiency post certification period.

Subjecting the data to structural break analysis: where,

H_0: No structural break

H_1: Presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 9.005 - 0.047x$

$R^2 = 0.032$

$RSSC = 2008.872$

$df = 70$

$t = 7.058 \qquad -1.531$

Regression model for the pre-certification period

$y = 6.352 + 0.077x$

$R^2 = 0.017$

$RSS1 = 1322.980$

$df = 34$

$t = 2.992 \qquad 0.768$

Regression model for the Post -certification period

$y = 22.853 - 0.294x$

$R^2 = 0.469$

$RSS2 = 379.320$

$df = 34$

$t = 7.687 \qquad\qquad -5.482$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (2008.872 - (1322.980+379.320))/(2)/(1322.980 + 379.320)/(72 - 4)$$

$$F = 6.123$$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is rejected. In a nutshell this shows that the regression models for the pre and post certification periods were different hence we can deduce that there was a structural break.

4.4.2 Fuel and Loss

During crude oil processing, a fraction of the crude throughput is used as fuel during refining. There is also a fraction that is lost as flue gases. These two combined, quantified as a percentage of the crude oil processed, constitute fuel and loss component and is used as a measure of refining efficiency. This component was analysed for the 36 months prior to certification and 36 months after certification. Table 4.5 shows the monthly fuel and loss for both pre and post certification periods.

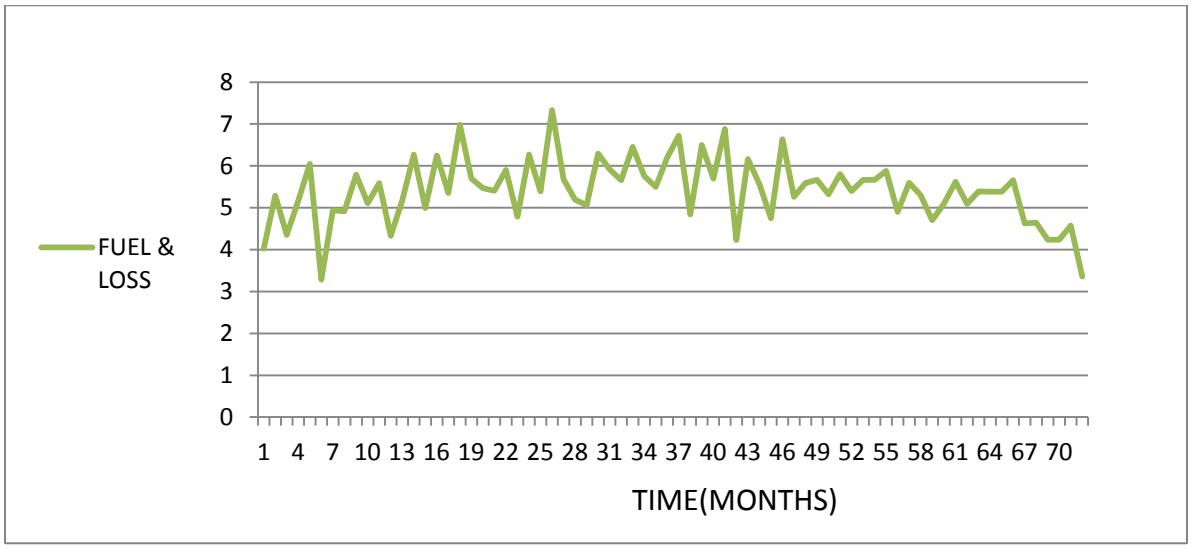
Table 4.5: Monthly Fuel and Loss Pre and Post Certification

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	4.02	5.18	5.39	January	6.72	5.67	5.62
February	5.29	6.27	7.33	February	4.84	5.32	5.09
March	4.35	4.99	5.68	March	6.5	5.8	5.39
April	5.17	6.25	5.19	April	5.7	5.4	5.38
May	6.05	5.35	5.06	May	6.88	5.67	5.38
June	3.28	6.98	6.29	June	4.23	5.67	5.66
July	4.94	5.7	5.92	July	6.16	5.88	4.63
August	4.92	5.47	5.66	August	5.57	4.9	4.64
September	5.79	5.41	6.45	September	4.75	5.6	4.24
October	5.11	5.9	5.76	October	6.64	5.3	4.24
November	5.59	4.79	5.5	November	5.26	4.7	4.57
December	4.33	6.27	6.2	December	5.59	5.1	3.36

Source: Research data (2016)

The data is presented graphically as follows:

Figure 4.5: Monthly Fuel and Loss Pre and Post Certification



The graph shows that the fuel and loss is decreasing over time post the certification period to a low of 3.36 %. The difference in means between pre certification and post certification at 5.5 % and 5.3% also depicts a reduction in the fuel and loss thus improved operational efficiency.

Structural break analysis

Regression model for the entire period 72 months

$y = 5.561 - 0.004x$

$R^2 = 0.012$

$RSSC = 41.935$

$df = 70$

$t = 30.167 \qquad -0.913$

Regression model for the pre-certification period

$y = 4.801 + 0.038x$

$R^2 = 0.247$

$RSS1 = 16.693$

$df = 34$

$t = 20.128$ 3.338

Regression model for the Post -certification period

$y = 7.669 - 0.043x$

$R^2 = 0.36$

$RSS2 = 12.679$

$df = 34$

$t = 14.108$ -4.371

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (41.935 - (16.693 + 12.679))/2/(\frac{16.693 + 12.679}{72 - 4})$$

$F = 29.08$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is rejected. In a nutshell this shows that the regression models for the pre and post certification periods were different hence we can deduce that there was a structural break.

4.5 Safety

To determine the effect of ISO 14001 certification on safety at KPRL, the number of environmental incidents and First Aid cases were analysed for the period under study.

4.5.1 Number of First Aid cases

The monthly records of First Aid cases were analysed for the 36 months pre-certification and 36 months post certification. Table 4.6 shows the monthly First Aid cases for both pre and post certification periods.

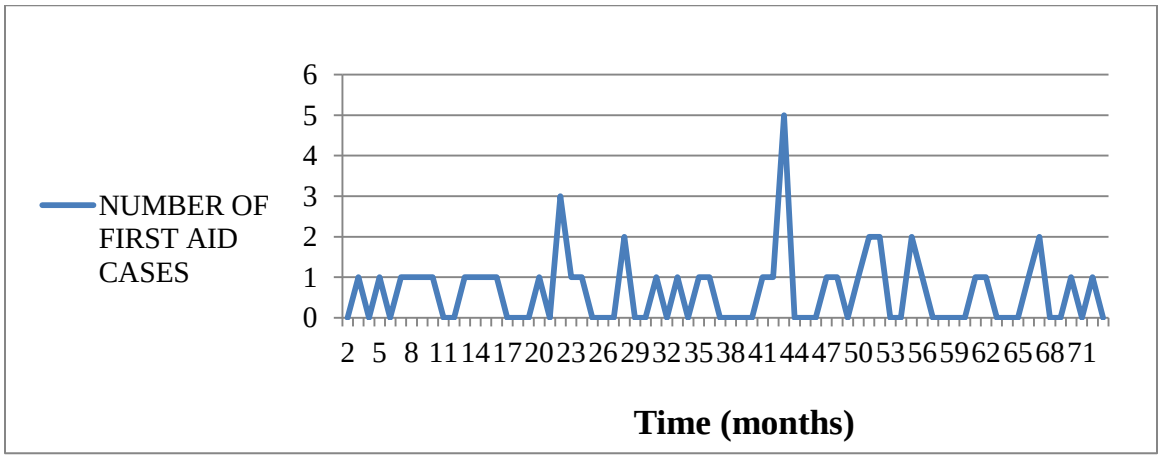
Table 4.6: Monthly First Aid Cases Pre and Post Certification

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	0	1	0	January	0	1	1
February	1	1	0	February	0	2	0
March	0	1	2	March	0	2	0
April	1	0	0	April	1	0	0
May	0	0	0	May	1	0	1
June	1	0	1	June	5	2	2
July	1	1	0	July	0	1	0
August	1	0	1	August	0	0	0
September	1	3	0	September	0	0	1
October	0	1	1	October	1	0	0
November	0	1	1	November	1	0	1
December	1	0	0	December	0	1	0

Source: Research data (2016)

The data is presented graphically as follows:

Figure 4.6: Monthly First Aid Cases Pre and Post Certification



From the graph the number of First Aid cases is at an average of 0.66 pre certification and 0.60 post-certification. This signifies a slight drop in the number of First Aid cases post certification period. This means that ISO 14001 certification led to drop in the number of occupational accidents at KPRL.

Subjecting the data to structural break analysis: where,

H_0: No structural break

H_1: Presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 0.664 - 0.001x$

R^2= -0.014

$RSSC = 52.597$

$df = 70$

$t = 3.214 \qquad -0.137$

Regression model for the pre-certification period

$y = 0.635 - 0.001x$

R^2= -0.029

$RSS1 = 16.549$

$df = 34$

$t = 2.674 \qquad -0.115$

Regression model for the Post -certification period

$y = 1.396 - 0.013x$

R^2= 0.019

$RSS2 = 35.304$

$df = 34$

$t = 1.539 \qquad -0.819$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (52.597 - (16.549 + 35.304)/(2)/(16.549 + 35.304)/(72 - 4))$$

F= 0.976

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is accepted. Hence we can deduce that there was no structural break between the two periods.

4.5.2 Number of Environmental Incidents

The monthly records of environmental incidents were analysed for the 36 months pre-certification and 36 months post certification. Table 4.7 shows the monthly environmental incidents for both pre and post certification periods.

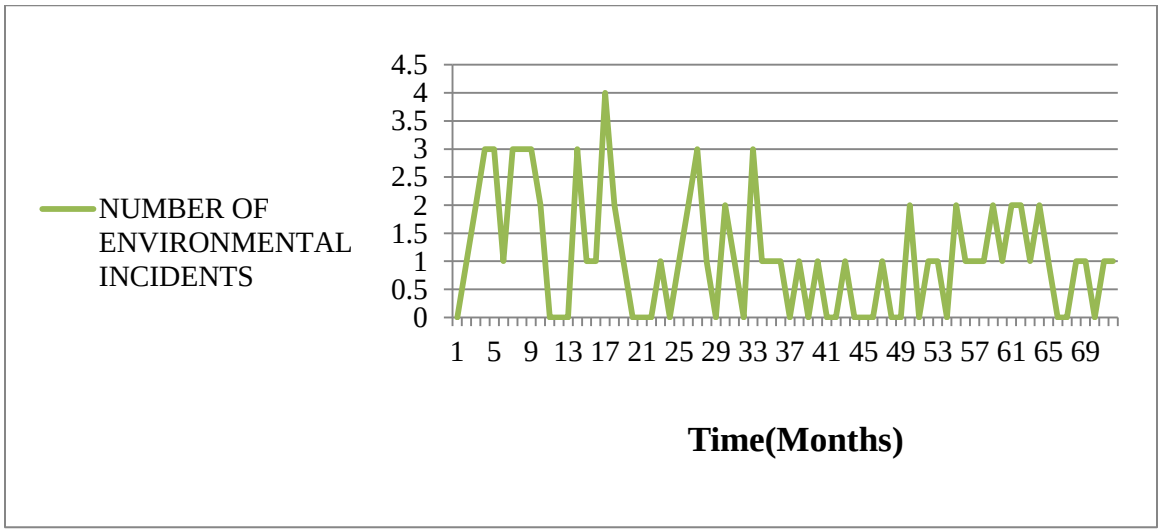
Table 4.7: Monthly Environmental Incidents Pre and Post Certification

PRE-CERTIFICATION PERIOD				POST CERTIFICATION PERIOD			
MONTH	**2005**	**2006**	**2007**	**MONTH**	**2009**	**2010**	**2011**
January	0	0	1	January	0	0	2
February	1	3	2	February	1	2	2
March	2	1	3	March	0	0	3
April	3	1	1	April	1	1	2
May	3	4	0	May	0	1	1
June	1	2	2	June	0	0	0
July	3	1	1	July	1	2	0
August	3	0	0	August	0	1	1
September	3	0	3	September	0	1	1
October	2	0	1	October	0	3	0
November	0	1	1	November	1	2	1
December	0	0	1	December	0	1	1

Source: Research data (2016)

The data is presented graphically as follows:

Figure 4.7: Monthly Environmental Incidents Pre and Post Certification



From the graph it can be deduced that the number of environmental incidents are reducing over time post the certification period. The trend shows a drop in the number of environmental incidents from an average of 1.38 % in the pre certification period to 0.77 in the post certification period. This indeed signifies an improvement in environmental and safety management in the company.

Subjecting the data to structural break analysis: where,

H_0: No structural break

H_1: Presence of structural break

When calculated F is more than or equal to critical F value from the tables, reject null hypothesis. When calculated F is less than critical F value from the tables, accept null hypothesis.

Regression model for the entire period 72 months

$y = 1.553 - 0.013x$

$R^2 = 0.068$

$RSSC = 70.355$

$df = 70$

$t = 6.503 \quad -2.263$

Regression model for the pre-certification period

$y = 1.827 - 0.24x$

$R^2 = 0.043$

$RSS1 = 48.377$

$df = 34$

$t = 4.499 \quad -1.237$

Regression model for the Post -certification period

$y = 0.023x - 0.457$

$R^2 = 0.109$

$RSS2 = 16.229$

$df = 34$

$t = 2.044 \qquad\qquad -0.743$

Calculating the F statistic

$$F = \frac{(RSSC - (RSS1 + RSS2)/(k)}{(RSS1 + RSS2)/(n - 2k)}$$

$$F = (70.355\text{-}(48.377 + 16.229))/2/(48.377 + 16.229)/(72 - 4)$$

$$F = 3.426$$

The critical F value from the tables at 95% confidence level and F (2, 68) is 3.138; this means the null hypothesis is rejected. In a nutshell this shows that the regression models for the pre and post certification periods were different hence we can deduce that there was a structural break.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings on the effect of ISO 14001 certification on the operational performance of KPRL. The conclusion and recommendations from the study are also given. Limitations of the study as well as suggestions for further research are also outlined.

5.2 Summary of Findings

This study had three objectives; to determine the effect of ISO 14001 certification on operational cost of KPRL, to establish the effect of ISO 14001 certification on safety at KPRL and to determine the effect of ISO 14001 certification on operational efficiency at KPRL.

The study has shown that the adoption of ISO 14001 EMS by KPRL had a positive effect on the operational cost of the company. The cost parameters under investigation including cost of water, cost of electricity and fuel cost were noted to be reducing over time during the period under investigation. Structural break analysis also showed that indeed there was a structural break between the pre and post certification periods for cost of water and fuel with the costs declining post the certification period. However, even though the cost of electricity declined post the certification, further analysis revealed that there was no structural break for this parameter between pre and post certification periods.

The study has also shown an improvement in the operational efficiency of KPRL post ISO 14001 certification. A decline in slops quantity as well as refinery fuel and loss were noted post the certification phase. Further analysis revealed the presence of a structural break for these parameters between pre and post certification periods. The study has also revealed an improvement in environmental and safety performance of KPRL with the number of environmental incidents reducing post the certification period. ISO 14001 certification was also noted to cause a reduction in the number of occupational accidents as deduced from the number of First Aid cases in the post certification period.

The structural break analysis conducted revealed a structural change for 71% of the variables under analysis (cost of water, cost of fuel, slops quantity, fuel and loss and number of environmental incidents), revealing that there was a change in the operational performance of KPRL as result of adoption and implementation of ISO 14001 EMS.

5.3 Conclusion

From this study it can be concluded that proper implementation of the requirements of ISO 14001 EMS standard leads to improvement in the operational performance of an organisation, which is in line with Henri and Giasson (2006) who noted that when properly implemented, ISO 14001 can give a firm a unique capability leading to competitive advantage thus having significant effects on its performance, especially operational and business performance.

It was noted that ISO 14001 certification leads to a reduction in operational cost, improvement in operational efficiency and better safety performance in the organisation. An interesting observation is that the effect becomes clearer and significant with time.

The study has shown that ISO 14001 certification led to a reduction in the number of environmental incidents at KPRL, this agrees with a study by Russo (2009) on the impact of ISO 14001 on emissions performance of 316 electronic facilities, both SMEs and multinational corporations and observed that organisations that were among the first to adopt ISO 14001 implementation were associated with lower emissions and the longer they were certified the lower the level of emissions from their facilities.

Analysing the operational efficiency of KPRL through the trend of slops production and percentage fuel and loss for both pre and post certification it can be concluded that proper implementation of ISO 14001 Environmental Management System led to improved operational efficiency of the organization. This is in line with Chattopadhyang (2001) who argued that implementation of ISO 14001 can result in cost saving through reduced energy consumption, improved operational efficiency, better raw material management, improved waste handling and management techniques, reversal of environmental impact as well as improved public image

5.4 Recommendations

The study has revealed that KPRL has achieved significant improvement in its operational performance as a result of ISO 14001 certification; however there are other areas that the company stands to benefit due to this certification. These include better corporate image, improved stakeholders confidence as well as improved staff morale. The researcher recommends that the organisation brands its vehicles, the company logo, bill boards, and sign posts with the words “ISO 14001 Certified Company”. This will serve to notify the external environment of the company’s concern about environmental management. Knowledge about the importance of ISO 14001 certification at KPRL was

clear only to the employees in the Health and Safety department. This means that the company needs to improve on its corporate communication, especially on the management systems in place so as to reap maximum benefits from the systems. The study has shown that ISO 14001 certification has a positive effect on environmental management as seen from the decline of environmental incidents post the certification period. The researcher recommends that the standard (ISO 14001 certification) be made compulsory for other oil companies, especially in the oil exploration sector so as to provide an environmental management framework which will help reduce environmental incidents when crude oil production goes full blast in Turkana in the near future.

One of the factors that affect profitability in the manufacturing sector, especially in Kenya is the cost of energy and other utilities. This study has revealed that adoption of ISO 14001 certification helps the organization reduce its cost of electricity, fuel and water. The researcher therefore recommends that other manufacturing entities adopt this Environmental Management System which will provide a framework for the management of internal resources in terms of energy and other utilities thus optimise on their use and as such realise improved bottom line.

While the study has shown an improvement in operational performance of the company post the certification period, there was no evidence to show that KPRL had assessed the effect of ISO certification on its performance. The researcher recommends that the certification body for example, Kenya Bureau of Standards (KEBS), SGS, Bureau Veritas, make it mandatory that the certified organizations conduct periodical assessments of their performance so as to ascertain whether in deed there is improvement.

5.5 Limitations of the Study

The research design for this study necessitated the use of secondary data from the organisation (KPRL). Divulgence of this information, which was considered as highly classified and confidential was a big challenge to the researcher. The period under study was also tricky as the respondents (Managers sharing data) had to spend a lot of time in the archives looking for the information. The busy schedule of some Managers was also a limitation to the study, in that data collection had to be delayed for some time thus affecting the project completion time.

5.6 Suggestions for Further Research

The study focused on the effect of ISO 14001 certification on operational performance of KPRL, an organisation that belongs to the petroleum sector. Further research can be carried out to establish the effect of ISO 14001 certification in other manufacturing sectors, for example cement manufacturing. The effect of ISO 14001 certification on operational performance in the service industry, particularly the hotel industry, is also another area that can be explored. The effect of ISO 14001 certification on the financial performance of KPRL can also be an interesting area of study.

REFERENCES

Ann, G., Zailani, S., & Abd Wahid, N. (2006). A study on the impact of environmentalmanagement system (EMS) certification towards firms' performance in Malaysia. Management of Environmental Quality: *An International Journal*, *17*(1), 73–93.

Armistead, C., & Machin, S. (1997). Implications of business process management foroperations management. *International Journal of Operations & Production Management*,*17*(9), 886–898.

Arimura, T. H., Hibiki, A., & Katayama, H. (2008). Is a voluntary approach an effectiveenvironmental policy instrument*? Journal of Environmental Economics and Management*,*55*(3), 281–295.

Aquilano, N., & Chase, R. B. (2001). *Fundamentals of Operations Management* (4th Ed.). New Jersey, USA: Prentice Hall.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*,*17*(1), 99–12.

Barney J. (2001). Is the resource based view a useful perspective for strategic management research? Yes. *The Academy Management Review*, *26*(1), 41-56.

Babkari, K. A., Bennett, R. A., & Franchetti, M. (2003). Critical factors for implementing ISO 14001 standard in United States industrial companies. *Journal of Cleaner Production*, *11*(7), 749–752.

Bai J, Perron P. (1998). "Estimating and testing linear models with multiple structural changes," *Econometrica*, *66*(1): 47-78.

Chattopadhyay, S. P. (2001). Improving the speed of ISO 14000 implementation: Aframework for increasing productivity. *Managerial Auditing Journal*, *16*(1), 36–40.

Chin, K.-S. (1999). Factors influencing ISO 14000 implementation in printed circuit board manufacturing industry in Hong Kong. *Journal of Environmental Planning and Management*, *42*(1), 123–134.

Delmas, M. (2009). Stakeholders and competitive advantage: The case of ISO 14001. *Production and Operations Management*, *10*(3), 343–358.

Evolution of ISO 14001 certificates in Kenya(2014). World distribution of ISO 14001 certificates in 2014. Retrieved from http://www.iso.org

Feldman, S. J., Soyka, P. A., & Ameer, P. G. (1997). Does improving a firm's environmental management system and environmental performance result in a higher stock price? *The Journal of Investing*, *6*(4), 87–97.

Florida, R. (1996). Lean and green: The move to environmentally conscious manufacturing. *California Management Review*, *39*(1), 80–105.

Haklik, J.E. (1997). Implementing ISO 14000: A practical, comprehensive guide to the ISO 14000 environmental management standards. *Choice Reviews Online*, *34*(08), 34–457.

Hale, M. (1995). Training for environmental technologies and environmental management. *Journal of Cleaner Production*, *3*(1-2), 19–23.

Ghisellini, A., & Thurston, D. L. (2005). Decision traps in ISO 14001 implementation process: Case study results from Illinois certified companies. *Journal of Cleaner Production*, *13*(8), 763–777.

Hart, S. L. (1995). A natural-resource-based view of the firm. *The Academy of Management Review*, *20*(4), 986.

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? an empirical examination of the relationship between emission reduction and firm performance. *Business Strategy and the Environment*, *5*(1), 30–37.

Henri, J. F., & Giasson, A. (2006). Measuring environmental performance: A basic ingredient of environmental management. *CMA Management*, *80*(5), 28-32.

Hillary, R. (2004). Environmental management systems and the smaller enterprise. *Journal of Cleaner Production*, *12(1)*, 561-569.

InternationalOrganization for Standardization (ISO). (2002). ''The Basics: ISO 14000 and environmental management systems for busy managers.

Jaffe, A., Peterson, S., Portney, P., Stavins, R. (1995). Environmental regulation and thecompetitiveness of U.S. manufacturing: what does the evidence tell us? *Journalof Economic Literature 33* (1), 132-163.

Jiangning, Z. (2006). The effect of the ISO-14001 environmental management system on corporate financial performance. *International Journal of Business Excellence*, *1*(1/2), 210.

Kairu, N.C.(2014).*Factors influencing implementation of environmental managementsystem ISO 14001 certification at Allpack Industries Limited*.Unpublished Master's Thesis. University of Nairobi, Nairobi, Kenya.

Kang, Y. (2005). "Third Party Inspections on Environmental and Safety Regulation: Theory andEmpirical Evidence." Ph.D. Dissertation. Philadelphia PA: University of Pennsylvan.

Kenya Petroleum refineries Ltd (2015). *www.kprl.co.ke*

Keoleian, G. A., & Menerey, D. (1994). Sustainable development by design: Review of life cycle design and related approaches. *Air & Waste*, *44*(5), 645–668.

Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science*, *42*(8), 1199–1214.

Mohammed, A. (2014). *Effect of ISO 9001:2008 certification on operational performance of Hashi Energy Kenya Limited*. .Unpublished Master's Thesis. University of Nairobi, Nairobi, Kenya.

Morrow, D., & Rondinelli, D. (2002). Adopting corporate environmental management systems: *European Management Journal*, *20*(2), 159–171.

Miles, M., Covin, J. (2000). Environmental marketing: a source of reputational, competitive, and financial advantage. *Journal of Business Ethics,2000*(23), 299-311.

Nee, G., & Abdul Wahid, N. (2010). The impact of ISO 14001 environmental management system (EMS) implementation on SMEs performance: An empirical study in Malaysia. *Journal of Sustainable Development*, *3*(2)

Newbert, S. (2008). Value, rareness, competitive advantage and performance: A conceptual level empiricalinvestigation of the Resource Based View of the Firm. *Strategic Management Journal*, *29*(7), 745-768.

Omondi, D. (2008). *Application of Lean Thinking to Business Process Management: The Case of Kenya Revenue Authority*. Unpublished Master's Thesis. University of Nairobi, Nairobi, Kenya.

Perron, G. M., Côté, R. P., & Duffy, J. F. (2006). Improving environmental awareness training in business. *Journal of Cleaner Production*, *14*(6-7), 551–562.

Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, *14*(3), 179–191.

Prakash, A. & Potoski, M. (2005). Covenants with weak swords: ISO 14001 and facilities' environmental performance. J*ournal of Policy Analysis and Management 24*(4): 745-769.

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, *25*(9), 898–916.

Rondinelli, D. A., Berry, M. A., & Vastag, G. (1997). Strategic programming for environmental management: Sonoco's take-back policy. *Business Horizons*, *40*(3), 23–32.

Rooney, C. 1993.Economics of pollution prevention: How waste reduction pays. *Pollution Prevention Review*. *3*(Summer): 261-276.

Rumelt, R. 1984. "*Towards a Strategic Theory of the Firm." in R. Lamb (ed). Competitive Strategic Management, Englewood Cliffs*, NJ: Prentice-Hall. 556-570.

Russo, M. V. (2009). Explaining the impact of ISO 14001 on emission performance: A dynamic capabilities perspective on process and learning. *Business Strategy and the Environment*, *18*(5), 307–319.

Smart, B. (1992). Beyond compliance: A new industry view of the environment. *Choice Reviews Online*, *30*(03), 30–1591.

Tan, L. P. (2005). Implementing ISO 14001: Is it beneficial for firms in newly industrialized Malaysia? *Journal of Cleaner Production*, *13*(4), 397–404.

Taylor, W. A. (1995). Organizational differences in ISO 9000 implementation practices. *International Journal of Quality & Reliability Management*, *12*(7), 10–27.

The Kenya Central Bureau of Statistics, (2014). *The Economic Survey 2014*. KenyaGovernment Printer, Nairobi.

Tibor, T., & Feldman, I. (1996). ISO 14000: A guide to the new environmental management standards. *Business Strategy and the Environment*, *18*(5), 40–64.

Warries, A. (2004). Lloyd Register Quality Assurance (LRQA). A new environment. A detailed briefing note on the revision of ISO 14001: 1996 to ISO 14001:2003 prepared forLRQA customers.

Watson, K., Klingenberg, B., Polito, T., Geurts, T.G., 2004. Impact of EMS implementation on financial performance. *Management of Environmental Quality15*(3),622- 628.

Voola, R., Carlson, J., & West, A. (2004). Emotional intelligence and competitive advantage: Examining the relationship from a resource-based view. *Strategic Change*, *13*(2), 83–93.

Zeng, S., Tian, P., & Shi, J. (2005). Implementing integration of ISO 9001 and ISO 14001. *Managerial Auditing Journal*, *20*, 394-407.

Zutshi, A., & Sohal, A. (2004). Environmental management system adoption by Australasian organisations: Part 1: Reasons, benefits and impediments. Technovation, *24*(4), 335–357.

APPENDICES

Appendix 1: Secondary Data Collection Form

YEAR :(2005, 2006, 2007, 2008, 2009, 2010, 2011)

MONTH	**QUANTITY OF CRUDE OIL PROCESSED**	**OPERATIONAL COST**			**OPERATIONAL EFFICIENCY**		**HEALTH, SAFETY & ENVIRONMENT PERFORMANCE**	
	(Metric Tonnes)	Electricity cost(Ksh)	Fuel cost (Ksh)	Cost of water (Ksh)	Fuel & Loss (% crude)	Slops Quantity(Tonnes)	Number of environmental incidents	First Aid Cases
January								
February								
March								
April								
May								
June								
July								
August								
September								
October								
November								
December								

Appendix II: Secondary Data
NUMBER OF ENVIRONMENTAL INCIDENTS

				YEAR			
MONTH	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
January	0	0	1	0	0	0	2
February	1	3	2	1	1	2	2
March	2	1	3	0	0	0	1
April	3	1	1	0	1	1	2
May	3	4	0	0	0	1	1
June	1	2	2	0	0	0	0
July	3	1	1	2	1	2	0
August	3	0	0	0	0	1	1
September	3	0	3	0	0	1	1
October	2	0	1	0	0	1	0
November	0	1	1	1	1	2	1
December	0	0	1	0	0	1	1

SLOPS QUANTITY (% CRUDE)

				YEAR			
MONTH	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
January	3.91	7.18	14.28	13.64	11.73	6.44	2.17
February	8.36	7.12	32.38	3.65	19.35	5.85	4.85
March	4.41	5.54	8.31	2.32	11.55	5.76	2.25
April	3.01	10.37	12.06	1.48	11.54	3.13	6.12
May	6.46	8.40	15.25	8.48	21.34	4.07	5.92
June	3.36	22.13	5.56	8.17	1.72	4.07	5.61
July	10.96	9.15	1.72	4.64	11.70	3.29	4.08
August	8.28	7.95	4.18	4.15	7.33	6.32	2.59
September	3.84	6.60	1.65	13.10	10.26	5.40	4.76
October	3.96	8.08	1.94	8.09	12.67	5.70	4.30
November	1.65	7.30	7.44	7.66	9.81	6.10	4.69
December	1.57	14.37	1.11	6.64	7.13	5.80	0.93

COST OF WATER ANALYSIS

			2005		
MONTH	**UNITS CONSUMED (m^3)**	**COST (@Ksh116/ m^3)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**WATER COST (USD/KBBL)**
JANUARY	87684	10,171,344	131,429.69	1199	110
FEBRUARY	67520	7,832,320	101,205.84	685	148
MARCH	76821	8,911,236	115,147.12	1196	96
APRIL	72262	8,382,392	108,313.63	1216	89
MAY	68899	7,992,284	103,272.83	1024	101
JUNE	64617	7,495,572	96,854.53	1028	94
JULY	53018	6,150,088	79,468.77	965	82
AUGUST	64965	7,535,940	97,376.15	1241	78
SEPTEMBER	61129	7,090,964	91,626.36	802	114
OCTOBER	72585	8,419,860	108,797.78	1119	97
NOVEMBER	61192	7,098,272	91,720.79	1049	87
DECEMBER	48893	5,671,588	73,285.80	841	87
			2006		

MONTH	UNITS CONSUMED (m^3)	COST (@Ksh116/ m^3)	COST IN USD (1USD=Ksh 77.39)	CRUDE THROUGHPUT (KBBL)	WATER COST (USD/KBBL)
JANUARY	66587	7,724,092	99807	1264	79
FEBRUARY	69045	8,009,220	103492	996	104
MARCH	55835	6,476,860	83691	867	97
APRIL	61053	7,082,148	91512	982	93
MAY	71345	8,276,020	106939	1235	87
JUNE	61343	7,115,788	91947	586	157
JULY	63759	7,396,044	95568	1149	83
AUGUST	68805	7,981,380	103132	1306	79
SEPTEMBER	58312	6,764,192	87404	806	108
OCTOBER	61417	7,124,372	92058	1137	81
NOVEMBER	69353	8,044,948	103953	976	107
DECEMBER	72536	8,414,176	108724	1120	97
			2007		
MONTH	**UNITS CONSUMED (m3)**	**COST (@Ksh116/m3)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**WATER COST (USD/KBBL)**

JANUARY	70156	8138096	105157	972	108
FEBRUARY	77102	8943832	115568	874	132
MARCH	67457	7825012	101111	1350	75
APRIL	85960	9971360	128846	1159	111
MAY	65246	7568536	97797	1189	82
JUNE	102761	11920276	154029	913	169
JULY	62323	7229468	93416	961	97
AUGUST	61185	7097460	91710	1260	73
SEPTEMBER	85445	9911620	128074	942	136
OCTOBER	70520	8180320	105703	1206	88
NOVEMBER	72784	8442944	109096	1086	100
DECEMBER	77135	8947660	115618	666	174
			2009		
MONTH	**UNITS CONSUMED (m^3)**	**COST (@Ksh116/ m^3)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**WATER COST (USD/KBBL)**
JANUARY	51389	5961124	77027.05776	891	86
FEBRUARY	62187	7213692	93212.19796	957	97
MARCH	54092	6274672	81078.58896	957	85

APRIL	61980	7189680	92901.92531	997	93
MAY	59747	6930652	89554.87789	894	100
JUNE	61521	7136436	92213.92945	766	120
JULY	62517	7251972	93706.83551	1065	88
AUGUST	69218	8029288	103750.9756	1065	97
SEPTEMBER	52285	6065060	78370.07365	1152	68
OCTOBER	60246	6988536	90302.82982	978	92
NOVEMBER	65375	7583500	97990.69647	1318	74
DECEMBER	48892	5671472	73284.3003	1158	63
			2010		
MONTH	**UNITS CONSUMED (m^3)**	**COST (@Ksh116/ m^3)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**WATER COST (USD/KBBL)**
JANUARY	63961	7419476	95871	827	116
FEBRUARY	38167	4427372	57209	1015	56
MARCH	37831	4388396	56705	1237	46
APRIL	48393	5613588	72536	1195	61
MAY	39411	4571676	59073	1158	51
JUNE	45596	5289136	68344	1328	51

JULY	42448	4923968	63625	822	77
AUGUST	39680	4602880	59476	1084	55
SEPTEMBER	37812	4386192	56676	836	68
OCTOBER	38748	4494768	58079	807	72
NOVEMBER	40801	4732916	61157	930	66
DECEMBER	37009	4293044	55473	1156	48
			2011		
MONTH	**UNITS CONSUMED (m^3)**	**COST (@Ksh116/ m^3)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**WATER COST (USD/KBBL)**
JANUARY	44443	5155388	66616	1269	52
FEBRUARY	45500	5278000	68200	990	69
MARCH	39052	4530032	58535	1382	42
APRIL	37690	4372040	56494	1003	56
MAY	30329	3518164	45460	1029	44
JUNE	48669	5645604	72950	1029	71
JULY	44540	5166640	66761	1200	56
AUGUST	31809	3689844	47679	1005	47
SEPTEMBER	36710	4258360	55025	1050	52

OCTOBER	40081	4649396	60077	1125	53
NOVEMBER	36259	4206044	54349	1130	48
DECEMBER	32927	3819532	49354	1039	48

COST OF ELECTRICITY ANALYSIS

			2005		
MONTH	**UNITS CONSUMED (KWh)**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**ELECTRICTY COST (USD/KBBL)**
JANUARY	3,694,070	21,240,902.50	274,465.73	1199	229
FEBRUARY	3,140,940	18,060,405.00	233,368.72	685	341
MARCH	3,342,050	19,216,787.50	248,310.99	1196	208
APRIL	4,150,130	23,863,247.50	308,350.53	1216	254
MAY	3,460,120	19,895,690.00	257,083.47	1024	251
JUNE	3,830,230	22,023,822.50	284,582.28	1028	277
JULY	2,837,160	16,313,670.00	210,798.17	965	218
AUGUST	3,932,240	22,610,380.00	292,161.52	1241	235
SEPTEMBER	3,352,930	19,279,347.50	249,119.36	802	311
OCTOBER	3,637,740	20,917,005.00	270,280.46	1119	242
NOVEMBER	3,741,430	21,513,222.50	277,984.53	1049	265
DECEMBER	2,479,050	14,254,537.50	184,190.95	841	219

			2006		
MONTH	**UNITS CONSUMED (KWh)**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=KSH 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**ELECTRICTY COST (USD/KBBL)**
JANUARY	3,766,440	21,657,030.00	279,842.74	1263.85989	221
FEBRUARY	3,868,660	22,244,795.00	287,437.59	996	289
MARCH	3,057,830	17,582,522.50	227,193.73	867	262
APRIL	3,568,250	20,517,437.50	265,117.42	982	270
MAY	3,993,950	22,965,212.50	296,746.51	1235	240
JUNE	2,991,610	17,201,757.50	222,273.65	586	379
JULY	3,880,840	22,314,830.00	288,342.55	1149	251
AUGUST	4,160,770	23,924,427.50	309,141.07	1306	237

SEPTEMBER	3,076,280	17,688,610.00	228,564.54	806	284
OCTOBER	3,771,570	21,686,527.50	280,223.90	1137	246
NOVEMBER	3,130,580	18,000,835.00	232,598.98	976	238
DECEMBER	4,192,860	24,108,945.00	311,525.33	1120	278
			2007		
MONTH	**UNITS CONSUMED (KWh)**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**ELECTRICTY COST (USD/KBBL)**
JANUARY	3,732,480	21,461,760.00	277,319.55	972	285
FEBRUARY	4,186,850	24,074,387.50	311,078.79	874	356
MARCH	3,740,280	21,506,610.00	277,899.08	1350	206
APRIL	4,208,570	24,199,277.50	312,692.56	1159	270

MAY	4,114,350	23,657,512.50	305,692.11	1189	257
JUNE	3,406,000	19,584,500.00	253,062.41	913	277
JULY	3,067,850	17,640,137.50	227,938.20	961	237
AUGUST	4,003,570	23,020,527.50	297,461.27	1260	236
SEPTEMBER	3,008,770	17,300,427.50	223,548.62	942	237
OCTOBER	3,703,670	21,296,102.50	275,179.00	1206	228
NOVEMBER	3,762,560	21,634,720.00	279,554.46	1086	257
DECEMBER	2,726,560	15,677,720.00	202,580.70	666	304
			2009		
MONTH	**UNITS CONSUMED**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT**	**ELECTRICTY COST (USD/KBBL)**

	(KWh)			**(KBBL)**	
JANUARY	3,284,480	18,885,760.00	244,033.60	891	274
FEBRUARY	3,869,120	22,247,440.00	287,471.77	957	300
MARCH	3,654,960	21,016,020.00	271,559.89	957	284
APRIL	3,437,270	19,764,302.50	255,385.74	997	256
MAY	3,122,750	17,955,812.50	232,017.22	894	260
JUNE	3,047,680	17,524,160.00	226,439.59	766	296
JULY	2,982,580	17,149,835.00	221,602.73	1065	208
AUGUST	3,416,270	19,643,552.50	253,825.46	1065	238
SEPTEMBER	3,804,870	21,878,002.50	282,698.06	1152	245
OCTOBER	3,274,360	18,827,570.00	243,281.69	978	249
NOVEMBER				1318	135

	2,388,730	13,735,197.50	177,480.26		
DECEMBER	3,549,960	20,412,270.00	263,758.50	1158	228
			2010		
MONTH	**UNITS CONSUMED (KWh)**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**ELECTRICTY COST (USD/KBBL)**
JANUARY	3,086,880	17,749,560	229352.1127	827	277
FEBRUARY	3,697,440	21,260,280	274716.1132	1015	271
MARCH	3,560,880	20,475,060	264569.8411	1237	214
APRIL	3,955,440	22,743,780	293885.2565	1195	246
MAY	3,569,160	20,522,670	265185.0368	1158	229
JUNE	4,215,480	24,239,010	313205.9698	1328	236

JULY	976,400	5,614,300	72545.54852	822	88
AUGUST	4,249,480	24,434,510	315732.1359	1084	291
SEPTEMBER	3,025,680	17,397,660	224805.0136	836	269
OCTOBER	3,001,800	17,260,350	223030.7533	807	276
NOVEMBER	3,710,400	21,334,800	275679.0283	930	296
DECEMBER	3,642,840	20,946,330	270659.3875	1156	234
			2011		
MONTH	**UNITS CONSUMED (KWh)**	**COST (@Ksh5.75/KWh)**	**COST IN USD (1USD=Ksh 77.39)**	**CRUDE THROUGHPUT (KBBL)**	**ELECTRICTY COST (USD/KBBL)**
JANUARY	3,766,800	21,659,100	279,869	1269	220.54
FEBRUARY	3,436,800	19,761,600	255,351	990	257.93

MARCH	3,586,680	20,623,410	266,487	1382	192.83
APRIL	3,487,800	20,054,850	259,140	1003	258.36
MAY	3,596,040	20,677,230	267,182	1029	259.65
JUNE	2,909,160	16,727,670	216,148	1029	210.06
JULY	3,013,680	17,328,660	223,913	1200	186.59
AUGUST	3,192,360	18,356,070	237,189	1005	236.01
SEPTEMBER	2,744,040	15,778,230	203,879	1050	194.17
OCTOBER	3,072,480	17,666,760	228,282	1125	202.92
NOVEMBER	3,016,920	17,347,290	224,154	1130	198.37
DECEMBER	2,700,600	15,528,450	200,652	1039	193.12

FIRST AID CASES

				YEAR			
MONTH	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
January	0	1	0	3	0	1	1
February	1	1	0	1	0	2	0
March	0	1	2	1	0	2	0
April	1	0	0	2	1	0	0
May	0	0	0	2	1	0	1
June	1	0	1	0	5	2	2
July	1	1	0	1	0	1	0
August	1	0	1	2	0	0	0
September	1	3	0	0	0	0	1
October	0	1	1	1	1	0	0
November	0	1	1	0	1	0	1
December	1	0	0	0	0	1	0

FUEL AND LOSS

YEAR							
MONTH	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
January	4.02	5.18	5.39	6.98	6.72	5.67	5.62
February	5.29	6.27	7.33	5.69	4.84	5.32	5.09
March	4.35	4.99	5.68	4.91	6.50	5.80	5.39
April	5.17	6.25	5.19	5.87	5.70	5.40	5.38
May	6.05	5.35	5.06	6.29	6.88	5.67	5.38
June	3.28	6.98	6.29	6.27	4.23	5.67	5.66
July	4.94	5.70	5.92	5.73	6.16	5.88	4.63
August	4.92	5.47	5.66	4.92	5.57	4.90	4.64
September	5.79	5.41	6.45	7.49	4.75	5.60	4.24
October	5.11	5.90	5.76	5.40	6.64	5.30	4.24
November	5.59	4.79	5.50	5.61	5.26	4.70	4.57
December	4.33	6.27	6.20	6.30	5.59	5.10	3.36

COST OF FUEL ANALYSIS

			2005		
MONTH	**QUANTITY CONSUMED (MT)**	**COST (@Ksh30570/TONNE)**	**COST IN USD (1USD=Ksh77.39)**	**CRUDE THROUGHPUT (KBBL)**	**FUEL COST (USD/KBBL)**
January	1,956	59,783,026	772,490.32	1199	644
February	1,461	44,648,145	576,923.96	685	842
March	2,053	62,770,179	811,089.02	1196	678
April	1,573	48,073,793	621,188.69	1216	511
May	1,006	30,763,970	397,518.68	1024	388
June	1,050	32,098,500	414,762.89	1028	403
July	2,074	63,390,013	819,098.24	965	849

August	2,734	83,584,999	1,080,049.09	1241	870
September	2,348	71,793,281	927,681.62	802	1,157
October	2,899	88,633,589	1,145,284.78	1119	1,023
November	1,161	35,480,905	458,468.86	1049	437
December	1,159	35,433,147	457,851.75	841	544
			2006		
MONTH	**QUANTITY CONSUMED (MT)**	**COST (@Ksh30570/TONNE)**	**COST IN USD (1USD=KSH77.39)**	**CRUDE THROUGHPUT (KBBL)**	**FUEL COST (USD/KBBL)**
January	2074	63,402,180	819,255	1264	648
February	1962	59,988,647	775,147	996	778
March	1585	48,445,614	625,993	867	722

April	1574	48,117,180	621,749	982	633
May	1538	47,019,783	607,569	1235	492
June	2934	89,680,540	1,158,813	586	1,977
July	2499	76,401,726	987,230	1149	859
August	1415	43,263,501	559,032	1306	428
September	1839	56,224,556	726,509	806	901
October	2067	63,188,190	816,490	1137	718
November	1277	39,035,605	504,401	976	517
December	2260	69,086,401	892,704	1120	797
			2007		

MONTH	QUANTITY CONSUMED (MT)	COST (@Ksh30570/TONNE)	COST IN USD (1USD=Ksh77.39)	CRUDE THROUGHPUT (KBBL)	FUEL COST (USD/KBBL)
January	2047	62,569,023	808,490	972	832
February	2612	79,860,316	1,031,920	874	1,181
March	2514	76,857,734	993,122	1350	736
April	2308	70,560,951	911,758	1159	787
May	3278	100,202,669	1,294,775	1189	1,089
June	1330	40,655,058	525,327	913	575
July	2075	63,441,068	819,758	961	853
August	2081	63,625,170	822,137	1260	652
September	2079	63,550,739	821,175	942	872

October	2079	63,550,739	821,175	1206	681
November	3064	93,678,768	1,210,476	1086	1,115
December	1659	50,722,993	655,421	666	984
			2009		
MONTH	**QUANTITY CONSUMED (MT)**	**COST (@Ksh30570/TONNE)**	**COST IN USD (1USD=Ksh77.39)**	**CRUDE THROUGHPUT (KBBL)**	**FUEL COST (USD/KBBL)**
January	2475	75,668,193	977,752	891	1,097
February	4017	122,804,591	1,586,828	957	1,658
March	2869	87,701,670	1,133,243	957	1,184
April	2642	80,765,940	1,043,622	997	1,047
May	3571	109,165,470	1,410,589	894	1,578
June	1011			766	521

		30,906,270	399,357		
July	3287	100,474,089	1,298,283	1065	1,219
August	3954	120,859,981	1,561,700	1065	1,466
September	2985	91,253,616	1,179,140	1152	1,024
October	2336	71,419,710	922,855	978	944
November	2086	63,771,194	824,024	1318	625
December	1722	52,641,011	680,204	1158	587
			2010		
MONTH	**QUANTITY CONSUMED (MT)**	**COST (@Ksh30570/TONNE)**	**COST IN USD (1USD=Ksh77.39)**	**CRUDE THROUGHPUT (KBBL)**	**FUEL COST (USD/KBBL)**
January	1918	58,621,609	757,483	827	916

February	2003	61,224,342	791,114	1015	779
March	2948	90,120,360	1,164,496	1237	941
April	1806	55,223,117	713,569	1195	597
May	1489	45,510,583	588,068	1158	508
June	2434	74,420,382	961,628	1328	724
July	2929	89,525,659	1,156,812	822	1,407
August	1326	40,550,838	523,980	1084	483
September	2620	80,097,167	1,034,981	836	1,238
October	2042	62,424,279	806,619	807	1,000
November	1393	42,581,502	550,220	930	592

December	1974	60,341,194	779,703	1156	674
			2011		
MONTH	**QUANTITY CONSUMED (MT)**	**COST (@Ksh30570/TONNE)**	**COST IN USD (1USD=Ksh77.39)**	**CRUDE THROUGHPUT (KBBL)**	**FUEL COST (USD/KBBL)**
January	1823	55730583	720126	1269	567
February	2571	78592613	1015540	990	1026
March	1778	54365428	702486	1382	508
April	2575	78707208	1017020	1003	1014
May	1258	38442968	496743	1029	483
June	2284	69816922	902144	1029	877
July	1737	53111488	686284	1200	572
August	1841	56279003	727213	1005	724
September	1800	55026000	711022	1050	677
October	1980	60516403	781967	1125	695
November	1924	58817562	760015	1130	673
December	1265	38669931	499676	1039	481