

# THE EXTENT OF ADOPTION OF LEAN THINKING IN THE KENYAN PETROLEUM INDUSTRY

L GICHERE ESTHER WAMUYU

UNIVERSITY OF NAIROBI  
KIBERA LIBRARY

A Research Project Submitted in Partial Fulfilment of the Requirements for the  
Award of Master of Business Administration, School of Business, University of  
Nairobi

2007



## DECLARATION


This research project is my original work and has not been submitted for a degree course in this or any other university.

Signed: Esther. W. Gichere. Date: 01/11/07

GICHERE ESTHER WAMUYU

D61/P/8247/03

This research project has been submitted for examination with my approval as the University Supervisor

Signed:  Date: 01/11/2007

ONSERIO NYAMWANGE

Management Science, School of Business,

University of Nairobi

## DEDICATION

To my parents, Hezekiah Gichere and Pascalina Gichere, as well as my sisters, Wangui and Gathigia for their love, support and encouragement

## ACKNOWLEDGEMENT

I would like to thank my family, parents and sisters for their continued support and encouragement during the entire duration of my studies. I thank my lecturers especially my supervisor, Onserio Nyamwange, whose stand and knowledge enabled me pick the research topic and give it the detail it deserves. I am in great debt to all my respondents from the various petroleum companies for sparing some time from their busy schedules to complete my questionnaire. I thank Daniel Kinyua for his guidance during administration of the questionnaire. I thank God Almighty for provision both in material and spiritual ways. However this list cannot be entirely exhaustive.

## ABSTRACT

Lean thinking seeks ways of eliminating waste. Lean thinking has been applied in both the manufacturing and service industries and is therefore applicable to any industry. The aim of the study was to examine the degree of adoption of lean principles in the Kenyan petroleum industry. Linked to this is the notion that the adoption of lean principles leads to market leadership as indicated by profitability.

A survey of the major petroleum companies in Kenya was conducted. The target population comprised of the five major petroleum companies that dominate the Kenyan market. The list of the five major companies was obtained from the Petroleum Institute of East Africa (PIEA). Because the relevant data were not available in secondary form, primary data collection was necessary. The questionnaire was divided into three parts: part A had general questions about the company; part B comprised of a scale to measure the extent of adoption of lean principles in the company and part C had operational dimensions of lean principles. The questionnaire was distributed electrically and in some instances by hand delivery. It was self administered with a few instances requiring a short interview.

From the study it was found that the companies in the Kenyan petroleum industry had widely adopted the lean principles and thus there continued leadership position in the Kenya market. Other companies are encouraged to adopt these principles in order to follow this path.

## TABLE OF CONTENTS

DECLARATION .....	i
DEDICATION .....	ii
ACKNOWLEDGEMENT .....	iii
ABSTRACT .....	iv
LIST OF TABLES .....	v
LIST OF ABBREVIATIONS.....	vi

### PART ONE: INTRODUCTION

1.1 Background .....	1
1.2 Statement of the Problem .....	3
1.3 Research Objectives .....	4
1.4 Significance of the Study .....	4

### PART TWO: LITERATURE REVIEW

2.1 Lean Concept .....	5
2.2 Principles of Lean Thinking .....	6
2.3 Technical Requirements .....	9
2.4 The Lean Enterprise .....	12
2.5 Lean and World Class Organisations .....	12
2.6 Examples of Lean Application .....	13
2.7 Benefits of Lean Thinking .....	14
2.8 Challenges of Lean Adoption .....	14
2.9 A Model for Evaluating the Degree of Lean Application .....	15
2.10 Lean in Kenya .....	23
2.10 The Kenya Petroleum Industry .....	25

### PART THREE: RESEARCH METHODOLOGY

3.1 Research Design .....	27
3.2 Population .....	27
3.3 Data Collection Method .....	27

3.3	Data Analysis .....	28
-----	---------------------	----

**PART FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSIONS**

4.1	Introduction .....	29
4.2	General Information .....	29
4.3	Adoption of Lean Principles .....	29
4.4	Elimination of Waste .....	30
4.5	Continuous Improvement .....	30
4.6	Zero defects .....	31
4.7	Just in time .....	31
4.8	Pull Instead of Push .....	31
4.9	Multifunctional teams .....	32
4.10	Decentralized Responsibilities .....	32
4.11	Integrated Functions .....	33
4.12	Vertical information systems .....	33
4.13	Challenges in adopting lean .....	33

**PART FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

5.1	Introduction .....	34
5.2	Summary .....	34
5.3	Conclusion .....	34
5.4	Recommendations for Policy and Practice .....	35
5.5	Limitations of the Study .....	35
5.6	Suggestions for Further Research .....	35

<b>REFERENCES</b> .....	36
-------------------------	----

**APPENDICES**

Appendix 1: Introduction letter .....	40
Appendix 2: Questionnaire .....	41
Appendix 3 : List of Companies .....	47

## LIST OF TABLES

2.1	Lean processes and tools .....	10
2.2	Common Obstacles related to Lean Implementation Efforts.....	16
2.3a	Elimination of Waste .....	19
2.3b	Continuous Improvement .....	19
2.3c	Zero Defects .....	20
2.3d	Just in Time .....	21
2.3e	Pull instead of Push .....	21
2.3f	Integrated Functions .....	21
2.3g	Multifunctional teams .....	22
2.3h	Decentralized Responsibilities .....	22
2.3i	Vertical Information Systems .....	23



## LIST OF ABBREVIATIONS

PIEA - PETROLEUM INSTITUTE OF EAST AFRICA

LPG - LIQUEFIED PETROLEUM GAS

KPRL - KENYA PETROLEUM REFINERY LTD

KPC - KENYA PIPELINE COMPANY

OTS - OPEN TENDER SYSTEM

MoE - MINISTRY OF ENERGY

NIST - NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

MEP - MANUFACTURING EXTENSION PARTNERSHIP

## PART ONE: INTRODUCTION

### 1.1 Background

A book titled *The Machine that Changed the World* (Womack and Jones, 1990) detailed the progress of the Japanese automobile industry and compared their production model to the traditional mass production model common in the United States. The Japanese model was termed “Lean” and has since been associated with the practice of deciphering the value added activities from those that are waste (“*muda*” in Japanese) in an organization and its supply chain (Comm and Mathaisel, 2006). In time, the abstractions behind lean production have spread to logistics, and from there to the military, to construction, and to the service industry (Poppendieck, 2002).

Lean thinking looks at the value chain and asks: How can things be structured so that the enterprise does nothing but add value, and does that as rapidly as possible? Companies that re-think the value chain and find ways to provide what their customers value with significantly fewer resources than their competitors can develop an unassailable competitive advantage (Poppendieck, 2002). Karlsson and Åhlström (1996) developed a model that operationalizes the determinants of a lean production system. Implicit to this is the notion that by introducing lean production, performance can be enhanced. This model contains nine principles: Elimination of Waste; Continuous Improvement; Zero Defects; JIT deliveries; Pull of materials; Multifunctional teams; Decentralisation; Integration of functions; Vertical information systems-

Crude oil and natural gas are the raw materials of the petroleum industry. They are used for the production of petrochemicals and other oil derivatives. After the production of crude oil is complete, it undergoes a distillation process which is the separation of heavy crude oil into lighter groups (called fractions) of hydrocarbons. As a result of the distillation process, various fractions of the crude oil are produced, such as fuel gas, liquefied petroleum gas (LPG) and Kerosene. The supply chain of the petroleum industry is divided into two different major segments: the upstream and downstream supply chains. The upstream process includes the acquisition of crude oil, which is the specialty

of the petroleum companies. The upstream process includes the exploration, forecasting, production, and logistics management of delivering crude oil from remotely located oil wells to refineries. The downstream supply chain starts at the refinery, where the crude oil is manufactured into the consumable products that are the refineries and petrochemical companies. The downstream supply chain involves the process of forecasting, production, and the logistics management of delivering the crude oil derivatives to customers around the globe (Hussain *et al*, 2006).

The Kenyan petroleum industry specialises in downstream activities. It was deregulated in late 1994 with the deregulation of retail prices of petroleum products and of the importation of crude oil and refined products. However, the sub-sector could not be fully deregulated mainly because of the market's dependence on KPRL for liquefied petroleum gas (LPG), and the absence of a viable infrastructure for its importation. From 1 January 2004, all importers of crude oil and petroleum products for domestic consumption have to be sourced through an Open Tender System (OTS) centrally coordinated through the Ministry of Energy (MoE). The current government regulation requires that 70 percent of the country's petroleum products requirements should be imported in crude form and the rest is in refined form. Due to the OTS, all the petroleum companies incur fairly similar costs, with differences occurring in overhead costs (pwc, 9<sup>th</sup> Jan 07). Pricing therefore is a key tool for competition and the marketers (oil companies) ensure they are cost-efficient to remain competitive. Customers benefit from this competition as marketers strive to provide *value added* products and services (Petroleum insight 4<sup>th</sup> qtr, October – December 2006).

The main players in the Kenyan petroleum sector are (Pricewaterhousecoopers, 9<sup>th</sup> Jan 07): five (5) major companies involved in the distribution of petroleum products and a growing number of independent petroleum distribution companies that have sprung up since the liberalisation of the sector; The Kenya Petroleum Refinery Limited (KPRL), which operates the only oil refinery in the country, and The Kenya Pipeline Company Limited (KPC), which operates the pipeline that runs from Mombasa to Nairobi, Nakuru, Kisumu and Eldoret.

According to PIEA (2006), the five companies holding more than 80 percent of the inland sales market share, were Total, Kenol/Kobil, Shell/BP, Chevron, and Mobil in 2006.

## 1.2 Statement of the problem

Lean thinking (the antidote to *muda*) provides a way to re-specify value, line up value-creating actions in the best sequence; conduct these activities without interruption whenever someone requests them, and perform them more and more effectively (Womack and Jones, 1996). Every company has to find its own way to implement the lean method: there is no universal way that will apply to all.

Lean Thinking (Womack and Jones, 1996) showed how firms in several industries in North America, Europe and Japan followed this path and have doubled their performance while reducing inventories, throughput times and errors reaching the customer by 90%. Among the benefits cited for lean thinking application (Fujimoto, 1999; Emiliani et al., 2003) are: higher quality products and services; increased market share; margin expansion; revenue growth; higher productivity; better customer focus; faster response to changing market conditions; and higher asset efficiency.

On the other hand, there are critics within and outside the in lean thinking movement. Mora (1999), submits that “only some 10 per cent or less of companies succeed at implementing ... and other lean manufacturing practices”. Sohal and Eggleston (1994), advise “that only 10 per cent have the philosophy properly instituted”. Repenning and Sterman (2001), advocate that companies use initiatives almost as a fad and submit that whilst the: “number of tools, techniques and technologies available to improve operational performance is growing rapidly, on the other hand, despite dramatic successes in a few companies most efforts to use them fail to produce significant results”. This is because organisations often view lean as a process whereas they should embrace it as a philosophy. Despite these shortcomings, when the lean principles are applied properly the benefits outweigh the shortcomings.

Given the benefits and success of lean application in Japan, Europe and USA, it was not clear if petroleum companies in Kenya could benefit from lean thinking. The supply chain in the petroleum industry is more complex than other industries. The supply chain is inflexible due to limited means of transportation, long lead times and manufacturing capacity of the refinery (Hussain *et al*, 2006). All these challenges in logistics influence the cost of petroleum products. Due to the open tender system (OTS) in Kenya all the petroleum distribution companies incur fairly similar costs, with differences occurring in overhead costs. Therefore competitiveness becomes a priority. The study was guided by two core questions: What is the extent of adoption of lean thinking in the Kenyan petroleum industry? What challenges face the petroleum companies in the adoption and implementation of lean thinking?

### **1.3 Research Objectives**

1. To establish the extent of adoption of lean principles in the Kenyan petroleum industry
2. To establish the challenges facing the petroleum companies in the adoption and application of lean principles in the Kenyan oil industry.

### **1.4 Significance of the study**

The study will provide managers and other decision makers in the Kenyan petroleum industry with a model for evaluating the adoption of lean production principles.

The study will be of assistance to the researchers and academics that plan on pursuing this area of research in the future.

## PART TWO: LITERATURE REVIEW

### 2.1 Lean Concept

The “batch and queue” mentality of mass production has persuaded managers to seek ever greater economies with more and more heavily automated, large-scale, dedicated equipment. Although this may appear to be the sensible solution for each separate entity, it introduces large amounts of unseen “waste” along the whole supply chain. Womack and Jones (1996) describe lean thinking as “the antidote” to *muda*. *Muda* is the Japanese word for waste and specifically “any human activity that absorbs resources but creates no value”. The essence of lean thinking is the elimination of *muda* wherever it exists – within the individual firm but also along the supply chain (Management Theory; the Antidote Issue, 1997).

Many definitions of lean are available. For example, the National Institute of Science and Technology (NIST) Manufacturing Extension Partnership (MEP) defines lean as (Buzby *et al*, 2002): a systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection (NIST/MEP, 1998; cited by Buzby *et al*, 2002)

Womack and Jones (1991) specify eight types of waste, attributing the identification of seven of them to the late Toyota Executive Taiichi Ohno and claiming the eighth as their own (Management Theory; the Antidote Issue, 1997):

- (i) *Defects* – mistakes which require rectification
- (ii) *Over-production* of goods that are not needed
- (iii) *Inventories* of goods awaiting further processing or consumption
- (iv) *Any processing* steps which aren't actually needed
- (v) *Movement* of employees from one place to another unnecessarily
- (vi) *Transport* of goods from one place to another without any purpose

- (vii) *Employees* waiting either for a process to finish or because an upstream activity has not delivered on time
- (viii) *The design* of goods and services which don't meet the needs of the customer

The Texas Manufacturing Centre (2001 city by Buzby *et al*, 2002) has added a ninth *waste area, material waste*.

## 2.2 Principles of Lean Thinking

Womack and Jones (1996) concluded that lean thinking can be summarized in five principles. These principles are value, value stream, flow, pull, and perfection.

### 2.2.1 Value

Womack and Jones (1996) state that value can only be defined by the ultimate consumer and is only meaningful when expressed in terms of a specific product with specific capabilities which meets the customer's needs at a specific price at a specific time. The problem is that while value is defined by the consumer, it is created by the producer and many things get in the way when producers try to express how they provide value. The authors contend that in company after company managers "skew" the way they view value because they still concentrate too much on their existing organisations and processes and cling to outdated definitions of value. Value can be created in two ways; first if internal waste is reduced, as the wasteful activities and the associated costs are reduced, increasing the overall value proposition for the customer or secondly if additional features or services are offered, which are valued by the customer. This could entail a shorter delivery cycle or smaller delivery batches, which might not add additional cost, yet add customer value (Hines *et al*, 2004).

Value is achieved through the use of the quality tools and continuous process improvement techniques espoused by shewhart (1989) (the plan, do, study, act cycle),

Deming (1986) (total quality management), Harry and Schroeder (2000) (six sigma), and many others.

### 2.2.2 Value Stream

The authors define the value stream as “all the specific actions required to bring a specific product (whether a good, a service, or increasingly, a combination of the two) through the three critical management tasks of any business”. These tasks they define as: the problem-solving or product definition task; the information management task; physical transformation. Identifying the entire value stream for each product (or in some cases for each product family) is the next step in lean thinking, a step which firms have rarely attempted but which almost always exposes enormous, indeed staggering, amount of muda (Womack and Jones, 1996).

They argue that using the concept of a value stream means that lean thinking must go beyond the confines of the individual firm, “the standard unit of scorekeeping”, and look at the entire set of activities that are involved in delivering value – from original raw material to the ultimately delivered product or service. This extension of the value stream across the organisational boundaries of different legal entities presents problems and it is here that Womack and Jones suggest a new organisational mechanism, something they call the *Lean Enterprise*.

Identification of the value stream can be achieved through the use of techniques like value stream mapping (VSM) (Tapping *et al.*, 2002). Such an analysis reveals three different types of activities (Womack and Jones, 1996): steps which undoubtedly create value; steps which create no value but are nevertheless essential because of current technologies and /or existing assets; many steps that create no value and are immediately avoidable.



### **2.2.3 Flow**

Womack and Jones (1996) warn that this step “requires a complete rearrangement of your mental furniture”. The mental furniture they refer to is our instinctive preferences for dealing with things in batches. The authors credit Taiichi Ohno and his fellow technical collaborators at Toyota with overcoming the challenge of creating continuous flow in small-lot production. The principle of creating flow is to create a value stream where the product, and its raw materials, components, and sub-assemblies, never stop in the production process, and where each aspect of production and delivery is fully synchronized with the other elements. The same approach can be applied to product development and order scheduling. Its adoption avoids waiting, downtime and large piles of work-in-progress at each step in the process. Womack and Jones (1996) argue that this enables product design time to fall from years to just months, order processing to come down from days to hours, and throughput time in physical production to collapse from months or weeks to days or minutes. It also significantly reduces both the number of people and the amount of space previously required.

### **2.2.4 Pull**

“Pull in simple terms means that no one upstream should produce a good or a service until the customer downstream asks for it”. Because of its responsiveness, this form of small-lot, even single-item, production means that the plant only makes what is ordered. Instead of pushing completed products at customers, customer orders pull newly produced products through the plant. The result is no finished stock inventory, no complex tracking system and no need to remainder unwanted goods (Womack and Jones, 1996). The authors give an example of publishing industry in the United States. One half of the books printed each year are shredded without ever finding a reader! This is because publishers and the printing and distribution firms they work with along the value stream have never learned about flow, so the customer can’t pull.

### 2.2.5 Perfection

Described by Womack and Jones (1996) as the final step in lean thinking, the continual hunt for perfection appears to be a natural outcome of the first four steps. Because they create a “virtuous circle” these first steps lead to the discovery of new sources of value, fresh areas of waste and newly revealed impediments to flow or pull. Each stage in the introduction of lean thinking can be followed up by another round and then another. The idea of total quality management (Deming, 1986) is to systematically and continuously remove the root causes of poor quality from the production processes, so that the plant and its products are moving towards perfection. This relentless pursuit of perfection is a key component in the transformation of an organisation that is ‘striving for lean’.

## 2.3 Technical Requirements

Rather than embracing one or two isolated tools, Emiliani (2004) suggests that it is important companies practice most, if not all, of the lean processes and tools summarized in the table 2.1.

In order for a lean initiative to be successful the following must be taken into considerations (Comm and Mathaisel, 2005):

- i. **Environment for change:** a key theme is that “leanness” is not just a change in processes or tools, but a complete overhaul of organisational thinking that must be embedded in all activities.
- ii. **Leadership:** Leadership is responsible for driving change initiatives. Change must come from the top. If an organisation’s leadership is not “walking the talk”, then employees will disregard any change initiative as just “talk”.

**Table 2.1 Lean processes and tools**

Lean process or tool	Explanation
Five Ss	Stands for: sort, sweep, straighten, shine, sustain. Important for establishing an organized workplace
Just-in-time	Subsequent operation acquires parts (or information) from the preceding operation when needed, in the quantity needed
Kaizen	Literally means “change for the better”, also interpreted as “continuous improvement”. Process used to identify and eliminate waste
Lean behaviors	Applying lean principles and tools to improve leadership behaviors and eliminate Behavioral waste (Emiliani, 1998a, b)
Load smoothing	Called “heijunka” in Japanese. Used to smoothe fluctuations in customer demand
Percent loading chart	A one-page diagram depicting the cycle time between operations or workers compared to the rate of customer demand. Helps identify workload imbalances
Policy deployment	Called “hoshin kanri” in Japanese. A process used to connect corporate strategy to key objectives and resources, including daily activities across functions
Quality function (“voice of the customer”)	A process used to incorporate the wants and desires of intermediate deployment and end-use customers in the design of goods and services
Root cause analysis	Methods used to determine the root cause of a problem and identify countermeasures to avoid repeat occurrences. Key tools are “5 Whys” (asking why five or more times until the root cause of the problem is discovered) and fishbone or cause-and effect diagram
Standard work chart	A one-page diagram showing the sequence in which work is performed
Takt time	The rate of customer demand. Used to establish a direct link between marketplace demand and workplace activities
Total productive	A program used to ensure that equipment is in good operating Maintenance condition and available for use when needed
Value stream maps	A one-page visual representation of material and information flows. Used to identify improvement opportunities and eliminate waste
Visual controls	Signs and other forms of visual information used to simplify the workplace and make it easy to recognize abnormalities

Source: Emiliani M.L. (2004) Improving Business School Courses by Applying Lean Principles and Practices, *Quality Assurance in Education* 12-4

- iii. **Culture:** The culture of an organisation must be open and honest, where employees feel empowered to give suggestions and actively participate in process mapping without fear of repercussions.
- iv. **Employee empowerment:** Providing employees with the permission and the tools that permit them to make changes in the process, along with providing appropriate recognition to employees when they do take initiative, is a key component to any change initiative. Cross functional groups are needed in all decision making changes.
- v. **Training:** Proper training will allow everyone on “the line” to understand the steps before and after. Not educating employees on the reasons behind these initiatives can breed resentment, mistakes, and a lack of understanding. This result will be more “muda” instead of less.
- vi. **Communication:** Successful managers will constantly “work diligently to share information and encourage the same from low level employees, a pillar of any lean system” (Green, 2002). Management change drivers must constantly communicate the reasons behind the changes, the end goals, and the measurements that will determine success. It is also the responsibility of leadership to develop an environment where open communication regarding changes is constantly shared.
- vii. **Measurement:** In any change initiative, measurement is the key way to tell how efficiently processes and systems are working. Measurements should be taken internally (process improvements, cycle time, waste elimination, financial statistics) and externally (through benchmarking, competitive analysis, industry statistics) for a true snap shot of the results. One of the key benefits of lean thinking is the creation of a culture focused on performance, holding each step accountable. Measurements are the only way to determine progress.

## 2.4 The Lean Enterprise

According to Womack and Jones (1996) the objectives of the lean enterprise are very simple: correctly specify value for the customer, avoiding the normal tendency for each firm along the stream to define value differently to favour its own role in providing it. Then identify all the actions required to bring a product from concept to launch, from order to delivery, and from raw material into the hands of the customer and on through its useful life. Next, remove any actions which do not create value and make those actions which do create value proceed in continuous flow as pulled by the customer. Finally analyse the results and start the evaluation process over again.

The mechanism of the lean enterprise is very simple: a conference of all the firms along the stream, assisted by technical staff from “lean functions” in the participating firms, to periodically conduct rapid analyses and then to take fast-strike improvement actions (Womack and Jones, 1996)

## 2.5 Lean and World Class Organisations

An organisation may develop into a world class status based on lean principles. A lead for quantifying “world class” was given by the definition of lean production by Womack *et al.* (1990) which “uses less of everything – half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product in half the time. Also, it requires keeping far less than half the inventory on site, results in many fewer defects, and produces a greater and ever growing variety of products”. The authors argued that the principles of lean production “can be applied equally in every industry across the globe” (Womack *et al.*, 1990), and that “LP will supplant both mass production and the remaining outposts of craft production in all areas of industrial endeavour to become the standard global production system of the 21st century” (Womack *et al.*, 1990).

## 2.6 Examples of Lean Application

The firm that is the main point of reference for the lean model is Toyota. The biggest changes in the Toyota production system were to be found in the reorganisation of work, the approach to automation and in human resource management (Fujimoto, 1996; as cited by Muffatto, 1999). Consequences of the evolution of the lean system to Toyota can be seen from two perspectives: performance and improvements in working conditions. Performance has been affected in many ways. Above all, checks on product functioning are carried out nearer to the place where it is actually made. This helps increase quality. Furthermore, it is easier for the operator to learn the work to be done thus reducing the time required for on the job training by 50 percent. The final result has been an increase in overall productivity.

Oxford Instruments Superconductivity (OIS) Ltd, a part of the Oxford Instrument Group, is a world leader in the supply of superconducting magnets and low temperature cryogenic environments to the scientific and industrial research community. It was in looking for the best to help deliver a new operational strategy, introduce a complete change in operational culture that OIS decided to undertake the implementation of an extensive lean program across the business and down to the suppliers. Right from the start OIS was not just looking to introduce “lean”, but to deliver improvements against strategic key performance indicators. In 2003, the company was looking for; a 50 percent reduction in lean time, 25 percent efficiency improvements, 100 percent delivery on time, 100 percent FTPR, 5 percent COQ, and a 15 percent material cost reduction – all by 2005. By mid 2004 the company was regularly achieving 100 percent on time delivery for many of the product lines. Equally, delivered quality has seen a similar turnaround. Over the past 18 months inventory has been reduced by almost 50 percent, while output has increased by 20 percent.

## **2.7 Benefits of Lean Thinking**

Lean thinking results in many benefits, including (Fujimoto, 1999; Emiliani et al., 2003): higher quality products and services; increased market share; margin expansion; revenue growth; higher productivity; better customer focus; faster response to changing market conditions; and higher asset efficiency.

A study conducted by Sohal and Egglestone (1994) to investigate the extent to which 'Lean Production' has been implemented within Australian organisations found that there were benefits accruing from the adoption of lean production. Two-thirds of the companies said that a strategic advantage had been generated by the adoption of lean production with the greatest improvement stemming from market competitive positioning, customer relationships and quality constraints. Other improvements were achieved in the following areas: increased flexibility; lowering of cycle times; greater sensitivity to market changes; higher productivity levels; stronger focus on performance; improved supplier bonds; and changed from reactive to proactive organization

Importantly, a key focus of lean is time and how time is used, with the intent of improving responsiveness to customers and ensuring that employees' lives are not being wasted while at work doing unnecessary things (Minoura, 2002). Leaders that understand and practice lean well create formidable businesses that compete on the basis of time because information (e.g. parts, documents, data, verbal communication) flows with fewer or even no interruptions (Fujimoto, 1999; Emiliani et al., 2003).

## **2.8 Challenges of lean adoption**

Quite often, the biggest barrier to adopting lean practices is organisational (Poppendieck, 2002). People think primarily about their own jobs and functional or departmental careers, and senior managers get rewarded for how well their individual company is doing (Management Theory, the Antidote Issue, 1997) what is known as sub-

optimization measurement. It is because of this that each part of the chain or channel is likely to define “value” in such a way that its own role in a providing it shows up favourably. Womack and Jones (1990) highlight the problem: nobody gives priority to the whole value stream. Given the way individual companies operate, there tends to be a “cold war” relationship between participants in the stream. As a result, each sees it as being in their interests to off-load costs and capture or divert profits – time and energy consuming activities that make practically no contribution in creating value (Management Theory; the Antidote Issue, 1997). These kinds of problems are normally avoided by structuring the organisation around teams that maintain responsibility for overall business value. A keen awareness is also fostered that the downstream department is the customer (Poppendieck, 2002).

A survey by the Lean Enterprise Institute Inc. (2004) reported the “State of Lean” based on data from 999 respondents (LEI, 2004; cited by Emiliani *et al*, 2005). The report identified “common obstacles” related to the respondents’ Lean implementation efforts as shown by table 2.2.

The data indicate that there are many obstacles, and that most companies have great difficulty implementing lean principles and practices. Their ability to achieve a Lean transformation across the enterprise is severely limited by the implementation process normally used by companies and often advocated by consultants (Swank, 2003; cited by Emiliani *et al*, 2005). It is also limited by the current level of knowledge possessed by the people leading and participating in the lean transformation.

## **2.9 A model for evaluating the adoption of Lean thinking**

Karlsson and Åhlström (1996) developed a model that operationalizes the derterminants of a lean production system. Implicit to this is the notion that by introducing lean production, performance can be enhanced. The model has been has been tested in an international manufacturing firm producing mechanical and electronic office equipment, mostly for export. In late 1991, the company decided to restructure their operations,



using lean production as the model for this endeavour. This model contains nine principles:

**Table 2.2 Common Obstacles related to Lean Implementation Efforts**

OBSTACLES	RESPONSE (%)
Backsliding to the old ways of working	36
Lack of implementation know-how	25
Lack of a crisis to create a sense of urgency	25
A traditional cost accounting system that doesn't recognize the financial value of shop-floor improvements	22
Resistance by middle management	21
Regarding lean as the "flavor-of-the-month"	19
Failing to remove "anchor draggers" who oppose change	18
Resistance by hourly employees	11
Resistance by supervisors	10
Failure of past lean projects	6

Source: Lean Enterprise Institute (LEI) (2004) '*LEI's First Annual State of Lean Report Detects Solid Gains and Common Obstacles*'

- i. **Elimination of Waste:** waste is something that the customer is not willing to pay for and it should therefore be eliminated. Perhaps the most important source of waste is inventory. Another source of waste in a manufacturing context is transportation of parts. Lack of quality is a further source of waste. Manufacturing parts and products that are defective and therefore need to be reworked is wasteful (Karlsson and Åhlström, 1996).
- ii. **Continuous Improvement:** if the elimination of waste is the most fundamental principle of lean production, then continuous improvement can be said to come second. The constant strive for perfection has its own word in Japanese – Kaizen. In the context of lean thinking, emphasis is placed on ongoing improvement

involving everyone. Involving everyone in the work of improvement is often accomplished through quality circles. These are activities where operators gather in groups to come up with suggestions on possible improvements. To this is tied an elaborate scheme for implementing suggestions, rewarding employees, and feeding back information on the status of the suggestions (Karlsson and Åhlström, 1996).

- iii. **Zero Defects:** zero defects denote how a lean company works in order to attain quality. The issue is to prevent defects from occurring, through discovering errors that can lead to defects. Each process should therefore be controlled through knowledge gathered about the parameters of the process. Another salient feature is the lack of personnel dedicated to quality control. Quality assurance is the responsibility of everyone (Karlsson and Åhlström, 1996).
- iv. **JIT deliveries:** closely related with zero defects is the principle of just-in-time. The ultimate goal in a manufacturing context is that every process should be provided with one part at a time, exactly when that part is needed. To be able to achieve this, a number of factors are important. Most of these can be found under the principle of waste elimination, which is also closely related to just-in-time (Karlsson and Åhlström, 1996).
- v. **Pull of materials:** closely related to the principle of just-in-time is the way in which material is scheduled, through pull instead of push. This entails forecasting demand from customers.
- vi. **Multifunctional teams:** perhaps the most salient feature of the work organisation in lean production is the extensive use of multifunctional teams. A multifunctional team is a group of employees who are able to perform many different tasks. One consequence of the use of multifunctional teams is that the number of job classifications decreases. This however requires efforts in staff

training. The number of tasks in which employees receive training increases (Karlsson and Åhlström, 1996).

- vii. **Decentralisation:** another important characteristic of a lean work organisation is that responsibilities are decentralised onto the multifunctional teams. First, and perhaps foremost, there is no supervisory level in the hierarchy. In the most elaborate form, it is done through rotating team leadership among employees. As a consequence, the number of hierarchical levels in the organisation can be reduced. Second, the number of functional areas that are the responsibility of the teams increases (Karlsson and Åhlström, 1996).
  
- viii. **Integration of functions:** a second important principle concerning the multifunctional team is the integration of different functions into the teams. This means that tasks previously performed by indirect departments are integrated into the team, increasing the work content of these teams. Thus, the number of tasks performed by the team increases, and consequently the number of indirect employees can be reduced. Support functions are no longer necessary to the same extent as in traditional systems (Karlsson and Åhlström, 1996).
  
- ix. **Vertical information systems:** the final principle is that of vertical information systems. Information is important in order for the multifunctional teams to be able to perform according to the goals of the company. The first issue is the mode in which information is provide to the employees. The objective is to provide timely information continuously, directly in the production flow. Second, there is the content of the information. The content can, in turn, be divided into two groups: strategic or operational. Strategic information is related to the overall performance and intentions of the company. Operational information is related to the performance of the team in question (Karlsson and Åhlström, 1996).

Tables 2.3a to 2.3i summarize the determinants and measurements of the nine principles:  
Key:

↑ = should increase

↓ = should decrease

↑ = Practice should change in this direction

**Table 2.3a Elimination of Waste**

Determinant	Measurement	Lean Indicator
Work in progress	Value of work in progress in relation to sales	↓
Lot sizes	Production run time between set-ups	↓
Set-up times	Amount of time need for die changes	↓
Machine down time	Number of hours machines are standing due to malfunction in relation to total machine time	↓
Transportation	Number of times parts are transported Parts: Total physical distance parts are transported Scrap: Value of scrap in relation to sales Rework: Value of rework in relation to sales	↓ ↓ ↓

**Table 2.3b Continuous improvement**

Determinant	Measurement	Lean Indicator
Suggestions	Number of suggestions per employee and year Percentage of implemented suggestions	↑
Organisation of Implementation	a Quality circles b Multifunctional teams, and spontaneous problem solving activities c Formal suggestion scheme d No explicit organisation	↑

**Table 2.3c Zero defects**

<b>Determinant</b>	<b>Measurement</b>	<b>Lean Indicator</b>
Responsibility for identification of defective parts	<ul style="list-style-type: none"> <li>a Workers identify defective parts and stop the line</li> <li>b Workers identify defective parts but do not stop the line</li> <li>c Quality control department identify defective parts and informs production management</li> </ul>	↑
Responsibility for identification of defective parts	<ul style="list-style-type: none"> <li>a Workers identify defective parts and stop the line</li> <li>b Workers identify defective parts, but do not stop the line</li> <li>c Quality control department identify defective parts and informs production management</li> </ul>	↑
Responsibility for adjustment of defective parts	<ul style="list-style-type: none"> <li>a Defective parts are sent back to the worker responsible for the defect to adjust it</li> <li>b Workers take out and adjust defective parts</li> <li>c Adjustment department adjusts defective parts</li> </ul>	↑
Quality control department	Number of people dedicated primarily to quality control	↓
Degree of process Control	<p>Processes are controlled through measuring inside the process</p> <p>Measuring is done after each process</p> <p>Measuring is done only after product is complete</p>	↑
Autonomous defect control	Percentage of inspection carried out by autonomous defect control	↑
Adjustment and repair area	Size of the adjustment and repair area	↓

**Table 2.3d Just-in-time**

Determinant	Measurement	Lean Indicator
Lot sizes	Production run-time between set-ups	↓
Work in progress	Value of work in progress in relations to sales	↓
Order lead time	Amount of time spend processing each order	↓
Level of just-in-time	a sequential just-in-time possible b Type specific deliveries just-in-time possible c Lots are delivered just-in-time	↑

**Table 2.3e Pull instead of push**

Determinant	Measurement	Lean Indicator
Backward request in relation to forward scheduling	The number of stages in the material flow that uses pull (backward requests) in relation to the total number of stages in the material flow	↑
Degree of pull	Percentage of the annual requirement value that is scheduled through a pull-system	↑

**Table 2.3f Integrated Functions**

Determinant	Measurement	Lean Indicator
Work content in teams	The number of different indirect tasks performed by the team	↑
Support function	The ratio of indirect employees in relation to direct employees	↓

**Table 2.3g Multifunctional teams**

<b>Determinant</b>	<b>Measurement</b>	<b>Lean Indicator</b>
Team structure	Percentage of employees working in teams	↑
Task structure	Number of tasks in product flow performed by teams	↑
Job classification	Number of job classifications	↓
Task rotation	Employees change tasks within the team Continuously Every hour Every day Once per week One per month One per year Less that one per year	↑
Training	Number of different tasks which employees are trained in Number of different functional areas employees are trained in Amount (in hours) of training given to newly employed personnel	↑

**Table 2.3h Decentralized responsibilities**

<b>Determinant</b>	<b>Measurement</b>	<b>Lean Indicator</b>
Supervisory tasks performed by the team	Team leadership rotates among team members Supervisory tasks performed by the team Separate supervisory level in the organisation	↑
Team leadership	Percentage of employees being able to accept responsibility for team leadership Percentage of employees having accepted responsibility for team leadership	↑
Organisation hierarchy	The number of hierarchical levels in the manufacturing organisation	↓
Areas of Responsibility	Number of functional areas that are the responsibility of the teams	↑

**Table 2.3i Vertical Information Systems**

Determinant	Measurement	Lean Indicator
Mode of information provision	Information continuously displayed in dedicated spaces, directly in the production flow. Regular meetings to discuss the information Oral and written information provided regularly Written information provided regularly No information to employees	↑
Strategic content in provision	Number of areas contained in the information given to employees Time perspective in the information	↑
Operational content in information	Number of different measures used to assess the performance of teams	↑
Information frequency	The frequency with which information is given to employees (differentiated by the content of the information)	↑

## 2.10 Lean in Kenya

### 2.10.1 General Motors, Supply Chain Development

General Motors Corporation (GM) has one of the most wide-spread lean manufacturing initiatives in place in the U.S. In the early 1990s, GM realised that it was not sufficient to just lean GM's operations. GM assigned a group of engineers to work closely with its suppliers to reduce costs and to improve product quality and on time delivery (General Motors Corporation, 2007).

General Motors operates an assembly plant in Kenya that produces vehicles adapted to the local roads conditions. Although vehicles are assembled from imported kits, GM Kenya makes extensive purchases from local suppliers. These total more than Sh1.5 billion (\$19 million) annually and involve ten key suppliers, all of whom are locally-



owned (although one sells under a global brand-name and works under licence from a global TNC). Following the global procedures of its parent, GM Kenya has an extensive supply chain development programme. The purchasing department sets each of its suppliers key performance indicators – for example, on defect rates (parts per million). It also includes the staffing of seven engineers who (undp, 2005): visit every supplier at least once per year, audit production efficiency and make suggestions for upgrading; visit any supplier that fails to meet its key performance indicator, in some cases also taking along production workers from its own lines to talk to the supplier and explain the problems which they experience with the defective materials. This helps the supplier to upgrade operations; visit any supplier that is introducing a new product or a new specification of product in order to get production up to the required specification.

### **2.10.2 Tetra Pak, Close Partnership with Local Supplier**

The Swedish company Tetra Pak has become a world leader in packages for fluid food (EIMS Studies, 2007). Tetra Pak Kenya started their operation in the late 1950's by importing packaging material from Sweden. It became clear in the mid-1970's that packaging material had to be produced locally to support the growth of customers. The main issue was the supply of raw paper, as it could not be found locally. This is when the local paper mill, Pan-African Paper, started operations, leading Tetra Pak to open a local packaging plant. However, Tetra Pak's technical specifications are extremely specific and demanding as the final product is to be used for sensitive liquid food-products, such as milk.

A very close collaboration then started with the mill and Tetra Pak. Experts were sent from Sweden to guide the mill, make sure that quality controls were adequate and that the production process would result in the right parameters. Close collaboration, teamwork between both partners and commitment from both sides made it possible to have today lose to 50 percent of the company's paper requirement sourced from the Kenyan mill. This resulted in a win-win situation: Tetra Pak was able to get local supply, saving greatly on logistics, and the mill was able to supply high standard products not only to

Tetra Pak but also to other customers. The collaboration continues today, with frequent meetings and exchange of ideas to keep improving all aspects of the partnership: logistics, supply, and forecasting to mention a few. The latest example of this partnership is the production of a low grammage paper that Tetra Pak is now using for low cost packaging (undp, 2005).

## **2.11 The Kenyan Petroleum Industry**

The five major companies are leaders in the industry. Chevron markets petroleum products under three world-class international brands: Chevron, Texaco, and Caltex (Chevron, 2007). The company has instituted an Operational Excellence Management System (OEMS) to be implemented by all its branches. The system establishes high expectations for leaders, the integration of Operational Excellence with business planning, and the use of a structured model for business units to develop their OE processes (Chevron, 2007).

Shell Kenya's vision is to be the leading oil products business in Kenya. Their mission includes the delivery of "world class shareholder returns by consistently providing distinctly superior value propositions to the customer". To this end, all Shell companies are expected to comply with The Shell General Business Principles (SGBP) as a matter of course. The principles are based on core values of honesty, integrity and respect for people. They also indicate the promotion of trust, openness, teamwork and professionalism (Shell, 2007).

Total Kenya's vision is to be a "leader in the quality of its products and services". It was the first oil company in Kenya to be awarded the ISO 9002 certification for its service network and for its customer order delivery process. The certification upgrade to ISO 9001:2000 was achieved in November 2003 (Total, 2007). Kenol/Kobil has implemented a code of conduct for all its branches. It aims to be the "leading brand in Kenya and a major player in Africa" by marketing products that meet high standards of quality at competitive prices. The company is ISO 9001:2000 compliant. Mobil in 2006

announced the sale of its assets in Kenya to Tamoil, a company with Lybian origins. In the same year it enjoyed a market share of 10.89 percent.

The five major petroleum companies were claiming to be heading towards attaining world class status, which according to Womack *et al*, (1996) can be achieved using lean thinking. They had different programmes all aimed at giving more value to customers while reducing waste. These lean principles have been successful in other parts of the world. The Kenyan petroleum industry had characteristics that differ from others in terms of infrastructure, logistics and capacity. Had the Kenyan petroleum companies adopted the full range of lean production methods (as measured by Karlsson and Ålhström) in their efforts to be market leaders? If so, what were the challenges they were facing in the adoption of these principles?

## **PART THREE: RESEARCH METHODOLOGY**

### **3.1 Research Design**

A survey of the five major petroleum companies in Kenya was conducted. These are the companies that held more than 80% of the inland sales market share (PIEA, 2006). This is commonly linked with the “80/20” rule which states that “20 percent of the known variables will account for 80 percent of the results” (Basile, 1996 as cited by Craft et al, 2002). This principle applies to the petroleum companies whereby 20% of the companies account for more than 80% of inland sales (PIEA, 2006).

### **3.2 Population**

The target population comprised of the five major petroleum companies that dominate the Kenyan market. The list of the five major companies was obtained from the Petroleum Institute of East Africa (PIEA). Only three companies filled in the questionnaire out of the five. Two respondents did not fill in the questionnaire claiming that doing so would be in contravention of their companies’ policy on information protection.

### **3.3 Data Collection Method**

The aim of conducting the survey was to determine the extent to which lean principles were adopted in the Kenyan petroleum industries using the Karlsson and Alstrom conceptual framework. Because the relevant data were not available in secondary form, primary data collection was necessary. A questionnaire was designed for this purpose. The questionnaire was divided into three parts: part A had general questions about the company; part B comprised of a scale to measure the extent of adoption of lean principles in the company and part C had operational dimensions of lean principles. Part B of the questionnaire was simplified for easier comprehension by the respondents. The questionnaire was distributed electrically and in some instances by hand delivery. It was self administered with a few instances requiring a short interview. Those who refused to

fill in the questionnaire could not assist with their reports for the reason mentioned earlier.

### **3.4 Data Analysis**

Analysis and interpretation of each principle in the questionnaire was done. The degree of adoption of lean principles was measured by asking the respondents to indicate on a scale of 1 to 5 what was relevant to their organisation followed by a list of the nine principles. The respondents rated their answers on a five-point scale with scores ranging from 1 (no adoption) to 5 (total adoption). The third part of the questionnaire focused on the operationalised indicators found to be suitable in assessing the changes towards the adoption of lean principles. These questions were mainly close ended and were analysed on a lean principle basis.

## **PART FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSIONS**

### **4.1 Introduction**

This chapter deals with data analysis and discusses the research findings. The questionnaire was divided into three parts. The aim of the study was to examine the degree of adoption of lean principles in the Kenya petroleum industry using the variables of the Karlsson and Åhlström (1996) model. Analysis and interpretation of each principle in the questionnaire has been done. The details are under three categories: general information, adoption of lean principles and operationalised dimensions of the nine principles. Three out of the five companies returned the questionnaire properly filled. Two respondents did not fill the questionnaire.

### **4.2 General information**

The respondents were all managers in the supply departments of these organisations. Each organisation had more than 200 employees and each had an inland market share ranging from 10 to 19 percent.

### **4.3 Adoption of Lean Principles**

Respondents were asked to rank on a scale of one to five, one being no adoption and five being total adoption if their companies had adopted the nine lean principles in part B of the questionnaire. Elimination of waste and continuous improvement stood out as principles adopted to a large extent with two of the three companies giving a score of 5 out of 5 and one company giving a score of 4 out of 5. Just in time, Pull of raw materials, multifunctional teams; decentralization; integration of functions; Zero defects and vertical information systems had an average of 4. The companies gave each of these principles scores ranging from 3 to 5. This indicates that the companies had to a wide extent adopted lean principles.

#### **4.4 Elimination of Waste**

Under this section respondents were asked if product losses had increased or decreased, steps that had been taken to reduce waste, how they dealt with transit material. These were covered from question 1 to 5 of part C. Question one in part C asked the respondents if over the last five years, product losses had increased or decreased. All the three companies responded that product losses had reduced. All the 3 companies indicated having taken steps to reduce waste by responding to question 2. Steps taken according to these companies include recycling slops, informing employees on the importance of reducing waste and welcoming suggestions from employees on how to reduce waste. 2 out of the 3 companies request rarely requested for extensions, therefore indicating that they rarely keep stocks for more than the necessary period. They all request for extensions on stocks for less than half. 2 out of the 3 companies frequently adhere to customers' delivery windows while one always adheres. 2 out of the 3 companies keep stocks to a minimum. However, this is partly due to the incapacity of the system to accommodate total demand. The findings are consistent with the responses in part B indicating that the three companies gave priority to elimination of waste as a lean principle.

#### **4.5 Continuous Improvement**

In this section respondents were asked about suggestion schemes in their organisation. This was covered by questions 9, 10, 11 and 14. All the three companies indicated that they had a suggestion scheme in their respective companies. 2 out of the 3 companies indicated that more than half of the suggestions were implemented while over the last five years suggestions had increased in all the three companies. 2 of the companies had multifunctional teams and spontaneous problem solving activities while 1 had a formal suggestion scheme. The companies had not yet reached the stage of forming quality circles. This indicates that the companies were putting an effort to involve everyone in improving company operations. This is also consistent with the rating given in part B of the questionnaire.

#### **4.6 Zero defects**

This section was addressed by asking respondents if they had a quality program and to specify which one. Respondents were also asked about the number of people who were dedicated to quality control and process control. These were questions 12, 13, 15, 17 and 18 in the questionnaire. All the 3 companies indicated having a quality programme. They all had ISO 9000 management series. This shows that they gave quality great importance and thus avoiding defects from the very beginning. All the 3 companies had personnel dedicated to quality control. Employees had been given the responsibility of identifying defective orders and stopping them as well as rectifying them and thus ensuring that quality assurance is the responsibility of everyone in the company. 2 companies had more than 75% of their employees dedicated to quality control. 2 of the companies' process control was measured inside the process and therefore achieving control over the process so as to reduce defects. This shows that the companies had adopted this lean principle consistent with their rankings in part B.

#### **4.7 Just in time**

Just in time can be achieved by most of the factors under elimination of waste. As earlier indicated all the three companies were able to reduce their waste levels by putting in place necessary measures. An additional question was customer delivery windows, number 6 in the questionnaire. 2 of the companies serviced customer orders within the same week. However 1 delivered within the same month. This delivery period is

#### **4.8 Pull instead of Push**

The respondents were asked about their level of stock holding and annual stocks requirements through questions 20 and 21. Pull instead of push is closely related to just in time. All the three companies relied on customer forecasts to meet orders; however



customer forecasts can easily hinder efforts to become lean. This was not consistent with the adoption of the lean principle of pull instead of push.

#### **4.9 Multifunctional teams**

An outstanding feature in a lean environment is the use of multifunctional teams. The respondents were asked to indicate if employees in their companies were working in teams, how frequently they changed tasks, if employees were trained in different tasks and in different functional areas. In the questionnaire, these were questions 22 to 27. All the 3 companies indicated that they use multifunctional teams. Team members in a multifunctional team were able to perform many different tasks. However, the companies did not place great emphasis on rotating team members in different tasks. Only 1 company rotated employees continuously. All 3 companies trained their employees in different tasks and different functional areas. This indicates that this lean principle had been adopted.

#### **4.10 Decentralized Responsibilities**

An important characteristic of a lean work organisation is that responsibilities are decentralized onto the multifunctional teams. This was put to the respondents by asking if team leadership was rotated among team members, if employees accepted responsibility for team leadership and if teams were responsible for functional areas. On the questionnaire, these were questions 29 to 31. All the three respondents indicated that team leadership did not rotate among the team. Team leadership only changed when the team leader is appointed to another task. Consequently the number of tasks in the team could not be increased which hindered the achievement of a lean organisation. However, when the opportunity arose members accepted team leadership. In 2 out of the 3 companies, teams are responsible for functional areas. This indicates that this lean principle was not widely adopted.

#### **4.11 Integrated functions**

An important characteristic of the lean work organisation is that tasks previously performed by indirect departments are integrated into the team, increasing the work content of these teams. Respondents were asked if teams had indirect tasks and to specify in questions 32 and 33. In 2 of the companies, teams had indirect tasks such as dealing with Human resources and financial matters. This lean principle had been adopted but not a wide extent.

#### **4.12 Vertical information systems**

Information is important in order for the multifunctional teams to be able to perform according to the goals of the company. The mode of provision of the information is important. Respondents through questions 34 to 37 were asked about information provision to employees. All 3 companies held regular meetings to discuss organisational issues. The content of information provided is important. 2 of the companies provided complete information while 1 provided partial information. For all 3 companies, more than one indicator was used to measure performance. Frequency of information provision is also given importance. For 2 of the companies, information was provided on a daily basis while in one it was provided on a weekly basis. This lean principle had been widely adopted.

#### **4.13 Challenges in Adopting Lean**

The final question put to the respondents was the challenges they faced in their efforts to attain world class status. The findings indicate that backsliding to the old ways of doing things was a major challenge according to the respondents. This was followed by resistance by employees and managers indicated 2 of the respondents. Failure of other projects was the least challenge as indicated by only 1 company.

## **PART FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

In this chapter, the findings of the study are summarized, discussed and conclusions drawn. The objectives of the study were to: establish the extent of adoption of lean principles in the Kenyan petroleum industry and the challenges facing the petroleum companies in the adoption and application of lean principles in the Kenyan oil industry.

### **5.2 Summary**

Elimination of waste and continuous improvement stood out as principles adopted to a large extent with two of the three companies giving a score of 5 out of 5 and one company giving a score of 4 out of 5. Just in time, Pull of raw materials, multifunctional teams; decentralization; integration of functions; Zero defects and vertical information systems had an average of 4. The companies gave each of these principles scores ranging from 3 to 5. This indicates that the companies had to a wide extent adopted lean principles. The respondents were also asked questions relating to operationalised dimensions of the lean principles in part C of the questionnaire. Their responses were to a large extent consistent with their rankings in part B of the questionnaire. Backsliding to the old ways of doing things was a major challenge in an effort to become lean, according to the respondents. This is followed by resistance by employees and managers. Failure of other projects is the least challenge.

### **5.3 Conclusion**

The research findings reveal that lean principles have been adopted widely in the Kenyan petroleum industry as indicated by the main companies. This has an implication for other companies as this contributes to a certain degree the leadership position in the industry. Secondly, the research findings reveal that effort to implement lean principles in the

companies is not enough as they keep backsliding to the old ways of doing things and they also encounter resistance from employees.

#### **5.4 Recommendations for Policy and Practice**

From the analysis of data collected, companies should adopt lean principles in order to achieve world class status. Lean principles lead to the success of companies by being responsive to customer needs. Companies can benefit from lean strategies that will increase their profitability such as introducing an environment of change towards lean thinking; good leadership; an open and honest culture; empowerment of employees; proper training for employees; and effective communication practices and proper performance measurement.

#### **5.5 Limitations of the Study**

One of the major limitations was the response rate. A survey of the five leading companies was done as they are the major players in the industry. Only three of the five respondents agreed to fill the questionnaire. The other two did not fill in the questionnaire claiming that doing so would be in contravention of their companies' policy on information protection. The respondents also took a long time to fill in the questionnaire claiming that they were very busy.

#### **5.6 Suggestions for Further Research**

More research is need in the entire Kenyan petroleum industry as well as other service industries as this is an area that relatively new in Kenya. This can be used to measure the adoption of lean principles in other industries and make comparisons. It is also recommended that research also be conducted using additional lean principle models.

## REFERENCES

- Bhasin, S., and Burcher, P. (2006) 'Lean Viewed as a Philosophy', *Journal of Manufacturing Technology Management*, 17:1
- Buzby, C.M, Gerstenfeld, A., Voss, L.E., and Zeng, A.Z., (2002) 'Using Lean Principles to Streamline the Quotation Process: A Case Study', *Industry Management & Data Systems*, 102:9
- Chevron Way – Vision, [http://www.chevron.com/about/chevtex\\_way/vision.asp](http://www.chevron.com/about/chevtex_way/vision.asp), [cited 16 January 2007]
- Comm, CL., and Mathaisel (2005) 'An Exploratory Study of Best Lean Sustainability Practices in Higher Education', *Quality Assurance in Education*, 13:3
- Emerald Group Publishing Limited, Innovations, (2005) 'the New Improvement Frontier: Developing Lean Administration', *Strategic Direction*, 21:11
- Emiliani, M.L., and Stec, D.J., (2005) 'Leaders Lost in Transformation' *Leadership and Organization Development Journal*, 25:5
- Harrison, A., (1998) 'Manufacturing Strategy and the concept of world class manufacturing', *International Journal of Operations and Production Management*, 18:4
- Hines P., Holweg M., and Rich N. (2004) 'Learning to Evolve: A Review of Contemporary Lean Thinking', *International Journal of Operations & Production Management*, 24:10
- Hines, P., Holweg, M., and Rich, N., (2004) 'Learning to Evolve: A review of Contemporary Lean Thinking', *International Journal of Operations & Production Management*, 24:10

Hussain R., Assavapokee T., Khumawala B., (2006) 'Supply Chain Management in the Petroleum Industry: Challenges and Opportunities' *International Journal of Global Logistics & Supply Chain Management*, 1:2

James-Moore, S.M., and Gibbons, A. (1997) 'Is Lean Manufacture Universally Relevant? An Investigative Methodology', *International Journal of Operations & Production Management*, 17:9

Karlsson, C., and Ålhström, P. (1996) 'Assessing Changes towards Lean Production', *International Journal of Operations & Production Management*, 16:2

Kenol and Kobil; Vision and Mission, <http://kenolkobil.com/home/default2.php?>. [cited 16 January 2007]

Kinnie, N., Hutchinson, S., and Purcell, J., (1998) 'Downsizing: is it always Lean and Mean?' *Personnel Review*, 27:4

Lean Enterprise Institute (LEI) (2004) 'LEI's First Annual State of Lean Report Detects Solid Gains and Common Obstacles' Available from: [www.lean.org/WhoWeAre/NewsArticleDocuments](http://www.lean.org/WhoWeAre/NewsArticleDocuments) [cited on 19 February 2007]

Leaning your customers [Online], <http://www.nwlean.net/prod.htm>, [cited 8 February 2007]

Management Theory 11 (1997) 'Applying Lean Thinking to a Value Stream to Create a Lean Enterprise', *The Antidote Issue* 8

Mason-Jones, R., Naylor, B., and Towill, D.R., (2000) 'Engineering the Leagile Supply Chain' *International Journal of Agile Management Systems*, 2:1

Papadopoulou, TC., and Özbayrak M, (2005) 'Leanness: Experiences from the Journey to Date', *Journal of Manufacturing Technology Management*, 16:7

Petroleum Institute of East Africa, (2006) 'Media Workshop Clarifies Misconceptions' *Petroleum Insight*, 4<sup>th</sup> Qty, October-December, Oakland Media Services, Nairobi

Petroleum Institute of East Africa, (2006) 'Industry News,' *Petroleum Insight*, 4<sup>th</sup> Qty, October-December, Oakland Media Services, Nairobi

Poppendieck M. (2002) 'Principles of Lean Thinking', *Poppendieck. LLC*, Eden Prairie, USA

PricewaterhouseCoopers (2006-2007) 'Energy, Utilities and & Mining', <http://www.pwc.com/servlet/pwcPrintPreview?LNLoc=/extweb/industry.nsf/docid...>

[cited 9 January 2007]

Robertson, M, and Carole, J., (1999) 'Application of Lean Production and Agile Manufacturing Concepts in a Telecommunications Environment' *International Journal of Agile Management Systems*, 1:1

Sánchez, A.M., and Pérez, M.P., (2001) 'Lean Indicators and Manufacturing Strategies' *International Journal of Operations & Production Management*, 21:11

Sohal, S.A, and Egglestone A., (1994), 'Lean Production: Experience Among Australian Organizations' *International Journal of Operations & Production Management*, 14:11

Soriano-Meier H., and Forrester P. L. (2002) 'A Model for Evaluating the Degree of Leanness of Manufacturing Firms', *Integrated Manufacturing Systems*, 13:2

Taj, S. (2005) 'Applying Lean Assessment Tools in Chinese Hi-Tech Industries', *Management Decision*, 43:4, 0025-1747

Total in Kenya [Online], [http://outremer.total.com/Os/OsKenya.nsf/V5\\_OPM/](http://outremer.total.com/Os/OsKenya.nsf/V5_OPM/), [cited 16 January 2007]

United Nations, (2005) 'Investment Policy Review: Kenya' *Unedited Advance Copy*, [www.ke.undp.org/IPC%20-FDI.pdf](http://www.ke.undp.org/IPC%20-FDI.pdf), [cited on 12 March 2007]

Womack, J.P., and Jones, D.T., (1996) '*Lean Thinking: Banish Waste and Create Wealth in Your Corporation*' Simon & Schuster UK Ltd, London

Womack, J.P., Jones, D.T., and Roos D., (1990) '*The Machine that Changed the World: the Story of Lean Production*' First Harper Perennial Edition, New York



**APPENDIX 1: LETTER OF INTRODUCTION**

**UNIVERSITY OF NAIROBI  
SCHOOL OF BUSINESS  
MBA PROGRAM – LOWER KABETE CAMPUS**

**DATE .....**

**TO WHOM IT MAY CONCERN**

The bearer of this letter .....GICHERE ESTHER WAMUYU.....  
Registration No : .....D61/P/8247/03 .....  
is a Master of Business Administration (MBA) student of the University of Nairobi.

He/She is required to submit as part of his/her coursework assessment a research project report on a management problem. We would like the student to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate if you assist him/her by allowing him/her to collect data in your organization for the research.

The Project is entitled: **THE EXTENT OF ADOPTION OF LEAN THINKING IN THE KENYAN PETROLEUM INDUSTRY**

The results of the report will be used solely for academic purposes and a copy of the same will be availed to the interviewed organizations on request.

Thank you.

**CO-ORDINATOR, MBA PROGRAM**

## APPENDIX 2: QUESTIONNAIRE

This questionnaire is designed to measure the degree of adoption of lean principles in the Kenyan petroleum industry in fulfilment of the MBA course at the University of Nairobi. The principles are elimination of waste; continuous improvement; zero defects, maintenance of minimum stock levels, customers determining the level of stock holding, multifunctional teams, decentralization of responsibilities onto the multifunctional teams, integration of different functions into the teams and provision of timely information to employees. The questionnaire is divided three sections. All responses will remain confidential.

### PART A

Name of Company: \_\_\_\_\_

Position in Company: \_\_\_\_\_

No. of employees: \_\_\_\_\_

Inland Market Share: \_\_\_\_\_

### PART B

On a scale of 1 to 5, where 1 is no adoption and 5 is total adoption of lean principles; please indicate (tick) which is relevant to your organisation:

Principle	1	2	3	4	5
Elimination of waste					
Continuous improvement					
Zero defect orders					
Maintenance of minimum stock levels					
The customer determines the level of stock holding					
Teams that are able to perform different tasks (multifunctional teams)					
Decentralization of responsibilities onto the multifunctional teams					
Integration of different functions into the teams					
Provision of timely information to employees					

### PART C

1. Over the last five years, product losses have:

- Increased
- Decreased

2. Have steps been undertaken to reduce waste in your organisation:

- Yes
- No

3. If yes, what steps have been taken?

---

---

---

---

4. For transit material, how would you rate the frequency of requesting extensions?

- Never
- Rarely
- Frequently

5. When extensions are requested, do you request for:

- The whole quantity
- More than half
- Less than half

6. Customer delivery windows are adhered to:

- Always
- Frequently
- Rarely
- Never

7. Are your stock levels kept to a minimum?

- Yes
- No

8. Please explain:

---

---

---

9. In your organisation, do you have a suggestion scheme?

- Yes

No

10. If yes, what percentage of suggestions is implemented?

None

Less than half

More than half

All

11. In the past five years, have suggestions:

Increased

Decreased

12. In your organisation, do you have a quality programme?

Yes

No

13. If yes, please specify \_\_\_\_\_

14. In your organisation, there are:

Quality circles

Multifunctional teams and spontaneous problems solving activities

Formal suggestion scheme

No explicit organisation

15. In your organisation, the following is true

Employees identify defective orders and stop them

Employees identify defective orders but do not stop them

There is a quality control department that identifies the defect and informs the supply department

16. In your organisation, the following is true

Defective orders are sent back to the employee responsible to rectify

Other employees take out the defective order and rectify

There is a department that rectifies the orders

17. What percentage of employees is dedicated to quality control?

0%

1% - 25%

26% - 50%

- 51%-75%
- 76%-100%

18. In your organisation, process control is done by:

- Measuring inside the process
- After each order processing step
- After an order is completed

19. Once an order is placed, product is delivered on:

- The same day
- The same week
- The same month

20. Level of stock holding is determined by:

- Customer orders
- Storage capacity
- Funds availability
- Other, please specify: \_\_\_\_\_

21. Your annual stocks requirements are determined by:

- Forecasts
- Actual customer orders
- Others, please specify \_\_\_\_\_

22. In your organisation, do employees work in teams?

- Yes
- No

23. If yes, employees change tasks within the team

- Continuously
- Every day
- Once per week
- Once per month
- Once per year
- Less than once per year
- Never

24. Are employees trained in different tasks?

- Yes

No

25. Are employees trained in different functional areas?

Yes

No

26. What amount of time (months) is given to newly employed personnel?

---

27. Does team leadership rotate among team members?

Yes

No

28. If no, what is the reason?

29. Employees accept responsibility for team leadership:

Always

Often

Rarely

Never

30. How many hierarchical levels are in the supply/operations department?

31. Are teams responsible for functional areas?

Yes

No

32. Do teams have indirect tasks?

Yes

No

33. If yes, which ones

---

---

---

34. Please tick what is appropriate for your organisation:

There are regular meetings to discuss organisation issue

Oral and written information is provided regularly

- Written information is provided regularly
- No information is provided to employees

35. Information provided to employees is:

- Partial
- Complete
- None is provided
- Other, please specify \_\_\_\_\_

36. The performance of teams is measured by:

- One indicator
- More than one indicator
- No indicator

37. Employees are given information on a:

- Daily basis
- Weekly basis
- Monthly basis
- Never

39. Which of the following obstacles has your organisation faced in aiming to achieve world-class status?

- Lack of implementation know-how
- Backsliding to the old ways of doing things
- Resistance by employees and managers
- Failure of other projects
- Other, please specify:

---

---

---

---

---

---

### APPENDIX 3: PETROLEUM COMPANIES, 2006

Company	Market Share (%)
Shell/BP	19.61
Kobil	17.68
Total Kenya	17.12
Chevron	14.24
Mobil Oil (Tamoil)	10.89
NOCK	4.31
Kenol	2.87
Gapco	2.78
Triton	1.95
Bakri International	1.49
Oilcom	1.33
Petro	1.21
Metro Petroleum	1.07
Galana Oil	0.93
Dalbit Petroleum	0.67
Engen	0.67
Tecaflex	0.48
Global Petroleum	0.22
MGS Petroleum	0.18
Fossil	0.16
Hass Petroleum	0.07
Addax Kenya	0.04
Hashi Empex	0.01
<b>TOTAL</b>	<b>100</b>

Source: Petroleum Institute of East Africa (PIEA), March 2007