

**THE APPLICATION OF LEAN CONCEPT AT MOMBASA
TECHNICAL TRAINING INSTITUTE**

BY

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**A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF
THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION,
SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI.**

2014

DECLARATION

STUDENT'S DECLARATION

I declare that this project is my original work and has never been submitted for a degree in any other university or college for examination/academic purposes.

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

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ACKNOWLEDGEMENT

This project research report is a culmination of concerted effort and support that I have received throughout my study period. I feel greatly indebted to many a people that I may not have enough space to mention all of them here.

I thank the Almighty God for granting me a chance in life to pursue this course. It has been a long struggle to make this milestone as God worked his way through Doctors Avi and Akenga who did whatever they could to decisively deal with my health challenges.

My studies would have not been possible without the love, patience, encouragement and understanding of my dear wife. My two little children Debra and Adrian, who would wonder why dad who is an adult goes to school, had to endure their father's unusually busy days. Some day in future, you will understand what transpired. My late father, and my mother who taught me the virtue of working hard. My brothers, sisters and friends who assisted in every way they could. I thank you all most sincerely.

I have come across great people in the University of Nairobi's School of Business during my two year study period that has shaped my life. My supervisors for the special role they played in undertaking my research project. Mr. Mwanyota for guiding me tirelessly from scratch to the last stage of writing the report. Dr. Njihia for valuable and prompt directions to make the research a success despite other administrative responsibilities, I always received an immediate feedback to my writing, thanks to ICT.

Finally, I acknowledge the contribution made by the heads of departments at MTTI without whose cooperation; data collection would have not been possible. Thanks for sparing time from your busy schedules to aid my academic endeavors.

DEDICATION

This research project is dedicated to my loving wife Happiness Kemunto, daughter Debra Bina and son Adrian Gwoki.

ABSTRACT

The service sector contributes a great deal to the economy of any country's Gross Domestic Product. In Kenya, the education sector alone contributes a great deal to GDP. At the same time, massive resources are invested to the same sector. Kenya's Vision 2030 indicates government's expenditure on education is equivalent to 7.0% of the country's GDP. This translates into one of the highest expenditure levels per student out of the education GDP in Africa. As the total expenditure for education rises, other challenges like improving the overall efficiency of the sector come to the fore. This amount of resources expended to the sector, forms the basis for this research inquiry into the TIVET sub-sector in a technical training institution with an aim of determining the extent to which lean concept, as a management tool, is applied to eliminate wastes at Mombasa Technical Training Institute. Lean thinking has been widely used in the manufacturing sector and now is getting increasingly useful in the service industry. A detailed literature review was done that revealed the use of lean concept in other sectors. A case study methodology was used in which the heads of departments at the institute were interviewed to obtain the required data. A case study methodology is of particular relevance in new or emerging situations where not much is known about the particular area under study. Content analysis was used to analyze the data that was collected. This project's findings indicated that indeed there are various types of wastes in the TIVET education programs that led to inefficiency in the system. The discussions in content analysis however, revealed the application of lean concept to a considerable extent at the institute thereby answering the research question, though direct reference was not made to lean concept itself. Recommendations to managers in the service industry as well as policy makers include reducing waiting time for examination results and reviewing the curriculum to make the content manageable within a given period.

Key words: Lean concept, Services

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LIST OF ABBREVIATIONS

GDP ó Gross Domestic Product

GOK ó Government of Kenya

HOD ó Head of Department

ITs ó Institutes of Technology

IMVP ó International Motor Vehicle Programme

KNBS ó Kenya National Bureau of Statistics

KNEC ó Kenya National Examinations Council

MBA ó Master of Business Administration

MTTI ó Mombasa Technical Training Institute

TIVET/TVET ó Technical Industrial Vocational and Entrepreneurship Training

TOC ó Theory of Constraints

TTIs ó Technical Training Institutes

TQM ó Total Quality Management

UK ó United Kingdom

USA ó United States of America

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

All organizations in the public and private sector have to constantly deal with high costs and eminent threats of dwindling profits. Firms, whether manufacturing or service, are driven by the urge to satisfy their customers by provision of maximum value at the lowest cost. The firm can provide value to customers in many ways, such as via superior production systems, lower cost structures and emphasis on customer service (Clulow, Barry & Gerstman, 2007). Any effort towards decreasing costs without adversely affecting the employee and customer lays the foundation of a competitive firm in the ever-changing business environment. With these facts in mind, managers would try to use various concepts and tools, among them lean, to attain the highest efficiency. Shah and Ward (2007), define lean as an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability. Another definition by Hopp and Spearman (2004), explains that treating lean primarily as the reduction or elimination of waste is one side of the coin. The other side is that lean is also a framework for enhancing efficiency and thus maximizing improvements.

In this research, three theories that underpin the application of lean concept will be highlighted. The first one is Porter's (1985) value chain analysis theory which analyzes value creation at the firm level. Value chain analysis identifies the activities of the firm and then studies the economic implications of those activities. The second one is the

productivity frontier model theory (Farell, 1957) which is a framework for analyzing economic efficiency in terms of realized deviations from an idealized cost or production frontier. The other one is the theory of constraints by Goldratt (1988) which proposes that it is the process that possesses the least capacity in the system that should be managed toward increased capacity, as it is that process that restricts the entire system from increased output. Lean in manufacturing and services share, among others, two defining characteristics which include: Increasing customer focus and involvement in the product development and delivery processes (Hanfield, 1994); and Eliminating waste from the value chain of activities from product development to product delivery or provision of the service (Womack & Jones, 1996). It is upon these two tenets of customer focus and continuous improvement to eliminate waste thereby increasing efficiency of firms that the above theories will lay the foundation of this study.

The importance of the service sector in any economy cannot be overemphasized. Services now constitute the majority of employer and source of income for developed economies, accounting for approximately three quarters of Gross Domestic Product (GDP) in USA and UK (Piercy & Rich, 2009). In developing countries, the situation is no different. For instance, in Kenya, the education sector alone contributed 5.8% to GDP in the year 2011 (KNBS, 2012), 6.1% and 6.7% in 2012 and 2013 respectively (KNBS, 2014) showing an upward trend. The education sector as a service is equally important in any country. Generally, the education sector in Kenya has experienced massive expansion in enrolment and the number of institutions over time (GOK, 2012a). This goes hand in hand with the colossal resources allocated to the sector. For example, the Ministry of

Education, Science and Technology combined with Teachers Service Commission were allocated the largest share (83 per cent) of the total recurrent expenditure in the financial year 2013/14 (KNBS, 2014).

1.1.1 Development of the Lean Concept

By the early 1980s, a clear quality gap between Western and Japanese products was emerging, with the most pronounced differences observed in the automotive industry. The International Motor Vehicle Programme (IMVP) at the Massachusetts Institute of Technology undertook an investigation into the superiority of Japanese management in the sector. The investigation by IMVP into automotive manufacture highlighted that Japanese companies were delivering higher quality products at lower costs than western businesses. This was attributed to a fundamentally different operating paradigm in use by Toyota. This approach was referred to as 'lean production' (Womack et al, 1990). Julien and Tjahjono (2009) explain lean as a philosophy of operation not a set of tools. Lean is about waste prevention whilst focusing on value for the customer in a flexible and responsive way to sustain and improve the business competitiveness. This philosophy can be traced back to the factories of Ford in 1920s and later in the Toyota Production System that developed from the 1950s until the present day.

To assist companies around the world in emulating these practices, five lean principles were identified to guide organizations in all sectors of the economy, including service, in lean transformation (Womack & Jones, 1996): Value: Determine what is the customer's value (specifically what they are prepared to pay for) in the product or service; The value stream: Map out (with a process or value stream map), how value is delivered. Use this as a basis for eliminating any area that does not add value; Flow: Ensure products and

information seamlessly flows from start to finish of the value stream. Remove inventory or buffer zones with the use of structural enablers such as modular designs, cellular working, general-purpose machines, and multi-skilled workers; Pull: Only deliver what is actually demanded (pulled) by the customer rather than serving from stocks or buffers; and Perfection: Continually seek to improve the process and systems with the above principles, striving for perfection (Piercy & Rich, 2009).

1.1.2 Lean Concept in Service Operations

The advocacy for lean production in the service industry started with Levitt's works on Production line approach to service and The industrialization of service. This was followed with numerous attempts at implementing lean in the service industry. A study by Bowen and Youngdahl (1998) indicate that Lean in service only started gaining momentum in the late 80s as a result of McDonald's utilisation of the Lean production flow concept in order to meet their customer's expectations. In the early 1990s, Lean was successfully implemented in service industries such as banking sectors and public sectors, and even hospitals and airlines were adopting this methodology to improve efficiency within their organisations George (2003) as cited by the same authors.

Hasle, Bojesen, Jensen and Bramming (2011) pointed out that lean is frequently applied outside the manufacturing sector: in services for example, hospitals, public administration and other places. Some key practices of lean production system can be applied in most sectors. It would benefit employees due to its promotion of a higher degree of participation and the possibility to eliminate strained working conditions.

Lean is the identification and elimination of process waste in order to maximize customer value (Kanakana, 2013). The study outlines seven forms of waste that must be identified

and eliminated. They are: Overproduction ó producing products which customers do not require at that moment; Defects ó failure to conform to specifications or customers' needs; Unnecessary inventory ó too much stock which is not required for production or by the customer; Inappropriate or over processing ó unnecessary activities or features that do not benefit the customer; Excessive transportation ó unnecessary movement of material; Waiting ó failure to deliver products when needed downstream, employee idling or waiting for stock; and Unnecessary motion ó unnecessary movement by employees.

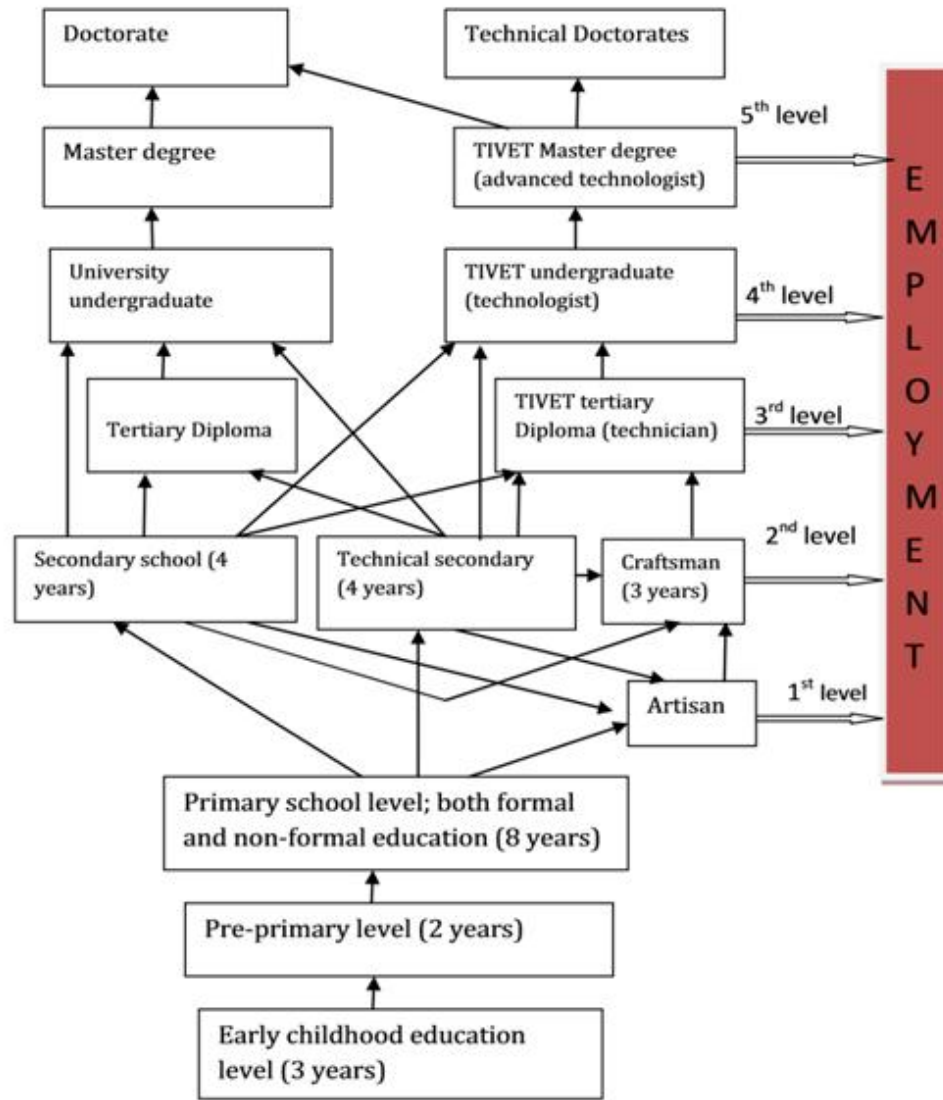
The dilemma to most operations managers is whether lean manufacturing tools and principles can be applied to service operations. In this regard, studies have indicated that not all principles and practices that apply to manufacturing can apply to service industries. To emphasize this fact, studies by Allyway and Corbett (2002), and Maleyeff (2006) outline core Lean principles which apply to any industry, including service industries as: value; customer focus; identifying the value stream; establishing flow or continuous flow; implementing a pull system; and striving for perfection. Organisations can then transfer these principles to fit their environment and ensure compliance to other service standards. Maleyeff (2006) further asserts that many of the Lean manufacturing tools are recommended to service environments with the understanding that service industries vary in their mandate and that organisations have to apply tools that are suitable to their organisations, as they see fit. Some of the Lean principle tools which apply to service industries are the 5s methodology, seven wastes of Lean and value stream mapping (Piercy & Rich, 2009). Other tools such as Visual aid management and Just in time are also considered to be applicable for service environments (Liker, 2004) as

cited by Maleyeff (2006). To apply all these tools, it is vital to understand and use them as required.

1.1.3 TIVET and Mombasa Technical Training Institute

Technical, Industrial, Vocational and Entrepreneurship Training (TIVET) is one of the three subsectors of tertiary education which include teacher training and higher education (GOK, 2012a). Generally, the education system in Kenya is structured into three main subsectors; basic education, secondary education and tertiary education as shown in figure 1.1 below.

Figure1.1: Structure and Organization of Education and Training in Kenya



Adapted from GOK (2005)

The duration of school-based technical and vocational education is between one and three years. According to the regulations, to qualify for the award of Diploma or Craft certificate in any field, the candidate must pass all the modules of the course for three or two year modules respectively. Candidates, who fail any paper (module unit) in a

particular module, will be referred in the paper failed and will be allowed to re-sit three (3) times and pass within a period of five (5) years after the date of the first sitting. Thereafter the candidate will be discontinued from further re-sitting the paper(s) (GOK, 2008, 2009).

Mombasa Technical Training Institute (MTTI) is one of the thirty five technical training institutes in Kenya under the TIVET sector in the Ministry of Education (KNBS, 2013). Information from its website (kenyacoastpoly.ac.ke) shows that it started in the year 1950 as a technical high school. It was elevated to a middle level technical college in 1984 to train middle and high level technical and management human power for both the private and public sectors of the economy. It is found at the Kenyan Coast in Mombasa County, Mombasa city. The institute currently has a population of 2,586 students. There is 93 teaching staff. Courses offered are at artisan, craft certificate and diploma levels spread across seven departments.

1.2 Research Problem

The background information has shown the use of lean principles and tools in improving the firm's competitiveness through the elimination of waste. Studies have indicated that lean concept has been successful in the manufacturing and service sectors. Liker and Morgan (2006) observed that firms that apply lean tools and principles become customer focused, continuously improve their operations through waste reduction and tightly integrate with upstream and downstream processes as part of a lean value chain which leads to increased efficiency and profitability. With lean's growing popularity in the business sector and its great bearing in a wide variety of contexts, there is a need for a study to establish the extent of its application in the education sector.

According to the Ministry of state for Planning, National Development and Vision 2030, Education is one of the sectors in the Social Pillar (GOK, 2012b). The paper asserts, "Kenya's education sector will require substantial investment to produce the required human resources for the priority growth sectors. One of the challenges facing the sector is to ensure that education provided meets high quality standards, and that its contents are relevant to the needs of the society. Another challenge lies in improving the overall transition rates". Indeed, the same policy paper states that the government's expenditure on education is equivalent to 7.0% of the country's GDP. This translates into one of the highest expenditure levels per student out of the education GDP in Africa. As GDP grows, total expenditure for education will rise, bringing other challenges like improving the overall efficiency of the sector.

Studies have shown that lean can be successfully implemented in the service sector leading to customer satisfaction, increased efficiency and competitiveness of firms through employee involvement and elimination of all forms of waste. For instance, Burgess and Radnor (2013) in their study on evaluating Lean in healthcare, claim that Lean implementation at the English National Health Service has been successful and continues to be popular in English hospital trusts and also continues to spread. Arlbjorn, Freytag and Haas (2011) concur that Lean can be implemented effectively in the public sector just like in any other service industry. In the food sector, Bowen and Youngdahl (1998) argue that these organisations have implemented the production line concept in their food service industry with the aim of improving customer satisfaction and efficiency. In the transport sector, Airlines such as Southwest airline have implemented Lean effectively and are subsequently reaping the financial benefits (Comm & Mathaisel,

2005b). Application of lean in service industries is in no doubt. However, the studies cited indicate that not much has been done in the education sector. Therefore, the focus of this study falls on exploring the application of lean tools and principles in TIVET education programs in a technical institution in Kenya. It will be an interesting study to see whether lean tools and principles have been used to result to a process of increased education outputs using low inputs as envisaged by educational managers. There is, therefore a need to carry out a research to answer the question: "To what extent is lean concept applied at Mombasa Technical Training institute's TIVET education programs?"

1.3 Research Objective

The objective of this study is to determine the extent to which lean concept is applied at Mombasa Technical Training Institute's TIVET education programs.

1.4 Value of the Study

The study will contribute to the academic world by providing a basis of using the lean concept in the education service sector. It will demystify the long held notion that "lean" is only applicable in the manufacturing sector. The study will equally set a firm foundation for further research culminating to evolution of new theories in management of the service industry.

The study will also help policy makers especially in the Ministry of Education to formulate policies that eliminates waste and ensures seamless flow of academic programs. Other public and indeed private sectors policy formulators will find its content helpful in their quest for customer satisfaction through value creation arising from continuous improvement and increased efficiency. This will be an eye opener to other

service sector managers who may consider embracing or rejecting lean in their operations to increase efficiency and profitability.

This research will prove particularly useful to the field of operations management and management science since it will add substantial knowledge that will be used as reference material in future works. Researchers will find the basis for conducting studies at other subsectors of education and other service sectors of the economy.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter seeks to highlight the relevant theories that support the lean concept and an empirical review of lean and the service sector. A general overview of wastes in the education sector is done and at the end of the chapter a summarized literature review is provided.

2.2 Theoretical Review

There are various theories that are used in the field of operations management. In this section the value chain theory, the productivity frontier model theory and the theory of constraints are briefly examined.

2.2.1 The Value Chain Theory

Porter's (1985) value chain framework analyzes value creation at the firm level. Value chain analysis identifies the activities of the firm and then studies the economic implications of those activities. It includes four steps: defining the strategic business unit; identifying critical activities; defining products; and determining the value of an activity. The main questions that the value chain framework addresses are as follows: what activities should a firm perform, and how? And what is the configuration of the firm's activities that would enable it to add value to the product and to compete in its industry? Value chain analysis explores the primary activities, which have a direct impact on value creation, and support activities, which affect value only throughout their impact on the performance of the primary activities. Primary activities involve the creation of physical products and include inbound logistics, operations, outbound logistics,

marketing and sales, and service. Porter defines value as 'the amount buyers are willing to pay for what a firm provides them. Value is measured by total revenue ... A firm is profitable if the value it commands exceeds the costs involved in creating the product' (Porter, 1985). Value can be created by differentiation along every step of the value chain, through activities resulting in products and services that lower buyers' costs or raise buyers' performance. Drivers of product differentiation, and hence sources of value creation, are policy choices (what activities to perform and how), linkages (within the value chain or with suppliers and channels), timing (of activities), location, sharing of activities among business units, learning, integration scale and institutional factors.

According to Hines, Holweg and Rich (2004), a critical point in the lean concept is the focus on value. Value is created if internal waste is reduced, as the wasteful activities and the associated costs are reduced, increasing the overall value proposition for the customer. Value is also increased, 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. A study by Mehri (2006) shows that American industry and higher education have accepted, with little question, the wisdom of value chain analysis theory and the lean concept Japanese way of managing firms.

2.2.2 The Productivity Frontier Model Theory

A number of methods for measuring efficiency have been proposed, all of which have in common the concept of the frontier; efficient units are those operating on the cost or production frontier, while inefficient ones operate either below the frontier (in the case of the production frontier) or above the frontier (in the case of the cost frontier) (Cullinane,

Song & Gray, 2001). The literature on frontier models began with Farrell (1957) as cited in Cullinane et al (2001) who suggested a useful, and subsequently widely accepted, framework for analysing economic efficiency in terms of realised deviations from an idealised frontier isoquant. A distinction exists between the methods employed to derive the specification of the frontier model: either statistical or non-statistical methods may be used. The former technique makes assumptions about the stochastic properties of the data, while the latter does not. Another difference concerns whether the chosen method is parametric or non-parametric. While the former imposes a particular functional form, the latter approach does not. The non-parametric approach revolves around mathematical programming techniques which are generically referred to as data envelopment analysis. The parametric approach, on the other hand, employs econometric techniques where efficiency is measured relative to a frontier production function which is statistically estimated.

Econometric approaches have a strong policy orientation, especially in terms of assessing alternative industrial organisations and in evaluating the efficiency of government and other public agencies. Mathematical programming approaches, on the other hand, have a much greater managerial decision-making orientation (Lovell, 1995). The policy orientation of econometric approaches more closely supports the purpose of this study, especially since they have a more solid grounding in economic theory (Bauer, 1990). In addition, a study by Oum and Waters (1996) compared the performance of alternative methods for measuring efficiency, focusing on the econometric method (in particular, the stochastic frontier model) and the mathematical programming method. As measured by the correlation coefficients and rank correlation coefficients between the true and

estimated relative efficiencies, the results show that when the functional form of the econometric model is well specified, the stochastic frontier approach generally produces better estimates of efficiency than the latter approach, especially when measuring firm-specific efficiency where panel data are available. The econometric approach involves the specification of a parametric representation of technology which itself can be divided into two different models; either deterministic or stochastic frontiers may be specified according to whether or not certain assumptions are made concerning the underlying data. The early parametric frontier models were deterministic in the sense that all economic units share a common fixed class of frontier. This is unreasonable and ignores the real possibility that the observed performance of the economic unit may be affected by exogenous (i.e. random shock) as well as endogenous (i.e. inefficiency) factors. To allocate all these factors, whether favourable or unfavourable and whether under or beyond the control of the economic unit, into a single disturbance term and to refer to the mixture as inefficient is clearly a dubious and imprecise generalisation.

As an alternative, the stochastic frontier model is motivated by the idea that deviations from the production frontier might not be entirely under the control of the economic unit being studied (Greene, 1993). Meeusen and van den Broeck (1977) independently constructed a more reasonable error structure than a purely one-sided one. They considered a linear model for the frontier production function as follows:

$$Y_{it} = f(X_{it}; \beta) \exp(v_{it} - u_{it}), \quad i = 1, 2, \dots, N; t = 1, 2, \dots, T,$$

where Y_{it} denotes the appropriate form of output for the i th firm at time t , X_{it} is a vector of inputs associated with the i th firm at time t and β is a vector of input coefficients for the associated independent variables in the production function. In the disturbance terms,

the component v_{it} represents a symmetric disturbance term permitting random variation of the production function across economic units due, not only to the effects of measurement and specification error but also, to the effects of exogenous shock beyond the control of the economic unit (e.g. weather conditions, geography or machine performance). The other component u_{it} (≥ 0) is a one-sided disturbance term and represents 'productive inefficiency' relative to the stochastic production function. The non-negative disturbance term u_{it} reflects the fact that output must either lie on or below its frontier. The deviation of an observation from the deterministic kernel of the stochastic production function equation arises from two sources: (i) symmetric random variation of the deterministic kernel $f(X_{it}; \cdot)$ across observations that is captured by the component v_{it} and (ii) asymmetric variation (or productive inefficiency) captured by the component u_{it} . The term u_{it} measures productive inefficiency in the sense that it measures the shortfall of output Y_{it} from that implied by its maximum frontier given by $f(X_{it}; \cdot) \exp(v_{it})$.

Nevertheless, any estimate of a firm's efficiency level is not consistent, as it contains statistical noise as well as productive inefficiency. In addition, stochastic frontier models suffer from two other difficulties. One is the requirement of specific assumptions about the distributions underlying productive inefficiency (e.g. half-normal and exponential) and statistical noise (e.g. normal). The other is the required assumption that regressors (the input variables contained in the vector X) and productive inefficiency are independent. This may well be an unrealistic assumption since if a firm knows its level of inefficiency; this should affect its input choices.

2.2.3 Theory of Constraints (TOC)

Developed by Dr. Goldratt (1988), the theory proposes that it is the process that possesses the least capacity in the system that should be managed toward increased capacity, as it is that process that restricts the entire system from increased output (Polito, Kevin & Vokurka, 2006). The concept of the TOC can be summarised as: Every system must have at least one constraint (anything that limits a system from achieving higher performance versus its goal): and the existence of constraints represents opportunities for improvement. A continuous improvement process consists of five steps: Identify the system's constraint(s); decide how to exploit the system's constraint(s); subordinate everything else to the above decision; elevate the system's constraint(s); and if in any of the previous steps a constraint is broken, go back to step one (Rahman, 1998).

TOC establishes conditions necessary for employee and customer satisfaction, and firm-wide effort for continuous increase in profit through waste elimination as espoused in lean concept (Gupta & Boyd, 2008). Rahman (1998) observed a reduction in paperwork backlog and an improvement in workers' productivity and morale when the TOC technique was applied to simplify administrative work.

Lean in manufacturing and services share, among others, two defining characteristics which include: Increasing customer focus and involvement in the product development and delivery processes (Hanfield, 1994); and Eliminating waste from the value chain of activities from product development to product delivery or provision of the service (Womack & Jones, 1996). It is upon these two tenets of customer focus and continuous

improvement to eliminate waste that the above theories are deemed applicable in this study.

2.3 Empirical Studies on Lean Concept and the Service Sector

Studies have shown the application of lean concept widely. For instance, Comm and Maithaisel (2005b) ascertained that lean is not credited with the same level of popularity in the service sector as in manufacturing. Companies and institutions in this sector appear to embrace many concepts of lean thinking without actually calling it lean. They have instead embraced the total quality management (TQM) initiative which is a prerequisite to lean thinking. In any case, lean thinking and total quality management share many of the same concepts: continuous focus on customer expectations, elimination of waste through process redesign, integrated product teams, and employee empowered cultures. The study was done in the universities and the focus was on which institution had the best cost reduction or containment initiatives. Although the initiatives were not implemented with the knowledge that they were called lean practices, their application eliminated waste, improved operational efficiency, and contributed to sustainability.

Another research by Rich and Piercy (2009), proposed a major role for lean improvement in the service sector and many researchers and practitioners have reiterated their call for lean adoption in services. Further, other researchers Bowen and Youngdahl (1998) also highlighted early that lean approaches such as work redesign, increasing training and a focus on process mapping in retail, airline and hospital management could generate positive results for companies, their investigation was based not on explicit lean improvement but a more general set of change principles, many of which share commonality with some aspects of lean thinking. In another study, Julien and Tjahjono

(2009) observed that while lean thinking has its roots in manufacturing, there are numerous examples of its impact on operations in other sectors in particular the service sector. Their study noted the closeness to the customer as an advantage to any organization interested in understanding and meeting their customer expectations.

A research done by Emiliani (2004), describes the application of lean principles and practices to the design and delivery of a graduate business school course, which resulted to higher level of student satisfaction in part through clearer expectations, less ambiguity regarding assignments over the semester, and better management of students' time both in and especially outside class. The researcher identified time as a key focus of lean management and how it is used with the intent of improving responsiveness to customers. The study emphasized the use of overarching lean principles as shown in the table I in Appendix II. It further explains that to achieve the above objectives, processes and tools are used in lean management to help people eliminate waste and add value to end-use customers as illustrated in table II in Appendix III. The intent of these processes and tools is to simplify work and the workplace, improve quality, reduce lead-times, and focus people on value-creating activities. Importantly, they also help people realize their innate desire to make positive contributions to the workplace, which enables a more consistent stream of successful outcomes.

One of the benefits of lean thinking is the creation of a culture focused on performance, and holding each step of the process accountable (Comm & Mathaisel, 2005a). In order for a lean initiative to be successful, seven best practice components must be present: environment for change, leadership, culture, employee empowerment, training, communication and measurement. The study also ascertains lean sustainability will lead

to improved services with lower costs. Lean provides a competitive advantage to a firm in any given industry. Emiliani (2004) affirms that business that practice lean management well are formidable time-based competitors because information (e.g. parts, documents, verbal communication) flows with fewer or even no interruptions. It also leads to high level of customer satisfaction. A study by Julien and Tjahjono (2009), underscores the importance of lean as it enhances a more effective response to the needs of customers by providing faster and more valuable services. In a very competitive environment, lean is usually the solution to track costs while optimizing some of the repetitive and wasteful steps, so as to obtain flexible and adaptive process. The lean philosophy can be transferred to the service industry, though there is a difference between service and manufacturing in defining value. In manufacturing context, the value of a product is often closely related to the specific functionality of the product and it is therefore relatively easy to distinguish between value adding and non-value adding activities. In the service sector, however, the customer is ó in many occasions and specifically in education ó directly involved in the production of the service. However, lean has one glaring disadvantage. The term ~~lean~~ has for many workers become synonymous with bad outcomes such as layoffs (e.g. Layoff Every Associate Now) (Emiliani, 2004).

The application of lean approaches in the service sector has been underway for several years. However, lean approaches have predominantly been limited to service contexts where a physical product exist e.g. retail supply chain or to healthcare. Piercy and Rich (2009) carried out a research in the pure service environment with the aim of assessing the suitability of lean production methodologies in the pure service context. The study

involved financial companies in the UK. Another research was done by Julien and Tjahjono (2009), in the same country at a safari park in Buckinghamshire, with the aim of introducing lean thinking to Woburn to enable it to increase profits through eliminating waste and improving the efficiency of key processes whilst concurrently increasing customer satisfaction. The two researches were done in the UK, a country in Europe which is different from the one under study ó Kenya in Africa. Further, the studies were conducted in different service sectors ó leisure and financial services which are different from the area of interest here ó education sector.

The findings in another study by Comm and Mathaisel (2005a, 2005b) could be applied to universities in Kenya, the two studies addressed different content ó lean sustainability and it is presumed the universities were already applying lean initiatives. The studies were done in universities in the USA whereas this study will be in a technical institution in Kenya ó different contexts. Emiliani (2004) did a study whose aim was to improve consistency between what was taught in the course and how the course was taught, and to determine whether it resulted in higher student satisfaction. The researcher states that the paper may have less applicability to students enrolled in full-time undergraduate or graduate programs. This research is specific and narrow in focus ó design and delivery of a business school course not entire institution. Technical institution students in Kenya are at certificate and diploma level, and most of them full-time and not working. The content and context of the study are different from the ones intended here.

Kanakana (2013) did a study in South Africa to explore whether implementing lean manufacturing principles in the service sector is feasible or viable and whether those organizations that have implemented these principles have gained from utilizing the

methodology. The qualitative approach was utilized to assess service organizations that have implemented lean manufacturing principles and the study revealed that although the methodology was designed for manufacturing industries, service industries could implement lean principles as well, thereby gaining organizational competitiveness and increasing customer satisfaction. The researcher concludes that lean in higher education has not been widely used as other sectors because higher education institutions are not knowledgeable about lean concepts although they utilize similar tools to maintain efficiency and effectiveness but these are not termed lean initiatives. The study used secondary data from literature to draw conclusions. This study is different in both the content it dwells on ó feasibility of implementing lean in service industry (not the application of lean tools and principles), and the context ó cites studies in higher education and not in TIVET education sector.

Womack and Jones (1996) defined waste ñas any human activity which absorbs resources but creates no valueö. Value defined as ña capability provided to a customer at the right time at an appropriate price, as defined in each case by the customerö. On the other hand, educational managers and planners see waste as anything that reduces educational outputs (standard achievement, completion rates, certification, and certain attitudes and values) and outcomes (longer term consequences of education such as employment, earnings and changes over time in attitudes and values and behavior) given inputs (characteristics of teachers, pupils, facilities, curriculum, and fiscal and other resources necessary for the maintenance or change of educational enterprise) through a process (outcomes of interaction between teachers, students, administration, materials and

technology in educational activities) (Adams, 1993). Studies have shown four categories of wastes in education as highlighted below.

The first one is wastage from low pupil to teacher ratios or vice versa. The ideal pupil to teacher ratio is 30:1 according to the Ministry of Education (GOK, 2005). However, there are usually varying numbers of students across different institutions. As the number of students increase, the individual contact time for individual student attention decreases and vice versa (Millot & Lane, 2002). This affects the corrective and immediate feedback, and the active participation of the teacher with the student that are important for learning (Millot, 1994).

The second one is wastage from low completion rates. Failure of the learner to complete the education cycle means the resources used to that level are wasted. This may be due to repetition, which is routinely used as an appropriate remedial tool for non-performing students (Millot & Lane, 2002). Lewin (2007) explains that many students in Kenya do not complete the full cycle of education because of repetition and dropouts. Yet repetition is partly a result of curricula that is widely designed on the assumption of grouping learners for teaching in class groups defined by the curriculum content and cognitive demand independent of age and capability, and ordering progression sequentially from grade to grade. In fact more than 50 per cent of enrolled learners fail to complete the education cycle (Abagi & Odipo, 1997).

The third is waste from under-utilization of learning contact hours. In a study by Millot and Lane (2002) they showed that students actually receive academic instruction for 364 hours or 34 per cent of a typical school year of 1080 hours. Inefficient utilization of

teaching time is costly to the education system. This may lead to incompleteness of the syllabus, extra time for coaching being sought and extra costs to be incurred by the parents (Abagi & Odipo, 1997). Time is also wasted during transition from one lesson to another accounting for 40 per cent leaving only 60 per cent functional time for the lesson (Amadio, 1997). Lockheed and Verspoor (1991) qualifies that the amount of actual classroom interaction depends on the amount of absenteeism by both teachers and students, and administrative burden borne by teachers, the number of holidays, and the amount of time scheduled for extracurricular activities.

And the fourth is waste from teaching load. The teaching load for technical institutions is 16 hours per week (GOK, 2005). However, teaching loads vary widely between schools, partly due to specialization and mastery in particular subjects (Onsomu et al., 2006). This leads to less workload for some teachers (under-utilization) and excess workload for others (over-utilization). In both cases, the optimal level is not attained leading to waste and the associated cost to the government.

2.4 Summary of Literature Review

The review done above shows that various studies have been done on the concept of lean and its use in different service sector including higher education. The studies have been done in developed economies (UK and USA) and a developing economy (South Africa). The researcher did not come across published materials on studies focusing on lean in the TIVET education service sector in Africa and specifically in Kenya. The developed countries are well endowed in terms of resources unlike Kenya which is a less developed economy. Furthermore, some of the studies were done in universities, which are contrastingly different from technical institutions in Kenya in all aspects. Clearly, there is

strong case for a research to be done in Kenya's TIVET institutions in this case Mombasa Technical Training Institute to establish the extent to which lean tools and principles are applied to eliminate waste in their education programs.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the research design to be used, the selection of case study, data collection method and how data will be analyzed. The methodology gives shape to what is studied (the research problem) and how it is studied (the methods) and indicates the relationship between the investigator and research participants.

3.2 Research Design

The researcher used a case study design. Patton and Appelbaum (2003) concurs with Yin (1981) that a case study is an empirical inquiry that investigates a contemporary phenomenon within a real-life context where the boundaries between a phenomenon and context are not clearly evident, and in which multiple sources of evidence are used. In general, case studies are the preferred strategy when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real life context (Yin, 1984 in Patton & Appelbaum, 2003). The researcher in this study had no control over events and the focus on application of lean concept at MTTI was a contemporary phenomenon within its real life context.

Hartley (1994) asserts that the case based methodology is of particular relevance in new or emerging situations where not much is known about the particular area under study. Indeed the use of lean in the TIVET education sector in the service industry had not been much studied, hence the suitability of this methodology. Further, the researchers reiterate that case based research is particularly effective at examining a phenomenon in the context of its real business environment as was the case in MTTI.

3.3 Selection of Case Study

MTTI is located within Mombasa city and is the only one in Mombasa County hence formed a good case for this study. The seven heads of departments who are in charge of daily operations of their respective departments formed representatives from the institute who answered questions in this study. This number was appropriate for the type of research design chosen since the researcher had enough time to get the detailed information required and also the respondents' offices were within the institute.

It has been noted that to be successful in study, and to enjoy its process, the researcher should choose a research topic that he or she is genuinely interested in (Daymon & Holloway, 2002). The topic for this research was chosen because the researcher takes a keen interest in the education sector particularly TIVET, and has worked as a trainer, in some TIVET training institutions in Kenya including MTTI.

3.4 Data Collection

Case studies typically combine data collection methods such as archival searches, interviews, questionnaires and observation (Patton & Appelbaum, 2003). The researchers further note that while quantitative data often appears in case studies, qualitative data usually predominates. In this research, in depth interviews were used. This is because it helped the researcher to capture attitudes and behaviours of the interviewees precisely. The interviewer was also at hand to clarify any misinterpretations that may have arisen in the process.

The heads of departments were interviewed using a prepared interview guide (see appendix I) which addressed specific issues like; Information on various non-value

adding activities ó wastes (it was also an occasion to highlight areas of potential improvements), and possible suggestions on reducing/eliminating waste. The qualitative responses were recorded on paper during the interviews and were later analyzed in relation to the objectives of the study.

3.5 Data Analysis

Since this was a qualitative study, data analysis was done by content analysis of the responses from the interviews in line with the study objectives. There tends to be significant amounts of data in case studies since respondents are given some scope to express themselves freely; this amount of data can overwhelm the researcher when attempting to analyze it (Ghauri & Gronhaug, 2010). To deal with this, content analysis was applied to seek structures and consistencies in the data collected (Myers, 2009). Content analysis is a step-by-step process: read through all the written responses; create a condensed list of responses; create a list of categories less than six; develop an operational definition of each category; and conduct inter-rater reliability analyses on a sample of each category (Devlin, 2006). Quantitative data was tabulated for use in supporting qualitative data in content analysis.

Codes were used as a shorthand strategy to distinguish, label, compile and consolidate data to make it easy to manage information for the purpose of interpretation. Hesse-Biber and Leavy (2011) outlines that the researcher starts with a topic and research questions; codes are generated from the data under study; and then the researcher doubles back to re-examine data applying the new code categories. Although these steps may have not been followed as precisely as presented, they acted as a guide to systematic data analysis and interpretation.

CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION OF FINDINGS

4.1 Introduction

This chapter starts with a brief description of the interviewees who participated in the study. An outline of data collected is presented with its analysis and discussion of the results.

4.2 Respondents' Description

The interviewees included the seven heads of academic departments in Mombasa Technical Training Institute. These are the persons responsible for the daily administration of their respective departments including directing and controlling of all learning activities. They were visited by the researcher on various dates during which appointments for interviews were made. All the Heads of Department (HODs) granted an interview on various dates and times as shown in table III in appendix IV. To easily identify the departments and keep their privacy, they were given codes ranging from D1 to D7. Similarly the HODs were coded HD1 through HD7 in that order respectively.

4.3 Analysis of Data and Presentation of Findings

To answer the research question for this study, an interview guide was prepared with two sections. The first section was to gather data on departments' size in terms of staff and student numbers. The second section comprised of six questions. The findings are presented in this chapter.

4.3.1 Findings: Size of the Departments

There are seven academic departments at Mombasa Technical Training Institute. The table 4.1 shows the number of tutors, their average teaching loads and students in each department as at the date of this interview.

Table 4.1 The Number of Teachers, Average load and Students in each Department

| Department | No. of teachers in the department | Av. Teaching load (hrs) per tutor per week | No. of students taking Artisan Course | No. of students taking Craft Certificate Course | No. of students taking Diploma Course | Total No. of students in the department |
|-------------|-----------------------------------|--|---------------------------------------|---|---------------------------------------|---|
| D1 | 09 | 14 | 76 | 04 | - | 80 |
| D2 | 24 | 20 | 151 | 94 | 30 | 275 |
| D3 | 13 | 20 | 64 | 115 | 50 | 229 |
| D4 | 14 | 16 | - | 77 | 78 | 154 |
| D5 | 6 | 44 | - | 51 | 91 | 142 |
| D6 | 19 | 28 | - | 252 | 30 | 282 |
| D7 | 30 | 18 | - | 174 | 200 | 374 |
| Grand Total | 115 | | | | | 1,536 |

From the figures shown in the table above, D7 had the largest number of students while D1 had the lowest. However, in the course of the interview it was revealed that there were serious disparities in the number of students at different levels. For instance, HD2 explained òwe have sixty students in one craft certificate class while another has seventeenö. HD1 noted; òThe number of students we recruit depends on those who apply for a specific course and are admitted upon meeting the minimum requirements set out by

KNEC ó we teach those who come, right now we have no diploma class while we have four students at craft level. We are waiting for the next intakeö. These numbers are way above or below the average number of thirty students set out by the Ministry of Education, Science and Technology.

4.3.2 Findings: Average Teaching Load

The average teaching load of each tutor per week ranged from fourteen to forty-four hours per week as shown in table 4.1 above. HD1, HD4 and HD7 did indicate that the tutors in their departments were comfortable with their teaching load. The other four departmentsø interviewees said there were frequent complaints of handling too much work in a week. HD2 explained that some tutors teach as many as 38 hours per week especially where the required expertise is not available. The highest teaching load was in D5 which is due to shortage of staff recruited by TSC as also observed in D6. Apart from teaching, the tutors are involved in various administrative works: Class tutors; Subject tutors; Teacher on duty; Heads of Sections and Heads of Departments. Other tutors are also involved in co-ordination of; Attachment, Sports activities, Examinations, Time-table, Projects, and Clubs and Societies.

4.3.3 Findings: Performance in the Last KNEC Examinations

The interviewees indicated that the overall performance is not good due the change in curriculum from the previous Technical Education Programme to the present Technical, Industrial, Vocational and Entrepreneurship Training programme. The former used to examine students after two and three years for Craft and Diploma courses respectively, while the latter examines students at the end of every module yearly. The performance of

the students at various stages of study from each department is as shown in the table 4.2 below.

Table 4.2 Percentage Pass at each Level per Department in KNEC November 2013

Series Examinations

| Department | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|-----------------|--------|-------|--------|--------|--------|--------|-------|
| Level | % Pass | %Pass | % Pass | % Pass | % Pass | % Pass | %Pass |
| Craft Module I | 0 | 60 | 42 | 28 | - | 28 | - |
| Craft Module II | 45 | - | 0 | 11 | 40 | 57 | - |
| Dip. Module I | - | 90 | 50 | 40 | 16 | - | 24 |
| Dip. Module II | - | 100 | 25 | - | 87 | - | 100 |
| Dip. Module III | - | - | - | - | 83 | - | 100 |

Another reason for the poor performance was the wide syllabus content that has to be covered in many module units within a year. The entry behavior of learners was also cited as a contributing factor to poor results. As HD4 noted "lower grades in sciences like Chemistry, Physics and Mathematics may be a major factor to poor performance in the department, yet my hands are tied to the minimum requirements set by KNEC which cannot be arbitrarily changed". A negative attitude by teachers towards their work characterized by absenteeism and lack of fees by students were also noted as factors that led to poor performance. However, one of the departments had an impressive performance of 100 per cent pass. This was attributed by HD7 to the hard work, competence and the long accumulated teaching experience of the tutors in the department.

Those students who are referred in one or two module units have to wait for three months to sit for their examination. The students who fail either drop out of school or they are advised to change the course of study. HD4 quipped that they no longer had business with those who failed in their examinations.

4.3.4 Findings: Waiting Period for Results

Internal examinations are done by all students in all departments at the end of a twelve weeks term. All the interviewees reported that the students then had to wait for a period of one month for them to receive the results of their end term examinations. HD7 aptly put it thus “During this period, the tutors are involved in marking heaps of scripts through which every word and sentence is read. Then the marks have to be compiled for the students to get their end of term reports – a process which takes time though nowadays computer packages are making life easy”. The respondents further explained that the holiday break could be the cause of laxity to providing prompt feedback to the trainees. There was a general agreement that this period could be reduced say to two weeks but HD7 observed that it could be too stressing to meet this timeline and quality assessment of the learners may be compromised. For the KNEC examinations the waiting period is three to four months for the candidate to receive their results. As HD2 explained this period is too long since it wastes up to two terms especially for a candidate who had a referral in the past examination. Although all the interviewees were for a short waiting duration, for example one month, HD5 explained that this period is a matter of policy that only KNEC can change. The exception was HD7 who felt that for proper assessment of the candidates the period of three months was appropriate.

4.3.5 Findings: Daily Time Management

The daily routine is similar across all the departments. There are two sessions of six hours used for learning activities daily in five days. The day starts at seven in the morning. HD2 noted that this contributes to lateness since most students and teachers commute to the institute hence loss of contact time between the trainer and trainee. Each lesson takes one and half hours giving a total of four lessons for the morning session and the same number of lessons for the afternoon session per day. There is a short break of fifteen minutes as from ten in the morning and a lunch break of half an hour as from quarter past one in the afternoon. After which, the afternoon sessions begin which stretch up to quarter to eight in the evening. There is no allowance for transition or change-over time between lessons. This leads to loss of some minutes as HD6 noted. HD7 observed that a lot of time is lost during this period due to frequent movements from one classroom to another with even more time lost to get chairs from other class rooms and settle down in the new room for another lesson. HD2 and HD3 emphasized on time lost during practical lessons for setting up the tools and materials at the start of the lesson and clearing of the same at the end of the lesson as significant. The time lost increases further when one technician is responsible for issuing and receiving of inventory to a large class.

4.3.6 Findings: Improving Academic Performance

Improved academic performance is achieved through different means. In D1 class attendance by both the trainees and trainer are key to good results. Continuous assessment tests are administered with strict professionalism. Besides, good relationship between learners and staff results to high morale. In D2 control sheets are used to monitor the attendance of learners and teachers during their allocated times. D3 and D4 use

comparison of previous results to act as a base from which to improve some more. D5, D6 and D7 use capacity building for lecturers through professional development short courses and seminars to improve their delivery during teaching. Generally, all heads of departments concurred that good academic performance was depended on syllabus coverage and constant revision to uplift the low performing students.

4.3.7 Findings: Communication amongst Members of Department

Communication amongst the members of staff and students is done through writing of notices and displaying them on notice boards for all the departments. The interviewees also concurred on holding at least one meeting every term. This meeting involves the teaching staff and the students and it is a must for the first year students to be oriented and candidates to be briefed on examination regulations. HD2 also holds meeting whenever there is an urgent issue to be dealt with. HD3 and HD6 arrange for briefing for the students going for attachment to explain what is required of them on their general conduct and discipline in industry. All departments organize for group counseling occasionally but individual counseling is given to an identified learner as the case may arise. All HODs hold departmental staff meetings at least twice in a term – at the beginning and at the end of the term. However, individual staff members can meet with the head of department as may be required. As HD2 put it; “in case of a disciplinary issue, I serve the respective member with an internal memo warning that member of dire consequences if the same irregularity is observed again”.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary and conclusions of the study based on the findings discussed in the previous chapter. The next part will provide recommendations to policy makers which will be followed by a disclosure of the limitations of the study. Lastly suggestions for further research work will be given.

5.2 Summary of Findings

The aim of this research was to determine the extent to which lean concept is applied at Mombasa Technical Training Institute's TIVET education programs. To ascertain this, a systematic inquiry was set out by first collecting data pertaining to various thematic areas that led to the following findings. The first one is that the number of students and tutors differ from one department to another which goes against the optimum average number of students per class and the average recommended teaching load per tutor.

Secondly, it was also shown that only one department recorded 100 per cent pass hence the rest had transition rates less than 100 per cent. Those students with refers had to re-sit for the papers failed or they dropped out of school altogether. These results were received after at least three months from KNEC and after at least one month for the internal examinations.

The third finding was the amount of time lost across all departments due to transition between lessons and set up time for practical lessons in addition to movements from one venue to another. Last but not least academic performance was enhanced by increasing

contact hours between trainees and tutors leading to syllabus coverage. In addition to that, there was good communication between all members of MTTI which provided clarity of what is expected of each individual. These will be discussed to establish the extent of application of lean concept at Mombasa Technical Training Institute based on the available factual data as presented in the next section.

5.3 Conclusions of the Study

The findings from the data collected are discussed in this section in relation to the aim of the study which is to determine the extent to which lean concept is applied at MTTI's education programs. This part elaborates the link between the theoretical foundations anchoring this study, the literature review and the data obtained from the field thereby drawing conclusions.

It has been shown that the students are at the centre of most activities done at MTTI. This is in line with the Value Chain theory featured in the theoretical review. Indeed value is increased, 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, Holweg & Rich, 2004). All the respondents showed keen interest in pursuing strategies that would lead to reduced waiting times especially the period between sitting for examinations and receiving results. The concern of MTTI's departments is to constantly improve the performance in examinations which is an effort towards increasing outputs hence educational efficiency. One of the respondents explained that changing the examination time lines is a KNEC policy matter that they are pursuing with other TTIs. This reflects on the Productivity Frontier Model's Econometric approaches that have a strong policy orientation,

especially in terms of assessing alternative industrial organisations and in evaluating the efficiency of government and other public agencies (Cullinane et al, 2001). The findings also indicated that the number of tutors available in specific specialities led to wastage due to over loading. This according to TOC is a constraint that restricts the entire system from increased output (Polito, Kevin & Vokurka, 2006) and it provides the opportunity for continuous improvement (Table I) a key objective of the lean concept.

The data in Table 4.1 indicate that there is a wide disparity in numbers of students in each department. A further examination of these numbers reveals that the disparity is even wider in different stages of study within a department. The review of government documents in chapter two gave a ratio of students to teacher in a class as thirty to one (GOK, 2005). It was found that there was a class with sixty students which is double the required number. On the other hand there was a class with no students which meant the teachers were waiting for another intake. Clearly, this constitutes one of the four wastes identified by educational managers which implies either too little time accorded to individual learners or too much time both of which lead to wastage. Managers who embrace lean concept would see this disparity as a delay in the subsequent operation from the preceding operation when needed in the quantity needed ó just in time (Table II). This will lead to lost time due to waiting contrary to lean concept principles and practices. A large number of students in a class would mean individual attention to learners could not be possible leading to behavioral waste (Table I). This inadequate time to attend to learners specific need violates the quality function deployment tool (Table II) and the respect for people principle (Table I).

The average teaching load per tutor per week was twenty two against the minimum sixteen set by the Ministry of Education Science and Technology (GOK, 2005). Furthermore at MTTI, there are departments with tutors having as high as twenty eight and forty four hours per week (Table 4.1). This is in addition to several other administrative duties that trainers undertake in the running of the institution. An overloaded tutor is unlikely to do thorough preparation for effective lesson delivery, could be overwhelmed in assessing and examining learners hence make faulty judgments in grading the trainees. Lean concept managers would see this as defects (Table I) in the learning process which may lead to repetition of the content that may have been inappropriately delivered. Learners are likely to be demoralized by inaccurate assessments and grading hence the need for lean behaviours (Table II) as a tool of lean concept. Educational managers agree that teaching load leads to wastage both ways whether under loading or over loading as cited early in educational wastes (Onsomu et al., 2006).

The general performance of the students in the KNEC examinations is one of the parameters used to measure educational output (Adams, 1993). The performance obtained from MTTI's latest performance in national examinations is as shown in table 4.2. The results indicated that only D7 recorded 100 per cent pass at two diploma stages. All other departments recorded less than 100 per cent. This imply low transition rates which the government cited in chapter one as one of the challenges that needed to be overcome. Educational managers see low transition rates and below standard achievement as contributors to low educational outputs (Abagi & Odipo, 1997) hence wastage. On the other hand, lean concept managers would identify this as going against

respect for people and over processing for the case of those students who repeat in a failed module unit(s) (Table I). In the same vein some trainers' attitude towards their students was portrayed as negative which lean concept thinkers view as disrespect for people. The low entry behavior for some courses that contributed to poor performance and low transition rates is akin to defective raw materials in the lean concept. The poor performance would lead to a borrowing from lean concept's continuous improvement in every department. As a matter of fact, good performance depended not only on the quality and experience of the lecturers but also the good relationship between them and the student which indicates respect for people. Constant revision with the student helps the trainee to incorporate the student's voice on what they deem valuable hence application of quality function deployment in (Table II).

The waiting period between the time students sit for their internal examinations and the time they receive their results was one month in MTTI. However this period increases considerably to three to four months for the KNEC examinations. Feedback should be timely and accurate for relevance in the learning process. Although various reasons were given by the respondents during the interview, this turn of events was a replica of the 'batch and queue' system in manufacturing operations (Emiliani, 2004). Lean concept managers view having one opportunity in a term as queuing and then giving large batches of information as a cause of wasteful variation and would advocate for immediate feedback to minimize waiting (Table I) period which is a form of waste too. Furthermore, during this period the student does not derive any value since in case of a fail another two terms will be required to register and sit for the refer(s). Lean behaviours (Table II)

would be involved to eliminate the behavioral waste that could have thus emanated from poor performance and long periods of waiting which is one of the eight wastes.

The daily activities at the institute follow almost the same routine controlled by a time table showing the sequence of lessons per day. The interviewees' observation that most learners commute to the institute daily led to lateness especially in the first session. Besides that, there is a lot of time lost during change over time from one lesson to another. Even more time is lost for set up of practical lessons and clearing the work stations for the next lesson including time spent to issue out materials to trainees. All these activities culminate to a significant reduction of contact hours between the trainee and trainer (Millot & Lane, 2002) ó a key category of waste which could lead to below standard performance. Another waste at MTTI's education programmes emanates from constant movement of both trainees and trainers from one class room to another. Managers who practice lean concept see excessive movement of people and transportation of materials (Table I) as waste which should be eliminated. Transportation of materials for practical lessons from the store to the work stations of trainees indeed consumes quite some time before the students settle for their practical activities. Furthermore the inventories of these materials were singled out as a challenge to technicians in receiving and issuing them.

The data collected indicated that there exists communication between various groups in each department. The confirmation that there is a mandatory orientation meeting for first time reporting students is in line with lean concept principle of respect for people (Table I). Again the students are briefed on what is expected of them when going to the field for industrial attachment. Whenever an individual trainer or trainee has a problem then

specific attention is given promptly. However, the frequency with which the meetings are held resonates with the batch and queue system where information is passed in loads which could lead to variation in interpretation in the course of processing which is a form of waste. The use of warning letters to the members of the department as a restraining measure to some undesired behavior could lead to the behavioral waste (Table II) and it does not underpin the basic lean concept principle of respect for people.

The research findings established that there were various wastes in MTTI's educational programs as envisaged by educational managers. The discussion on the data showed several instances where some lean concept principles and practices and processes were applied and yet several other instances where they were not. As it had been underscored by Comm and Maithaisel (2005b), institutions in the service sector embrace many concepts of lean thinking without actually calling it lean ó consistent with the findings at the institution under study. This revelation led to a conclusion that to a considerable extent, some lean concept principles and objectives, processes or tools are applied at MTTI's education programs.

5.4 Recommendations

The findings from this study showed that quite an amount of time is lost by the trainees as they wait for the results of the previous examination. These results are a pre-requisite to starting the preceding module. Lean concept would recommend for a review of the periods to minimize waiting which is characteristic of batch and queue system in manufacturing operations. This can be done without compromising the quality of the process by say leveraging on information and communication technology.

Another prominent finding was on the small number of tutors employed to teach in some departments which led to associated over-utilization of the affected tutor. This leads to stressed employees and the associated behavioral waste in lean concept principles. A recommendation would be thus for the managers to ensure enough personnel is deployed in offering any service to the satisfaction of the customers.

Last were the findings that showed consistent low transition rates from one level of study to another. This was attributed to the long syllabus content that had to be covered within a year. It would therefore be recommended that the curriculum be reviewed to adequately provide the relevant knowledge and skills without compromising quality as lean concept managers would say "less is more".

5.5 Limitations of the Study

There are two limitations to this study. The first one relate to the findings on the extent of the application lean concept within various departments at MTTI. Different departments were found to apply lean concept principles and tools to different levels. This made it difficult to draw general conclusion about its application at the institute. For that purpose, the conclusion should be treated sparingly since it did not represent per se what happens in individual departments.

The second limitation is on the design of the study. This study was based on case study done at MTTI. There are various parameters that differ from one institution to another in a country. Although the TIVET education programs are similar, caution is advised when using these results for generalizing to other TTIs and studies as indeed is the case with all case studies.

5.6 Suggestions for Further Research

This research focused on only one context involving a TTI's education programs. There is need for future research to determine the extent of application of lean concept in other education sectors including but not limited to basic education, secondary education and other levels of tertiary education. Furthermore this research only focused on MTTI. Future research may be based on a comparative study in other TTIs that could be having different unique challenges and strengths.

This study relied on information from seven heads of department. In the course of the study, one respondent lightly declined to comment to one of the questions saying policy matters are handled by the relevant ministry. A future study can be designed to include all stakeholders in the education sector including policy makers, senior managers, HODs, tutors and trainees to give an all inclusive view of data, its analysis and conclusions.

REFERENCES

- Allyway, M. and Corbett, S. (2002). Shifting to lean service: Stealing a page from manufacturers' playbooks. *Journal of organizational excellence* 21 (2), 45 ó 54.
- Amadio, M. (1997). Primary Education: Length of Studies and Instructional time. *Educational Innovation and Information* 92, 2 ó 7.
- Arlbjørn, J.S., Freytag, P.V. and Haas, H.D. (2011). Service supply chain management: A survey of lean application in the municipal sector. *International Journal of Physical Distribution and Logistics Management* 41 (3), 277 ó 295.
- Bauer P. (1990). Recent developments in the econometric estimation of frontiers. *Journal of Econometrics* 46, 39 ó 56.
- Millot, B. and Lane, J. (2002). The Efficient Use of Time in Education. *Education Economics* 10 (2), 209 ó 228. Retrieved (26/07/2014 at 1220hrs)
- Bowen, D.E. and Youngdahl, W.E. (1998). ðLeanö service: in defense of a production- line approach. *International Journal of Service Industry Management* 9(3), 207 ó 225.
- Burgess, N. and Radnor, Z. (2013). Evaluating Lean in healthcare. *International Journal of Health Care Quality Assurance* 26 (3), 220-235.
- Comm, C.L. and Mathaisel, D.F.X. (2005a). A case study in applying lean sustainability concepts to universities. *International Journal of Sustainability in Higher Education* 6 (2), 134 ó 146.
- Comm, C.L. and Mathaisel, D.F.X. (2005b). An exploratory study of best lean sustainability practices in higher education. *Quality Assurance in education* 13 (3), 227 ó 240.
- Clulow, V., Barry, C. and Gerstman, J. (2007). The resource- based view and Value: the customer óbased view of the firm. *Journal of European Industrial Training* 31 (1), 19 ó 35.

- Mehri, D. (2006). The Darker Side of Lean: An Insider's Perspective on the Realities of the Toyota Production System. *Academy of Management Perspectives* 20(2), 21 ó 42.
- Daymon, C. and Holloway, I. (2002). *Qualitative research methods in public relations and marketing communications*. New York: Routledge.
- Julien, D.M. and Tjahjono, B. (2009). Lean thinking implementation at a safari park. *Business Process Management Journal* 15 (3), 321 ó 335
- Devlin, A. S. (2006). *Research methods: Planning, conducting and presenting research*. Belmont, CA: Thomson Wadsworth.
- Adams, D. (1993). Defining Educational Quality. *Institute for International Research. IEQ Publication: Biennial Report* 1993.
- Emiliani, M.L. (2004). Improving business school courses by applying lean principles and practices. *Quality Assurance in Education* 12 (4), 175 ó 187.
- Patton, E. and Appelbaum, S. H. (2003). The case for case studies in management research. *Management Research News* 26 (50), 60 ó 71.
- Farrell, M. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society* 120 (3), 253ó290.
- George, M.L. (2003). *Lean Six Sigma for Service* 2003: McGraw-Hill. p. 381.
- Ghauri, P., and Gronhaug, K. (2010). *Research methods in business studies* (4 ed.). London, UK: Prentice Hall.
- Goldratt, E.M. (1988), "Computerized shop floor scheduling", *International Journal of Production Research* 26 (3), 443 ó 55.
- Government of Kenya (2005). *Draft Report on Staffing Norms in Kenya*, Ministry of Education Science and Technology, Nairobi.

- Government of Kenya (2008). *Technical, Industrial, Vocational and Entrepreneurship Training. Diploma in Electrical and Electronic Engineering Syllabus and Regulations*. K.I.E. June 2008. Ministry of Education Science and Technology, Nairobi.
- Government of Kenya (2009). *Technical, Industrial, Vocational and Entrepreneurship Training. Craft Certificate in Electrical and Electronic Technology Syllabus and Regulations*. K.I.E Feb. 2009. Ministry of Education Science and Technology, Nairobi.
- Government of Kenya (2012a). *A policy Framework for Education and Training – Reforming Education and Training in Kenya*. Ministry of Education Science and Technology. Nairobi.
- Government of Kenya (2012b). *Kenya Vision 2030 – A Globally Competitive and Prosperous Kenya*. Ministry of State for Planning, National Development and Vision 2030. Nairobi.
- Greene, W. (1993). The econometric approach to efficiency analysis. *The Measurement of Productive Efficiency: Techniques and Applications*. Oxford University Press, New York, pp. 68-119.
- Hanfield, R.B. (1994). Effects of concurrent engineering on make-to-order products, *IEEE Transactions on Engineering Management* 41 (4), 384 - 393.
- Hasle, P., Bojesen, A., Jensen, P. L., and Bramming, P. (2012). Lean and the working environment: a review of literature. *International Journal of Operations Management* 32 (7), 839 - 849.
- Hesse-Biber, S. and Leavy, P. (2011). *The practice of qualitative research* (2nd ed.). Thousand Oaks California: Sage Publications.
- Hopp, W. J. and Spearman, M. L. (2004). To pull or not to pull: What is the question? *Manufacturing and Service Operations Management* 6 (2), 133 - 148.

<http://kenyacoastpoly.ac.ke> (Retrieved 21/05/2014 at 1121hrs)

Liker, J.K. and Morgan, M.J. (2006). The Toyota Way in Services: The Case of Lean Product Development. *Academy of Management Perspectives* 20 (2), 5 ó 20.

Kanakana, M.G. (2013, July 9th ó 11th). Lean in service industry. Paper presented at SAIE25 Proceedings, 2013. Pp 574-1 - 574-10. Kanakana@tut.ac.za (Retrieved 24/01/2014 at 1033hrs).

Lewin, K.M. (2007). Improving Access, Equity and Transitions in Education: Creating a Research Agenda. *Research Monograph* 1, 1 ó 46. <http://www.create-rpc.org>. Retrieved (26/07/2014 at 1220hrs)

Kenya National Bureau of Statistics (2012). *Facts and Figures 2012*. Retrieved 03/06/2014 at 1354hrs, from website: www.knbs.or.ke

Kenya National Bureau of Statistics (2013). *Economic Survey 2013*. Retrieved 04/07/2014 at 1446hrs, from website: www.knbs.or.ke

Kenya National Bureau of Statistics (2014). *Economic Survey 2014*. Retrieved 04/07/2014 at 1347hrs, from website: www.knbs.or.ke

Cullinane, K., Song, D.W. and Gray, R. (2001). A stochastic frontier model of the efficiency of major container terminals: assessing the influence of administrative and ownership structures. *Transportation Research Part A* 36 743 ó 762.

Liker, J. (2004). *The Toyota Way*. 2004, New York, NY: McGraw-Hill.

Lockheed, M., A. Verspoor and Associates (1991). *Improving Primary Education in Developing Countries*, Oxford University Press, Oxford, UK.

Lovell, C. (1995). Econometric efficiency analysis: a policy-oriented review. *European Journal of Operational Research* 80 (3), 452 ó 462.

- Gupta, M. C. and Boyd, L.H. (2008). Theory of constraints: a theory for operations management. *International Journal of Operations and Production Management* 28 (10), 991 ó 1012.
- Maleyeff, J. (2006). Exploration of internal service systems using lean principles. *Management Decision* 44 (5), 674 ó 689.
- Meeusen, W. and van den Broeck, J. (1977). Efficiency estimation from CobbóDouglas production functions with composed error. *International Economic Review* 18 (2), 435 ó 444.
- Millot, B. (1994). Macroeconomics of Educational Time and Learning, *International Encyclopedia of Education* 6(2), 3545 ó 3550.
- Myers, M. D. (2009). *Qualitative research in business and management*. London: Sage.
- Piercy, N. and Rich, N. (2009). Lean transformation in the pure service environment: the case of the call centre. *International Journal of Operations Management* 29 (1), 54 ó 76.
- Abagi, O. and Odipo, G. (1997). Efficiency of primary education in Kenya: Situational analysis and Implications for Educational Reform. *Institute of Policy Analysis and Research*, Discussion Paper No.004/97
- Onsomu, E.N., Kosimbei, G. and Ngware, M.W. (2006), *Impact of Gender and Socio-Economic Factors on Learning Achievement in Primary Education in Kenya: Empirical Evidence*, KIPPRA DP/56, Kenya Institute for Public Policy Research and Analysis, Nairobi.
- Oum, T.H. and Waters, W. (1996). A survey of recent development in transportation cost function research. *Logistics and Transportation Review* 32 (4), 423ó463.
- Hines, P., Holweg, M. and Rich, N. (2004). Learning to evolve. A review of contemporary lean thinking. *International Journal of Operations and Production Management* 24(10), 994 ó 1011.

- Porter, ME. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press: New York.
- Polito, T., Watson, K. and Vokurka, R.J. (2006). Using the theory of constraints to improve competitiveness: An Airline case study. *Journal of operations management* 16 (1), 44 ó 50.
- Yin, R. K. (1981). The case study crisis: Some answers. *Administrative Science Quarterly* 26 (1), 58 ó 65.
- Shah, R. and Ward, P.T. (2007). "Defining and developing measures of lean production". *Journal of Operations Management* 25 (4), 785 ó 805.
- Rahman, S. (1998). Theory of Constraints: A review of the philosophy and its applications. *International Journal of Operations and Production Management* 18 (4), 336 ó 355.
- Womack, J.P. and Jones, D.T. (1996), *Lean Thinking: Banish Waste and Create Wealth in your Corporation*, The Free Press, New York, NY.
- Womack, J.P., Roos, D. and Jones, D.T. (1990). *The Machine That Changed the World: The Massachusetts Institute of Technology 5-Million-Dollar, 5-Year Report on the Future of the Automobile Industry*, Rawson Associates, New York, NY.

APPENDICES

Appendix I: Interview Guide

I am a post graduate student pursuing a Master of Business Administration course in the University of Nairobi. The course requirements include conducting a research and compiling a research project report. This interview guide will assist in data collection to compile the report. You are kindly requested to spare a few moments and answer the questions. Your answers will be confidential and the information provided will be solely for academic purposes. The project is titled: **The Application of Lean Concept at Mombasa Technical Training Institute.**

SECTION A: GENERAL INFORMATION

Please fill in the blank spaces as appropriate.

Name of your department (*optional*) _____

Number of teachers in the department _____

Number of students taking Craft Certificate Course _____

Number of students taking Diploma Course _____

Total number of students in the department _____

SECTION B

Please answer all the questions in this section.

Q1. What percentages of students pass in the KNEC examinations at the end of each module?

Craft certificate course Module I _____

Craft certificate course Module II _____

Diploma course Module I _____

Diploma course Module II _____

Diploma course Module III _____

(Probe: Why the numbers you have indicated above; What happens to those who fail module unit(s)? Request for results of the past year)

Q2. For how long do students wait to get results after doing their internal and KNEC examinations?

(Probe: Why the period stated? Can it be shortened? How?)

Q3. Briefly explain the daily routine of a normal learning day?

(Probe: length of lesson; lessons per day; breaks in a day; transition or change-over time between lessons).

Q4. What is the average teaching load of tutors in your department?

(Probe: Other duties for the tutors?)

Q5. How do you ensure improved academic performance in your department?

(Probe: How is allocated time used?)

Q6. How is communication effected in your department?

(Probe: How many times in a term/year? Do you meet as individuals or groups?)

This is the end of the interview. I sincerely appreciate your cooperation in answering questions. Thanks.

Appendix II: Table I. Key lean principles and objectives

| Key lean Principles and Objectives | Explanation |
|---------------------------------------|---|
| 1. Continuous improvement | Day-to-day activities performed to improve business processes in response to changing market conditions. Called <i>ōkaizenō</i> in Japanese, which literary means <i>ōchange for betterō</i> , and is often interpreted as <i>ōcontinuous improvementō</i> . Utilizes specific processes to achieve improvements. |
| 2. Respect for people | People (i.e. stakeholders such as associates, customers, suppliers, investors, and the community) are valuable resources to which a business owes its existence. Disrespecting people creates waste. |
| 3. Eliminate waste | Eliminate activities and behaviours that add cost but do not add value as perceived by end-use customers. The original seven wastes; overproduction, waiting, transportation, processing, inventories, movement, and defects. The eighth waste is behavior. Waste is called <i>ōmudaō</i> in Japanese. Important related concepts are the elimination of unevenness (<i>ōmuraō</i> in Japanese), and unreasonableness (<i>ōmuriō</i>). |
| 4. Create value for end-use customers | Focus on the value-creating activities that end-use customers desire. |

Appendix III: Table II. Lean processes or tools

| Lean process or tool | Explanation |
|--|--|
| 1. Five Ss | Stands for: Sort, Sweep, Straighten, Shine, Sustain. Important for establishing an organized workplace. |
| 2. Just-in-time | Subsequent operation acquires parts (information) from the preceding operation when needed in the quantity needed. |
| 3. Kaizen | Literally means "change for better", also interpreted as "continuous improvement". Process used to identify and eliminate waste. |
| 4. Lean behaviours | Applying lean principles and tools to improve leadership behaviors and eliminate behavioral waste |
| 5. Load smoothing | Called "heijunka" in Japanese. Used to smooth fluctuations in customer demand. |
| 6. 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. |
| 7. Policy deployment | Called "hoshin kanri" in Japanese. A process used to connect corporate strategy to key objectives and resources, including daily activities across functions. |
| 8. Quality function deployment ("voice of the customer") | A process used to incorporate the wants and desires of intermediate and end-user customers in design of goods and services. |
| 9. 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. |
| 10. Standard work chart | A one-page diagram showing the sequence in which work is performed. |
| 11. Takt time | The rate of customer demand. Used to establish a direct |

| | |
|----------------------------------|---|
| | link between workplace demand and workplace activities. |
| 12. Total productive maintenance | A program used to ensure that equipment is in good operating condition and available for use when needed. |
| 13. Value stream maps | A one-page visual representation of material and information flows. Used to identify improvement opportunities and eliminate waste. |
| 14. Visual controls | Signs and other forms of visual information used to simplify the workplace and make it easy to recognize abnormalities. |

Appendix IV: Table III. Data Collection Schedule

| SN | Date | Activity |
|----|--|--|
| 1. | Fri. 5 th ó Tue. 9 th September, 2014 | Visiting various departments for appointments with the HODs for interviews. |
| 2. | Wed. 10 TH September, 2014 | - Interview with HOD Information and Communication Technology at 11.45am. |
| 3. | Thur. 11 TH September, 2014 | - Interview with HOD Business at 4.00pm. |
| 4. | Fri. 12 th September, 2014 | - Interview with HOD Applied Science at 10.00am. - Interview with HOD Mechanical Engineering at 2.00pm. |
| 5. | Mon. 15 th September, 2014 | - Interview with HOD Electrical and Electronics Engineering at 2.00pm. |
| 6. | Tue. 16 th September, 2014 | - Interview with HOD Secretarial and Languages at 1.45pm |
| 7. | Wed. 17 th September, 2014 | - Interview with HOD Hospitality and Tourism Management at 11.30am. |
| 8. | Thu.18 th ó Fri. 26 th September, 2014 | - Drafting a fair copy of the collected data. |
| 9. | Mon. 29 th Sept. ó Wed. 15 th Oct. 2014 | - Writing of the research project draft report. |

Appendix V: Introduction Letter for Data Collection