



School of Commerce

**THE EFFECT OF LEAN MANUFACTURING PRACTICE ON OPERATIONAL
PERFORMANCE OF ETHIOPIAN ARMY FOUNDATION ADAMA GARMENT
INDUSTRY**

BY:

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**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
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Statement of Declaration

I, Mesfin Tedela Demeke, declare that the thesis entitled “The Effect of Lean manufacturing practice on operational performance of Ethiopian army foundation Adama garment industry” is my original work. I have carried out the present study independently with the guidance and support of my research advisor Fesseha Afework (Asst. Prof.). Moreover, this study has not been presented for any other program or university and that all sources of materials used have been acknowledged accordingly.

Declared by: Mesfin Tedela Demeke

Signature _____ Date _____

This is to certify that Mesfin Tedela Demeke has carried out his research work on the topic “The Effect of Lean manufacturing practice on operational performance of Ethiopian army foundation Adama garment industry”. The work is original and is suitable for submission for the award of Master of Arts in Logistics and Supply Chain Management

Advisor: Fesseha Afework (Asst. Prof.)

Signature _____ Date _____



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The Researcher

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LISTS OF ACRONYMS AND ABBREVIATIONS

GDP	Gross Domestic Product
HRM	Human Resource Management
JIT	Just -In -Time
LM	Lean Manufacturing
MOTI	Ministry of Trade and Industry
MRP	Material Requirement Planning
TPM	Total Production Maintenance
TPS	Toyota Production System
TQM	Total Quality Management
USD	United States dollar
WIP	Work in Process
UNIDO	United Nations Industrial Development Organization

Abstract

Lean manufacturing concept is to create more value for customer by eliminating non-value adding activities. Manufacturing firms operating in the presents' rapidly changing and highly competitive market have been pressured to improve all aspects of operational performance; quality and customer response time and reduce cost of manufacturing. This research sought to examine the effect of lean manufacturing practices on the operational performance of Ethiopian army Adama garment industry. The study guided by three objective; To determine the extent to which Ethiopian army Adama garment industry have adopted lean manufacturing practices, To establish the effect of lean manufacturing practice on operational performance of Ethiopian army Adama garment industry and finally the challenge faced by the industry when implementing lean manufacturing. The study adapted a descriptive research design with the use of cross-sectional data. The target population was 297 Ethiopian army Adama garment industry employees from different departments, from this 121 respondents were used as sample. A questionnaire was used to collect primary data. Out of the 121 research instruments distributed, 107 questionnaires were collected and analyzed representing 88.4% response rate which was considered adequate. Data analysis was done with the use of SPSS which produced descriptive statistics and regression models used to present the results in tables and figures. The finding indicated that Ethiopian army Adama garment industry not well practiced lean manufacturing. It was also clear that Ethiopian army Adama garment industry had not seen an improvement in their operational performance. The effect of lean manufacturing on operational performance of Ethiopian army Adama garment industry was tasted against two operational performance metrics; product quality and on time delivery. The outcome showed that lean manufacturing practices; Just in Time, Total quality management, Total productive maintenance, and Human resource management are positively related to operational performance. Moreover, lean manufacturing practices have been employed to a small extent and have negatively affected operational performances to a large degree. The study also established that the most challenge in adopting lean manufacturing was lack of proper training/inadequate human resource development and the least was lack of resources. The study recommended that the Ethiopian army Adama garment industry should concentrate on all aspects of lean manufacturing practice to bring superior operational performance. Implementation process of these strategies should be given top priority during formulation of organization policies.

Keywords: *Lean Manufacturing, Lean Practices, Operational Performanc*

CHAPTER ONE

INTRODUCTION

In this chapter, topics used as a road map for the remaining parts of the research like; the background of the study, background of the organization, statement of the problem, research questions, objectives of the study, significance of the study, limitations of study, scope of the study, and organization of the study are discussed.

1.1 Background of the study

Today's fiercely competition in the market, has made organizations realize that the concept of traditional mass production has to be integrated with new ideas .New ideas which will propel any organization to face global competition. The focus of many organizations as pointed out by Mazanai, M. (2012), has been on cost reduction, increase in operational efficiency, improving levels of quality, maximizing profits and satisfying customer needs. Performance of any manufacturing company is greatly affected by the type of manufacturing practices adopted.

Lean manufacturing, often coined as Toyota production system (TPS) in academic literature, started in Toyota Motor Manufacturing Company after the Second World War when most Japanese organizations including Toyota were confronted with the challenge of managing production facilities with limited resources (Liker, 1998, Pavnaskar et al. 2003). This challenge motivated Toyota managers to develop various elements of TPS aimed at reducing waste. Thus, Lean manufacturing is a manufacturing philosophy that shortens the time between the customer order and the product build/shipment by eliminating sources of waste. Another way of looking at lean is that it aims to achieve the same output with less input- less time, less space, less human effort, less machinery, less material, less costs (Nahmias, 2001). Today, it has helped Toyota achieve the distinction of being the best car manufacturing company in the world (Stewart and Raman, 2007). Application of lean is not limited to the automotive sector only, but, it has also found acceptance in a wide range of manufacturing industries.

Lean Manufacturing (LM) is a methodology that involves the simultaneous use of many techniques and tools. Shah and Ward (2003) have developed the measurement scale of LM, identifying four bundles of practices: Just-In-Time (JIT), Total Quality Management (TQM), Human Resource

Management (HRM) and Total Productive Maintenance (TPM). Common lean tools according to Feld, (2000) and Nahmias, (2001) are: 5S focusing on effective work organization and standardized work procedures. Total quality management (TQM), a continuous improvement practice, which involves employees and problem solving teams. Total preventive maintenance (TPM), where regular maintenance is carried out by employees, on their equipment and machines of use to detect any anomalies. Just-in-time (JIT), this is a system where demand is initiated by the customers, then the demand taken backwards to raw material. JIT system employs quality function deployment in product manufacturing.

Operational performance is the efficiency and effectiveness an organization transforms its input into output. Schemer and Morgan (1998), Clinton and Chen (1998), established that to be able to compete globally organizations must be able to re-orient their manufacturing processes and be able to measure their performance. Benchmarking practices aimed at adopting manufacturing excellence cannot generate better results if organizations lack the capacity to understand and measure their performance.

According to Voss (1997), operational performance is an organization's process parameter that is measurable. Operational performance is measured as a compound of performance too is influenced. The bundles of LM practices have different effects on performance. Cue (2001), tested the awareness of performance while Shah and Ward (2003) tested the awareness of "improvement" in performance. The impact of lean manufacturing on organizational performance of manufacturing organizations is a measure of effectiveness. Various dimensions of performance (cost, quality, flexibility and delivery). Companies that focus on performance results in adopting LM as a measure of performance improvement strategy. Shah and Ward (2003) established that, by the implementation of lean manufacturing practices, namely: TPM, TQM, JIT, and HRM operational performance too is influenced.

Ethiopian economy is dominated by agriculture that accounts to 46.5 percent of its total GDP. Government of Ethiopia has developed an agricultural led industrialization strategy with the view to bring about sustainable growth (UNIDO, 2007). Currently, in Ethiopia there are 50 medium and large sized textile and garment industry. With exports of about 12 million USD, that is only making about 1% of Ethiopia's total export volume, and comparably small amounts of foreign direct

investment, Ethiopia is not really present yet on the global map of textiles, Ministry of trade and industry (MOTI & ECBP, 2008).

1.2 Background of the Organization

The industrialization of Ethiopian garment manufacturing started in the 1950's. In 1958, an Italian took the lead to establish Addis Garment Factory. In the 1990's, with the development of free market economy, private investment had increased in garment sub-sector and in the meantime more than 30 garment factories have been established.

Adama Garment Industry was established in 1980 E.C in order to enhance the readiness for combat of the Army by producing canvas and Military clothes. It is located at about 105km away from Addis Ababa and 5km on the way Adama to Wonji town. It occupies a total area of 113,500 square meters and currently it has 4 factories, they are Heavy duty factory; namely, Garment factory; Cabin and Décor factory; and Parachute and Drag Shute factory. Adama Garment Industry in vision to see the industry as a leading mode/garment industry and to be competitive on east African market; by creating national industry technology network, be competent on the given filed and sell products in reasonable price and quality to the domestic and east Africa market; obtain hard currency by selling different garment products to the market and creating international and national partnership with different organization and facilitate technology transfer to the country. (Company brusher published in 2018).

The core business of Adama garment industry is manufacturing and selling military and other garment products in a just-in-time base. The industry produce major products such as military uniforms, work place uniforms, different canvas and tent, Insignia, different badges, sleeping bags, suspender, waist belt, and parachute and drug shut. Raw materials are supplied from China, Turkey, India and Local textile factory such as Almeda. The industry have different customers from public and governmental organization such as Ethiopian National Defense, Ethiopian Federal police, Oromiya regional police, Addis Ababa Police, Ethiopian Metal and Engineering Corporation, Ethio-telecom, Commercial Nominees, Sugar factories and Ethiopian Electric and power corporation. (Source: the company's brusher published in 2018).

The benefit of lean manufacturing seems to be outstanding in terms of gains in profit, quality production and global competition, yet problems can arise even after a lean system has long been operational. This study will examine the effect and challenges in implementing lean manufacturing

practice in operational processes particularly Ethiopian Army Foundation Adama Garment Industry. In order to investigate lean manufacturing effect four set of lean manufacturing practices will be used. Namely JIT, TQM, TPM, and HRM.

1.3 Statements of the problem

The success of textile and garment companies in their competition for the global market rests in large part on their focus on more effective and efficient manufacturing processes. The necessity to reduce the cost of production has also caused manufacturers to focus on waste minimization. Textile and garment industries are among the most labor intensive industries known, and in developed countries labor has become expensive. Because of this, these industries are expanding in Africa as a way to involve its idle human power and to give Africa a chance to participate in the global market. Many are now beginning to increase in Ethiopia, producing products for local and foreign customers. However, these industries are not as profitable as they were expected to be and their customers are becoming dissatisfied.

Ethiopian textile and garment industry has been exercising a traditional old production system for more than half of a century. These firms are not able to use their resources effectively. For instance looking labor productivity in garment sub-sector, one operator produces 5 polo-shirts per shift but the international benchmark is 20 to 24 polo-shirts per operator per shift. The major causes for low productivity on those firms are: low skill of the operators, old machineries and equipment, poor quality of raw materials, poor facilities and infrastructure, more idle time, poor handling of materials, and others (Du Yuzhou, 2004).

According to Second National Workshop on *“Future Prospects and the Role of Textile and Garment Sectors in Achieving the Millennium Development Goals of Ethiopia”* (Addis Ababa Aug. 12, 2018), the general overview of existing situations of Ethiopian garment sub-sector, revealed the following weakness; Poor quality of labor force, limited variety, low quality of products, low market concept, unclear market role, absence of market networking, lack of skilled human resources, poor productivity, and poor infrastructure.

The industry partially started work with lean in 2017 through the use of four lean tools, such as TQM, JIT, TPM and HRM to minimize wastages and improve productivity, on time delivery, quality and satisfy customer expectation.

In the May 2018, Adama garment industry annual report pointed out that, military clothes are not fully supplied to Ethiopian armed force in accordance with their mission. In addition to this, the industry still faces several side common constraints such as, poor quality of product, poor delivery performance, lack of skilled and trained manpower and machines are not chronically associated and not fully automated. Due to this customers are dissatisfied with the poor quality of the product and the industry is not working in full capacity.

As per the report, these deficiencies have a great impact on the operational performance of the industry. This problem may arise from uneconomical use of resources and related to how successfully adopted various lean manufacturing practices. Shah and Ward (2003) established that by the implementation of lean manufacturing practices, namely: TPM, TQM, JIT, and HRM operational performance is too influenced.

Many researchers around the world studied and commented on possible benefits of implementing lean manufacturing (LM) concept and its effect on operational performance. Malonza (2014) while doing a case study of Mumias Sugar Company confirmed that lean manufacturing practices have a positive effect on operational performance. But, the adoption of lean principles and tools are still found to be difficult. Few number of studies have been conducted in this study area so far in the context of Ethiopian garment sector. However, no research has been conducted about the effect of these practices in the operational performance of military garment industry. This is the gap the study seeks to fill.

To fill the gap, this study has been look on how lean manufacturing practice is adopted in Adama Garment Industry, one of Ethiopian military industries. Moreover, it tries to study the effect of this practice on the operational performance of the industry and its challenges in implementing the lean manufacturing practices.

In summary, the emphasis of this paper has been to point out the effect of lean manufacturing practice (JIT, TQM, HRM and TPM) on the results of operational performance of Adama Garment industry and to suggest the best possible applicable practices in accordance with the nature of the industry. Therefore in this study, Ethiopian Army Foundation Adama Garment Industry has been assessed in light of the following three research questions:

1.4. Research Questions

1. What is the extent to which Lean manufacturing practices are implemented in Ethiopian army Adama Garment Industry?
2. What is the effect of lean manufacturing practices on operational performance of Ethiopian army Adama Garment Industry?
3. What are the challenges facing the implementation of lean manufacturing practices in Ethiopian army Adama Garment Industry?

1.5 Objective of the study

1.5.1 General Objective

The General objective of this study is to ascertain how lean manufacturing practice affect the operational performance of Ethiopian Army Adama Garment Industry.

1.5.2 Specific objectives

- i. To assess the extent to which Lean manufacturing practices have been adopted by Ethiopian Army Adama garment industry.
- ii. To determine the effects of Lean manufacturing practices on the operational performance of Ethiopian Army Adama garment industry.
- iii. To find out the challenges faced by Ethiopian Army Adama garment industry to implement lean manufacturing practices.

1.6 Significance of the study

The research findings will assist Ethiopian Army Adama garment industry know the extent to which lean practices are influencing operational performance of the industry and with this information the firm will be in a position to formulate better operational strategies.

The findings of the study will be used by future researchers and academicians in areas of lean manufacturing and operational performance of garment industry and add to the existing body of garment manufacturing knowledge.

1.7 Scope of the study

In Ethiopian Army all manufacturing industries have different manufacturing practices and this practices has its own effect positively and/or negatively on their operational performance. However, for the sake of effectiveness and efficiency, and to manage the limited project time and

budget, this study focused only on Ethiopia Army Adama Garment industry lean manufacturing practices specifically TQM, JIT, TPM, and HRM. Moreover, it tries to study the effect of this practice on the operational performance of the industry and its challenges in implementing the lean manufacturing practices. The study did not cover the other Ethiopian army manufacturing industries.

Ethiopia Army Adama Garment industry was selected as a study area because such research has not been done so far in this level. This lack of research, especially under the Ethiopian Army context, has been a major motivation to carry out this study. This paper can be regarded as the first attempt to explore the existing lean manufacturing practice and its effect on operational performance of Ethiopia Army Adama Garment industry.

1.8 Limitation of the study

Some limitation factors have been the quality of response, interest of respondents to respond on time, and clarity of management and their feelings during an interview.

This study assessed the effect of lean manufacturing practice on operational performance from the perspective of the manufacturing company which could be considered as a limitation. It would be more complete if the perspective of suppliers and customers were also incorporated.

1.9 Organization of the study

This study comprises of five chapters in general. The first chapter is an introduction of the study, background of the study, statement of research problems, research questions, objectives of the study, significance of the study, scope of the study, limitation of the study, definition of terms and organization of the study. The second chapter deals with related literature review that contained summarized theory and empirical evidences that were published for academic purposes. The third chapter deals with research design and methodology, the fourth chapter deals with data analysis, results and discussion of findings and interpretation of the results. The fifth and final chapter also deals with summary, conclusions and recommendations drawn from the research results.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter gives an overview of literature on historical background of lean, definition of lean and lean manufacturing practices and how these practices affect operational performance. This chapter also address the challenges faced in the manufacturing industry while implementing lean. It reviews inputs by other authors on lean practices and the impact they have on operational performance. It cover theoretical reviews, empirical studies, summary of the studies and conceptual framework.

2.2. Theoretical Literature Review

The source of a firm's competitive advantage lies in how it is viewed from the outside as opposed to the observable strategic factors. Westbrook (1995) observed that operation management academics must embrace creative tension between theory and practice. Lean practices are components of lean systems with underlying theories that enable organizations to influence its activities. The theories to be discussed include theory of constraints and knowledge based view.

2.2.1 Theory of Constraints (TOC)

The Theory of Constraints is an instinctive framework used in identifying the most important limiting factor that stands in the way of achieving a set objective and then systematically improving that constraint until it is no longer the limiting (Goldratt, 1992). Umble and Spoede (1991) argue that if any other factor other than the weakest link is strengthened, the strength of the whole chain is not increased. Improvements in the processes should focus on the weakest areas in the organization. The main constraints include the policies or the procedures put in place. Lack of clear goals to be followed often leads to conflicts among the different functions on the organization slowing improvement (Weston, Blackstone & Gardiner, 2007).

The TOC can be effective where a well laid out standardized process is established which can divulge and describe clearly problematic areas which are well known to members of the organization (Jaideep, 1996). Throughput, operating expense and inventory comprise the TOC set of measurements. This theory is based on the presumption that resources tend to be a limiting factor in many organizations thus should only be utilized towards well defined objectives. This will in turn enable the organization to improve its financial position and attract more customers

(Weston, 1991). This in effect means that only the limiting factors should be improved. TOC integrates the varied management processes as viewed in the whole organization context.

It highlights the different and interdependent nature of the processes of the organization as an interconnection of different departments, processes and functions where the materials are transformed into the final product. TOC enumerates the processes used in operations into a simple structure of throughput, inventory, and operating expenses (Fawcett & Pearson, 1991). TOC relates to lean thinking in that both emphasize on organizational performance with the aim of attaining high results and returns.

2.2.2 Knowledge Based View

This theory considers knowledge to be the most important resource of the organization (Thompson & Walsham, 2004). Firms apply knowledge for product delivery. This is entrenched in the organization through its policies, culture and employees. Knowledge is created and held by individuals, not organizations. Organizations thrive through sharing of knowledge with and among its employees (Kogut & Zander, 1996).

The knowledge is demonstrated in many forms and located on many levels in the organization. This can be leveraged and transferred to other members in the organization thus ensuring continuity and continuous improvement. The organizations' customers focus affects selection and skill development of products employees which in turn facilitates sharing of knowledge across individuals to influence superior quality and efficiency (Jayanth & Xu, 2016).

2.2.3 Historical background of Lean

Henry Ford first develops a manufacturing concept of continuous moving assembly line – the first approach for mass production. The Ford model of a worker performance in simpler and repetitive tasks has been replaced by job rotation and teamwork, which mainly improve employee morality but also yield substantial benefits in terms of higher quality and employee suggestions for improvements in the process.

This model changes the way managers view the production as the emphasis becomes the specialization of job tasks performed by unskilled workers. The spread of mass production- high product volumes, lower cost per unit, job standardization was supported by the scientific management school and its founder Frederick Taylor. The model's efficacy was not questioned by

the managers till Taiichi Ohno of the Toyota group in Japan noted some flaws in the model. Mass production required high levels of inventories for needed materials, large amount of capital and space, low quality of the products, over standardization of the products and in that way the organizations become highly inflexible to customer demand and resistant to any changes. Lean production was defined by contrasting it with two existing production systems approaches, i.e. craft production and mass production. In craft production, skilled workers use relatively simple but very flexible tools to produce one of a kind products to meet precise customer requirements. In mass production, highly skilled specialists design products to be made in high volumes by relatively unskilled operators using expensive and inflexible machines.

2.3 Lean Manufacturing

Organizations are facing competition in the market, therefore there is need to adopt appropriate business improvement practices to be able to compete effectively in the market and gain a competitive edge. The benchmark of lean manufacturing is embodied by Toyota Production System. The Toyota Production System was developed to improve quality and productivity and is predicated upon two philosophies that are central to Japanese culture: elimination of waste and respect for people (Chase, *et. al*; 2007).

Lean production is an integrated set of activities designed to achieve high – volume production with minimal inventories of raw materials, work – in – process and finished goods. This definition of lean leaves no room for surplus or safety stock. No safety stocks are allowed as they would be waste. Any hidden inventory in storage areas, transit system, carousels and conveyors is a key target for inventory reduction (Chase, *et. al*; 2007). The term lean is often used interchangeably with the terms lean manufacturing and lean production. It is called lean, because in the end, the process can run: using less material requires less investment, using fewer inventories, consuming less space and less people (Wilson, 2010). The basis of Toyota Production System is the absolute elimination of waste and its major goal is cost reduction without increasing prices.

2.2.5 Definition of Lean

According to Wilson (2009) the popular definition of Lean Manufacturing and the Toyota Production System usually consists of the following;

- I. It is a comprehensive set of techniques which when combined allows you to reduce and eliminate the wastes. This will make the company leaner, more flexible and more responsive by reducing waste.
- II. Lean is the systematic approach to identifying and eliminating waste through continuous improvement by flowing the product or service at the pull of your customer in pursuit of perfection (Nash and Ward, 2006).

According to Drew (2004) the lean operating system consists of the following:

- ✓ A lean operating system follows certain principles to deliver value to the customer while minimizing all forms of loss.
- ✓ Each value stream within the operating system must be optimized individually from end to end.
- ✓ Lean tools and techniques are applied selectively to eliminate the three sources of loss: waste, variability and inflexibility.

Thus the organization who wants to implement lean should have strong customer focus, should be willing to remove wastes from the processes they operate on daily basis and should have the motivation of growth and survival. According to Burton and Boeder (2003) the major five principles of Lean are as follows:

Principle 1: Accurately specify value from customer perspective for both products and services.

Principle 2: Identify the value stream for products and services and remove non-value adding waste along the value stream.

Principle 3: Make the product and services flow without interruption across the value stream.

Principle 4: Authorize production of products and services based on the pull by the customer.

Principle 5: Strive for perfection by constantly removing layers of waste.

2.3 Best Lean Manufacturing Practices

There are different types of lean practices that can be done under LM. Shah & ward (2003) identified 22 LM tools, which were categorized into four groups: (HR) human resources, (TQM) total quality management, (JIT) just-in-time and (TPM) total preventive management. The

categorization was based on the frequency of citations in literature. On the other hand, lean tools and practices were categorized based on implementation field, such as externally and internally directed lean tools (Shah & Ward 2003; Olsen 2004).

Lean manufacturing is a comprehensive set of practices that when matured and put together, will reduce and eliminate waste. Lewis (2000) and Chase (2006) conclude that lean manufacturing is a set of integrated practices designed to achieve a high production volume, using the right quantity of inventories of raw materials, work in process and finished goods.

Motwani (2003) points that a lean production system as an integrated system of manufacturing requires implementation of different LM practices. They further suggested that the implementation of these practices can give in higher operational performance. For example, reduction in work - in process inventory, links to human resource capability by empowering teams to be able to solving problems. Thus the problem solving ability can help teams improve on their skills of identifying the root courses of quality problems which help to improve workflow and equipment efficiency improvement. The main lean manufacturing activities are JIT, TPM, TQM, and HRM.

Total Productive Maintenance (TPM) maximizes equipment effectiveness by use of planned predictive and preventive maintenance of the equipment and using current techniques of maintenance optimization. Kumar et al. (2006) established that TPM can reduce inventory, lead time and random machine breakdowns. TPM is measured in terms of overall equipment effectiveness (OEE) increase, as a function of other production losses and downtime.

Cua (2001) emphasizes that maintenance reflects on new process equipment or technology. TQM relates to products quality sustainability by continuous improvement and process that is centered on the needs of the customers. Practices of TQM include measurement capability (statistical methods), programs of quality management, formal programs of continuous improvement and process capability.

According to Abdulmalek and Rajgopal (2006) Just-In-Time (JIT) is a system where the demand is initiated by the customer. The demand is then channeled backwards from the final assembly all the way to raw material, thus “pulling” all requirements just when they are needed. Harrison and Van (2008) established that the origin of JIT was from the inventory holding concept of reduction,

which requires that components and parts to be delivered only when they are required for production and not before.

The company partners with the suppliers upstream through early supplier involvement, product design and development involvement, quality improvement and feedback program involvement and just – in - time delivery. The customer demand pull initiates a production process designed to maximize the product flow through the value stream necessitating partnership with the suppliers and the customers (Nordin, Deros and Wahab, 2010). Flow is the concept that parts and assembles items into value adding activities in essence reduces production cycle and lead time with ideal state of creating one piece flow which is frequently not possible due to obstacles (Wilson, 2010). The flow principle ensures smooth and continuous flow limiting the number of tasks and optimizing the loop iterations to achieve overall value through concurrent engineering (Oppenheim, Murman and Secor, 2009). The benefit of flow: efficiency in plant design, synchronization, increases production flexibility and responsiveness, improving effectiveness and reliability, autonomous and planned maintenance (Slack, Chambers and Johnston; 2010). The obstacles to flow included: inventory, batch processes, distance, variations, defect creating process, non – value adding activities and changeovers. The obstacles are handled through rate balancing, distance reduction, elimination of defects and bottlenecks and inventory removal through lean tools and techniques such as cell manufacturing, quick changeovers, standardization, synchronized production and total productive maintenance (Arnas, Jabbour and Saltorato, 2012).

2.3.1 Just in Time

Just in time is an integrated set of activities designed to achieve high volume production using the minimal inventories of raw materials, work in process and finished goods. Just in time is also based on the logic that nothing will be produced until it is needed (Shivanand 2006).

Just-in-time manufacturing is a Japanese management philosophy applied in manufacturing. It involves having the right items with the right quality and quantity in the right place at the right time. The ability to manage inventory (which often accounts for as much as 80 percent of product cost) to coincide with market demand or changing product specifications can substantially boost profits and improve a manufacturer's competitive position by reducing inventories and waste. In general, Just in Time (JIT) helps to optimize company resources like capital, equipment, and labor. The goal of JIT is the total elimination of waste in the manufacturing process. The philosophy of

JIT is a continuous improvement that puts emphasis on prevention rather than correction, and demands a companywide focus on quality. The requirement of JIT is that equipment, resources and labor are made available only in the amount required and at the time required to do the work. It is based on producing only the necessary units in the necessary quantities at the necessary time by bringing production rates exactly in line with market demand. In short, JIT means making what the market wants, when it wants, by using a minimum of facilities, equipment, materials, and human resources (Roy 2005).

According to Shivanand (2006) JIT principles are based on the following points;

- ✓ It is commonly used to describe the stockless production manufacturing approach, where only the right parts are completed at the right time.
- ✓ It is not a destination but a journey.
- ✓ Reducing inventory, improving quality and controlling cost.
- ✓ A “Pull System” where the parts are produced only when they are required.

Pull and Push System

In push system, when work is finished at a workstation, the output is pushed to the next station; or, in the case of the final operation, it is pushed on to the final inventory. In this system, work is pushed on as it is completed, with no regard for whether the next station is ready for the work or not. In this way, the Work in Process (WIP) is unbalanced in all operations throughout the shop floor (Roy, 2005).

The push system is also known as the Materials Requirements Planning (MRP) system. This system is based on the planning department setting up a long-term production schedule, which is then dissected to give a detailed schedule for making or buying parts. This detailed schedule then pushes the production people to make a part and push it forward to the next station. The major weakness of this system is that it relies on guessing the future customer demand to develop the schedule that production is based on and guessing the time it takes to produce each part. Overestimation and underestimation may lead to excess inventory or part shortages, respectively (Shivanand, 2006).

Whereas in pull system; each work station pulls the output from the preceding station as it is needed. Output from the final operation is pulled by customer demand or the master schedule. Thus in pull system work is moved in response to demand from the next stage in the process. The Kanban system is used to monitor the effective pull process.

2.3.2 Total Productive Maintenance (TPM)

Machine breakdown is one of the major headaches for people related to production. The reliability of the equipment on the shop floor is very important because if any one of the machines is down the entire shop floor productivity may be nil. The tool that takes care of these sudden breakdowns and awakes maintenance as well as production workers to minimize these unplanned breakdowns is called total productive maintenance. Total Productive Maintenance (TPM) is a maintenance program, which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to increase production, increase employee morale and job satisfaction. (Bisen & Srivastava, 2009)

According to Nakajima (1988), vice-chairman of Japan Institute of Plant Maintenance, TPM is a combination of American preventive maintenance and Japanese concepts of total quality management and total employee involvement. TPM is a methodology originated by Japan to support its lean manufacturing system. TPM is a proven manufacturing strategy that has been successfully employed globally for achieving the organizational objectives of core competence in the competitive environment. TPM implementation methodology provides organizations with guidelines to transform fundamentally their shop-floor by integrating culture, process and technology.

As stated by Nakajima (1988), Total Productive Maintenance (TPM) as the name suggests consists of three words:

1. **Total:** signifies to consider every aspect and involving everybody from top to bottom;
2. **Productive:** emphasis on trying to do it while production goes on and minimize troubles for production; and
3. **Maintenance:** means equipment upkeep autonomously by production operators in good condition repair, clean, grease, and accept to spend necessary time on it.

2.3.2.1 Pillars of Total Productive Maintenance

According to Kumar (2008) the following are the set of tools or pillars of Total Production Maintenance (TPM);

1. Breakdown maintenance (BM): this is the maintenance strategy, whereby repair/restoration is initiated after the equipment failure/stoppage or upon occurrence of severe performance decline. This maintenance strategy was primarily adopted in manufacturing organizations, worldwide, prior to the 1950s. In this strategy, machines are serviced only when repair is drastically required. This concept has the disadvantage of long unplanned stoppages, excessive damage, spare parts problems, high repair costs, excessive waiting and maintenance time, and high troubleshooting problems (Kumar, 2008).

2. Preventive maintenance (PM): this concept, introduced in 1951, is a kind of physical check-up of the equipment to prevent equipment breakdown and prolong equipment service life. PM comprises of maintenance activities that are undertaken after a specified period of time or amount of machine use. During this phase, the maintenance function is established and time based maintenance (TBM) activities are generally accepted. This type of maintenance relies on the estimated probability that equipment will break down or experience deterioration in performance in a specified time interval. The preventive work undertaken may include equipment lubrication, cleaning, parts replacement, tightening, and adjustment. The production equipment may also be inspected for signs of deterioration during preventive maintenance work (Kumar, 2008).

3. Predictive maintenance (Pd.M.): predictive maintenance is often referred to as condition based maintenance (CBM). In this strategy, maintenance is initiated in response to specific equipment condition or performance deterioration. The diagnostic techniques are deployed to measure physical condition of the equipment such as temperature, noise, vibration, lubrication, and corrosion. When one or more of these indicators reach a predetermined deterioration level, maintenance initiatives are undertaken to restore the equipment to desired condition. This means that equipment is taken out of service only when direct evidence exists that deterioration has taken place. Predictive maintenance is premised on the same principal as preventive maintenance although it employs a different criterion for determining the need for specific maintenance activities. The additional benefit comes from the need to perform maintenance when imminent and not after the passage of a specified period of time (Kumar, 2008).

4. Autonomous Maintenance Initiatives: the manufacturing organization should encourage equipment operators to work alongside maintenance workers, as part of the TPM program, to perform tasks that prevent deterioration of production equipment. In TPM, this type of operator involvement in maintenance activities is called autonomous maintenance (AM). The organization needs to recognize that equipment operators have significant potential for making contributions to improvement in equipment performance, since the ‘I run it, you fix it’ attitude cannot effectively eliminate breakdowns and defects. The organization should endeavor to build the sense of ownership of the equipment and adapt autonomous maintenance initiatives through proactive involvement of equipment operators to eliminate thoroughly failures, stoppages, and defects and accelerated equipment deterioration. The organization should train the operators to perform autonomously routine cleaning, lubrication, tightening, adjustment, inspection, and re-adjustment (Kumar, 2008).

5. Computerized maintenance management systems (CMMS): computerized maintenance management systems assist in managing a wide range of information on maintenance workforce, spare-parts inventories, repair schedules, and equipment histories. It may be used to plan and schedule work orders, expedite dispatch of breakdown calls, and manage the overall maintenance workload. CMMS can be deployed to automate the PM function and to assist in the control of maintenance inventories and the purchase of materials. CMMS has the potential to strengthen reporting and analysis capabilities (Kumar, 2008).

2.3.3 Total Quality Management (TQM)

TQM is a structure of processes, policies and procedures used to enhance the operations of an organization. Organizations are thus able to maintain competitiveness by maintaining the quality of their products. (Chapman and Khawaldeb, 2002).

TQM is an approach used for continued refining and maintaining the quality of goods and services delivered by ensuring the employees are well trained. TQM is applicable to every operation in the company and recognizes the strength of employee involvement (Belusky, 2012). It includes a set of precepts, practices, methods, and techniques to improve quality and ensure customer satisfaction.

TQM's makes certain the quality meets the customer's preferences in a manner that is affordable to the client. Adoption of TQM results in better quality of services, enhances the image of the company by treating a loyal customer base, reduces employee turnover and in turn leads to increased sales. Meek (2006) explained that organizations need to make the transformations from the current practice of attempting to assure quality to actually measuring and improving the quality from both the internal provider perspective and external customer perspective.

2.3.4 Human Resource Management (HRM)

According to Absar (2014) "HRM practices can contribute to superior productivity by improving the quality of employees work Life". At this point, lack of appropriate HRM practices always enhance turnover rate, decrease the productivity rate and huge job dissatisfaction among employees though effective implementation of HRM practices is help to increase overall organizational performance and growth. Therefore, according to Holtom *et al.* (2005), high turnover rate is a negative sign among the workforce which affect employee work performance and productivity. High turnover always create the gap of production as new skilled needed to be developed as the skilled performer left, new skill development to fulfil the gap is always costly (Hughes and Bozionelos, 2007). Absar and Mahmood (2011) denoted that, "due to lack of proper HR policies and procedures, labor-intensive manufacturing firms are facing shortage of workers, and high job turnover in developing countries

According to Batt (2007) "if the firm invests on human capital it may increase the worker's productivity". Appelbaum *et al.* (2012) stated that, "job enlargement and increasing autonomy of workers will decrease the amount of wastage and the inefficiency rate in production, as the firm takes the advantage of unused skills from non-managerial workers".

Bangladesh is the cheapest labor country, the average labor cost per hour is only \$0.3 (Ismail, Seddiqe and Basak, 2014). Actually the future of this sector is fully depends on the effective utilization of its workforce. According to Rahman (2011) against technological scenery, a thorough analysis of human resource management practices on manufacturing industries especially on Bangladesh garment sector is very much needed. HRM practices are immensely necessary for the achievement and ensuring quality performance in the organization. Therefore, effective utilization of human resource is the prime challenge and precondition of organizational business success (Rahman, 2011).

Each organizations success and quality goal accomplishment is largely depends upon the capabilities of human resources (Budhwar & Debrah, 2001). Human resource management (HRM), employee empowerment and involvement in lean implantation as the key success factor as the focus is on “teamwork”.

Boyer (1996) stated the successful implementation of lean manufacturing rely on well-trained employees and other key to successful lean practice is worker empowerment, defined as giving workers more responsibility and control of the manufacturing process. This is because only employees can identify ways of improving the existing process or product (Rahman, 2011). Management that fails to embrace the implementation of lean process may interrupt the effort to improve business performance and identified management support and communications as important variables in a lean manufacturing implementation (Worly & Doolen, 2006).

2.4 Operational Performance

Performance of the internal processes is revealed by operational performance measure in terms of cost & waste reduction, delivery performance, product quality improvement, productivity improvement and flexibility (Jeyaraman and Teo, 2011). Operational performance measures can be categorized into five groups i.e. speed, quality, cost, customer satisfaction and overall productivity (Graban, 2009). Benchmarking practices aimed at adopting manufacturing excellence cannot generate better results if organizations lack the capacity to understand and measure their performance.

Holweg (2005) defines operational performance as an organization’s process that is being measured. Operational performance consists of mainly: Process equipment’s reliability and defects rate, cycle time of production, in time delivery, quality cost and scrap reduction. Birech (2011) established various measures of performance within operational area like, individual performance measure, which include: quality measures, productivity measures, inventory measure, lead-time measures, and preventive-maintenance measures. According to Bou and Beltran (2005), Shah and Ward (2003) TQM reduces process variance which makes the manufacturing process simple and closely matches customer demand and production, while JIT has an impact on quality management by reducing lot sizes hence decreasing waste potential and rework. Elisa (2013) established that those organizations that have adopted the TQM approach have shown to be positively associated

with general performance improvement with higher operation efficiency and improved financial results.

From review of operational performance, literature Hill (1993) argues that every company must determine the criteria upon which it will operate against its competitor. The manner in which a firm safeguards, sets up and uses its assets will define the level to which it can effectively pursue a particular operational performance objective. The main aim of the operations department is to deliver the goods and services needed by the customers whilst managing assets effectively. Operational performance typically measures the success of lean practices (Punnakitikashem, 2013).

2.5 Challenges of Lean implementation

Many companies are aware of the powerful and beneficial effects of integrating the Lean philosophy, especially with success stories such as Toyota's. However, no matter how beneficial it is, implementing Lean is not devoid of its challenges, there are some important topics and principles of Lean approach that is been identified as challenges to the organizations (Bhatia and Drew, 2007). These factors on the other hand, can also be considered as the critical success factors that need to be in place for a successful implementation and sustainable Lean processes.

2.5.1 Management Support

Although the success of Lean implementation may be affected by many variables, total commitment by top management can be agreed by many researchers to be one of the most important elements. Total commitment and leadership should not only be revealed by management, there is the need for everyone within the organization to be involved and this should be made possible through the interest shown by top management through communication (Worley & Doolen, 2006). Successful Lean implementation can also be affected if top management refuse to show a little bit more interest on their side for the employees to appreciate. These leave the employees demotivated and their desire to drive Lean to its successful end weakens. The only way to create a true Lean transformation is with a strong leadership at the top of the organization, and shows commitment. Lack of management support, both intellectually and physically, may lead to a host of other issues including limited access to resources, lengthy decision-making processes and breakdown of communication (Jadhav *et al.* 2014).

2.5.2 Employee Training and Education

A company that invests in training and development generally tends to have satisfied employees. The roles played by each employee on the effort of joining together to achieve the goals of the organization, gets to be more effective when they are offered training and education in the course of executing their job (Zhang, *et al.* 2012). In order to improve the competence and competitiveness of employees, education and training becomes a collaborative affair, which needs to be a top priority by all concerned. According to Netland (2015), Training and education of both employees and management turned to be the second most important element that need to be put in place for a successful implementation.

2.5.3 Communication

Lean projects are easily terminated, lack of team autonomy and lack of organizational communication. When the benefits that has been obtained from Lean are not well communicated to employees, the motivation leaves and the will to continue becomes very low making the Lean process to collapse eventually. Employees need to be properly informed of the changes that are being administered in the organization (Jadhav *et al.* 2014).

2.5.4 Workers' Participation

This is known to be one of the biggest barriers that the organization needs to break before Lean can be implemented successfully. The main aim of implementing Lean management is to eliminate waste from the business process and create value to the end customer, employees usually are faced with the 'fear factor' of losing their jobs when they realize that their jobs do not add any values. Employees get to be reluctant to new implementations (such as Lean) because they know this may result in staffing reduction (Jadhav *et al.* 2014). Management and employees sometimes feel that the 'new approach' Lean they want to adapt is somehow just another approach aimed at improving processes, this makes them feel resistance and skeptical of what Lean benefit they can possibly get (Asnan, *et al.* 2015). The outcome of the study was that, whiles it is significant to management commit to full implementation of Lean processes, the engagement of everyone in the process of change is also very important especially in the early stages (Asnan, *et al.* 2015).

Moreover, LM implementation is not a one-off process but rather, it is continuous (Mwacharo, 2013) and should constantly be supported (Drew, Blair and Stefan, 2004). The firms or organizations need to revise their strategy on a regular basis to sustain the efficiency achieved due

to lean adoption; a company must be well prepared before implementing LM and must commit to doing all the hard work needed for a smooth transition into lean thinking. Otherwise LM might prove to be beneficial initially, but in the long run, it will fail miserably (Bicheno and Holweg, 2016). Although one might think that reducing inventory, as instructed by LM, at once is the solution, this is not the right way to implement lean. It should be a gradual process, identifying waste and removing it step-by-step. Therefore, determining the real waste in all the departments is also a big challenge. Therefore, keeping motivation for a regular assessment of already implemented LM tools is one of the major obstacles to lean adoption.

2.6 Empirical Literature review

2.6.1 Lean manufacturing practice

Maina (2013) in the study of food companies in Nairobi that are implementing lean management practices, found that organizations that adopted lean manufacturing enjoyed the benefits associated with it, like improved operational performance by reducing and eliminating waste in some instances. He further established also that, throughput increased, quality improved, flow line increasing and scaling down in work-in-process as expected to build -to schedule. He concluded that most organizations have not fully embraced and implemented the lean practices, hence not fully enjoying the benefits of lean manufacturing.

The continuous process industry where cement manufacturing falls in was explored by Rono (2013) in a case study of Bamburi Cement. The study sought to determine the degree to which lean manufacturing practices have been embraced at Bamburi Cement Limited, the drivers and barriers to effective implementation of lean manufacturing and finally the benefits of implementing lean manufacturing practices. The research findings revealed that Bamburi Cement Limited have systems and structures of lean manufacturing practices well in place. However, they are not practically or well implemented thus hindering the organization from reaping full benefits of lean manufacturing.

According to Womack & Jones (2003), implementation of lean not only on manufacturing facilities but also on all the departments of a company such as accounting, human resources, marketing, distribution and so on is also a major challenge. To reap the total benefit of lean philosophy all departments need to modify their operations accordingly otherwise the results could be detrimental, with significant losses (Bicheno and Holweg, 2016).

Shah and Ward (2003) identified common practices supported by substantive literature. Instead of assuming any combination of practices, they explored the best grouping (bundles) for all 22 practices by using data from the Industry Week's Census of Manufacturers. Contextual factors such as plant size, plant age, and unionization states were included. Just in time (JIT), total preventive maintenance (TPM), total quality management (TQM), and human resource management (HRM) were selected as core groups including specific techniques.

2.6.1.1 Just in time

Previous study by Cua *et al.* (2006) which found that JIT has a significant and positive effect on quality. JIT's main objective is to reduce inventory through the application of one piece flow, pull system, takt time, cell manufacturing, levelled production, kanban, visual control, multifunctional employees, and JIT purchasing.

Mackelprang and Nair (2010) indicate that JIT deliveries from suppliers are positively associated with inventory, cycle time and delivery performance. In the same vein, Jones *et al.* (1997) argue that JIT linkages with suppliers on the one hand improve efficiency because of better shipment scheduling and removal of extra-costs due to emergency shipments, and on the other hand, reduce the overall lead time, exploiting the benefits deriving from manufacturer-supplier synchronization.

Green and Inman (2005) stated that, JIT practices (JIT equipment layout, JIT links with suppliers, JIT link with customer) reduce lead times, having a direct impact on delivery performance, but also directly improve quality conformance because JIT practices decrease process variability.

2.6.1.2 Total Quality Management

Kanyank (2003) suggests that, the optimal management of TQM practice will lead to better operational performance. Moreover, Wiele *et al.* (2001) shows change to fit of TQM to other management theories will only occur when a strong internal motivation for and emotional involvement in the implementation of TQM.

Shah and Ward (2003) indicate that, total quality management (Top-Management Leadership for Quality, Customer Involvement and Supplier Quality Involvement) reduce scraps and reworks, resulting in a reduction of process variability and an improvement of quality conformance of the final product.

Lin *et al.* (2005) reveal that, TQM practices are significantly correlated with supplier participation, customer involvement and top management leadership for quality. Which, in turn, influences organizational performance. Manufacturing companies developing strategic alliances with their critical suppliers and customers by adopting total quality approach enable them to reduce production cost, improve quality performance and competitiveness (Lo & Yeung, 2004).

Wong (2003) suggested that, Partnerships are needed in all internal customer-supplier relations, in all external supplier relations, in external customer relations and between managers and their subordinates. The clue is to build a total system of customer-supplier relations, which are working close together in their own interest for reducing waste and improve quality.

2.6.1.3 Total Production Maintenance

Vinodh *et al.* (2011) suggests that it strives to maintain equipment in optimum condition in order to prevent unexpected breakdowns, speed losses and quality defects occurring from process activities. Equipment's should be operated at 100% capacity 100% of the time.

Lycke and Akersten (2000) have suggested that TPM is a highly structured approach and careful, thorough planning and preparation are keys to successful organization-wide implementation of TPM and so is senior management's understanding and belief in the concept. As studied by Mather (2005) total production maintenance is a prerequisite for success as a lean manufacturer.

Ahuja *et al.* (2006) report that TPM implementation can significantly contribute towards improvement in operational performance in the manufacturing enterprises; leading to world class competitiveness; it is also considered to be an effective strategic improvement initiative for improving quality in maintenance engineering activities. Cua *et al* (2006) stated that, TPM has been widely recognized as a strategic weapon for improving manufacturing performance by enhancing the effectiveness of production facilities.

2.6.1.4 Human Resource Management

Limited as lack of support from the top management and resistant to culture change. Malonza (2014) noted that MSC had not fully implemented lean manufacturing practices with some of the practices employed noted as below average.

Studies have shown on Human Resource Management (HRM) Practices in Bangladesh Garments Sector. Farhanarashid and Cheazlantaib (2018), garment is the rising sector for further investment,

now a day a much concern is needed to improve and sustain garments companies growth. In this aspect, they proved that, HR practices didn't get much attention which need to be measured and analysis in the aspect of Bangladesh garment sectors quality performance improvement as in garment sector human resources is the main advantage for industrial growth and sustainable competitive advantage in business.

According to Kwasi AG & Vidyarana B. (2001) in their study on lean manufacturing implementation in Gana, Employee training has been identified as an important element of lean manufacturing implementation. Under lean manufacturing employees are required to perform multiple tasks, undertake quality control, continuous improvement activities, do preventive maintenance and provide suggestion for productivity and quality improvement. In Studying the implementation of lean manufacturing in Kenya Mombasa country sugar company, Elain M. (2016) reported that, education and training of all employees in lean philosophy has a positive influence in quality improvement and on time delivery performance.

Dr. Rajendra and Nina Jain, (2014) studied the effectiveness of HRM practice in textile industries, Manpower planning practices, They noted that, Training and development practices, Performance appraisal practices, Team work & employee participation practices helps in achieving business objectives and therefore have positive effect on the growth and development of Textile industries.

2.6.2 Lean manufacturing practice and operational performance

Shah and Ward (2003) found that Just in time (JIT), Total Quality Management (TQM), Total production maintenance (TPM), and Human Resource Management (HRM) are positively related to operational performance.

Malonza (2014) in his study seeking to establish the effect of lean practices and operational performance of Mumias Sugar Company Limited Kenya (MSC), established that lean manufacturing practices had a constructive quality effect on operational performance. Through improved operational performance, there was reduction on waste, improved efficiency and reduced lead times between the processes. Tourki (2010) states that, organizations that adopted lean manufacturing, have an advantage over the others to survive in the global competitive environment.

Jabbour *et.al.* (2012) investigated the operational performance variables in automotive companies in Brazil. They suggested that the cost of product, quality of products, manufacturing flexibility and reliability in quick delivery together indicate the relative measure of operational performance.

Suruchi and Sibichan (2014) studied the human resource factors influencing employee performance in garment manufacturing firms. They found that there is significant relation of employee performance with HRM practices including training, performance appraisal compensation, recruitment and selection.

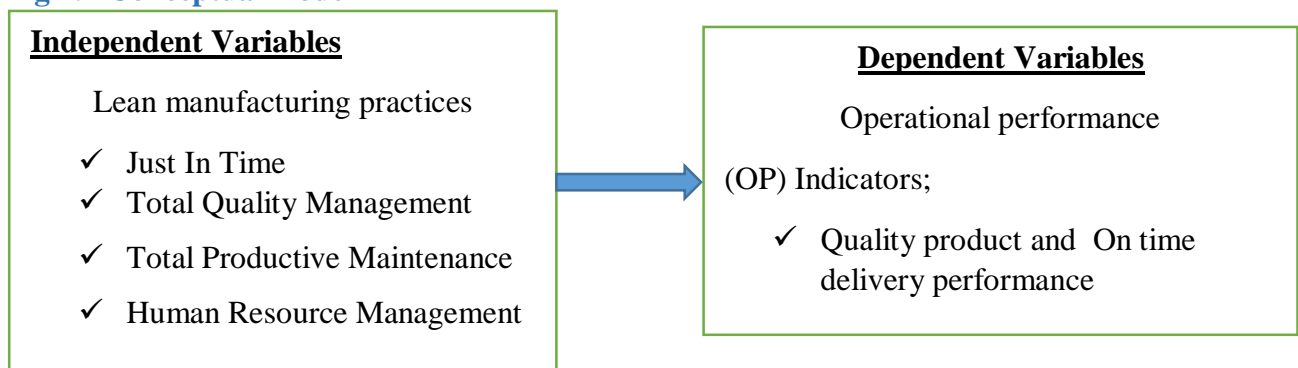
2.7 Literature Gap

Many researchers around the world studied and commented on possible benefits of implementing lean manufacturing (LM) concept and its effect on operational performance. Being in developing countries like Africa so many industries are struggling to be world class. Hence, lean manufacturing practice has got a lot of attention in Africa manufacturing industries. But, the adoption of lean principles and tools are still found to be difficult. Few number of studies have been conducted in this area so far in the context of Ethiopian garment sector. However, as far as the knowledge of the researcher is concerned, no research has been conducted about the effect of these practice in the operational performance of military garment industry. So, this research was conducted with the motive of fulfilling the above stated gap.

2.8 Conceptual framework

In this study, the framework is comprised of lean practices as the independent variables. Operational performance measures are the dependent variables to evaluate Adama garment industry.

Fig 2.1 Conceptual model



Source; Author (2019)

CHAPTER THREE

METHODS OF THE STUDY

3.1 Introduction

Research design and methodology is very crucial that helps the researchers how to address the research problems and provides the overall structure for the procedures that researchers should follow. It is also very important to get meaningful data to achieve objectives of the study. Thus, this chapter presents the research philosophy, design and strategies, data sources, data collection instruments, sampling design and sample size, data processing procedures, data analysis tools and ethical considerations of the study.

3.2 Research Philosophy

To be familiar with research philosophies is very crucial to identify the most appropriate methodologies. In turn, most appropriate research methodologies have paramount importance to gather the relevant data to address the study objectives. According to Creswell (2003), there are three major research philosophies which include positivism, constructionist and pragmatic that the researcher should consider in selecting appropriate methodologies for their studies. For this study the researcher selected the pragmatic one. This is because for the mixed methods of researches, pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis. As a philosophical underpinning for mixed methods studies Morgan (2007), conveyed its importance for focusing attention on the research problem in social science research and then using pluralistic approaches. Thus, in mixed methods research, investigators use both quantitative and qualitative data because they work to provide the best understanding of a research problem.

3.3 Research Design

Research design is a blue print for selecting the sources and types of data relevant to the research questions. It basically, provides answers for such questions like: what techniques to be used to gather data, and what kind of sampling to be applied, (Zikgmund et al. 2003).

The research design for this study was descriptive research design. Because, most of the social science research comes under this design and it describes the real and current situation of Ethiopian army Adama garment industry lean manufacturing practices and its effect on operational

performance by acquiring input from all departments in the industry like production, logistics, marketing and human resource to achieve the objectives defined. Descriptive research design collects data from all participants in the population and seeks to provide a true measure of the population. To collect data the researcher used cross-sectional survey method for questionnaire and experience survey method for interview question. This is because the cross-sectional survey is preferable to conduct research employing large number of people questioning about their attitudes and opinions towards the specific issue, events or phenomena at one point in time from the sample respondents and experience survey is survey of people who have had practical experience with the problem was studied (Marczyk and Dematteo 2005). In general, a survey typed questionnaire approach is relatively low cost of money, time saving, and simple approach. Moreover, by using survey methods, it can clarify the question the survey respondents and recording their responses to be used as data for analysis (Chang, 2002). It also enables the researcher to effectively administer and manage the tasks when the data collection takes place.

The study employed both qualitative and quantitative ones. Nowadays mixed method is considered as a tool to triangulate the result of single approach through multiple methods (Johnston 2010). A quantitative method was selected because it is viewed as an effective to gather large data and comprehensive issues at a specified period of time. While the qualitative method was selected based on the assumption that it enables the researcher generate meanings and phenomena within the real context of the research participants and to fill the gap left by the quantitative one (Kothari 2004). Therefore, mixed method was adopted in order to make the study more reliable through triangulation.

Based on the responsibility in organization and the person who can assess lean practices and operations performance, employees in production, logistics, marketing, human resource and the middle and top management in production or manufacturing (such as director, head of department, and manager) was posited as element of unit of analysis.

3.4 Population and Sample size

Adama Garment Industry has 297 permanent and temporary employees for the year of 2018 in the garment factories. The population of this study was comprised in Adama garment industry departments, such as production, logistics, marketing, design and human resource.

Adama Garment Industry has organized in to different functional departments, such as Production, marketing, logistics, human resource, design and management body collectively form organization structure. This structure is very important for a researcher to determine what type of sampling techniques to be used and how many sample size to collect.

The participants of this study was employees who had participated in production, marketing, material administration and human resource department. To give equal chance to be representative of that population, Simple random sampling technique was used to draw samples from employees. Non-probability sampling, which is Convenience / purposive sampling approach, was used to interview five managers for reliable information.

Table 3.1 Total population

S/N	List of Adama Garment Industry departments	Total No of employees en each department
1	Production	228
2	Design	30
3	Marketing	10
4	Logistics and Purchasing	18
5	Human resource	11
Total		297

Source; (Adama Garment Industry HR department, 2019).

In the determination of sample size the three criteria was very important to gather the required data from sample respondents. These included the level of precision, the level of confidence or risk and the degree of variability in the attributes being measured that enable the researchers to determine appropriate sample size (Miauou & Michener, 1976). Therefore, by considering these issues sample size to collect data through questionnaire for this research was determined by using Yamane's (1967) formula.

$$= \frac{N}{1+N(e)^2}n$$

Where:

n = the sample size

N=the study population

e = the level of precision

l = designates the probability of the event occurring. Therefore:

$$n = \frac{297}{1 + 297(0.07)^2} = \mathbf{121}$$

Therefore, 121 respondents was used as sample for this study to gather data through questionnaire. The researcher deemed necessary to take independent sample for each Adama Garment Industry departments to ensure equal representation because departments have different number of employees. Therefore, the sample size for each department was calculate by using proportion. The study used proportionate sample allocation formula so as to make each stratum sampled identical with proportion of the population. Therefore, proportional sample size from each stratum was calculated by using the following formula.

$$n_i = \frac{n * N_i}{N}$$

Where: n_i = sample size for individual Adama Garment Industry departments

N_i = the total number of employees in each Adama Garment Industry departments

N=the total number of employees in Adama Garment Industry

n= the total sample

Table 3.2: Proportional sample for each departments

No	List of departments	Total No of employees in each department	No of sample size in each department
1	Production	228	93
2	Design	30	12
3	Marketing	10	4
4	Logistics and Purchasing	18	7
5	Human resource	11	5
Total		297	121

Source; Author 2019

On the other hand, the researcher used a judgmental type of non-probability sampling, (purposive sampling approach) to interview for general manager, technical operator and department heads a total of 5 persons for reliable information and these participants are selected by the researcher on the strength of their experience of the phenomenon under study.

3.5 Data Sources and Types

As indicated in the previous section, the study used both qualitative and quantitative data. Using both types of data is vital to offset the limitations inherent with one method with the strength of other method (Creswell 2003). The study used both primary and secondary data sources to get consolidated data so as to reach on concrete findings. The primary sources of data was collected from the respondents currently working in Adama Garment Industry different departments. As part of primary sources data was also obtained from key informants and discussants. To supplement the primary data, secondary sources was collected through extensive review of published and unpublished Literature (annual reports of Adama garment industry and related journals and books).

3.6 Data Collection Instruments

To increase the breadth of information obtained from the respondents in relation to lean manufacturing practices in Ethiopian Army Adama Garment Industry departments, this study used two types of data collection instruments.

Questionnaires: in this study structured questionnaire was prepared in the form of Likert scale to collect the required data in relation to lean manufacturing practices effect on operational performance specifically JIT, TQM, TPM, and HRM, and challenges that Adama garment industry faced during the process of implementing lean manufacturing techniques and tools. For this purpose the researcher used standard instrument, this instrument has been well validated and used by several researchers in global manufacturing planning and control studies. Such data collection instrument is develop in order to gather large data and avoid pressure on the respondents (Creswell 2003). Questionnaire was prepared before the time of distribution and the researcher has discussed with those selected workers how to respond correctly, to minimize risks of improper responses.

Interview: is an adaptable way of finding things out. The human language is very useful in opening of what lies behind people's action (Zikgmund, et al. 2003). Semi-structured interview questionnaire was prepared for 5 persons (general manager and department heads) and arranged

orderly in understandable, precise and clear manner. It should be clear, to the point, and able to avoid leading concepts. Time table for interview with management was arranged before the time of interviewing considering their interest to discuss on the matter.

3.7 Data Analysis Methods

This research used the methods of descriptive, correlation and regression analysis. Descriptive data analysis approach is appropriate due to the nature of the study. According to Marczyk and Dematteo (2005) in purely descriptive studies precise and comprehensive description facts is the primary focus of the study. Correlation analysis is a statistical tool for the exploration of relationships between variables upon another (Park and Lord 2009). Regression analysis is a technique employed on one variable to determine the effect of another variable (Vohra, 2011). Thus, for the purpose of the study descriptive statistics like frequency distribution, percentage, mean and standard deviation was used by the help of SPSS V20. Data collected through interview was analyzed by content analysis. In establishing the effect of lean practices on operational performance, multiple regression analysis was used. The multiple linear regression model was used to determine the nature of the relationship between lean manufacturing practices and operation performance.

The following model was used to show the relationship between lean manufacturing practices and operational performance:

$$Y=a+ (b_1x_1) + (b_2x_2) + (b_3x_3) + (b_4x_4);$$

Where Y=operational Performance, a = the Y intercept when x = zero;

b₁, b₂, b₃, and b₄, are the regression weights attached to the variables;

x₁=JIT, x₂ = TQM, x₃= HRM x₄ = TPM

3.8 Validity Test

According to R. Kothari (2004) Validity is the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. Validity is the extent to which any instrument measures what is intended to measure. This instrument has been well validated and used by several researcher in global manufacturing planning and control studies and Doctoral thesis on achieving multiple performance through lean manufacturing. In addition the survey questionnaire was validated by professionals.

3.9 Reliability Test

Reliability refers to the extent to which data collection techniques or analysis procedures brings out reliable findings. Reliability analysis is concerned with the internal consistency of the research instrument.

The data collected in survey was evaluated for reliability using Cronbach's alpha-coefficient method. One of the most commonly used indicators of internal consistency is Cronbach's alpha coefficient. Identically, Cronbach's alpha coefficient of a scale should be above 0.7. The test was conducted in SPSS.

Table 3.3 – Reliability test

Cronbach's Alpha	N of Items
.80	75

Source: SPSS Result, 2019.

The reliability of the questionnaire used by the present study has been pilot tested with 10% of the sample by using Cronbach Alpha. As indicated in table 3.3, the SPSS result shows that the questionnaire's reliability is 0.80 Cronbach's Alpha and hence, reliable.

Lean management practices	Coefficient Cranach's Alpha Reliability
Just in time practice	.816
Total quality management practice	.789
Human resource management practice	.855
Total production maintenance practice	.779
Overall reliability coefficient	.867

Source: SPSS Result, 2019.

The reliability of the used questionnaire was tested according to Cronbach's α . It shows how closely the instrument elements are related to a group and to what extent they measure the same concept Tavakol, M. and Dennick, R. (2011). Table 4.15 presents the Cronbach's α of the survey.

The overall reliability coefficient of the framework's variables is 0.867, and that of individual variables ranging from 0.7 to 0.8, which is good for scale reliability.

The findings suggest that all of the components had relatively high internal consistency. Cronbach (1951) argued that a reliability coefficient of 0.70 is considered "acceptable" in most social science research situations

3.10 Ethical consideration

In doing any research, there is an ethical responsibility to do the work honestly and with integrity. The basic principle of ethical research is to preserve and protect the human dignity and rights of all subjects involved in a research project (Leedy and Ormrod, 2013). In this regard, the researcher assured that the respondents' information were confidential and used only for the study purpose. The researcher also committed to report the research findings in a complete and honest manner, without confusing others about the nature of the results. As a general rule, therefore the study was not raising any ethical anxiety.

CHAPTER FOUR

RESULT AND INTERPRETATION

4.1. Introduction

This section discusses the results of the study based on the research tools presented in preceding sections of the report. The purpose of this study is to assess the effect of lean manufacturing practice on operational performance of Ethiopian Army Adama Garment Industry. All the items comprising the lean manufacturing practices and operational performance constructs were developed from Likert-scaled items, with values ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The product quality and on time delivery are the two operational performances considered in this study. Data were collected from Adama Garment Industry five departments (Production, Logistics & purchasing, human resource, Marketing and Design) based on questionnaires. In addition, from five departments 5 persons were interviewed and this has helped the researcher to discuss the issues in details. For five departments 121 questionnaires were distributed; of which 107 were returned. After editing the returned questionnaires were successfully completed, tailed and analyzed. The study has employed SPSS and Microsoft-excels in analyzing the collected data. Percentage, mean and standard deviation have been used to analyze the raw data. In order to make the research reliable and establishing if there is a relationship between lean manufacturing practices and operational performance the researcher has made use of descriptive and correlation and regression analysis.

4.2. Respondents’ Demographic Profiles

The study sought to establish the General Information of the respondents employed in the study with regards to the job Category, length of service in the current position and academic levels. This bio data points at the respondents’ appropriateness in answering the study questions.

Table 4.1 Respondents’ Demographic Profiles

	Variables	Frequency	Percentage
Respondents Job Category	Production workers	84	78.5
	Logistics & Purchasing expert	6	5.6
	HRM expert	5	4.7
	Marketing expert	4	3.7
	Design expert	8	7.5

	Total	121	100
Length of Service in the current Position	Less than 5 years	7	6.5
	5 to 10 years	25	23.4
	10 to 15 years	28	26.2
	above 15 years	47	43.9
	Total	121	100
Educational level of Respondent	Certificate	9	8.4
	Diploma	37	34.6
	Under graduate	56	52.3
	Graduate	5	4.7
	Total	121	100

Source: Survey Data, 2019

As table 4.1 shows majority of the respondents (78.5%) indicated that they work interactively in production department, 5.6% of the respondent rates indicated that they work in logistics and purchasing department, 4.7% of the respondent rates indicated that they work in HRM department, 3.7% of the respondents rate indicated that they work in marketing department and 7.5% of the respondents rate indicated that they work in design section.

The respondents were asked to indicate the number of years worked in their current position firm. Table 4.1 shows the results of the research question. 4.2, 23.4% respondent rates indicated that they had been in the present garment industry for 5 to 10 years. 26.2% respondent rates indicated a period of 10 to 15 years, 6.5% respondent rates indicated a period of less than 5years, while another 43.9% respondent rates indicated they had worked for over 15years current position. This implies that, since more than 70 % of the respondents have experience of manufacturing garment industries operation they have full information to answer the questionnaires developed by the researcher.

The respondents were asked to indicate their academic highest attained levels. Table 4.1 the study findings indicate that, 52.3% had Bachelor degrees, 34.6% had Diploma's, 4.7% had master's degree while 8.4% had certificate. As King and McGrath, (2002)found, education is one of the factors that positive on growth of manufacturing industries and business men with larger stocks of human capital, education and vocational training are better placed to adapt their enterprises to

constantly changing business environment. So, most of the respondent can understand the questionnaires to give reliable answer.

4.3. To find out the extent to which Lean manufacturing practices are implemented in Adama Garment Industry:

The respondents were asked to indicate their views of the attributes of the Lean Manufacturing practices adopted by firms that were presented to them. They were asked to rate the nature and extent to which they consider Just in time, Total Quality management, Human resource management and Total production maintenance significant in Lean Manufacturing practices. The study findings are presented in Table 4.5 to Table 4.8.

4.3.1 Just In Time Implementation

The study aimed at finding the extent which the Just in Time practices were adopted in Ethiopian Army Foundation Adama Garment Industry. The findings obtained are as presented by Table 4.2

Table 4.2: Just In Time Practices

Just In Time Practices	N=107	Minimum	Maximum	Mean	Std. Deviation
Just-in-Time Equipment Layout		1.00	4.20	2.5570	.56770
Just-in-Time Delivery by Suppliers		1.00	3.80	2.3907	.50236
Just-in-Time Link with Customers		1.00	3.80	2.5850	.57868
Aggregate mean				2.5109	

Source: Survey Data, 2019

As presented, Just-in-Time equipment layout had a mean of 2.55, Just-in-Time delivery by suppliers had a mean of 2.39, and Just-in-Time Link with Customers had a mean of 2.58. Just-in-time practice had aggregate mean of 2.5109. This shows that the Just in Time practices in Ethiopian Army Foundation Adama Garment Industry were established to have small extent of adoption (mean <3.0, std. deviation >5.0).

According to the response of Ethiopian army foundation Adama garment industry managers and department heads on interview question, manufacturing facilities are not ideal for the production process. For instance raw material storage, design/cutting section and main production section were so far apart that they could not easily move materials from place to place, so they have to

spend the extra expenses and manufacturing process delays at a specific time. The industry relationship with suppliers is not a just in time base. They do not have a raw material at the moment they want, the raw material they own can't be delivered on time. Because they do not have a strong and permanent relationship with suppliers. In addition, the biggest problem is the procurement bureaucracy that they have. For example the canvas factory has been discontinued for four months due to lack of raw material problem. In addition to this, they have replied that the factory has many customer. But because of on time delivery problem some customers are moving to another manufacturer and some of customers chosen the factory to be accountable only for the fact that factory is governmental.

Mackelprang and Nair (2010) indicate that JIT deliveries from suppliers are positively associated with inventory, cycle time and delivery performance.

Green and Inman (2005) stated that, JIT practices (JIT equipment layout, JIT links with suppliers, JIT link with customer) reduce lead times, having a direct impact on delivery performance, but also directly improve quality conformance because JIT practices decrease process variability. As a matter of fact, JIT decreases the possibility to produce defects because it reduces the number of production process activities and eliminating errors associated to these activities.

However, the above questionnaire and interview result in contrast to the literature. JIT practice (JIT equipment layout, JIT links with suppliers, and JIT link with customer) has been small adopted in Ethiopian army Adama Garment industry. The concept based on JIT, is that inventories are not valuable and should be regarded as waste. The respondent stated that raw materials are ordered to arrive just in time are not enough for a batch before garment manufacturing process begins. Supplier delivery is not managed to be just in time when raw materials are needed and manufacturing equipment's layout are not located close together.

4.3.2 Total Quality Management Implementation

The study aimed at finding the extent to which the total quality management practices were adopted in Ethiopian Army Foundation Adama Garment Industry. The findings obtained are as shown by Table 4.3;

Table 4.3: Total Quality Management Practices

Total Quality Management Practices	N=107	Minimum	Maximum	Mean	Std. Deviation
Top Management Leadership for Quality		1.40	4.00	2.5047	.52582
Customer Quality Involvement		1.00	4.40	2.6075	.56962
Supplier Quality Involvement		1.20	4.40	2.4355	.54101
Aggregate mean				2.5159	

Source: Survey Data, 2019

As presented, top management leadership for quality had a mean of 2.5, customer quality involvement had a mean of 2.6, and supplier quality involvement had a mean of 2.4. Total quality management practice had aggregate mean of 2.5159. This implies that the total quality management practices had small extents of adoption (mean <3.0, std. deviation >5.0).

According to the interview question, there is a raw material quality issue in Ethiopian army foundation Adama garment industry. The reason is that when they chose suppliers, they based on list price rather than quality. In addition to this they have a problem to develop clear specification and there is a problem of procurement ethics, so that the role the management to fix the above problem is weak. In general they have difficulty working close to suppliers and customers to ensure quality.

Shah and Ward (2003) indicate that, total quality management (Top-Management Leadership for Quality, Customer Involvement and Supplier Quality Involvement) reduce scraps and reworks, resulting in a reduction of process variability and an improvement of quality conformance of the final product.

Lin et al., (2005) reveal that, TQM practices are significantly correlated with supplier participation, customer involvement and top management leadership for quality. Which, in turn, influences organizational performance. Manufacturing companies developing strategic alliances with their critical suppliers and customers by adopting total quality approach enable them to reduce production cost, improve quality performance and competitiveness (Lo & Yeung, 2004).

However, the above total quality management practice shows that there is lack of top-management leadership for quality, lack of customer involvement and lack of supplier quality involvement. It

implies that TQM practices are not practically or well implemented in Ethiopian army Adama garment industry. Thus, hindering the industry from gaining full benefits of lean manufacturing.

4.3.3 Human Resource Management Implementation

The study aimed at finding the extent to which the human resource management practices were adopted in Ethiopian Army Foundation Adama Garment Industry. The findings obtained are as shown by Table 4.4:-

Table 4.4: Human Resource Management Practices

Human Resource Management Practices	N=107	Minimum	Maximum	Mean	Std. Deviation
Employee Suggestions and Feedback		1.00	3.20	2.3907	.42416
Multi-Functional Employees		1.00	3.60	2.3196	.43685
Task-Related Training for Employees		1.20	3.60	2.2710	.43198
Aggregate mean				2.3271	

Source: Survey Data, 2019

As presented, Employees feedback had a mean of 2.39, multi-functional employees had a mean of 2.31, and task-related training for employees had a mean of 2.27. Human resource management practice had aggregate mean of 2.3271. This indicates that the human resource management practices had small extents of adoption (mean <3.0, std. deviation >5.0).

According to the interview question, Ethiopian army foundation Adama garment industry managers and department heads, they do not have experience to accept employee's opinion and suggestion in plan and organized manner. In addition to this the industry do not have task-related training practice to train workers in a professional manner, but at a time they work to raise the level of employee's skill by providing COC test. Most of the staffs enhanced their skill in the long run experience.

Studies have shown on Human Resource Management (HRM) Practices in Bangladesh Garments Sector Farhanarashid and Cheazlantaib (2018), garment is the rising sector for further investment, now a day a much concern is needed to improve and sustain garments companies growth. In this aspect, they proved that, HR practices didn't get much attention. which need to be measured and analysis in the aspect of Bangladesh garment sectors quality performance improvement as in

garment sector human resources is the main advantage for industrial growth and sustainable competitive advantage in business.

According to Kwasi AG & Vidyarana B. (2001) in their study on lean manufacturing implementation in Ghana, Employee training has been identified as an important element of lean manufacturing implementation. Under lean manufacturing employees are required to perform multiple tasks, undertake quality control, continuous improvement activities, do preventive maintenance and provide suggestion for productivity and quality improvement. In Studying the implementation of lean manufacturing in Kenya Mombasa country sugar company, Elain M. (2016) reported that, education and training of all employees in lean philosophy has a positive influence in quality improvement and on time delivery performance.

However, the result clearly indicates that Ethiopian army foundation Adama garment industry HRM (Employee suggestions implementation and feedback, multi-functional employees and Task-Related Training for Employees) practices were implemented in small extent. In this aspect, the above findings proved that, HR practices didn't get much attention in the industry. In general the training process to increase the skill and capacity of production workers, staffs and leadership is extremely poor.

4.3.4 Total Production Maintenance Implementation

The study aimed at finding the extent to which the total production maintenance practices were adopted in Ethiopian Army Foundation Adama Garment Industry. The findings obtained are as shown by Table 4.5:-

Table 4.5: Total Production maintenance Practices

Total Production maintenance Practices	N=107	Minimum	Maximum	Mean	Std. Deviation
Cleanliness and Organization		1.60	4.00	2.9327	.54665
Autonomous Maintenance		1.40	4.00	2.7084	.62058
Preventive Maintenance		1.20	3.80	2.3234	.52388
Aggregate mean				2.6548	

Source: Survey Data, 2019

As presented, cleanliness and organization had a mean of 2.9, Autonomous Maintenance had a mean of 2.7, and Preventive Maintenance had a mean of 2.3. Total production maintenance practice had aggregate mean of 2.5109. This indicates that the total production maintenance practices had small extents of adoption (mean <3.0, std. deviation >5.0).

According to the interview question, the factory is almost clean. However they still have some shortcoming in manufacturing equipment's. Such as, employee will not be able to understand the reason why reducing the production capacity of manufacturing machinery, preventive maintenance is not applied in a planned and organized approach. In addition to this repairing are done when the machines are breakdown, so production will stop until they repair the machine. This is why the leadership give less attention to preventive maintenance.

As studied by Mather (2005) total production maintenance is a prerequisite for success as a lean manufacturer. Cua et al (2006) stated that, TPM has been widely recognized as a strategic weapon for improving manufacturing performance by enhancing the effectiveness of production facilities.

Total production maintenance as a strategy of lean manufacturing, strive to enhance machine efficiency and effectiveness through optimizing all types of maintenance activities. In Ethiopian Army Foundation Adama Garment Industry the respondents indicated that the overall equipment effectiveness of garment manufacturing machines are not in good working condition since they are not maintained regularly. With a moderate extent the technical operators own the machines themselves, perform some of the autonomous maintenance task (Cleaning, inspection, lubrication and tightening).

4.3.5 Summary of results of implementation of lean manufacturing practices

Table 4.6: implementation of lean manufacturing practices

Lean manufacturing Practices	Mean	Std. Deviation
Just-in-Time practice	2.5109	.44391
Total quality management practice	2.5159	.47028
Human resource management practice	2.3271	.32820
Total production maintenance practice	2.6548	.46295

Source: Survey Data, 2019

The summary provides an overall representation of the results of implementation of lean manufacturing practices. The results show that Just-in-time (mean 2.5109 and standard deviation 0.44391), total quality management (mean 2.5159 and standard deviation 0.47028), human resource management (mean 2.3271 and standard deviation 0.32820), and total production maintenance (mean 2.6548 and standard deviation 0.46295).

The study found out that these lean manufacturing practices were not practiced to a great extent, thus, Ethiopian army Adama garment industry are not in full application, this implies that they are not enjoying the full benefits of application of lean manufacturing practices.

Maina (2013) in the study of food companies in Nairobi that are implementing lean management practices, found that organizations that adopted lean manufacturing enjoyed the benefits associated with it, like improved operational performance by reducing and eliminating waste.

However, in Ethiopian army foundation Adama garment industry selected lean manufacturing practices (JIT, TQM, HRM and TPM) had not fully implemented all of the practices employed noted as below average, it implies that selected lean manufacturing practice negatively affect operational performance specifically quality conformance and on time delivery.

4.4 Impact of Lean manufacturing Practice on operational performance

The respondents were asked to rate the nature and extent of impact of lean manufacturing implementation in Adama garment industry to the provided statements. Table 4.7 shows the study finding;

Table 4.7: Impact of Lean manufacturing implementation

Impact of Lean manufacturing implementation	N=107	Min	Max	Mean	Std. Deviation
Product Quality Improvement		1	4	2.60	.811
On Time Delivery Performance		1	4	2.24	.671
Lead Time Reduction (Time efficiency)		1	4	2.30	.703
Inventory Reduction		1	4	2.60	.811
Wastage Reduction		1	4	2.24	.671
Reducing Customer Complains On Quality and Delivery		1	4	2.30	.703

Source: Survey Data, 2019

As shown, Adama garment industry striving to ensure product quality improvement had a mean of 2.6; on time delivery Performance had a mean of 2.4; lead time reduction (time efficiency) had a mean of 2.3; inventory reduction had a mean of 2.6; wastage reduction had a mean of 2.2; and reducing customer complains on quality and delivery had a mean of 2.3. This implies that the lean practices negatively influences the operational performance of Ethiopian Army Foundation Adama Garment Industry to a great extent (mean <3.0, std. deviation >6.0).

Malonza, (2014) in his study seeking to establish the effect of lean practices and operational performance of Mumias Sugar Company Limited Kenya (MSC), established that lean manufacturing practices had a constructive quality effect on operational performance. Through improved operational performance, there was reduction on waste, improved quality, efficiency and reduced lead times between the processes.

Maina, (2013) in the study of food companies in Nairobi that are implementing lean management practices, found that organizations that adopted lean manufacturing enjoyed the benefits associated with it, like improved operational performance by reducing and eliminating waste in some instances.

Based upon the analysis in above, the implementations of JIT, HRM, TQM and TPM reduce the operational performances of Ethiopian army Adama Garment Industry, and lean manufacturing practices had negative effects on the operational performance of the industry. Therefore, implementing lean manufacturing (JIT, HRM, TQM and TPM) has an important strategy for increasing a firm's competitiveness.

4.5 Correlation Analysis

The researcher was interested in establishing if there is a relationship between lean manufacturing practices and operational performance i.e. to see if they are correlated. The previous descriptive analysis showed a linear relationship between lean manufacturing practices and operational performance. Pearson's correlation was therefore used to categorize the type of correlation (positive or negative) by considering the predictor variables (Just in Time (JIT), Total Quality Management (TQM), Human Resource Management (HRM), Total production Maintenance (TPM)) that were strongly or weakly correlated with the dependent variable (operational performance). In order to develop the Pearson's correlation matrix, the means of the variables were calculated and grouped into four dimensions; Just in Time (JIT), Total Quality Management

(TQM), Human Resource Management (HRM), Total production Maintenance (TPM). According to Bluman, Allan G. (2009), the Pearson's correlation coefficient is denoted by r and is by design constrained as follows: $-1 \leq r \leq 1$. The range of the correlation coefficient is from -1 to +1. If there is a strong positive linear relationship between the variables, the value of r will be close to +1. If there is a strong negative linear relationship between the variables, the value of r will be close to -1. When there is no linear relationship between the variables or only a weak relationship, the value of r will be close to 0.

Cohen (1988) reported the commonly used set of descriptors for the interpretation of correlation coefficients for social science as follows:

- ✓ Value of 0.00-0.09 equals no correlation.
- ✓ Value of 0.10-0.29 equals the low correlation;
- ✓ Value of 0.30-0.49 equals the medium correlation;
- ✓ Value of 0.50-1.00 equals the high correlation.

Table 4.8: Pearson's Correlation Coefficient Matrix

		JITP	TQMP	HRMP	TPMP	OP
JITP	Pearson Correlation	1				
	Sig. (2-tailed)					
TQMP	Pearson Correlation	.628**	1			
	Sig. (2-tailed)	.000				
HRMP	Pearson Correlation	.425**	.589**	1		
	Sig. (2-tailed)	.000	.000			
TPMP	Pearson Correlation	.687**	.677**	.562**	1	
	Sig. (2-tailed)	.000	.000	.000		
OP	Pearson Correlation	.715**	.699**	.581**	.652**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Result, 2019.

Key: OP is operational performance, JITP is Just in Time Practice, TQMP is Total Quality Management Practice, HRMP is Human Resource Management Practice and TPMP is Total Productive Maintenance Practice.

As shown in table 4.8, all the independent variables (the lean manufacturing practices) had a positive correlation with operational performance. This relationship shows that as the lean manufacturing practices change, operational performance changes in the same direction but at varying degrees. In addition, the positive relationship between operational performance and total quality management Practice, human resource management practice and total productive maintenance practice was moderate. The positive relationship between operational performance and Just in Time Practice was high. Although the independent variables had a moderate relationship with operational performance, Total quality management practice ranked at $r=.699$, Total production maintenance practice ranked at $r=.652$, Human resource management practice ranked at $r=.581$ and Just in time practice high relationship with operational performance ranked at $r=.715$.

4.6 Regression Analysis

According to Bluman, Allan G. (2009) Regression is a statistical method used to describe the nature of the relationship between variables, that is, positive or negative. A positive relationship exists when both variables increase/decrease at the same time and in a negative relationship, as one variable increases, the other variable decreases, and vice versa. Regression examines the relationship between one dependent variable and one or more independent variable. It shows the effect of one unit change in an independent variable on the dependent variable.

4.7 Tests for the Model Assumptions

4.7.1 Test for Multicollinearity

In statistics, multicollinearity (also collinearity) is a situation in which two or more independent variables in a multiple regression model are extremely correlated, implying that one can be linearly predicted from the others with a considerable degree of accurateness (Hair *et al.* 2010; Martz, 2013). The results of multicollinearity for the variables under study are documented in table 4.9.

Table 4.9 Test for Multicollinearity

Variables	Collinearity Statistics	
	Tol	VIF
Just in time practice	.478	2.090
Total quality management practice	.434	2.302
Human resource management practice	.603	1.658
Total production maintenance practice	.399	2.508

Source: SPSS Result, 2019.

Tolerance value of .10 or less than as cited as problematic collinearity although .20 and above has been suggested and VIF (variance inflation factor) value 10 or great are often suited as indicative of problematic collinearity. In this study the values of tolerance and VIF for each independent variable were within the threshold of .10 - 10 it show that multicollinearity was not a problem in the study.

4.7.2 Test of Normality

Table 4.10 Test of Normality

Lean Practice	Skewness	Kurtosis
Just-in-Time practice	0.210	0.540
Total quality management practice	0.494	0.894
Human resource management practice	-0.375	1.583
Total production maintenance practice	0.117	0.673

Source: SPSS Result, 2019.

According to Elliott AC and Woodward (2007) Statistical errors are common in scientific literature, and about 50% of the published articles have at least one error. Many of the statistical procedures including correlation, regression, t tests, and analysis of variance, are based on the assumption that the data follows a normal distribution. The assumption of normality is especially critical and the value of the score greater than +2 or less than -2 is significance.

From the above analysis done, Just in Time had a skweness of 0.210 and tolerance of 0.540. Total Quality Management had a skweness of 0.494 and tolerance of 0.894. Human resource management had a skweness of -0.375 and tolerance of 1.583. Total Productive Maintenance had

a skewness of 0.117 and tolerance of 0.673. Notably, for all the variables, skewness and kurtosis statistics were within ± 2 and hence the data was normality distributed. The normality assumption of linear regression analysis was in place.

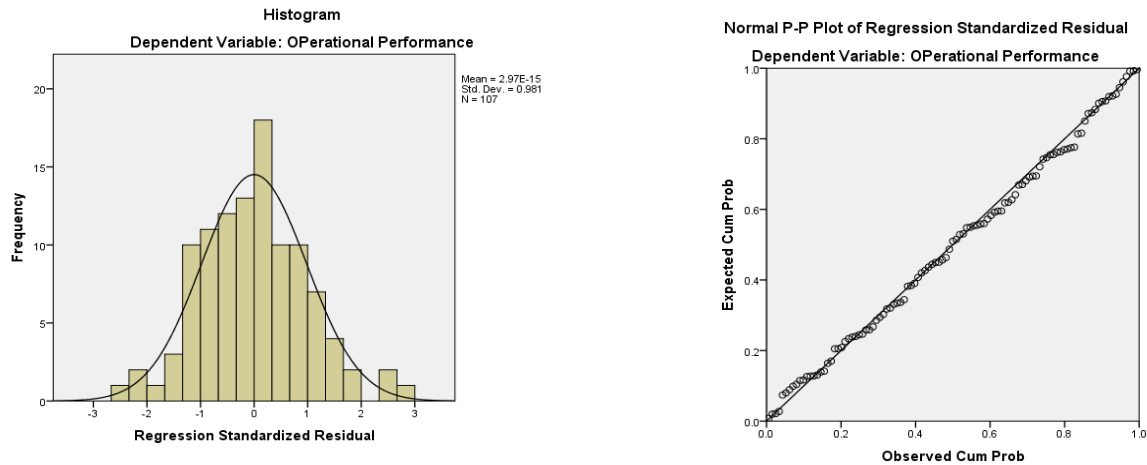


Figure 4.1 Histogram and p-p plots show that a normal distribution.

Source: SPSS Result, 2019.

4.7.3 Model fit

Table 4.11 shows the results for variations between the dependent and independent variables. Although R2 value does guarantee that the model fits the data well, this study assumed that R2 was the best indicator for how well the independent variables explain variations in dependent variable. R2 is the coefficient of determination and shows how operational performance is influenced by lean manufacturing practices combined.

Table 4.11: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805 ^a	.648	.635	.28553

Source: SPSS Result, 2019.

From the table above, the coefficient of determination was found to be .648 this means that variations in lean manufacturing practices causes 64.8% change in dependent variable operational performance with 35.2% explained by other factors captured under the error term. Thus, the result shows that the predictors identified in this study are influencers of operational performance to a high extent. It also demonstrates that there was a strong relationship between the variables. This

represents a good fit since the rule of thumb has it that an R-square between 60% and 69% represents a good model.

Table 4.12: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	15.339	4	3.835	47.037	.000 ^b
Residual	8.316	102	.082		
Total	23.655	106			

Source: SPSS Result, 2019.

ANOVA P- value of 0.000 (Less than 0.05) implies that the model of operational performance is significant at the 5% significance hence it's a suitable prediction model. The F-statistic was 47.037 with a P-value of 0.000 which is less than .05. This indicates that the model was statistically significant at the 5% level of significance implying that lean manufacturing practices have a statistically significant relationship with operational performance.

A multivariate regression model was applied to determine the significant of each of the four independent variables with respect to the operational performance in adopting lean manufacturing practices. The table of coefficients below also measures the individual contribution of each independent variable to changes in the dependent variable. This is represented by the coefficient Betas for each of the predictor.

Table 4.13: Significance and Distribution of Coefficients

	Unstandardized		Standardized	t	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	.283	.215		-1.318	.190
Just in time practice	.431	.090	.405	4.773	.000
Total quality management practice	.275	.089	.274	3.073	.003
Human Resource Management practice	.297	.109	.206	2.731	.007
Total Production Maintenance practice	.074	.095	.073	.784	.435

Source: SPSS Result, 2019.

The regression model found is;

$$Y = -.283 + 0.431JITP + 0.275TQMP + 0.297HRMP$$

From the above table 4.13, Just in time practices has a positive relationship with operational performance and the relationship is statistically significant at the 5% significance level ($\beta = .431$; $p = .000 < .05$). Total quality management practice has a positive relationship with operational performance and the relationship is statistically significant at the 5% significance level ($\beta = .275$; $p = .003 < .05$). Human resource management has a positive relationship with operational performance which is statistically significant at the 5% significance level ($\beta = .297$; $p = .007 < .05$). However Total production maintenance has a positive correlation but the relationship is not statistically significant at the 5% significance level ($\beta = .074$; $p = .435 > .05$).

It is observed that all the coefficients are positive meaning that a change in any one of lean manufacturing practice affects operational performance in the same direction.

From the above findings, just in time practice, Total quality management practice and Human resource management practice were found to have positive statistically significant relationships with operational performance. Total production maintenance practices were found to have weak correlations which were not statistically significant. The coefficients are positive for Just in time practice, Total quality management practice, Human resource management practice, and Total production maintenance which would indicate that as the selected lean manufacturing practices become larger or increases, it is related to a higher operational performance.

Overall, the consistency of regression coefficients on the selected lean manufacturing practices suggests that these variables are important factors influencing operational efficiency at different degrees although the relationship for Just in time practice, Total quality management practice and Human resource management practice was significant. However, Total production maintenance has a positive correlation but the relationship is not statistically significant predictors of operational performance. Additionally, the results show that multicollinearity did not pose a problem in the study since all the variables met the criteria of Tolerance should be >0.1 or VIF (variance inflation factor) <1 .

4.8 Challenges to Lean Manufacturing Implementation

The respondents were asked to indicate the possible challenges or constraints their garment industry encounter or a likely to encounter in the implementation of lean manufacturing practices. The responses were measured on a scale of 1-5 and outcomes are displayed in table 4.8

Table 4.14: Challenges to Lean Manufacturing implementation

Challenges	N	Minimum	Maximum	Mean	Std. Deviation
Lack of top management commitment to lean implementation	107	1	5	3.11	1.049
Lack of resources	107	1	5	2.28	.833
Resistance to change	107	1	5	2.67	1.156
Lack of all stakeholder engagement	107	1	5	3.63	1.120
Lack of proper training/inadequate Human Resource Development	107	1	5	3.42	1.150
Inadequate managerial skills	107	1	5	2.62	1.195
Poor infrastructure	107	1	5	2.94	1.188
Lack of skilled man-power	107	1	5	3.38	1.226

Source: Survey Data, 2019

The results in table 4.14 above show that majority of the respondents with great extent indicated that lack of all stakeholder engagement is the challenges to Lean Manufacturing Implementation $m=3.63$. The respondents with moderate extent indicated that lack of proper training/inadequate human resource development is the challenges to Lean Manufacturing Implementation $m=3.42$. The respondents with moderate extent indicated that lack of skilled man-power is the challenges to Lean Manufacturing Implementation $m=3.38$. The respondents with moderate extent indicated that lack of top management commitment is the challenges to Lean Manufacturing Implementation $m=3.11$.

The respondents with small extent indicated that poor infrastructure is the challenges to Lean Manufacturing Implementation $m=2.94$. The respondents with small extent indicated that resistance to change is the challenges to Lean Manufacturing Implementation $m=2.67$. The respondents with small extent indicated that inadequate managerial skills is the challenges to Lean

Manufacturing Implementation m=2.62. The respondents with small extent indicated that lack of resource is the challenges to Lean Manufacturing Implementation m=2.28.

Asnan, et al. (2015) the outcome of the study was that, while it is significant to management commit to full implementation of Lean processes, the engagement of everyone in the process of change is also very important especially in the early stages

However, the result above shows that, lack of all stakeholder engagement, lack of proper training/inadequate human resource development, lack of skilled man-power and lack of top management commitment is greatly challenged the implementation of lean manufacturing in Ethiopian army Adama garment industry.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This Chapter provides a summary of discussions on lean practices implemented at Ethiopian army Adama garment industry, the impact they do have on operational performance of the firm and challenges faced by the industry. A conclusion on the general findings of the research is given followed by recommendations that are grounded on the findings of the study. Finally, the study limitations and suggestion on areas that can be considered for further research are discussed.

5.2 Summary of the Findings

This study sought to achieve three objectives namely; to assess the extent to which lean manufacturing practices have been adopted, to determine the effect of lean manufacturing practices on the operational performance, and to find out the challenges faced by Ethiopian army foundation Adama garment industry to implement lean manufacturing practices.

5.2.1 Measuring the adoption lean manufacturing practice

JIT practice (JIT equipment layout, JIT links with suppliers, and JIT link with customer) had aggregate mean of 2.5109. It has been small adopted in Ethiopian army Adama Garment industry. Raw materials are ordered to arrive just in time are not enough for a batch before garment manufacturing process begins. Supplier delivery is not managed to be just in time when raw materials are needed and manufacturing equipment's layout are not located close together.

Total quality management practice had aggregate mean of 2.5159. It shows that there is lack of top-management leadership for quality, lack of customer involvement and lack of supplier quality involvement. It implies that TQM practices are not practically or well implemented in Ethiopian army Adama garment industry. Thus, hindering the industry from gaining full benefits of lean manufacturing.

HRM (Employee suggestions implementation and feedback, multi-functional employees and Task-Related Training for Employees) practices had aggregate mean of 2.3271. The practice were implemented in small extent. In this aspect, HR practices didn't get much attention in the industry. In general the training process to increase the skill and capacity of production workers, staffs and leadership is extremely poor.

TPM practices had aggregate mean of 2.6548. It indicated that the overall equipment effectiveness of garment manufacturing machines are not in good working condition since they are not maintained regularly. With a moderate extent the technical operators own the machines themselves, perform some of the autonomous maintenance task (Cleaning, inspection, lubrication and tightening).

In general the result found out from the study that all the lean manufacturing practices/independent variables (Just-in-Time, Total Quality Management, Human Resource Management and Total Production Maintenance) practices had below moderate extents of adoption with some even having very small extents of adoption. This is an implication of the acceptance and use of lean practices are not the major strategies in ensuring maximal operational performance while reducing waste. This is supported by the findings which established the effect of lean practices on operational performance.

5.2.2 Effect of lean manufacturing practices on operational performance

In Ethiopian Army Foundation Adama Garment Industry operational performance related to product quality improvement, on time delivery Performance, lead time reduction (time efficiency), inventory reduction, wastage reduction and reducing customer complains on quality and delivery performance had aggregate mean of 2.38. It implies that, the lean practices negatively influences the operational performance of Ethiopian army foundation Adama garment industry to a great extent (mean <3.0, std. deviation >6.0). This shows that the lean practices influence how the operations of an organization are undertaken.

The regression analysis was further used to establish the direction of relationship that existed between the dependent and independent variables. The coefficient of determination value obtained was 0.648. This implies that 65% of the variation seen in operational performance of Ethiopian army foundation Adama garment industry is explained by the variables in the study mainly; Just in Time, Total quality management, Human resource management and Total productive maintenance. This also means that only 35% of the variation seen in operation performance of Ethiopian army foundation Adama garment industry is explained by other variables which are not in the model. The relationship was significant as the p value obtained was less than 0.5. Additionally, the model coefficients obtained revealed that, Just in Time had 0.000, Total quality management had .003, Human resource management .007 had significant positive relationship

with operational performance. Total production maintenance practices were found to have weak correlations which were not statistically significant.

5.2.3 Challenges facing the implementation of lean manufacturing

The research also looked into the challenges facing the implementation of lean manufacturing practices and confirmed that lack of stockholder engagement, lack of proper training/inadequate human resource development, lack of skilled manpower, lack of top management commitment, poor infrastructure, employees resistance to change, inadequate managerial skill and lack of resource affect organizational performance in that order. the result shows that, lack of all stakeholder engagement, lack of proper training/inadequate human resource development, lack of skilled man-power and lack of top management commitment is greatly challenged the implementation of lean manufacturing in Ethiopian army Adama garment industry.

5.3 Conclusion

The study sought to establish the lean practices implemented by Ethiopian army Adama garment industry. This study concludes all the lean practices (Just-in-Time, Total Quality Management, Human Resource Management and Total Production Maintenance) implemented in a small extent. This is an implication of the acceptance and use of lean practices are not the major strategies in ensuring maximal operational performance while reducing waste.

Secondly, the study also sought to determine the effect of implemented lean practices on operational performance at Ethiopian army Adama garment industry. From the results, lean practices had negative significant impact on operational performance of Ethiopian army Adama garment industry. More importantly, lean manufacturing practice namely JIT, TQM, HRM and TPM great influence on manufacturing operational performance of Ethiopian army Adama garment industry. Additionally, the relationship between all the lean management practices in this study and operational performance was significant at $P < 0.05$. In the study, R^2 of .064 showed that all the predictors could offer 64% explanation of variation or changes in operational performance of Ethiopian army foundation Adama garment industry. The consistency of regression coefficients on the lean management practices suggests that these variables are important factors influencing operational efficiency although at different degrees. Thus, based on the findings of this study, the research question of this study was answered, and the conclusion is that small practicing lean manufacturing leads to decreased operational performance for garment industry.

Finally, the study concluded that, lack of all stakeholder engagement, lack of proper training/inadequate human resource development, lack of skilled man-power and lack of top management commitment is greatly challenged the implementation of lean manufacturing in Ethiopian army Adama garment industry.

5.4 Recommendations

Lean manufacturing practices should be utilized to improve quality and on time delivery; to stay competitive in today's marketplace, a company must understand its customers' wants needs and designs processes that meet their expectations and requirements. Based on the above major findings and the conclusions, the following recommendations are strongly forwarded to help the industry give attention on its future lean manufacturing practice.

- ✓ In reference to the finding of this study, lean manufacturing practices have strong and positive correlation with operational performance. The industry in this respect need improve product quality and on time delivery performance to strengthen and maintain its competitive positioning. Managing lean manufacturing practices greatly contributes to operational performance. Strategically looking for the lean manufacturing practices and focus should be there for improvement.
- ✓ All machines performing similar type of operations should be grouped at one location in the Adama garment manufacturing process layout. Process layout design determines the best relative locations of functional work centers. Work centers that interact frequently, with movement of material or people, advice to be located close together.
- ✓ Under lean manufacturing employees are required to perform multiple takes and provide suggestion for productivity and quality, so the company should be invest in employee training program and encourage workers participation in lean manufacturing operation planning and execution.
- ✓ Since lean manufacturing practices have an effect on operational performance, special attention might be given to appropriately use the practices towards enhancing quality and delivery Performance.
- ✓ The firm might recognize the need to ensure strong relationship with suppliers and customers. The fact that, delivery dependency to suppliers and customer relationships

through regular interactions aims at providing the necessary feedback for production. Improvements in this regard have been instrumental towards an effective operational performance. This has been the bases for quality improvement and on time delivery to the satisfaction of customers. Thus, industry stress the point that long-term partnership should be made with suppliers and customer. Improvement might be done in collaboration with them.

- ✓ To strengthen and move ahead in manufacturing operational performance, it is advisable for the firm to give more importance to lean manufacturing practice practices. The top management advice to endeavor to train and develop employee competencies by updating their skill, knowledge, and attitude on lean manufacturing to enable higher productivity and achieve highest standards of quality, to eliminate product defects, equipment failures (breakdowns) and accidents, to develop multi-skilled workforce, and to create a sense of pride and belonging among all employees.
- ✓ Successful operation in today's competitive environment modern manufacturing required enhancing the effectiveness of production facility. Thus, the industry advice to be supported by both effective and efficient maintenance practice and procedures.
- ✓ In order to enhance competitive positioning, the firm might develop strategic capabilities link lean manufacturing practices to competitive advantage.

5.5 Limitations of the Research

Due to tight schedules of the top management and department head in Adama garment industry, the study encountered difficulties in gaining access to the interview respondents and the researcher had to keep rescheduling their time to align with the availability of the respondents.

Information relating to Lean manufacturing practices is always treated with sensitivity. This caused difficulties in convincing the respondents of the importance of giving sincere answers to the asked questions evidenced through reluctance of accepting invitation to participate in the study to counter the challenge, the research had to inform the respondents in advance the purpose for the research study being carried out, that it was meant for academic purpose only and not for other investigations.

5.6 Suggestions for Further Research

This study concentrated on the study of lean manufacturing practices and the performance of organizations in the military garment manufacturing sector. The researcher recommends further research on the same topic but in other military manufacturing, both within the country and outside the country. This will help to establish whether the same effects will be held true in military manufacturing organizations and in other parts in and out of the country. The findings of the study will motivate the practitioners in Adama garment industry to explore the adoption of lean. The finding of the study can assist the managers of Adama garment industry in planning for a successful lean transformation.

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APPENDICES

APPENDICES I Questionnaire



School of Commerce

Dear Respondent;

I am a Master's Degree student currently conducting a survey on the topic "The effect of lean manufacturing practice on operational performance," at Addis Ababa University School of Commerce in Logistics and Supply Chain Management. The main objective of this survey is to examine the effect of lean manufacturing practice on operational performance of Adama garment industry. This survey is made for the employees of Adama garment industry in different departments, therefore your response is extremely important. Kindly take a few minutes to complete the questionnaire below by answering all questions accurately regarding your understanding of Lean manufacturing practice in your company (unit).

All information gathered in this survey is strictly confidential and will not be representative of any individual respondent. The answers to every question will be combined to aid in the final analysis of the information provided in this study. Therefore, there is no potential for tracing an individual respondent on a given information. It is used only for academic purpose. Thank you very much for taking your time to respond to the survey. Your contribution to this study is appreciated greatly.

Kind Regards,

Mesfin Tedela

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Part 1: General Information of the Respondent

- 1. Job Category (1) Production workers
 - (2) Logistics & Purchasing expert
 - (3) HRM expert
 - (4) Marketing expert
 - (5) Supportive staff

2. How long have you been in this position? (YESR)

- (1) Less than 5 years (2) 5 to 10 years (3) 10 to 15 years (4) above 15 years

3. Educational level of Respondent (EDLR)

- (1) Certificate (2) Diploma (3) Under graduate (4) Graduate (other).....

PART 2: To find out the extent to which Lean manufacturing practices are implemented in Adama Garment Industry?

Please indicate to what extent are the following lean manufacturing practices adopted at Adama garment industry? - (tick the type):

(5 = to a very high extent, 4 = high extent, 3 = Moderate extent, 2 = low extent, 1 = Very low extent)

Just In Time (JIT) Practice

Code	Equipment Layout	5	4	3	2	1
J_EL1	We have laid out the shop floor so that processes and machines are in close proximity to each other.					
J_EL2	Our machines are grouped according to the product family to which they are dedicated.					
J_EL3	The layout of our shop floor facilitates low inventories and fast throughput.					
J_EL4	Our processes are located close together, so that material handling and part storage are minimized.					
J_EL5	We have located our machines to support JIT production flow					
Code	Just-in-Time Delivery by Suppliers	5	4	3	2	1
J_SUP1	Our suppliers deliver to us on a just-in-time basis.					

J_SUP2	We receive daily shipments from most suppliers.					
J_SUP3	We can depend upon on-time delivery from our suppliers.					
J_SUP4	Our suppliers are linked with us by a pull system.					
J_SUP5	Suppliers frequently deliver materials to us.					
Code	Just-in-Time Link with Customers	5	4	3	2	1
J-CL1	Our customers receive just-in-time deliveries from us					
J-CL2	Most of our customers receive frequent shipments from us					
J-CL3	We always deliver on time to our customers					
J-CL4	Our customers have a pull type link with us					
J-CL5	Our customers are linked with us via JIT systems					
Any other (please indicate)						

Total Quality Management (TQM) Practice

Code	Top Management Leadership for Quality	5	4	3	2	1
T-TML1	All major department heads within the plant accept their responsibility for quality.					
T-TML1	Plant management provides personal leadership for quality products and quality improvement.					
T-TML1	The top priority in evaluating plant management is quality performance					
T-TML1	Our top management strongly encourages employee involvement in the production process.					
T-TML1	Our plant management is personally involved in quality improvement projects.					
Code	Customer Quality Involvement	5	4	3	2	1
T_CUQI1	We frequently are in close contact with our customers.					
T_CUQI2	Our customers seldom visit our plant.					
T_CUQI3	Our customers give us feedback on our quality and delivery performance.					

T_CUQI4	Our customers are actively involved in our product design process.					
T_CUQI5	We regularly survey our customers' needs.					
Code	Supplier Quality Involvement	5	4	3	2	1
T-SQI1	We strive to establish long-term relationships with suppliers.					
T-SQI2	Quality is our number one criterion in selecting suppliers.					
T-SQI3	We use mostly suppliers that we have certified.					
T-SQI4	We maintain close communication with suppliers about quality considerations and design changes.					
T-SQI5	We actively engage suppliers in our quality improvement efforts					
Any other (please indicate)						

Human Resource Management (HRM) Practice

Code	Employee Suggestions – Implementation and Feedback	5	4	3	2	1
HR_ES1	Management takes all product and process improvement suggestions seriously					
HR_ES2	We are encouraged to make suggestions for improving performance at this plant.					
HR_ES3	Management tells us why our suggestions are implemented or not used.					
HR_ES4	Many useful suggestions are implemented at this plant.					
HR_ES5	My suggestions are never taken seriously around here.					
Code	Multi-Functional Employees	5	4	3	2	1
HR-MFE1	Our employees receive training to perform multiple tasks.					
HR-MFE2	Employees at this plant learn how to perform a variety of tasks.					
HR-MFE3	The longer an employee has been at this plant, the more tasks they learn to perform.					
HR-MFE4	Employees are cross-trained at this plant, so that they can fill in for others, if necessary.					

HR-MFE5	At this plant, each employee only learns how to do one job.					
Code	Task-Related Training for Employees	5	4	3	2	1
HR-TRT1	Our plant employees receive training and development in workplace skills, on a regular basis					
HR-TRT2	Management at this plant believes that continual training and upgrading of employee skills is important					
HR-TRT3	Employees at this plant have skills that are above average, in this industry					
HR-TRT4	Our employees regularly receive training to improve their skills					
HR-TRT5	Our employees are highly skilled, in this plant					
Any other (please indicate)						

Total Production Maintenance (TPM) Practice

Code	Cleanliness and Organization	5	4	3	2	1
PM_CO1	Our plant emphasizes putting all tools and fixtures in their place.					
PM_CO2	We take pride in keeping our plant neat and clean.					
PM_CO3	Our plant is kept clean at all times.					
PM_CO4	Employees often have trouble finding the tools they need.					
PM_CO5	Our plant is not disorganized and dirty.					
Code	Autonomous Maintenance	5	4	3	2	1
PM-AM1	Production equipment are maintained as per the schedule					
PM-AM2	Operators understand the cause and effect of equipment deterioration.					
PM-AM3	Basic cleaning and lubrication of equipment is done by operators.					
PM-AM4	Production leaders, rather than operators, inspect and monitor equipment performance.					
M-AM5	Operators inspect and monitor the performance of their own equipment.					

Code	Preventive Maintenance	5	4	3	2	1
PM-PM1	We upgrade inferior equipment, in order to prevent equipment problems					
PM-PM2	We estimate the lifespan of our equipment, so that repair or replacement can be planned					
PM-PM3	We use equipment diagnostic techniques to predict equipment lifespan					
PM-PM4	We do not conduct technical analysis of major breakdowns					
PM-PM5	Manufacturing engineers are often on the shop floor to assist with production problems					
Any other (please indicate)						

PART 3: To find out the Effect of Lean Manufacturing Practices on Operational Performance at Adama Garment Industry.

Please rank by a tick in the appropriate box the nature and extent to which the implementation of Lean Manufacturing practices has impacted to your company using the following ratings;

5 = To a very large extent, 4 = Large extent, 3 = Moderate extent 2 = Small extent 1 = Very small extent

Code	Operational performance indicators	5	4	3	2	1
OP1	Product Quality Improvement					
OP2	On Time Delivery Performance					
OP3	Lead Time Reduction					
OP4	Inventory Reduction					
OP5	Wastage Reduction					
OP6	Reducing Customer Complains on Quality & Delivery					

PART 4: Challenges to Lean Manufacturing Implementation

1) Listed below are some of the challenges/ barriers which prevent firms from adopting Lean Manufacturing practices. Please rank by a tick in the appropriate box the extent to which you agree with these challenges using the following rating;

(5 = strongly agree, 4 = Agree, 3 = Neutral 2 = Disagree, 1 = Strongly Disagree).

Code	Lean manufacturing practices implementation challenges	5	4	3	2	1
LMPC1	Lack of top management commitment to lean implementation					
LMPC2	Lack of resources					
LMPC3	Resistance to change					
LMPC4	Lack of all stakeholder engagement					
LMPC5	Lack of proper training/inadequate Human Resource Development					
LMPC6	Inadequate managerial skills					
LMPC7	Poor infrastructure					
LMPC8	Lack of skilled man-power,					
Any other (please indicate)						

APPENDIX II Interview Questions

The interview guide is divided into 4 parts. Section A will be seeking general information, Section B will be seeking information on the extent to which lean manufacturing is employed on Adama garment industry, section C will be seeking information on the effect of lean manufacturing practice on operational performance while Section D will be seeking information on Challenges to lean manufacturing implementation during garment manufacturing process.

Section A: General Information

Tick [√] correct answer

1. What is your job title?

Technical Operator [], Manager [], Department Head []

2. How long have you been in the Industry?

0-5 years [], 6-10 years [], 11-15 years [], 16-20 years [], Over 21 []

3. How long have you worked in your current position?

0-5 years [], 6-10 years [], 11-15 years [], 16-20 years [], Over 21 []

SECTION B: Extent to which lean manufacturing practices and operational performance is employed in manufacturing process at Adama garment industry.

Interview questions

1. What is the level of implementation of each lean manufacturing practice?

SECTION C: The effect of lean manufacturing practices and operational performance of garment manufacturing.

Interview questions

1. What are the effect of lean manufacturing practices implementation on operational performance of garment industry?
2. What are the driving forces behind lean manufacturing implementation?

SECTION D: Challenges to Lean Manufacturing Implementation

1. Please explain as thoroughly as possible the challenges that Adama garment industry faced during the process of implementing lean manufacturing techniques and tools.

Appendix III Descriptive Statistics; for all independent variables

[DataSet1] C:\Users\Admin\Desktop\VID223\Mesfin Research SPSS Doc.edited 22.sav

Descriptive Statistics (Just-in-time Equipment Layout)

	N	Minimum	Maximum	Mean	Std. Deviation
We have laid out the shop floor so that processes and machines are in close proximity to each other.	107	1	4	2.48	.744
Our machines are grouped according to the product family to which they are dedicated.	107	1	5	2.71	.752
The layout of our shop floor facilitates low inventories and fast throughput.	107	1	4	2.54	.634
Our processes are located close together, so that material handling and part storage are minimized.	107	1	4	2.50	.782
We have located our machines to support JIT production flow	107	1	4	2.55	.768
Valid N (listwise)	107				

Descriptive Statistics (Just-in-Time Delivery by Suppliers)

	N	Minimum	Maximum	Mean	Std. Deviation
Our suppliers deliver to us on a just-in-time basis.	107	1	4	2.30	.690
We receive daily shipments from most suppliers.	107	1	4	2.35	.754
We can depend upon on-time delivery from our suppliers.	107	1	4	2.44	.849
Our suppliers are linked with us by a pull system.	107	1	4	2.48	.718
Suppliers frequently deliver materials to us.	107	1	4	2.39	.711
Valid N (listwise)	107				

Descriptive Statistics (Just-in-Time Link with Customers)

	N	Minimum	Maximum	Mean	Std. Deviation
Our customers receive just-in-time deliveries from us	107	1	4	2.50	.794
Most of our customers receive frequent shipments from us	107	1	4	2.78	.850
We always deliver on time to our customers	107	1	4	2.58	.790
Our customers have a pull type link with us	107	1	5	2.64	.838
Our customers are linked with us via JIT systems	107	1	4	2.42	.825
Valid N (listwise)	107				

Descriptive Statistics TQM (Top Management Leadership for Quality)

	N	Minimum	Maximum	Mean	Std. Deviation
All major department heads within the plant accept their responsibility for quality.	107	1	5	2.45	.704
Plant management provides personal leadership for quality products and quality improvement.	107	1	4	2.43	.754
The top priority in evaluating plant management is quality performance	107	1	4	2.62	.854
Our top management strongly encourages employee involvement in the production process.	107	1	5	2.35	.891
Our plant management is personally involved in quality improvement projects.	107	1	5	2.68	.808
Valid N (listwise)	107				

Descriptive Statistics TQM (Customer Quality Involvement)

	N	Minimum	Maximum	Mean	Std. Deviation
We frequently are in close contact with our customers.	107	1	5	2.51	.732
Our customers seldom visit our plant.	107	1	4	2.65	.814
Our customers give us feedback on our quality and delivery performance.	107	1	5	2.78	.850
Our customers are actively involved in our product design process.	107	1	5	2.56	.892
We regularly survey our customers' needs.	107	1	4	2.53	.839
Valid N (listwise)	107				

Descriptive Statistics TQM (Supplier Quality Involvement)

	N	Minimum	Maximum	Mean	Std. Deviation
We strive to establish long-term relationships with suppliers.	107	1	4	2.38	.785
Quality is our number one criterion in selecting suppliers.	107	1	5	2.43	.790
We use mostly suppliers that we have certified.	107	1	4	2.36	.745
We maintain close communication with suppliers about quality considerations and design changes.	107	1	5	2.50	.862
We actively engage suppliers in our quality improvement efforts	107	1	5	2.48	.862
Valid N (listwise)	107				

Descriptive Statistics HRM (Employee Suggestion sand Feedback)

	N	Minimum	Maximum	Mean	Std. Deviation
Management takes all product and process improvement suggestions seriously	107	1	3	2.25	.766
We are encouraged to make suggestions for improving performance at this plant.	107	1	5	3.01	.830
Management tells us why our suggestions are implemented or not used.	107	1	4	2.12	.774
Many useful suggestions are implemented at this plant.	107	1	4	2.32	.735
My suggestions are never taken seriously around here.	107	1	4	2.16	.767
Valid N (listwise)	107				

Descriptive Statistics HRM (Multi-Functional Employees)

	N	Minimum	Maximum	Mean	Std. Deviation
Our employees receive training to perform multiple tasks.	107	1	4	2.08	.702
Employees at this plant learn how to perform a variety of tasks.	107	1	4	2.21	.714
The longer an employee has been at this plant, the more tasks they learn to perform.	107	1	4	2.60	.775
Employees are cross-trained at this plant, so that they can fill in for others, if necessary.	107	1	4	2.33	.774
At this plant, each employee only learns how to do one job.	107	1	4	2.33	.810
Valid N (listwise)	107				

Descriptive Statistics HRM (Task-Related Training for Employees)

	N	Minimum	Maximum	Mean	Std. Deviation
Our plant employees receive training and development in workplace skills, on a regular basis	107	1	4	2.23	.808
Management at this plant believes that continual training and upgrading of employee skills is important	107	1	4	2.09	.783
Employees at this plant have skills that are above average, in this industry	107	1	4	2.59	.726
Our employees regularly receive training to improve their skills	107	1	4	2.21	.599
Our employees are highly skilled, in this plant	107	1	4	2.21	.762
Valid N (listwise)	107				

Descriptive Statistics TPM (Cleanliness and Organization)

	N	Minimum	Maximum	Mean	Std. Deviation
Our plant emphasizes putting all tools and fixtures in their place.	107	1	4	2.73	.808
We take pride in keeping our plant neat and clean.	107	1	5	2.65	.825
Our plant is kept clean at all times.	107	1	5	2.67	.844
Employees often have trouble finding the tools they need.	107	1	5	2.72	.899
Our plant is disorganized and dirty.	107	1	4	2.21	.898
Valid N (listwise)	107				

Descriptive Statistics TPM (Autonomous Maintenance)

	N	Minimum	Maximum	Mean	Std. Deviation
Production equipment are maintained as per the schedule	107	1	4	2.40	.738
Operators understand the cause and effect of equipment deterioration.	107	1	4	2.61	.774
Basic cleaning and lubrication of equipment is done by operators.	107	1	5	2.64	.827
Production leaders, rather than operators, inspect and monitor equipment performance.	107	1	5	2.59	.726
Operators inspect and monitor the performance of their own equipment.	107	1	5	2.70	.849
Valid N (listwise)	107				

Descriptive Statistics TPM (Preventive Maintenance)

	N	Minimum	Maximum	Mean	Std. Deviation
We upgrade inferior equipment, in order to prevent equipment problems	107	1	4	2.33	.737
We estimate the lifespan of our equipment, so that repair or replacement can be planned	107	1	4	2.14	.841
We use equipment diagnostic techniques to predict equipment lifespan	107	1	4	2.51	.793
We do not conduct technical analysis of major breakdowns	107	1	4	2.07	.723
Manufacturing engineers are often on the shop floor to assist with production problems	107	1	5	2.44	.838
Valid N (listwise)	107				

Appendix IV Collinearity statistics between independent variable

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	Total Quality Management (TQM) Practice	.478	2.093
	Human Resource Management (HRM) Practice	.604	1.655
	Total Production Maintenance (TPM) Practice	.501	1.997

a. Dependent Variable: Just In Time (JIT) Practice

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	Human Resource Management (HRM) Practice	.682	1.467
	Total Production Maintenance (TPM) Practice	.440	2.275
	Just In Time (JIT) Practice	.526	1.900

a. Dependent Variable: Total Quality Management (TQM) Practice

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	Total Production Maintenance (TpM) Practice	.429	2.333
	Just In Time (JIT) Practice	.479	2.086
	Total Quality Management (TQM) Practice	.491	2.037

a. Dependent Variable: Human Resource Management (HRM) Practice

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	Just In Time (JIT) Practice	.601	1.664
	Total Quality Management (TPM) Practice	.479	2.088
	Human Resource Management (HRM) Practice	.648	1.542

a. Dependent Variable: Total Production Maintenance (TPM) Practice