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PRODUCTIVITY IMPROVEMENT OF ANBESSA SHOES S.C
THROUGH LEAN TOOLS

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Productivity improvement of Anbessa shoes S.C through lean tools

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ADDIS ABABA UNIVERSITY
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ABSTRACT

Ethiopian footwear manufacturing companies have limitations to compete in the global market. This sector is considered to play major role in increasing country's economy especially in export. But it is not competitive in the international market due to various internal and external factors.

This study was a case analysis on the development of an improved model that works to enhance productivity in the selected shoe factory. The procedures include literature survey, data gathering, and interview with the experts and factory observation to assess the existing work flow. The data analysis was done using Pareto analysis, Cause and effect diagram, lean maturity, value stream mapping and an AutoCAD.

Lean manufacturing is to remove waste, decrease the lead time, increase the PCE and rise the profit and productivity .This work addresses the implementation of lean tools by selecting a gentle man shoe model known as SAWA Lafric and observed its production activity then evaluate Process Cycle Efficiency (PCE), Value Added (VD), Non Value Added (NVD) activities, lead time and takt time. The current state and after the implementation of lean tools, the PCE, takt Time and lead Time is 7.79%, 61,234sec, 14.05sec/pair and 17.08%, 27,949sec, 11.16sec/pair respectively. Lean maturity of the case company assessed and Color codes were assigned for the maturity level and the assigned color codes were Green: Above industry baseline, Yellow: At or near industry baseline and Red: Below industry baseline. The green , yellow and red code for existing lean maturity were 0,17 & 3 respectively and after the implementation of lean tools the code became 11,9 & 0 respectively.

By this study the lean wastage was evaluated; the existing machine layout was assessed and new machine layout is proposed using AutoCAD. After all the production flow was rearranged by minimizing several NVD times such as transportation, waiting, inspection, etc. a productivity improvement model was proposed. This model is significant as it can resolve the identified problems in awareness Creation on management and manpower, improvement strategies, future VSM, as well as continual improvement of the process.

Keywords: *-productivity, Lean maturity, waste, Value Stream Map(VSM),*

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ABBREVIATION

ADLI - Agriculture Development Led Industrialization

ADLI- Agricultural Development Led Industrialization

AME -American Excellence Award

ASSC- Anbessa Shoe share company

BPR - Business Process Reengineering

BSC - Balanced Scorecard

EFI- Ethiopia Footwear Industry EFI

EIC- Ethiopian Investment Commission

ELFI-Ethiopian Leather footwear industry

ELI - Ethiopian leather industry

EPC- Export Promotion Council

EQA -Ethiopian Quality award

FDI- Foreign Direct Investment

HR -Human Resource

LAI -Lean Advancement Initiative

LDI- Local Direct Investment

LESAT -Lean Enterprise Self-Assessment Tool

LFI -Leather Footwear Industry

LIDI- Leather Industry Development Institute

LLP- Leather and leather

NBE-National Bank of Ethiopia

NVAD -Non value added activities

OEE - Overall Equipment Effectiveness

PDC -Product development Center

PM- Performance measurement

RHS-Raw Hide and Skin

RPS - Renault Production System

SME - small and medium enterprise

CHAPTER ONE

1 INTRODUCTION

Economic development is among the main aims of every country in the world and economic growth is fundamental to economic development. Among the different variables that contribute to economic growth export is the one that accelerates the growth. Agosin (2007) finds that export diversification has a stronger effect on per capital income growth.

Most leather goods and footwear manufactured are export-oriented. In today's manufacturing field higher productivity achievement is a very important factor. With the higher productivity, other various factors must be taken into consideration in manufacturing industries such as global competition, lead time and customer need in terms of quality and quantity (MA & NA, 2018)

Export performance measures the extent to which the firm meets its vision when exporting a product in an international market, whether economic (profits, sales, costs, etc.) or strategic (expansion of market, increase in market share abroad, etc.), through the planning and execution of its global marketing strategy. (Cavusgil & Zou, 1994).

The Ethiopian leather industry (ELI) has comparative advantage in the sector as it is capable with abundant livestock resources. In livestock resources Ethiopia stood second from Africa and 8th from world. This huge amount of population in livestock provides sufficient opportunity for the growth of the sector.

The leather and leather products (LLP) sector is the fifth largest export sector of Ethiopia which is considered as the highest priority sector of the government for its increasing value addition. Finished leather represents the largest share of Ethiopia's output and export and it accounted for around 60 per cent of total leather-related exports in 2016. The value of exports of crust leather fell from more than \$90 Million in 2011 to nil in 2016 after the introduction of a 150% tax on export of semi-finished crust leather in December 2011. In parallel, finished leather exports rose from \$25.3 Million to \$67.6 Million during the same period, the main destinations being China, Hong Kong, Italy, Thailand, India and United Kingdom which constitute 88.8% share (Company, 2018).

Due to the fact that the Ethiopian Leather Footwear Industry (LFI) has a huge potential for boosting the country's economy, the government gives higher priority to this sector. However, its

overall productivity of the sector is unsatisfactory due to various factors which include: poor performance measurement practice, limitation with inputs, poor production planning and control practices, high manufacturing cost. Most performance measurement and improvement methods are insufficiently prepared to learning and only few consider the personal ambitions of employees, which in turn lead to insufficient change in the organization's performance. Even the existing methods are not suitable, mostly financial based and also face failure in the implementation due to poor implementation strategy or guideline (Kassaneh & Havinal, 2017).

According to the study by Kassaneh & Workalemahu, 2018 to improve Ethiopian footwear industry a new method for performance measurement and improvement called "total performance score card (TPS)" together with measurement framework and guideline to implement TPS as a result the performance of Ethiopia Footwear Industry (EFI) has been enhanced.

Gonfa revealed in her research the Ethiopian footwear industry to be globally competitive or to improve performance the researcher recommended, import substitution strategy in complement with the export-oriented strategy, Promoting Investment on supporting, Government involvement to create access to reliable and low cost of inputs and access to finance is crucial for shoe industry competitiveness, Thus the researcher focused on the external factor (Gonfa, 2012).

Furthermore, according to the study by Eshetu, the factory's productivity is low when compared to an international benchmark and factory standard. Human, machine, material, method, process, and organizational factors all contribute to multidimensional productivity. The researcher created an integrated continuous productivity improvement model that included lean, ergonomic, and job analysis to increase the productivity of the case business (Eshetu, 2017).

To compete in the global competition firms within this sub sector and understanding the productivity measurement and improvement tool that brings continuous improvement in different level that conveys the firm to improve the productivity.

The use of Lean maturity and value stream mapping (VSM) concepts can be uses in minimizing the non-value added activity(NVD). As a result, using Anbessa Shoe Sc. as a case company, this study focuses on identifying obstacles to improving productivity and developing productivity improvement model for Ethiopian footwear industries.

1.1 Background of the study

In 2018, the value of export leather and leather products increased by 4.8 % to reach 5.2 bln USD, while imports increased by 3.8 % to reach 4.5 bln USD. China, Italy and Hungary were the top exporters in 2018. They accounted for 21.0, 9.3 and 7.1 % of world exports, respectively. USA, Romania and Germany were the top destinations, with respectively 18.1, 9.6 and 5.7 % of world imports

The Ethiopian leather industry is a relatively older industry with more than 80 years of involvement in processing leather and producing leather products. Indeed Ethiopia possesses one of the world largest livestock populations, this enormous population of livestock provides ample opportunity for the development of the leather industry in the country. However, the livestock potential remains lagging behind in its role to accelerate the country's economic development. Lack of effective, efficient and coordinated support in terms of supply of raw hides, skins and other production inputs as well as other related problems are among the challenges faced to achieve the target(UNCTAD, 2018)

Ethiopia has one of the largest livestock sector in the world and the formal LLP sector has existed for almost a century (LIDI 2017). The government under the Emperor Haile Selassie started to regulate the sector and established the Livestock and Meat Marketing Board in 1964 (Schaefer & Abebe, 2015). The Dreg-regime prohibited foreign investors and established the National Leather and Shoe Corporation to manage eight tanneries and six large shoe factories. The value of LLP exports increased from an average of USD 53 million between 1996 and 2000 to USD 135 million between 2013 and 2017 (UNCTAD, 2018) the increase in the value of Ethiopian LLP sector was initiated by the introduction of an export tax on different types of semi-processed leather and increase in new entrants of foreign direct investment (FDI) companies in the leather footwear and gloves sub-sectors.

Today, the value of Leather further prepared after tanning or crusting of the year 2014,2015 & 2016 is USD 62.8 million ,USD 64.7 million & USD 42.3the million respectively. Similarly, employment almost doubled from 11,365 employees in 2012/13 to 21,094 in 2017/18 mainly due to growth in the footwear-sub-sector. Employment levels in tanneries, on the other hand, are stagnating(UN, 2016).

The export of Ethiopia leather footwear started only in 2005; the export value has been growing steadily since then and is expected to make a big impact on the Ethiopian economy. Also the job

opportunities the industry creates could make a significant impact on poverty reduction. At the end of 2014/15 budget year total of 11,138 jobs are created in the sub sector among this females employee took 6,114 and the remaining 5,024 are taken by male employees. On the other hand, 8,310 employees (4,973 female and 3,337 male) are working in large and medium factories; 2,828 workers (1,141 female and 1,687 male) involve in different cluster and micro and small enterprises.

However despite the efforts made to develop the sub sector by different stakeholder such as UNIDO, LIDI, and other concerned bodies, still these industries are not competitive enough within the rapid pace of globalization as expected. One of the main reasons for this is their low productivity as compared to their competitors which are found in East Asia and European countries. The constraints in the sector are lack of awareness to compete in the international market, low productivity of the sub sector which is characterized by shortage of quality skins & hides, high production waste, low utilization of capacity, absence of good work procedure, poor work standardization(Cherkos, 2011; Faruk & Subudhi, 2019; Gebrewahid & Wald, 2015) The opportunity in the ELFI are locally sourced raw material combined with inexpensive labor and these position the country well to grow in the global marketplace.

In 2018, Ethiopia had 30 tanneries with 7,516 employees processing hides and skins to different types of finished leather. By mid-2018, the footwear sector consisted of a few thousand artisanal footwear manufacturers and 19 to 22 formal firms. The formalized footwear sector employed 11,145 people and produced roughly 5 million pairs of leather shoe in 2017/18(Grumiller, 2019) There are 30 tanneries and having a possibility of producing up to 500 million square feet of finished leather per year there are 21 medium and large scale footwear manufacturers. The production capacity of shoe factories including production of Small and Micro enterprises rise to 15 million pairs per year. There are more than 43 garments and goods factories and four gloves factories producing leather gloves, garments, bags & different kinds of leather articles. There are over 400 small and medium enterprises are individually producing leather products with capital ranging from 100,000 ETB – 20 million ETB in different regions of the country.(LIDI, 2019)

1.2 Statement of the problem

Even though Ethiopia has a comparative advantage of footwear industry as compared to China (16.22 % leather foot ware world exporter) in lower cost of production only few companies have

used the advantage. One of the main reasons is low level of productivity in the sub sector. For example, international benchmark has a production of 6500 pairs/shift/day whereas the achievement of most of EFI is not more than 2000 pairs/shift/day. Also, the international benchmark has labour productivity 16pairs/shift/person but Ethiopian shoe factories have about 4 pairs/shift/person (Eshetu, 2017). The major problems outlined in the case company are discussed as follows.

i. Production section

High manufacturing costs results from rework (61,903pair of shoe per annum),Poor and disorganized production plan result from no systematic method of authorizing, documenting and recording the various stages of plans in such a way that they can be used as feedback for assessing and tracking results, as well as taking corrective action owing to a high rate of downtime, defect rate ,excess inventory , Poor plant layout result in enhance transportation wastage , Low labor productivity and Low overall equipment efficiency (OEE) are 3.389%, 9.629%,14.93%,21.35% , 3.389pairofshoe/shift/worker and 20% respectively.

ii. Product development section

There is no known method of forecasting fashion considering international competitors due to limited resources, lack of skill and technology accessibility. Due to these they do not use innovative process instead they are using reverse engineering and also the department uses time study other than method study.

iii. Sales and Marketing process problems

They also do not perform market research and sell their goods in a small way, The customer and the industry don't have any sharing of resource and database,Weak distribution system management: high inventory hold-up - finished products stock, resulting in capital constraints, obsolete (damage, faulty, or despair) stock in each retail store, low annual sale results, and high selling and distribution costs.

iv. Purchasing and Distribution process problems

Poor inventory management with retail shops and warehouses, Stick on limited number of suppliers they do not update themselves as per the need of the market and lacks measuring the performance of the suppliers.

v. Human Resources problems

Employee dissatisfaction (unsatisfactory pay, no house allowances) reduces labor productivity, Skill enhancement trainings are not delivered on a regular basis in a planned and recorded manner, such as by creating appropriate training records such as a list of defined training topics that occur as a result of actual skill gap audits and training reports.

1.3 Research Questions

This research attempts to answer the following basic research questions:-

- ❖ How does a company evaluate overall productivity?
- ❖ How to minimize the non-value added activities (NVAD) using the current value stream mapping (VSM)?
- ❖ How does a company determine its overall leanness, PCE, Lead time, OEE, VSM and maturity level?
- ❖ What are the challenges of the case company in improving of productivity?
- ❖ What kind of productivity performance improvement model can be used to address the issue?

1.4 Objectives of the study

1.4.1 General Objective

The general objective of the study is to improve productivity of ASSC through lean tools that works to enhance productivity of ASSC

1.4.2 Specific Objectives

The specific objectives of the study are:-

- ❖ Examine the factory's existing productivity.
- ❖ Identifying the value added activities (VAD) and non-value added activities (NVAD) so as to minimize the lead time of the factory.
- ❖ Measure and assess the factory's current PCE, Lead time, OEE, VSM and Identifying its overall leanness and maturity level of case company and also Propose future VSM and improving PCE and Lead time
- ❖ Identify the challenges of the case company in improving of productivity
- ❖ Develop a model for improving productivity of a case company

1.5 Significance of the Study

Through the implementation of an improving productivity model for enhancement productivity factors available in the factory, the study's findings support ASSC as well as other footwear companies. Furthermore, the enhancement strategy results in noticeable improvements in the footwear manufacturing process as well as general working conditions.

The research will also have leanness and maturity level measure that will help to increase the productivity of the manufacturing process.

The study findings will be used as an input for academician, research improvement model for other related manufacturing sector to improve their productivity.

1.6 Scope and Limitation of the Study

1.6.1 Scope of the Study

The study was focused on improving productivity and challenges that hinder the productivity in a case to ASSC. ASSC is taken as a show case because it is one of the oldest shoes factories in the country and a market leader, commanding approximately 65% to 70% of the local shoe retail

business. It also contributes significantly to the generation of foreign currency for the country by exporting shoes to different parts of the world with more than 37 retail shops all over the nation, more than 80% of its total production is intended for export market, it's one of the industries equipped with the art of the technology machineries to European standard complying with international measurements..

Methodologically, this study was applied both qualitative and quantitative aspects of research so as triangulate the instruments from different directions. The participants and head of firms are located in case company, which in turn limits the findings to be applicable to other industries, engaged in footwear of the country. Meanwhile, there is an indication that the findings of this study can be generalized to other industries engaged in footwear of the country having similar structure, settings and group of an industry.

1.6.2 Limitations of the Study

Due to COVID-19 the data collection period were not be accomplished according to the plan and it cause prolonged time. This cause the researcher to incur additional resource and time In addition to this the data collection which were planned were group discussion was changed into one-to-one interview. But these problems have been fixed by the use of observation, secondary data from the literature and the data from the case company.

1.7 Organization of the study

After discussion of first chapter on the introduction, background, statement of the problem, research question, objectives, significance, scope and limitation of the study; the second chapter presents the important literatures surveyed from reference materials. Chapter three presents the methods of the research, ways of data collection strategy and source of data and Tool and method of Data Analysis; Chapter four provides overview of Ethiopian footwear sector; Chapter five gives data collection, analysis and interpretation; Chapter six gives proposed the future states of shoe production line and customized for model implementation process proposed. The final chapter presents the conclusion and recommendations drawn from this study. In addition, the chapter gives the possible study areas that can be undertaken in the future.

CHAPTER TWO

2 RELATED LITERATURE REVIEW

2.1 Introduction

In the improving productivity of the industry measuring the productivity of the industry is the first task to do without measuring the productivity it is impossible to improve it. Therefore, in this research both productivity measurement and improvement were studied. To understand the subject matter of productivity measurement and improvement different journals, articles, and books are reviewed. Hence, this chapter gives brief discussion of the various concepts of productivity measurement and improvement

2.2 Definition and concepts of productivity

The terms performance, productivity and profitability (PPP) have coinciding meanings. The three terms are labelled as ratios, and they are used easy to confuse. These measurements terms are crucial ingredient of improvement work, and they are a vital ways of measuring information so as in the improving the output of the industry. The results in the measurement help in assessing the problems in improvement and decide the measures or approach for improvement and also help evaluate the results of an improvement program. In profit making & non-profit making organization performance also defined as proper combination of efficiency and effectiveness .Efficiency mean to “doing things right” and effectiveness mean to “doing the right things” (Grünberg, 2004).

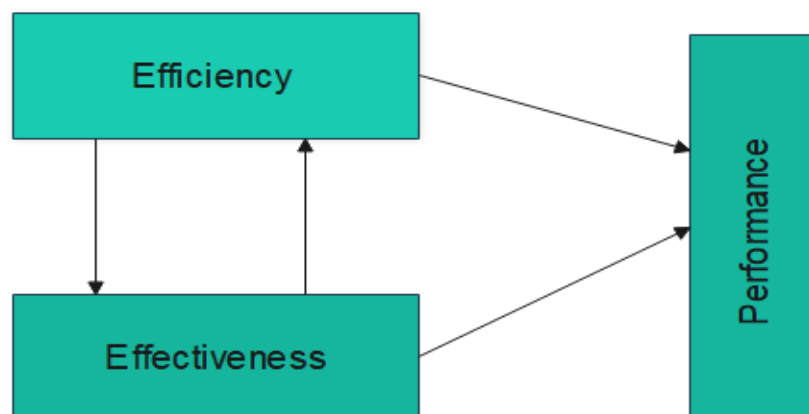


Figure 2-1 Components of performance

Depending on the purpose Performance of a manufacturing firm can be defined in several ways. From a socio-economic perspective, profit is the most common measure of a firm's performance. Other indicators include internal rate of return, productivity, superior quality and reliability, flexibility, efficiency, effectiveness, capacity utilization, growth of output and net present value, and market share. Manufacturing performance as the relationship between the quality and quantity of physical outputs in relation to inputs used in the production process. Productivity is one indicators of performance under the umbrella of performance.

So as to determine the level of performance, it should be measured .The basic logic behind to performance measuring is that setting plan and detecting deviation from the sated plan. In measuring Performance information gets on a specific program such as on the condition on inputs, activities, outputs, intermediate outcomes, or end outcomes. Performance measurement includes both the collection and analysis of numerical data on each activity on the process (Wholey, 1999).

2.3 Productivity

Productivity measure the efficiency and effectiveness of organization resource (input) are utilized or the creation of products or services (output).In footwear industry the “input “are manpower, machine and factory resource to make the product and the “output” is the number of product produced. Productivity expressed in terms of labour productivity, machine productivity (Overall Equipment Effectiveness (OEE)).(Ali, 2018)

Overall Equipment Effectiveness (OEE) is the gold standard for measuring manufacturing productivity.

Simply said – OEE identifies the fraction of manufacturing time that is genuinely productive. An OEE score of 100 % means you are manufacturing only Good Parts, as quick as feasible, with no Stop Time. That means 100 % quality (only good parts), 100 % performance (as quickly as feasible), and 100 % availability in OEE terms (no Stop Time).

The shoe industry's low productivity can be attributed to a variety of factors, these are: (1) a lack of technology investment, (2) lengthy supply chains carried out by businesses and (3) the company's machine productivity is dwindling. The Kaizen system was introduced by the case company in order to increase and improve productivity. Despite the fact that the program has been implemented, the corporation has never measured the equipment's or its employees' effectiveness. Breakdown, Setup and Adjustment, Idling, Reduced Speed, Quality Defect, and

Start-up are all challenges in the stitching section of case company, so the company cannot identify the variables that cause losses in operations, resulting in low plant or equipment effectiveness.

OEE is made up of three primary pieces, one of which availability (time of machine availability), quality (number of units produced) and performance (number of units produced)

The outcomes of mathematical calculations OEE is expressed as a percentage (percent). Calculations of OEE on the basis of an equation (1)

$$OEE = Availability * Performance Rate * Quality Rate \dots\dots (1)$$

- **Availability**

The availability of equipment's net time is referred to as loading time. During a period of time, such as a day, week, or month, as demonstrated in a formula (2)

$$Availability = \frac{Run\ Time}{Daily\ working\ hour} * 100\% \dots\dots (2)$$

Run Time is simply daily working hour less down Time, where down Time is defined as all-time where the manufacturing process was intended to be running but was not due to Unplanned Stops (e.g., Breakdowns) or Planned Stops (e.g., Changeovers).

- **Performance Rate**

Performance takes into account anything that causes the manufacturing process to run at less than the maximum possible capacity when it is running...

The performance rate of a machine is the rate at which it performs. Producing products on a line or at a plant dependent on operating conditions capacity -based as defined in the following formula

Performance is the ratio of Actual Capacity to Design / Installed Capacity. It is calculated as

$$Performance\ Rate = \frac{Actual\ Capacity}{Design(Installed\ Capacity)} * 100\% \dots\dots (3)$$

- **Quality Rate**

Is the average level of products produced according to standards compared to products that not in accordance with the standards. (Wahyudin et al., 2019).

$$Quality\ Rate = \frac{Processed\ Amount - (Reject + Rework)}{Processed\ Amount} * 100\% \dots\dots (4)$$

2.4 Productivity Measurement

The purpose of the productivity measurement is the first step to evaluate and comprehend the current state of the process. The steps involving in productivity measurements are collecting data on measures of quality, cost, and throughput/cycle time. Measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress towards pre-established goals. Productivity measures the ratio of type or level of input used to the direct products and services delivered by a platform (outputs). (Angerasa, 2018)

2.5 Productivity Improvement Tools

In productivity improvement, it is significant to link the actions to productivity measures and set targets which should be achieved based on the strategy of the company. It is important to support continuous improvement at a strategic level as well as to give the continuous improvement work strategic direction to maintain positive effects.

The use of the various improvement models and tools has been variable with equally variable impact. The aim of the review under this sub-section is to raise awareness and understanding of some of the more popular productivity improvement models and tools available. And also the abundance of approaches in the literature indicates that no single improvement program appears to have comprehensively met the requirements of manufacturing productivity improvement. The following tools are enabling the industry to compute in the market

- **Balanced Scorecard(BSC)**

These tools look at customers, finances, internal processes, and learning and innovation. To be balanced scorecard is one that contains: -multiple perspectives of performance -leading and lagging measures -internally focused and externally focused measures -short-term and long-term measures -quantitative and qualitative measures

Several researchers including noted that the firm performance is an integral part of the enterprise itself because this is the primary indicator where people can judge whether the enterprise is doing well or not The firm performance can serve some functions as well as a few purposes. (Journal et al., 2019; Tavani et al., 2014) In the small and medium enterprise (SME), the balanced scorecard can be applied to recognize the linkages among the goals and objectives and organizational outcomes. The BSC relations financial consequences with operational data thereby creating avenues to modify or line up operations with long-term enterprise goals, such as

how the BSC has been adapted to measure the firm performance in the SMEs are addressed in the remainder of this segment (Niven, 2011)

- **Business Process Reengineering(BPR)**

It concentrates on deep-seated change to improve operations. This approach associate the hard case for reengineering with the softer people aspects ensuring the solution can be implemented with minimum problems

- **Total Quality Management (TQM):**

Focus on overall activities on the industry and control business processes and customer satisfaction. Activities such as improvement, statistical control, supply control and quality engineering are ingredients of TQM.

- **Kaizen:**

Means continuous improvement which is a Japanese business philosophy of making continuous improvements and enhancements in business processes. Kaizen techniques are based on the principles of focused continuous improvement, commitment of leadership, empowerment of staff, hands on doing not proposing, and elimination of waste and low budget incremental improvements with occasional breakthroughs.

- **Six Sigma:**

This means that there are just six standard deviations between the average and the minimum or maximum acceptable standard. In practice this means that very few outcomes deviate from the ideal. The idea is that if you can measure the number of defects in a process, you can then systematically eliminate them and optimize the process.

- **Lean :**

It originated in the mass production setting of the automobile industry, specifically the Toyota Production System (TPS). It is primarily focused on the minimization of waste of any form. When wasteful action is eliminated the result is that less effort, space, and capital are required and lead time is reduced whilst quality increases and the cost of quality decreases. From its manufacturing roots, lean has subsequently expanded to business practice generally.

2.6 Lean Concept

Lean is an administration approach for progress as well as a methodology that is attentive in reducing cost, cycle time, waste and increase productivity (Eshetu, 2017). It also assesses a process by equating the value-added steps versus the non-value-added.

2.7 Evolution of Lean

According to The Lean Management Maturity Self-Assessment Tool Based on Organizational Culture Diagnosis Wieslaw Urbana,* Lean is not a single piece of introduction into the industry. It is a continuous and never- ending process of improvement. Therefore, understanding the advancement in a Lean journey is very valuable for managers. Lean manufacturing in Toyota Production System (TPS)emphases on eliminating waste, reducing inventory, improving throughput, and inspiring employees to bring attention to problems and suggest improvements to fix these(MA & NA, 2018). The main scope of lean manufacturing is to remove waste and decrease the cycle time to rise the profit and productivity by increasing the production and decreasing the cost of product .A main concept of lean manufacturing is pulling production in which the flow on the factory floor is driven by demand from downstream pulling production upstream and & its scope is to eliminate waste and reduce the cycle time as a result increase the profit and competitiveness (MA & NA, 2018; Ramakrishnan & Nallusamy, 2017).

The lean philosophy principles were originally applied in 50s in the motor's production and later starting from 2000 and onwards, the lean concept has participated in a greater degree of eventuality and the scope has been distended to include the organizational learning perspective and currently the lean concept is applicable to both production and service industry.

On Table 2-1 the different practices from the Lean philosophy and their characteristics are presented (Bezanue Eshetu).

Table 2-1 Lean practices and their characteristics

Lean practices	Lean Characteristics
Just in Time (JIT)	Production levelling ,Pull system ,Production according to Takt time and Process synchronization
Resource reduction	Producing in small batches, Waste elimination, Reduction of set up time, Reduction of lead time and Reduction of stock

Human relation management	Team organization, Multidisciplinary training and Workers involvement
Improvement strategies	Improvement circles, Continuous improvement (kaizen) and 5 why analysis
Defect control	Automation, Failure prevention, 100% inspection and Line stoppage
Supply chain management	Mapping value flow(VSM and flow charts) and Workers involvement
Standardization	5 s, Standard work and Visual management and control
Scientific management	Policy deployment, Multi manning, Reduction of work force, Layout adjustment and Cellular manufacturing

Source: (Eshetu, 2017)

2.8 Lean Levels

Creating a lean culture in a company necessitates behavioral improvements at all levels of the organization. To implement improvement, there is a clear need to use supportive resources and trainings. On the one hand, being lean is often part of a company's core business plan and should be included in any significant and strategic decision. Equipping workers with effective techniques and procedures and encouraging them to use a suitable collection of those techniques for any challenges or improvement events, on the other hand, can have a significant effect on a company's success.

There are two key areas of realistic and academic studies that have been attempted to drive lean to a more efficient and successful definition. First, the strategic viewpoint of lean five concepts, which focuses more on the intellectual perspective of lean as a management theory and a way of thinking. Second, lean as an organizational improvement strategy, which focuses on lean as a collection of management strategies and tools for improvement from a functional standpoint (Ali Maasouman & Demirli, 2015).

2.8.1 Lean Principles in Strategy

Lean, according to (Ali Maasouman & Demirli, 2015) occurs on two levels: strategic and operational. They concluded in their study on the evolution of lean that recognizing the difference between lean thought at the strategic level and lean development at the operational

level is critical to implementing the right techniques and strategies and creating value from customers.

2.8.2 Lean Principles in operational Level

The main objective of the Lean management in the operational level standard is to increase the value creation through waste reduction, meaning, create more value with fewer resources. As described on the book Lean thinking, Womack et.al (1996) refined lean principles to five.

- **Value and Waste (MUDA):**

To identify “value”, from the customer perspective, is important to answer the questions: What do clients want? When and how do they want it? What combination of resources, abilities, availability and price is the ideal one for the client? Muda is the Japanese word for “waste”, specifically any human activity which absorbs resources but creates no value. Lean means “manufacturing without waste”. Waste is everything other than lowest amount of equipment, materials, parts, and working time that are completely vital to production. According to Highways England Lean Maturity Assessment (HELMA, 2018) the eight types of waste are :

1. Transportation: Diminish the distance between processes, and avoid temporary material locations. The causes for excessive transportation are poor route planning ,complex material flows , poor layout and disorganized workplace
2. Inventory (stock) excess: Offer material when needed by the customer and only in the quantity required. The causes for unnecessary inventory are over-production ,unbalanced line , long lead times ,high rework rate and lack of material requisition and issuance standards
3. Motion excess: Simplify standardized work sequence to eliminate redundant movements. The causes for unnecessary motion are poor lay-out and housekeeping , disorganized work place and storage locations , unclear, non-standardized work instructions and unclear process and materials flow
4. Waiting time: Assure machine availability, assure manpower & assure resource, Perform preventive maintenance. The cause of waiting are line imbalance ,inflexible work force , unscheduled machine downtime ,long set-up , material shortage or delay and manpower shortage or delay
5. Over production: Produce only the amount of goods necessary-not faster, sooner, or more. The causes for over production are volume incentives (sales, pay, purchasing) ,high

capacity equipment ,line imbalance; poor scheduling, poor production planning and cost accounting practices that encourage buildup of inventory

6. Over processing and extra process steps: - Provide only the required amount of processing and effort for each operation. The causes for over processing are unclear customer specifications , frequent engineering changes and unclear work instructions
7. Defects or rejects: - Perform each operation without error. Build quality into every process. The causes for defects are unclear customer specifications ,incapable processes, lack of process control, unskilled personnel and incapable suppliers
8. Skills misapplication: encouraging and making constructive use of the creativity. The causes skills misapplication are imagination of the people actually doing the work

Most companies waste 70-90 % of their available resources. Even the top lean manufacturers possibly waste 30 %. Interestingly, every company has to find its own way to implement the lean method: there is no universal way that will apply to all. Despite the wide knowledge and available resources, many companies are struggling to stay “lean”.

- **Value Stream mapping (VSM):**

It is a method for demonstrating and examining the logic of a production process. The map gives a graphical summary of the stream of material and information in a production process. It is the set of all the value added and non –value added activities.

Through reviewing different literature the advantages of VSM is described as follows

- ✚ Shows a clear image for the manufacturing process
- ✚ Identifies the loss & the causes for the loss from the value stream
- ✚ Allows envisioning the future effects of the improvement measures
- ✚ Allows fast & well-organized actualization of the process within the company
- ✚ Recognizes the prospects of improving the processes
- ✚ Uses a common language for all the processes that take place within the company
- ✚ Can be used as a base for upgrading plan;
- ✚ Facilitates the understanding of products cost components
- ✚ Allows quick reaction to demand variation
- ✚ Facilitates the growth of contribution to added value
- ✚ Has as effect the reaction the reduction of production time
- ✚ Standardization of production process

- ✚ Offers an overview image by incorporating different subjective views

The disadvantages of VSM are:

- ✚ In case of large manufacturing nomenclature VSM is hard to achieve
- ✚ Regardless of the human resources VSM presents the situation technically (Ofileanu, 2015)
- **Flow:** - the lack of a continuous value flow is the main responsible for huge loads of stock either on storage houses as throughout the production line, constantly consuming human capital.
- **Pull:** - The pull system, on the other hand, is the capacity to design, schedule and make exactly what the customer needs. It means you can throw away the sales forecast and simply make what customers actually tell you they need.
- **Perfections** :- This principle implies the strongest and continuous commitment of people in order to improve all the processes and activities in companies. . This is implied on the key idea of Lean Production: “doing more with less” and less means less space occupied, less transports, less inventories, and most important, less human effort (Eshetu, 2017)

2.9 Lean practices

According to Setianto & Haddud, 2016 Lean manufacturing (LM) is one of the management approaches that was imitative mostly from the Toyota Production System (TPS) by the idea of eliminating wastes from manufacturing systems. As a long term method with a complex process, organizations may face difficulties to achieve maximum benefits from lean implementations. It is significant to remind that what has been attained in Toyota cannot be easily adopted in other manufacturing businesses. As information, adopting lean practices is not an easy mission and many companies have described implementation difficulties the researchers also argue that the obstacles of lean implementation are mostly related to social and managerial issues. In measuring & assessing lean development practices, defining the maturity level is very important to describe sequential steps and guide the organization to achieve maximum leanness levels and manufacturing business performance .Therefore, it is important to clearly define each maturity level within milestone attributes being assessed including tactical and strategic nature.

2.10 Existing Lean Management maturity assessment model

As a starting point for developing an instrument to assess lean service adoption, a literature review was conducted. The literature review was intentionally broad. In improving the performance first the current level of performance should be measured the researcher used the terms “lean” and “leanness” interchangeably together with four keywords related to measurement: “assess”, “measure”, “evaluate” and “audit”.

Instruments for assessing the adoption of lean in manufacturing have been around since the mid-1990s (Malin Malmbrandt and Pa”rA° hlstro”m Stockholm, 2015). Three main types of items could be identified in lean assessment .These are enablers of lean adoption, the second focus on use of lean practices, and the third on operational performance.

(1) **Enablers of Lean:** - often include management commitment, training for employees and time and resource allocation .These types of items stress the importance of achieving behavioral and even cultural change for the adoption of lean to be sustainable.

(2) **Lean practices:** - focus on the way of working that is seen as consistent with lean principles. Examples of these types of items can be usage of processes.

(3) **Operational Performance:** - refers to items measuring operational performance and are similar to financial performance measures in that they focus on the results of lean adoption, for example, increased productivity

In general, assessment models or maturity models can be a useful tool for assessing an organization's or a process' ability. The findings are then used to create a roadmap for the organization's or processes ideal future state. Qualitative and quantitative surveys, as well as academic and industrial research, are suggested in the literature to capture the current state of organizations.

2.10.1 Qualitative Assessment for LMM

In recent years, a number of qualitative assessment methods for the evaluation and implementation of lean concepts have been developed. On the operational level, for example, Renault Company created the "Renault Production System (RPS)" based on the Nissan Production method. In order to raise RPS has set four strategic goals for customer loyalty.

- ✚ Achieve the required level of quality
- ✚ Lower average production costs
- ✚ Output at the right time and in the right quantity

✚ Shared respect and personal responsibility

To improve industrial output, RPS rules, procedures, and techniques are used. Product and Process Design, Inbound Supplying, Outbound Logistics, and Manufacturing are the four primary manufacturing roles. The RPS visual model depicts the equipment and procedures used by Renault in its production system. RPS also develops a regular excellence roadmap, which outlines how the RPS is implemented and evaluated. The RPS roadmap also ensures that all change programs are coordinated and moving in the same direction as the RPS plan. The roadmap is backed up by an evaluation framework that provides general checklists for system criteria at each stage of excellence in the system's eight pillars. The method is evaluated in each pillar based on the "desired degree of generalization," "management," and "desired outcomes."

For over fifteen years, the Massachusetts Institute of Technology (MIT) has been conducting research and promoting enterprise-level transitions in large complex sociotechnical enterprises through its Lean Advancement Initiative (LAI) research team. These businesses have operated in a variety of industries and government agencies, including aerospace, automobile, communications, health care, transportation, manufacturing, military procurement and logistics, testing laboratories, and more. What has come out of both field action study and its analysis? The definition of "overarching" enterprise values and transition methodologies that are independent of industry or entity is used in case studies in graduate courses. The following five elements make up a transformation system: Enterprise Thinking Key Principles, Enterprise Transformation Roadmap, Lean Enterprise Self-Assessment Tool (LESAT), Enterprise Strategic Analysis for Transformation (ESAT), and Enterprise Architecting (Nightingale, 2009).

To complete the model, LAI proposed a lean evaluation system, lean Enterprise Self-Assessment Tool (LESAT). LESAT is a useful tool for determining an organization's readiness for transition as well as its maturity level. The MIT-developed "Lean Enterprise Self-Assessment (LESAT)" is aimed at the enterprise leadership team and is designed to help both the "as-is" (current state) and "to-be" (desired state) states of the company in terms of lean manufacturing. With 54 lean enterprise activities, LESAT recognizes three major dimensions of an enterprise: lean transformation/leadership, life cycle processes, and supporting infrastructure processes. Each activity is graded on a scale of one to five, with a maturity matrix evaluation sheet included. LESAT is a systematic, informative, and action-oriented tool that identifies the gaps and provides a roadmap for achieving the desired maturity level. (Kolla et al., 2019)

Main characteristics of each level in LESAT has described as follow. These are :-

- Level 1: “Some knowledge of this practice; intermittent improvement” In a few places, activities could be underway.”
- Level 2: “General awareness; ad hoc solution used in a few cases.” areas of varying levels of efficiency and long-term viability.”
- Level 3: “A formal approach/methodology used in a variety of situations. ”Stages in most areas; supported by metrics; excellent “maintenance.”
- Level 4: “Continuous refinement and change around the board” the company; improvements in performance are maintained.”
- Level 5: "Excellent, well-defined, creative approach is completely implemented across the extended enterprise (across internal and external value streams); recognized as best practice"

2.10.2 Quantitative Assessment for LMM

The second set of assessments evaluates leanness based on performance outputs produced as a result of lean implementation. Data envelopment analysis (DEA)-leanness, for example, was proposed by (Ali Maasouman & Demirli, 2015; Wan & Chen, 2009) as a single index of leanness standard. They developed a lean measurement method and determined the future improvement path using a Slacks Based Model (SBM).

2.11 Selection of an appropriate model or tool

Each tool have its own place to apply and to solve the problem and when we apply the tools each have both positive and negative components and the situation and where it is used affects the applicability. Before selecting a specific productivity improvement tool or approach. First the following questions should be address. These questions are: What are you targeting to change and improve? What result are you looking for? Does the improvement need to be complete covering all the organizations activities or designed for a specific task, service or area of activity? What is the key driver for change i.e. inspection or review, change of staff, etc. What is the timescale for the change? What resources are available? To what extent do you want to involve staff in the changes? Individual authorities and organizations will need to undertake research to decide on the approach or balance of approaches that would best suit their organization and circumstances.

Industries and other organizations are always targeting for better productivity. There are accessible a series of tools, methodologies and models designed to improve their industries and achieve higher productivity. The Lean Management approach looks to be the most active tools in terms of attaining substantial performance improvement in a comparatively fast way. Lean maturity tool is helpful for companies in many ways, mainly in thoughtful existing gaps in Lean acceptance and recognizing further change paths.

Lean Management's development route is unique in each organization and Lean transformation is intensive on Lean practices these are tools and techniques. Lean practices might considerably vary between organizations targeting at Lean excellence. . For this research the idea of a Lean maturity assessment is based on organizational culture is intended judge an organization & the qualitative evaluation of lean maturity assed (Urban, 2015).

There is a wide variety of lean strategies and approaches which can be used to improve the organizational effectiveness and performance. With the widespread adoption of the lean production model, the number and variety of management tools associated with it has grown.

In his book "Toyota Production System: Beyond Large-Scale Production,"(Langstrand, 2016) presented the core TPS principles and techniques. TPS House, a demonstrative model of the Toyota Production System, depicts a range of key tools 22 and techniques under the two pillars. Just-in-time and automation (Jidoka) is the two foundations, and the tools/principles are as follows:

- ✚ Heijunka: - “Leveling the type and quantity of production over a fixed period of time. This enables production to efficiently meet customer demands while avoiding batching and results in minimum inventories, capital costs, manpower, and production lead time through the whole value stream.” <https://www.isixsigma.com/methodology/lean-methodology/heijunka-the-art-of-leveling-production/> accessed in Jun 16,21
- ✚ Standardized work: - defines how a job is performed; it details the interaction of the operator and machine or process to complete the work as “waste free” as possible.
- ✚ Kaizen: - Kaizen is a Japanese term meaning "change for the better" or "continuous improvement." It is a Japanese business philosophy regarding the processes that continuously improve productivity and involve all employees.
<https://www.investopedia.com/terms/k/kaizen.asp> accessed in Jun 16,21

- ✚ Continuous flow: - Lean method that allows the act of moving a product through the production process from start to finish without stopping. In pure continuous flow, the cycle time equals the lead time, as the product never sits in a queue waiting to be worked on
- ✚ Takt time: Takt-time is the unit of time in which a product must be produced (supply rate) in order to match the rate at which that product is needed (demand rate). It is calculated by dividing the total available time per day by the daily customer demand.(MA & NA, 2018)
- ✚ Pull system: - is a Lean technique for reducing the waste of any production process. Applying a pull system allows to start new work only when there is customer demand for it. This allows reducing overhead and optimizing storage costs.

The researches were further examined and evaluated based on the following key factors on performance:

- Value stream mapping (VSM)
- Takt Time Analysis
- Identifying, quantifying and reduce the non-value added activities (NVD)
- Improvement strategies
- Lean culture associated with human resource Employee satisfaction, Quality
- Customer Collaboration, Coordination & satisfaction
- Supplier Collaboration, Coordination & satisfaction
- Export challenges & determinates
- Value stream mapping (VSM)

It is a method for demonstrating and examining the logic of a production process. The map gives a graphical summary of the stream of material and information in a production process. The researcher describe VSM in four stages these are determine the value stream to be improved, current state VSM, future state VSM, implementation procedure .In current state VSM the researcher plot the current VSM using free hand sketch following commonly used symbols and it also incorporate production process data . (Langstrand, 2016)These are

- ✚ Customer demand: The number of products that the customers are expected to buy or order during a certain time period.

- ✚ Cycle time (C/T): The time required to complete one cycle of an operation; or to complete a function, job, or task from start to finish. For automated or compound processes, the cycle time is the time between each output from the process.
- ✚ Process time (P/T): Total time required to properly handle an item within a process step. This includes order preparation time, run time, move time, inspection time, and put-away time. For simple processes, the cycle time and the process time can be used interchangeably.
- ✚ Changeover time (C/O): Activities that are required to prepare an operation or process for another type of product. The time allocated for this is called changeover time. Also known as setup time.
- ✚ Number of operators (Op. or the symbol)
- ✚ Capacity (Cap.)
- ✚ Available time
- ✚ Uptime/downtime: Time when equipment is available / unavailable for production due to e.g. equipment breakdown or planned maintenance.
- ✚ Quality or defects rate (Q)
- ✚ Number of product variations
- ✚ Batch size
- ✚ Inventory levels(Langstrand, 2016)

- **Takt Time Analysis**

It is the production step that we need to be able to preserve in order to meet customer demand. This is calculated by the following formula.

$$\text{Takt time} = \text{Available Time} / \text{Customer Demand}$$

After determining the Takt Time comparing the Takt time with cycle time if some activity has a cycle time that is longer than the takt time, the company will not be able to deliver a sufficient amount of products to meet the customer demand. Then assessing the balance of the production process is relating the cycle times between operations this helps us to recognize potential bottle necks in the process (Langstrand, 2016). There has been a lot of research conducted worldwide on productivity of footwear industry and their improvement for the last years. This study has reviewed the recent literature ranging from 2004 to 2019.

Table 2-2 Literature for “productivity improvement – footwear in particular”

Sr. No	thematic topics	Author	methods and tools	Findings	challenge/Gap
1	Footwear Design Strategies for the Thai Footwear Industry to Be Excellent in the World Market	Adul Adulyan ukosol and Thanin Silpchar u,2020	Applied/used SPSS and structural equation modeling (SEM) mixed method	Both descriptive and inferential statistics analyzed using the SPSS program. Multivariate statistical analysis and structural equation modeling (SEM) were conducted through AMOS with the evaluation of data model fit for four values	The research neglected human factors.
2	Simulation Modeling and Analysis for Stitching Line of Footwear Industry	Chen, J. C., & Chen, J., 2014	The model was done by using Flexsim 5.1.2 step by step based on the specification from the company by observation, Validation and verification process was conducted in assistance of company	Product with lower production steps will enable to reach higher UPMH. Usage of 2-lines is more favorable as it's resulting in higher UPMH. Higher batch size will also increase UPMH. Here, batch size of 6 is more recommended to use. Lower task time deviation is slightly better than the higher one.	Only one performance parameters are used . The simulation based on operational practice. Involve method to optimize workstation and operator assignment. Quite troublesome to conduct an experiment in the

			personnel and by comparing results with specified design.		real production floor
3	Performance improvement Towards a method for finding and prioritizing potential performance improvement areas in manufacturing operations	Grünberg, T.,2004	Formulating a relevant research problem influenced phase comprises of analysis, the heaviest part of the work (for The third phase and the second theoretical part, is synthesis of the analyzed material	proposes a methodology for improvement work	The gap with this study is it looks into the theoretical aspect and it lacks the real case experience.
4	System Dynamics and Learning Scenarios for Process Improvement and Regional Resilience: A Study in The Footwear Industry of Southern	Machado, C., Sellitto, M. A., & Morandi, M. I. W,2017	Systems dynamic model of the impact of the footwear-industry activity of a city in the south of Brazil over the city resilience. Cause and effect diagram to List factors influencing the	From the systemic analysis, five main learning scenarios were identified: (i) the ASIS, (ii) the uniform distribution of investment, (iii) the labor training investment, (iv) the value-added marketing investment, and (v) the solid waste treatment investment.	It doesn't establish a performance index so as to generate models that would be capable of controlling evolutionary paths toward process improvement and of increasing the regional resilience of the industry.

	Brazil		performance of operation		
5	Labor Productivity Measurement and Improvement : In Case of Ethiopian Medium and Large Footwear Industry	Abdi Angeras a ,2018	Quantitative and qualitative data collection methods/techniques were used. The quantitative ways of data collection methods included observation, questionnaire and secondary data whereas the qualitative methods were observation, interview and secondary data	footwear companies' average labor productivity had magnitude of 1.83, 1.98, 2.09, 2.15 and 2.19pairs/day/person from 2006EC to 2010EC respectively ; and their respective average annual labor productivity index were 1.07, 1.09, 1.06 and 1.06 from 2007EC to 2010ECrespectively	Only looked labor productivity as export performance factor
6	Performance Measurement and Improvement Method for Leather Footwear Industries	Kassane h and Workale mahu,2018	observation, survey questionnaire, interview and discussion with company experts	a new method for performance measurement and improvement called “total performance scorecard” and implementation guideline for EFI	TPS is firm level tool which can rarely solve external factors
7	Competitiveness of	Birkines hGonfa,	Shoe producers in Ethiopia	At the firm level, all the determinants of	The study focused on only the

	Ethiopian Shoe Industry: Response to Export Market	2012	specifically located in Addis Ababa Porter diamond model	competitiveness (Factor conditions, related and support industries, firm structure, strategy and rivalry, Demand conditions) are found to be insignificant	external factor that hinder the export performance
8	Integrated Model for Continuous Productivity Improvement in Footwear Industry: (A Case of Anbessa Shoe S.C.)	Bezaneh Eshetu,2017	Integrated Continuous Productivity Improvement model consisting lean, ergonomic and work study by using a questionnaire and secondary data	model consisting lean, ergonomic and work study developed	Identifying additional productivity indicators which are not considered in the study due to data shortage. Didn't assess the lean maturity of the case company

Most literatures measure performance in financial performance which has been the primary measure of success in most manufacturing companies. Manufacturing firms have established financial planning systems for measuring their productivity on a regular monthly, quarterly and annual basis. But the researcher Define current productivity in the elements of quality, cost, flexibility, reliability and innovation which will enable you not only to evaluate current productivity, but also identify productivity problem areas and prioritize for initiating the improvement process.

The most common areas of study were lean, lean maturity in manufacturing sector, challenges and factors hindering productivity of footwear industry .Certain articles also dealt with the productivity Measurement and Improvement Method for Leather Footwear Industries. However, in certain cases the productivity of the footwear sector was measured based on certain factors such as product quality, capital, export knowledge, technological capability and export promotional support.

Most studies are conducted in developed countries such as US, Australia, China, Turkey, China and others and it's difficult to conclude from this study findings of developed countries as Ethiopia is developing and has different social, economic and political factors. Although there are few studies conducted in Ethiopia, they are based on secondary data (trend), broad and focusing on productivity improvement the manufacturing sector of the country rather the productivity improvement of footwear industry.

2.12 Summary of literature review, literature gaps

The studies and research on lean assessment models have been grouped into two primary categories based on a survey of the literature. On the one hand, there have been various attempts to codify and shape lean approaches into a synchronized collection of tools and processes, particularly at the operational level. The transformation principles and infrastructure requirements of lean as a management philosophy were not considered in these investigations.

Several studies, on the other hand, have attempted to explain lean as a comprehensive approach at the corporate level. These studies generally failed to provide a link between the lean concepts in holistic view and the daily practices of lean in the operational level. In fact, they don't provide a systematic approach to apply lean values and principles in production & related section with the production cells.

In terms of evaluation measures, two types have been used in the creation of the practical and academic lean assessment models. On the one hand, some research focuses on evaluating lean methods and methodologies through the analysis of inputs and processes. Some data gathering methods in this research are direct observation, documents from case study and interview and lean assessment is measured by overall equipment efficiency (OEE) are recommended to record evidence of lean tool and methodology deployment. The extent to which lean is applied is measured in these circumstances against the presence of evidence on the implementation of lean tools and concepts. Although helpful instructions and descriptions are commonly recommended for clarifying assessment criteria, human judgment bias impacts the outcome of these models' evaluations. Furthermore, many studies place a greater emphasis on lean tools and processes than on results. As a result, they were unable to track the effectiveness of lean practices. Some scholars, on the other side, proposed assessing leanness by output evaluation. Overall organizational performance, as determined by key performance indicators, is employed as a measure of leanness in this research. Although these studies provide a good indicator of lean

efficacy, they do not provide sufficient visibility into any potential flaws or gaps in the system's implementation. Leanness and performance indicators have been consolidated into a single indicator in several researches that included both qualitative and quantitative measures. As a result, they failed to provide a means of evaluating lean effectiveness.

Thus to the knowledge of the researcher, there are limited research on lean maturity assessment in improving performance of footwear industry. Therefore, this research seeks to fill this knowledge gap on lean maturity assessment in improving export performance of footwear industry in case of Anbessa shoe Share Company

CHAPTER THREE

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter explores the research methodology used for conducting the research study by describing the research process, research design, Research Approach, Research strategies, data collection approaches and instrument, and finally data analysis. Selection of research methods depends on the research objectives, nature of the subject and implementing facilities. The purpose of selection of research methodology is to identify an approach to find out the answer to the research questions more exactly and easily. Therefore to accomplish the objective of the thesis, the researcher has applied the following methodologies.

3.2 Research Design

To attain the main purpose of this study, the researcher followed the following research strategies such as literature review, interview, and observation. The research were carried out by applying a combination of both qualitative and quantitative research approaches

3.3 Research Approach

In this research, the required elements towards the productivity of a product which are responsible are production waste, VSM, and lean maturities were considered. The different causes for decline the performance were qualified in terms of lean assessment which helps to identify areas of performance lag and opportunities for improvement. The basic stages of Anbessa shoe S.C production line from shop order receive to packing having in intermediate process of planning & controls, cutting, stitching, lasting & finishing were as follows in the following Figure.

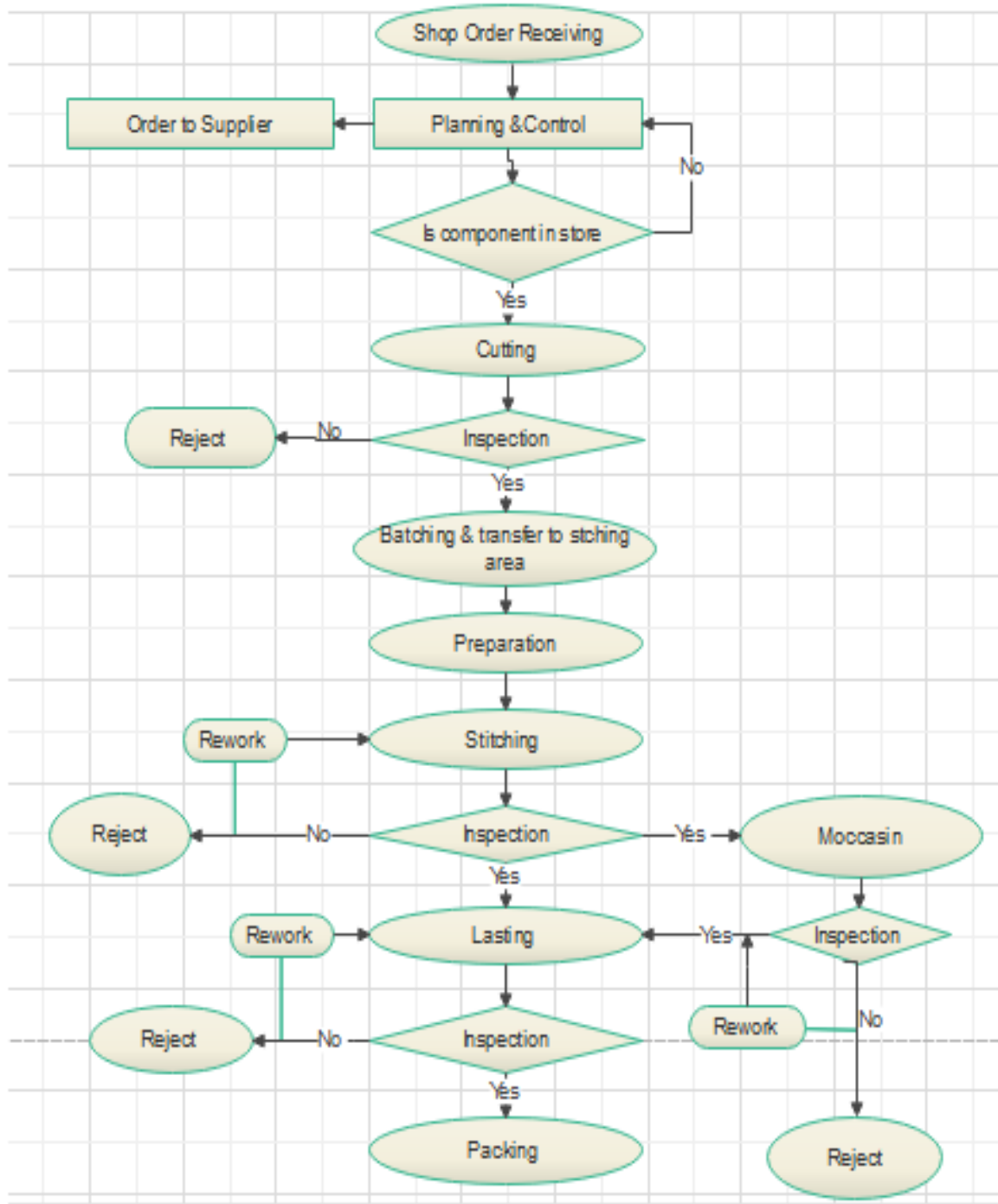


Figure 3-1 Present process mapping of production line of Anbessa Shoe Share Company

3.4 Data collection strategy and sources of data

The lean maturity assessment and sustaining culture in this research, key informants were selected with individuals who are considered to be particularly expert about the topic of attention and having direct relation with the productivity of case company these are Product development Center (PDC), production, Quality, Human Resource ,Sales and marketing and purchasing. In addition, the structure of the interview question is adapted from a readymade interview questions from Ethiopian Quality award (EQA), American Excellence Award (AME) and American lean Sensi questionnaire that Interview was made, recorded and attached in Appendix A. and namely:

1. purchasing in an organization: The sub criteria observed at this section are Purchasing and Distribution, Supplier Collaboration, Supplier Coordination, Supply Performance, investigate the average number of suppliers for each raw material or purchased item, outsourcing, incoming inspection, where and how often supplies are delivered
2. Production: activities taken in an organization. In the Production sub criteria observed are Facility, equipment downtime and uptime, type of maintenance used, setups which measures setup time for equipment and efforts in setup time reduction. The quick setup or change over is a must for a lean production system
3. PDC: activities taken in an organization. In the product development center sub criteria observed are Facility
4. Quality: activities taken in an organization. Investigates the statistical process control (SPC) training, portion of operations that are using the SPC, and who is doing it (operator or quality control office). The last question is about the overall defect rate.
5. Human Resource(HR) activities taken in an organization In the HR sub criteria observed are Employee Collaboration , Employee Coordination & Employee satisfaction
6. Sales & marketing: in this sub criteria Customer Collaboration , Customer Coordination & Customer satisfaction

The study will use both primary and secondary data as a source of data .The primary data was collected from interview questions & personal observations of researchers for the selected sample is SAWA Lafric is selected because other than any export product the company has export the item for a long period of time.The secondary data was taken through company's document, the internet, books, journals, related studies and other sources of information.

3.5 Target Population and Method of Sampling

The sampling method was purposive; is a type of non-probability sampling that is most effective when one needs to study a certain cultural domain with knowledgeable experts within.(Tongco, 2007). The survey interview was distributed to the target group such as. PDC manager, production manager, Sales & Marketing manager, kaizen head, Purchasing & Distribution Head, and quality control head.

3.6 Research Variables

Dealing with the basic research subjects of this research, the basic variables of the study comprises of both dependent & independent variables.

- Dependent variable – productivity

Generally productivity has been measured qualitative and quantitative. Qualitative measures of productivity are quality of raw material, customer satisfaction and collaboration, employee satisfaction. However, quantitative measures have the existing value of wastes, labor absenteeism and labor productivity.

- Independent variable – Wastes

The impact of wastes on firm, productivity is tested by assessing the eight wastes during production i.e transportation, inventory, motion excess, waiting, over production , over processing, defects/rejects and skill misapplication and the nature and the quantity of wastes in case company count on two factors. These are the type of materials being cut (leather, textile, rubber etc) and the type of assembling technology (stitching, lasting, packaging etc.).

- Independent variable – Labor productivity

The measures used to improve productivity include labor productivity which is achieved through human resources (awareness and commitment), organizational resources (planning and coordination) and lastly training (entrance & on-job).

- Independent variable – capability development

Capability development has been tested using variables such as product development. (Adulyanukosol & Silpcharu, 2020) in the study that captured the impact of capability development on a firm's productivity are (1) design, (2) market analysis, (3) innovation, and (4) information technology productivity with all these four variables.

3.7 Tool and Method of Data Analysis

Once primary and secondary data are collected, they are analyzed according to the objective of the research. To manipulate the raw data collected from interview & secondary sources data Microsoft Office 2010 Excel used and to draw current VSM, propose VSM, cause and effect diagram & process mapping of case company Wondershare EdrawMax used. To analyze the transportation wastage the machinery layout were done using AutoCAD and interview question used from questions from AME excellence award because this is practical in footwear industry and interpret the collected Data from interview using tables the evaluated numerical data taken from AME excellence award and evaluated. Also it is used to present the result of the data through different charts like Pareto chart for downtime, root cause of low productivity, bar graph to show the status of each parameter and line chart to explain OEE.

3.8 Ethical Consideration

As suggested by (Sekaran, 2003) the researcher has ensured the strict adherence of the following ethical conducts:

- Respondents take part in the research voluntarily and data was collected based on the permission of the individual.
- The purpose of the research was clearly explained to respondents the recorded voice of respondent is used only for research purpose only.
- Information provided by respondents was treated with strict confidentiality and the researcher ensured that participants would remain anonymous throughout the study.
- There was no misrepresentation or distortion of the actual data collected from respondents.

CHAPTER FOUR

4 OVERVIEW OF ETHIOPIAN FOOTWEAR SECTOR

4.1 Background the Sub-Sector

4.1.1 Historical Background of Ethiopian Footwear Industry

The Ethiopian leather industry is a relatively older industry with more than 80 years of involvement in processing leather and producing leather products. Indeed Ethiopia possesses one of the world largest livestock populations. This enormous population of livestock provides ample opportunity for the development of the leather industry in the country. However, the livestock potential remains lagging behind in its role to accelerate the country's economic development. Lack of effective, efficient and coordinated support in terms of supply of raw hides, skins and other production inputs as well as other related problems are among the challenges faced to achieve the target (UNCTAD, 2018).

Ethiopia has one of the largest livestock sector in the world and the formal LLP sector has existed for almost a century. The government under the Emperor Haile Selassie started to regulate the sector and established the Livestock and Meat Marketing Board in 1964 (Schaefer & Abebe, 2015). The Dreg-regime prohibited foreign investors and established the National Leather and Shoe Corporation to manage eight tanneries and six large shoe factories. The value of LLP exports increased from an average of USD 53 million between 1996 and 2000 to USD 135 million between 2013 and 2017 (UN Comtrade 2018) the increase in the value of Ethiopian LLP sector was initiated by the introduction of an export tax on different types of semi-processed leather and increase in new entrants of FDI companies in the leather footwear and gloves sub-sectors.

Footwear Industry is at a least stage of development in the country which is only two factories before 1991 but at present it reached 21 medium and large scale footwear manufacturers. The production capacity of shoe factories including production of Small and Micro enterprises rise to 15 million pairs per year. The shoe industry is emerging and promising industries(LIDI, 2019)

4.1.2 Anbessa Shoe S.c.

Anbessa shoe Sc. selected for the study because of the following main reasons:

- The ASSC stayed in the sector for Long time.
- The major producer of footwear relative to other local footwear factories
- Having a variety product type.
- Poor performance related with the designed capacity.

4.2 Define the Process of ASSC

Anbessa Shoe Company is one of the largest and pioneer shoe manufactory and distributor in Ethiopia. It was established in 1932 E.C and started production at the time when such technology was not widely known among the general population of the country. Its establishment was apparently in response to increased demand for shoes, which must have been triggered by the presence of a sizable Italian occupation army that invaded the country.

Currently, it produces different types of ready-made shoes both for local and international market. From the company's wide varieties of products ,some of them are export standard, sportswear, military shoes, workers' shoes, civilian shoes, special orders shoes for handicaps are some of them. The company's activities range from component making to production of ready-made foot wear. In recent years, it has widened its product mix by adding export standard products which has now becoming the main product type of the company (Gossaye, 2006).

ANBESSA shoe factory have different department such as production, design and product development, sales and marketing, distribution, finance and accounting, and human resource development and administrative.

4.3 SWOT analysis for the leather sector

SWOT analysis is a study about the strengths, weaknesses, opportunities and treats. The strength and weakness are internal and the opportunities & treats are external aspects or factors.

Table 4-1 SWOT analysis of Ethiopian footwear

SWOT analysis for the leather sector	
Strengths	Weaknesses

Fairly modern technology.	Lack of strategic management.
Relatively large capacity.	Poor marketing capability.
Good basic finishing capability.	Shortage of working capital.
Easily trainable and relatively low wage human resource pool.	Poor supply chain coordination.
Government owned institute of leather and leather	Lack of creative finishing skills.
Opportunities	Threats
Recognition as supplier of leather.	Poor quality raw material from some suppliers.
Stable economic and political environment.	Shortage of supply of skins.
Low wages and cheap utility costs.	Fluctuation of power supply.
Leather has good natural quality.	High transportation costs.
Presence of training institutions.	Delay in customs clearance.
Presence of accreditation and testing facilities.	Insufficient supply of financing.
High investment on infrastructure development.	Unstable economic conditions in destination countries.
Presence of strong air cargo and sea transportation	Shortage of chemical supply.
	Environmental protection regulation costs.

Source: (UNCATD, 2018)

CHAPTER FIVE

5 DATA COLLECTION, ANALYSIS AND INTERPRETATION

5.1 Introduction

Process Flow of case company is presented in the chapter four and the procedure is as follow: Shop order flows from planning & control to PDC and this section develop the design and time study then flow the order to production control and this section reviews the order and checks the bill of materials in the stock with the quantity required to make the ordered amount then Production control releases the work order to the shop floor to start production of the shoe. The operation stages include cutting, stitching and lasting mainly but moccasin operation include depending on the model. There is quality inspection at all work station

5.2 Data Collection and Data Analysis

To get performance related information observation, interview and informal discussion has been conducted with production head and supervisors, PDC head and senior, quality head, purchasing and marketing heads , human resource head and planning department . The firm has high production capacity relative to other footwear factories; but it is not using the capacity effectively. Information Collected to generate a VSM of a product, at first the observations about the product and the manufacturing processes related to it were collected. Some basic information about ASSC and its product were acquired from the PDC department, production head allowed to visit the different job floors , the planning and quality department provide the annual data and to measure the lean maturity of case company the selected personnel contribute interview .

5.3 Export sales volume

Even though the main market for the case company is the export market and the export sales volume in quantity of ASSC in 2017, 2018, 2019 & 2020 are 3,026, 51,505, 11,114and 7,092 respectively which is very minimal by taking this figure and generalize as a whole leads to incorrect conclusion. Thus, the researcher takes both local and export data. The number of exports per pair ASSSC Factory is shown in Table 5-1 below.

5.4 Annual production volume

Main factory has a designed capacity of producing 10,000 pair of shoes per day but its current attainable capacity on average 4100 pairs of shoes per day. The firm has a trend of preparing timely (quarterly) production reports which show production against the plan. Due to pandemic Covid -19 the efficiency of the factory became down and to compensate the loss in production the production manager uses over time and additional manpower .Thus the efficiency of Oct., Nov.& Dec. became increases. The monthly number of annual production shoes is shown in the table 5.1.

Table 5-1 Export sales quantity in pairs of ASSC

Shipping Year							
2017(Jan17-Dec. 17)		2018 (Jan.18-Dec. 18)		2019(Jan.19-Dec. 19)		2020(Jan.18-Mar. 18)	
Destination	Quantity (Pair)	Destination	Quantity (Pair)	Destination	Quantity (Pair)	Destination	Quantity (Pair)
France		Kenya	18,274	Somaliland	917	France	4,592
		Sudan	648	France	5,200		
		Uganda	60	USA	1,827		
USA	60	France	8,635	Madagascar	30	Madagascar	2,500
		Canada	8,928	Netherlands	2,840		
		USA	10,720				
Somaliland	600	Nigeria	500	Somaliland	300		
		Italy	3,800				

Source: export department, 2017, 2018 2019 &2020 annual report

Table 5-2 Annual productions (2020)

Month	Cutting			Stitching			Lasting & Finishing		
	plan	Actual Production	Efficiency (%)	plan	Actual Production	Efficiency (%)	plan	Actual Production	Efficiency (%)
Jan.	99820	68102	68%	99820	65609	66%	99820	73364	73%
Feb.	97651	72570	74%	97651	77402	79%	97651	65606	67%
Mar.	97651	72570	74%	97651	77402	79%	97651	65606	67%
Apr.	99820	22902	23%	99820	20247	20%	99820	28464	29%
May.	88970	22365	25%	88970	18124	20%	88970	10747	12%
Jun.	104161	44048	42%	104161	38587	37%	104161	60526	58%
July	79903	66809	84%	79903	57878	72%	79903	45903	57%
Aug.	80407	63304	79%	80407	65446	81%	80407	73577	92%
Sept.	70498	55604	79%	70798	55533	78%	70498	53172	75%
Oct.	85675	80743	94%	85675	79055	92%	85675	63079	74%
Nov.	90401	76148	84%	90401	78667	87%	90401	30326	34%
Dec.	97096	92547	95%	97096	100540	104%	97096	95869	99%
Total	1092053	737712	68%	1092353	734490	67%	1092053	666239	61%

Source: Planning department, 2020 annual report

5.5 Waste

Several wastes were found after observing the procedures on the shop floor and these influenced the overall productivity of the organization. Out of the eight wastes the major wastes noticed in the industry are as follows:

5.5.1 Unnecessary inventory

There are several types of inventory: unsold finished goods in a warehouse, work in progress caught up in the process and pending production of raw materials. Work-in-progress (WIP) is a big problem of excess inventory in production, which cannot be quickly marketed either to

clients or other businesses. In cutting, sewing and lasting, ASSC's WIP inventory occurs are summarized as follows.

Table 5-3 Inventory by section

PRODUCTION PROCESS	CUTTING	STITCHING	LASTING	TOTAL
INPUT	624,854	666,211	628,441	1,919,506
OUTPUT	677,855	673,079	582,718	1,933,652
WIP	138,701	39844	108,073	286,618

Source: planning & control department, 2020annual report

5.5.2 Waiting

As mentioned in the literature waiting is any state of idleness in the usually assumed working hours occurred at the workplace. The equipment involved in manufacturing and/or working in that workplace may be noticeable in such a state of waste. Diverse reasons of NVD activities or down time in production stages were recognized and summarized in the following table with the respective frequency , percentage and cumulative of percentage (Sayid Mia, 2017).

Table 5-4 Annual Downtime and cause of downtime

Month	Section	Machine Repair / Low Machine efficiency (min)	Material Not matching to Specification (min)	Poor Quality Material (min)	Material Not Available (min)	Line Change Over (min)	Operator Not Available / Low efficiency (min)	Machine Start-up Loss (min)	Total downtime (min.)
Jan.	Cutting	85	26	53	0	0	1397	0	1561
	Stitching	1198	1644	3287	271	527	1729	158	8814
	Lasting	1043	1793	3586	31	139	344	396	7332
Feb.	Cutting	0	164	327	0	0	0	0	491
	Stitching	757	315	631	1182	882	564	132	4463
	Lasting	593	1294	2587	124	388	264	118	5368
Mar.	Cutting	60	242	484	0	0	0	0	786
	Stitching	676	479	958	1427	368	0	45	3953
	Lasting	338	987	1975	1188	280	0	232	5000
Apr.	Cutting	0	46	91	0	0	0	0	137
	Stitching	30	73	147	30	35	0	0	315
	Lasting	35	102	205	20	90	0	0	452
May	Cutting	0	161	323	0	0	0	0	484
	Stitching	209	86	171	0	99	0	0	565
	Lasting	0	0	0	0	0	0	0	0
Jun.	Cutting	0	161	323	0	0	0	0	484
	Stitching	265	20	40	0	0	0	0	325
	Lasting	15	33	67	0	50	0	0	165
Jul.	Cutting	0	160	320	0	0	0	0	480
	Stitching	912	353	707	68	0	0	0	2040

	Lasting	70	0	0	270	0	0	0	340
Aug.	Cutting	90	160	320	0	0	0	0	570
	Stitching	571	363	727	75	0	160	0	1896
	Lasting	519	0	0	30	0	000	0	549
Sep.	Cutting	0	68	136	0	0	0	0	204
	Stitching	699	11	22	90	0	0	360	1182
	Lasting	1211	151	302	285	456	0	40	2445
Oct.	Cutting	20	173	346	0	0	0	0	539
	Stitching	385	119	238	0	170	0	0	912
	Lasting	305	120	239	15	0	0	0	679
Nov.	Cutting	60	366	732	376	0	0	0	1534
	Stitching	321	70	140	401	200	0	65	1197
	Lasting	349	376	751	30	311	0	90	1907
Dec.	Cutting	75	350	699	0	0	0	0	1124
	Stitching	729	124	247	285	200	0	0	1585
	Lasting	783	160	319	30	85	0	0	1377

Source: planning & control department, 2020 annual report

5.5.3 Pareto Analysis for down Time

Pareto Analysis is a statistical decision-making method that is used to pick a small number of tasks that have a large overall impact. It is based on the Pareto principle, which states that by doing 20% of the work, you will get 80% of the benefit of doing the entire job. Alternatively, in terms of quality assurance, a vast majority of issues such as poor quality material ,machine repair /Low machine efficiency & material not matching to specification (80%) are caused by a few primary causes such as machine startup losses, line changeover, operator not available /low efficiency & material not available

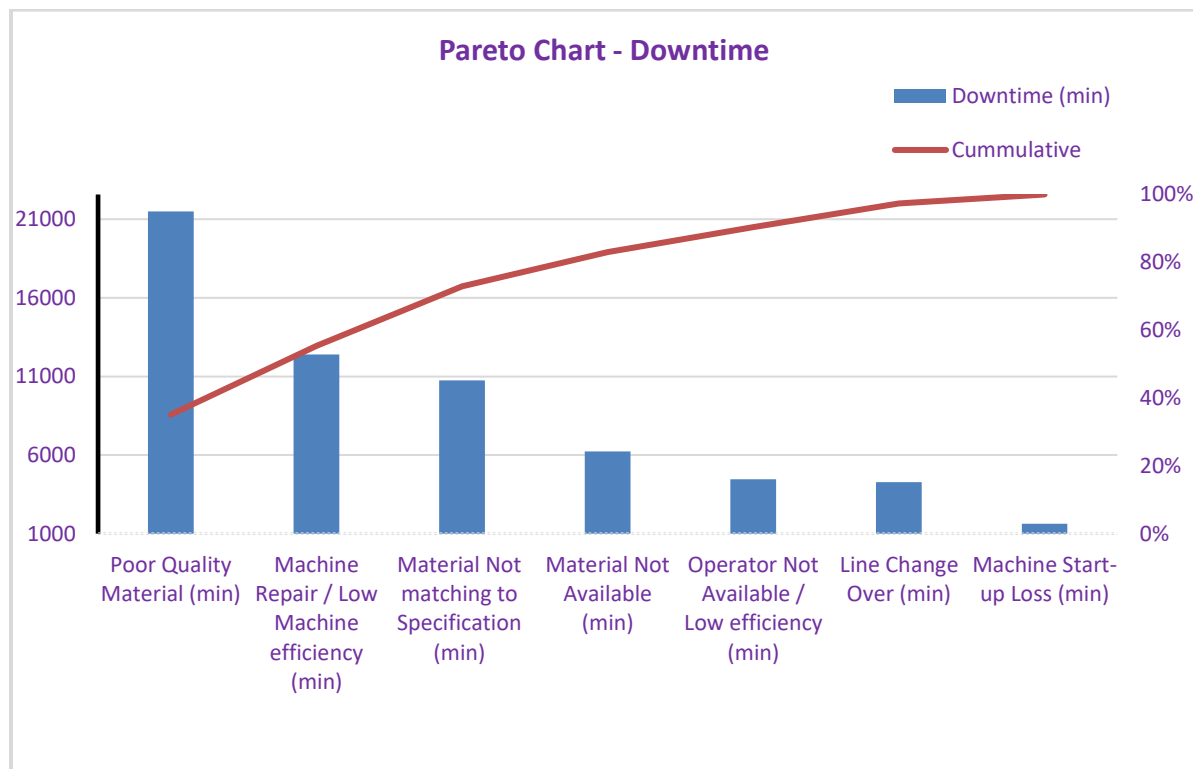


Figure 5-1 Pareto chart of Annual Down time

From the above pareto diagram the total wastes due to downtime (Non- value adding time): 61,255 min per annum. The causes for this downtime are classified as three major groups and their percentages contributing to non-value adding time are given bellow:

- ✚ Quality (52.64%)
 - Poor Quality Material: 21,500min (35.09%)

- Material not matching to Specification: 10,750 min (17.55%)
- ✚ Queuing time (47.36%)
 - Queuing by raw material: 6,228min (10.17%)
 - Waiting time by Operators: 4,458min (7.28%)
 - Waiting time by the machines: 18,319min (29.91%)
 - ✓ Line Change Over: 4,280min (6.99%)
 - ✓ Machine Start-up Loss: 1,636min (2.67%)
 - ✓ Machine Repair / Low Machine efficiency: 12,403 min (20.25%)

$$DownTime = \frac{\text{Total DownTime}}{\text{Total Working Time}} * 100\%$$

Similarly using table 5-5 and the above formula, the current down time for cutting, stitching and lasting is 3.28%, 10.65% and 10.02 % respectively, this deviates from target value for stitching lasting section sections.

5.5.4 Defect

The quality department record the quality control per line ,listed cause of the defect and analyze failure analysis .The possible causes of the defects are sole Dirt/oil stains/pen marks, Edge distances not correct as specified, burned leather by heat, Loose threads and sloppy trimming, Poor color match within shoe pair, Internal dermis Difference ,wrinkled Internal part of shoe(lining), Incorrect shoe sole sticking, internal part broken, adhesive not completely clean, blasted stitch, Toe Alignment Difference, Vamp difference, wrinkled Vamp, unevenness of back stitch, back height difference, wrinkled Tomay ,Sole deformed, the Blanca not corrected, Socks not covering in sole etc... The following table illustrate that the number of defect rework and reject quantity for the fiscal year of 2019/20.

Table 5-5 Annual Defects, Rework &Reject (Jan 1/2020- Dec 20/2020)

Month	Jan.	Feb	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Defect	340	9247	397	3810	10103	8165	9305	468	6054	6805	4703	4713
Rework	261	8016	394	3810	9966	8116	9256	235	6012	6656	4515	4666
Rejected	5	54	3	0	137	49	49	52	42	149	188	47

Source: Quality department, 2020 annual reports

Due to quality defect the company rejected 775 pair of shoes from local market & 47 pair of shoes from export market and the estimated price for exports markets like TEDY, SAWA and Madagascar is 17.5 USD/pair and for local market is 875 ETB and this implies that the company losses 637,000.00ETB per Annum. The defect of case company is 9.629% which is more than internationally accepted defect rate i.e. 3%. This implies that an industry having 9.629% has a problem in losing cost due to quality defect

5.5.5 Over Transportation

Material transportation is important, but it adds little value to the final product. Eliminating or minimizing this form of waste in the industry can result in a reduction in overall lead time or cycle time. Since the cutting and stitching sections are located in different floor this results in additional time lost in transporting the components of shoes .The following figure represent the current machine layout of the plant. The following table summarizes the average Transportation wastage recorded as the material moved from cutting floor to stitching floor then back to lasting floor.

Table 5-6 Transportation wastage

Operation time in a day(min)	Average Transportation (min)	normal time/day	Extra time lost in transporting the components of shoes(min)
465minutes	96.2		198.55

The daily average production is 3971pair/ day and time lost while in transporting the components of the shoe from cutting floor to the stitching floor is 3sec/ pair. So, additional 198.55min/day spent while the components are moved from cutting section (ground) to the stitching (first floor) section. Accordingly the total transportation time spent /day is 294.75min.

Due to the nature of the layout, there is a difficulty transferring material from one area to another; the existence of a burrowed floor causes fatigue on the worker when moving material from the cutting section to stitching section and to various sections. These results in additional 198.55 min time lost and exhaustion for workers assigned to material

transportation. In addition, the existence of temporary material locations due to an unorganized work environment increases transportation time. Due to this the current layouts rearrange so as to reduce this time lost. So as to minimize the transportation wastes the layout were rearranging the machineries in three different options. The Researcher considered three layout options and proposed a layout having minimum transportation time .

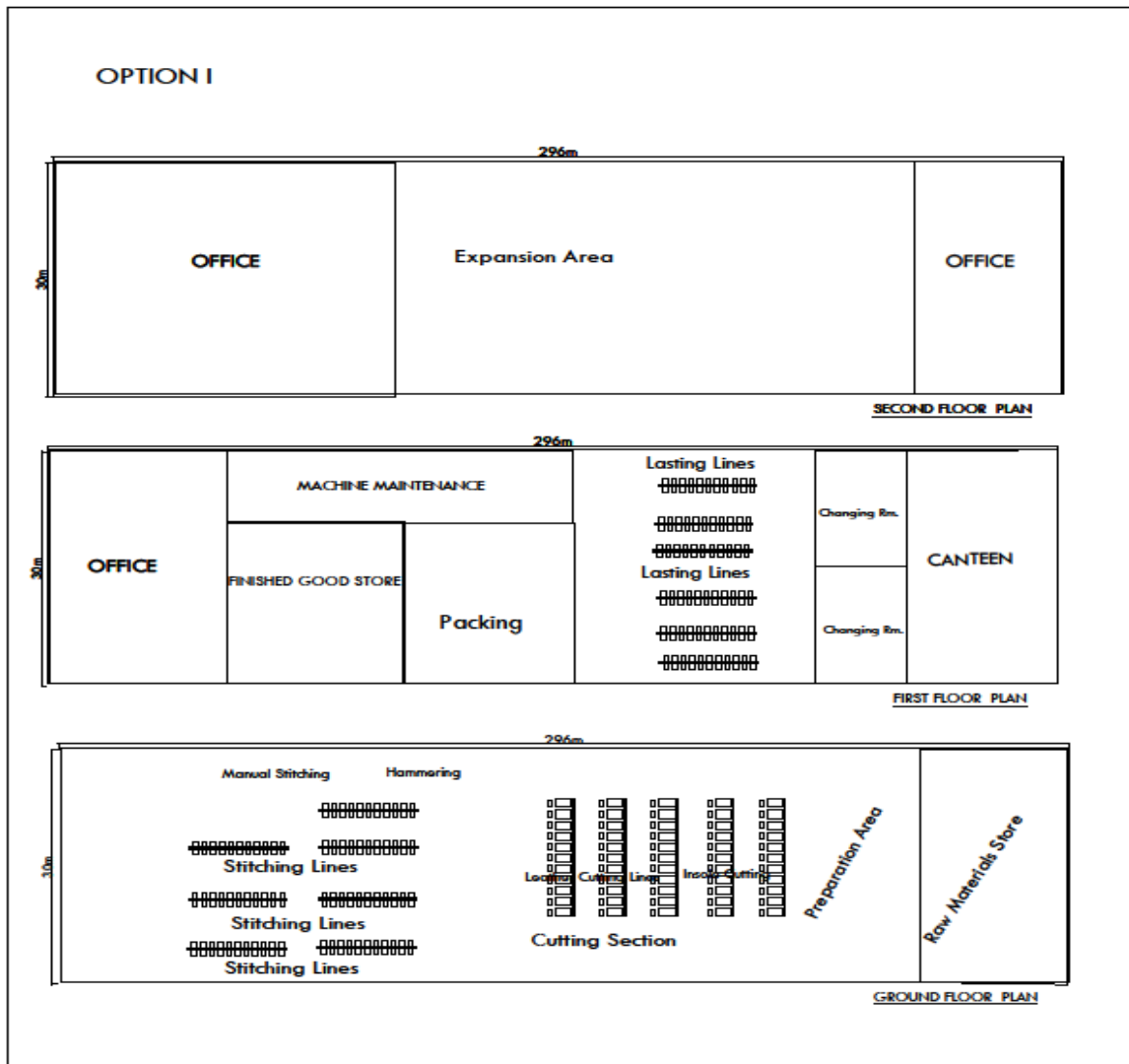


Figure 5-2 machineries layout for option-1

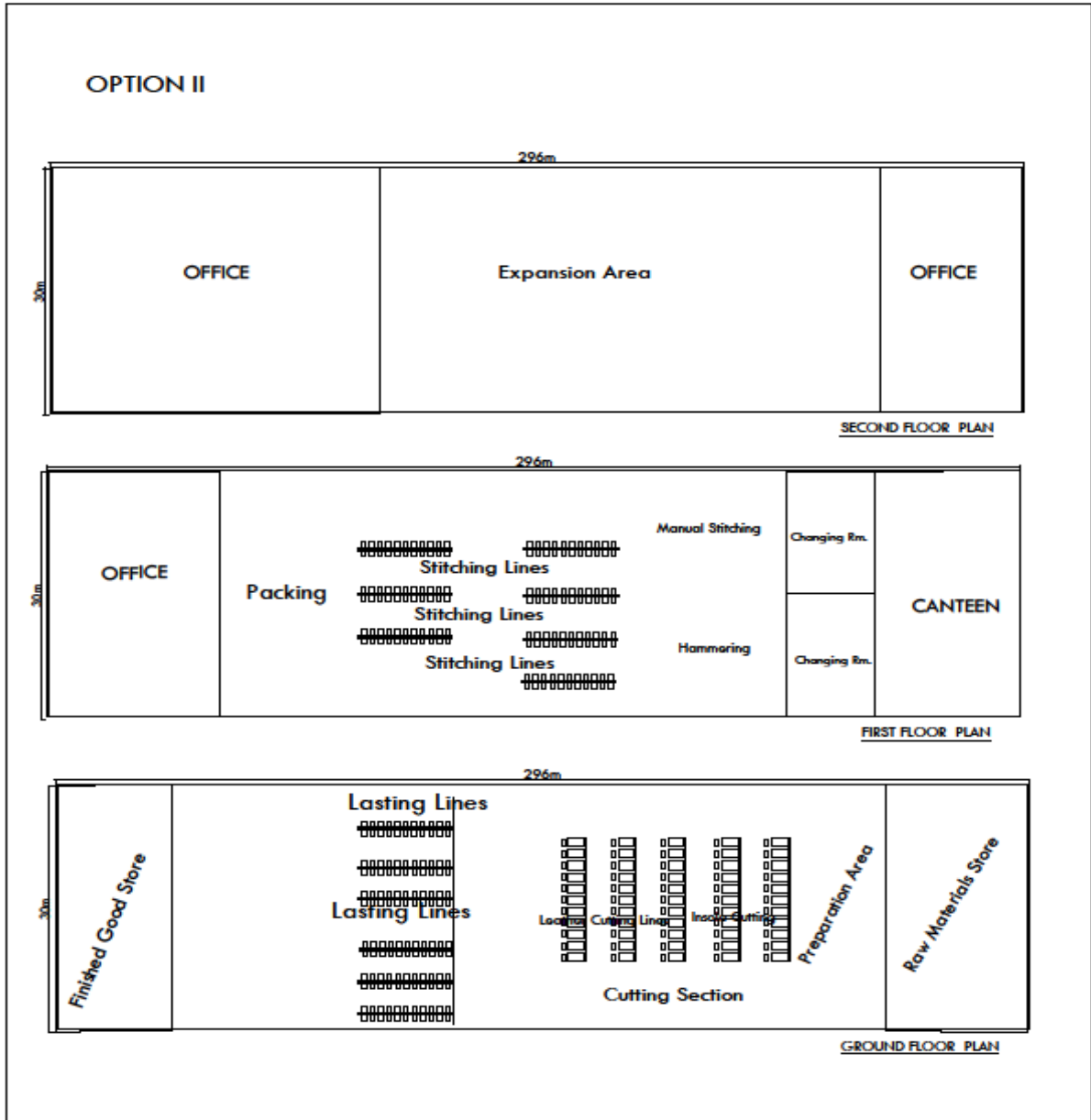


Figure 5-3 machineries layout for option-2

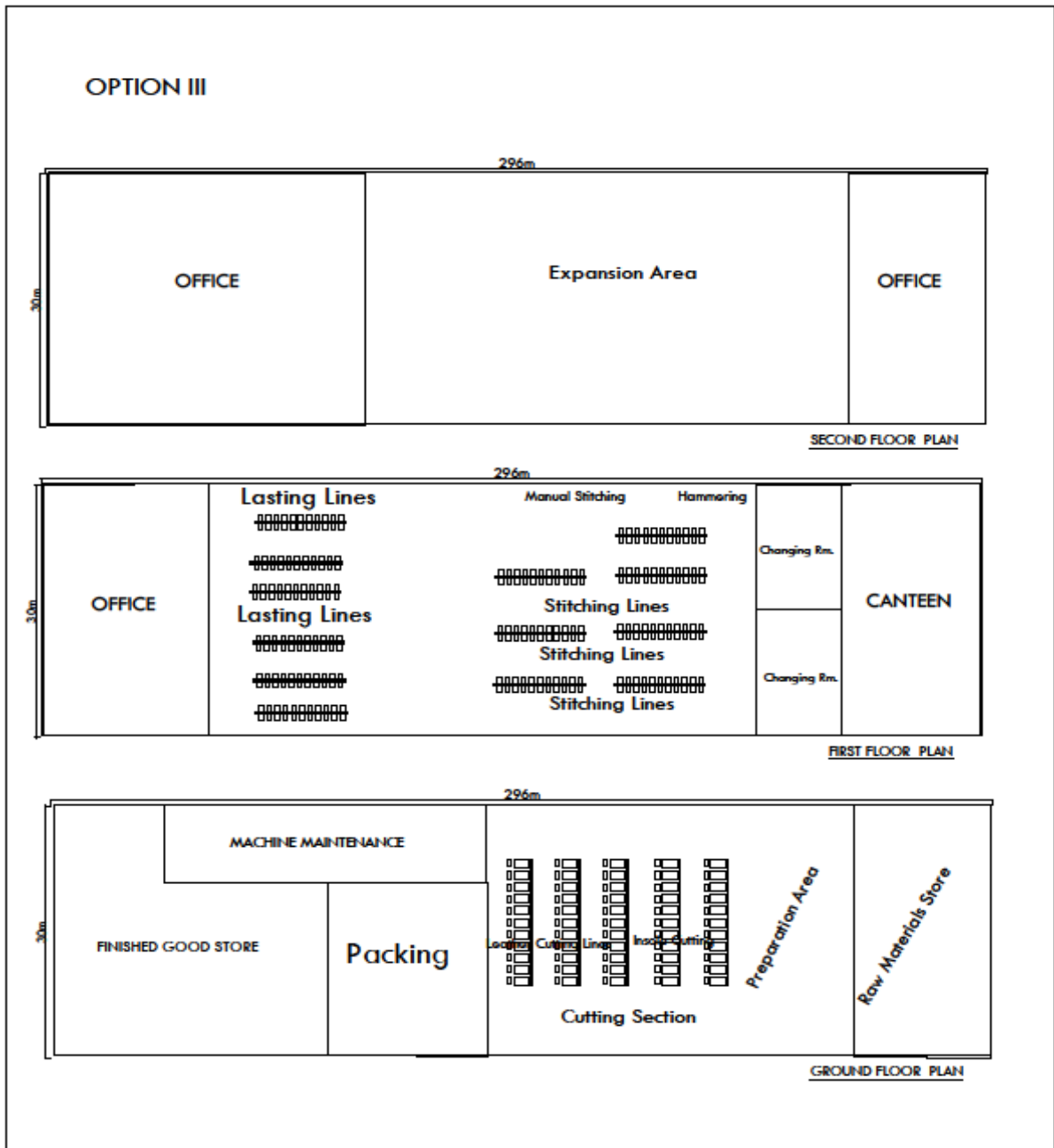


Figure 5-4 machineries layout for option-3

Option-1: arranging the raw material store, preparation area, cutting section and stitching section to be in the ground floor, Canteen, changing rooms, Lasting sections, Packing sections , finished goods store, machine maintenance and office to be in the first floor and office, expansion area and office to be in the third floor.

Option-2: arranging the raw material store, preparation area, cutting section, Lasting sections and finished goods store to be in the ground floor, Canteen, changing rooms, manual stitching , hammering , stitching section, Packing sections and office to be in the first floor and office, expansion area and office to be in the third floor.

Option-3: arranging the raw material store, preparation area, cutting section, Packing sections and finished goods store to be in the ground floor, Canteen, changing rooms, stitching section , Lasting sections and office to be in the first floor and office, expansion area and office to be in the third floor.

Table 5-7 Transportation wastage for different option layout

		Operation	Inspection	Transportation	Delay	Storage	Transportation(min) for Option - 1	Transportation(min) for Option - 2	Transportation(min) for Option - 3
	To Cutting	○	□	➡	⊔	▽	3.7	11	7.5
	materials(sock foam, toe puff, back box, eye stay toepuff and back box skiving	●	□	➡	⊔	▽			
	stamping (model, size & date) on tongue and pictograph on quarter lining	●	□	➡	⊔	▽			
	To preparation	○	□	➡	⊔	▽			
	Waiting	○		➡	⊔	▽			
Preparation (Sock Lining preparation)	attaching sock lining on eva foam	●	□	➡	⊔	▽	3.8	12	7.7
	stitch sock lining with eva foam	●	□	➡	⊔	▽			
	quality check	○	■	➡	⊔	▽			
	stamping logo on sock lining	●	□	➡	⊔	▽			
	final QC	○	■	➡	⊔	▽			
	rearranging and dispatch	○	□	➡	⊔	▽			
Preparation (Insole preparation)	cutting texn board	●	□	➡	⊔	▽	3.4	10	6.9
	cutting shank board	●	□	➡	⊔	▽			
	shank grooving	●	□	➡	⊔	▽			
	shank skiving	●	□	➡	⊔	▽			
	attaching shank steel with shank board by revet	●	□	➡	⊔	▽			
	apply glue on texn board and shank board then attaching texn with shank board	●	□	➡	⊔	▽			
	molding	●	□	➡	⊔	▽			
	beveling	●	□	➡	⊔	▽			
	disbatch	○	□	➡	⊔	▽			
	Storage	○		➡	⊔	▽			

stitch eye stay with quarters and its lining					
tope line stitch around collar and eyestay with lining					
apply glue and attach vamp over tongue then attach tape on it					
decorative stitch at center of vamp with tongue					
apply glue and attach toe cap on vamp					
stitch toe cap on vamp					
apply glue and vamp and tongue with vamp and tongue lining					
stitch vamp over tongue with lining					
tope line stitch around tongue with tongue lining					
in process quality					
stitch around collar with lining					
punch eyelet place					
apply glue and attach vamp with quarter					
stitch vamp with quarter with lining same as lock stitch					
stitch lasting margin allowance					
Quality Inspection					
burning excess threads					
temporary shoe lacing					
final quality inspection					
rearranging and disbatch					
Storage					
Waiting					
To lasting					
sole roughing					
last loading					
last cleaning					
upper loading					
out sole cleaning (washing using solution)					
attaching insole on last					

	back part molding								
	insert to steam then toe lasting								
	apply glue on sides of the upper								
	side closing								
	insert to steam and heel seat lasting								
	apply cream and insert to heat tunnel								
	heel seat shaping								
	pounding								
	irroning to remove wrinkle								
	in process quality inspection								
	first level upper roughing								
	marking area of sole seattng								
Lasting	second level upper roughing following marking								
	first adhesive coating on upper and out sole								
	second adhesive coating on upper and out sole								
	sole and upper dryer								
	sole and upper re-activator								
	attach in sole with upper and pressing								
	waiting								
	sole stitching with upper cleaning, and inserting to chiller (cooling) machine								
	removing temporary shoe lace and de-lasting								
	apply glue and insert sock lining								
	inserting tissue paper								
	painting on extra rough and apply cream on upper								
	Final brushing								
	shoe lacing								
	final quality inspection								
Finsihing goods store	To finishing goods store								
	Storage								
	Waiting								
Total Transportation Time							96	295	195

5.6 Overall equipment efficiency

OEE on the basis of an equation (1)

$$OEE = Availability * Performance Rate * Quality Rate \dots\dots (1)$$

5.6.1 Availability

The availability of equipment's net time is referred to as loading time. During a period of time, such as a day, week, or month, as demonstrated in a formula (2)

$$Availability = \frac{\text{Annual working hr.} - \text{Annual downtime}}{\text{Annual working hr.}}$$

Table 5-8 Annual Availability of the case company

Month	Section	Machine Repair / Low Machine efficiency (min)	Material Not matching to Specification (min)	Poor Quality Material (min)	Material Not Available (min)	Line Change Over (min)	Operator Not Available / Low efficiency (min)	Machine Start-up Loss (min)	Total downtime (min.)	Total downtime(hr .)	Monthly Working Days	Availability
Jan.	Cutting	85	26	53	0	0	1397	0	1561	1.084028	23	0.952868
	Stitching	1198	1644	3287	271	527	1729	158	8814	6.120833	23	0.733877
	Lasting	1043	1793	3586	31	139	344	396	7332	5.091667	23	0.778623
Feb.	Cutting	0	164	327	0	0	0	0	491	0.340972	22	0.984501
	Stitching	757	315	631	1182	882	564	132	4463	3.099306	22	0.859122
	Lasting	593	1294	2587	124	388	264	118	5368	3.727778	22	0.830556
Mar.	Cutting	60	242	484	0	0	0	0	786	0.545833	23	0.976268
	Stitching	676	479	958	1427	368	0	45	3953	2.745139	23	0.880646
	Lasting	338	987	1975	1188	280	0	232	5000	3.472222	23	0.849034
Apr.	Cutting	0	46	91	0	0	0	0	137	0.095139	23	0.995864
	Stitching	30	73	147	30	35	0	0	315	0.21875	23	0.990489
	Lasting	35	102	205	20	90	0	0	452	0.313889	23	0.986353
May	Cutting	0	161	323	0	0	0	0	484	0.336111	21	0.983995
	Stitching	209	86	171	0	99	0	0	565	0.392361	21	0.981316

	Lasting	0	0	0	0	0	0	0	0	0	21	1
Jun.	Cutting	0	161	323	0	0	0	0	484	0.336111	23	0.985386
	Stitching	265	20	40	0	0	0	0	325	0.225694	23	0.990187
	Lasting	15	33	67	0	50	0	0	165	0.114583	23	0.995018
Jul.	Cutting	0	160	320	0	0	0	0	480	0.333333	22	0.984848
	Stitching	912	353	707	68	0	0	0	2040	1.416667	22	0.935606
	Lasting	70	0	0	270	0	0	0	340	0.236111	22	0.989268
Aug.	Cutting	90	160	320	0	0	0	0	570	0.395833	23	0.98279
	Stitching	571	363	727	75	0	160	0	1896	1.316667	23	0.942754
	Lasting	519	0	0	30	0	0	0	549	0.38125	23	0.983424
Sep.	Cutting	0	68	136	0	0	0	0	204	0.141667	23	0.993841
	Stitching	699	11	22	90	0	0	360	1182	0.820833	23	0.964312
	Lasting	1211	151	302	285	456	0	40	2445	1.697917	23	0.926178
Oct.	Cutting	20	173	346	0	0	0	0	539	0.374306	24	0.984404
	Stitching	385	119	238	0	170	0	0	912	0.633333	24	0.973611
	Lasting	305	120	239	15	0	0	0	679	0.471528	24	0.980353
Nov.	Cutting	60	366	732	376	0	0	0	1534	1.065278	23	0.953684
	Stitching	321	70	140	401	200	0	65	1197	0.83125	23	0.963859
	Lasting	349	376	751	30	311	0	90	1907	1.324306	23	0.942421
Dec.	Cutting	75	350	699	0	0	0	0	1124	0.780556	25	0.968778
	Stitching	729	124	247	285	200	0	0	1585	1.100694	25	0.955972

	Lasting	783	160	319	30	85	0	0	1377	0.95625	25	0.96175
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From The above table the availability of cutting, stitching & lasting section can be extracted as follows in the following graph

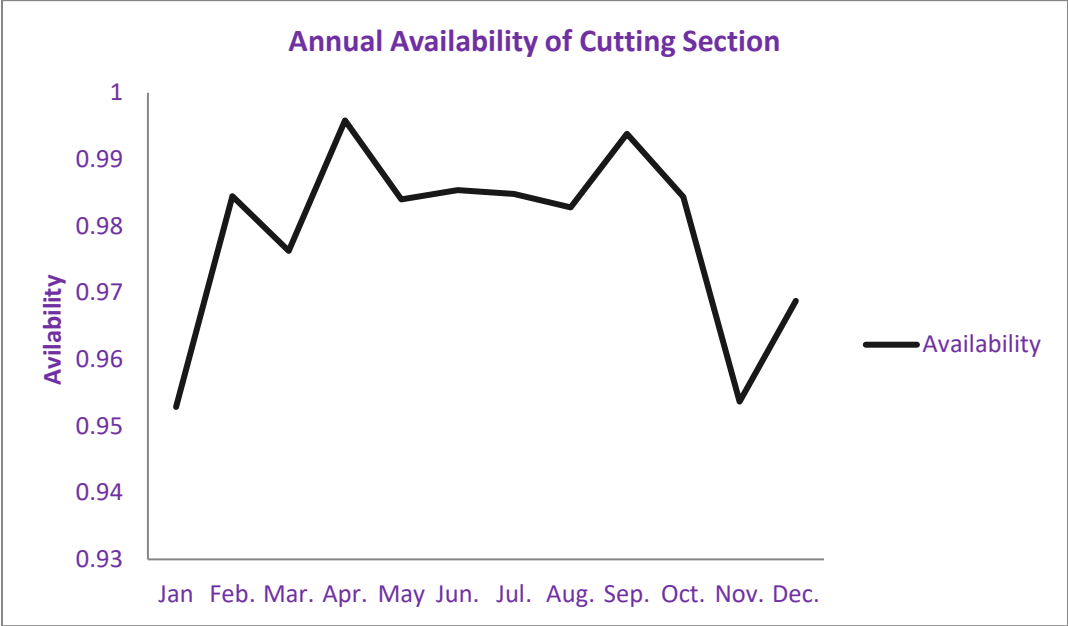


Figure 5-5 Annual Availability of cutting section

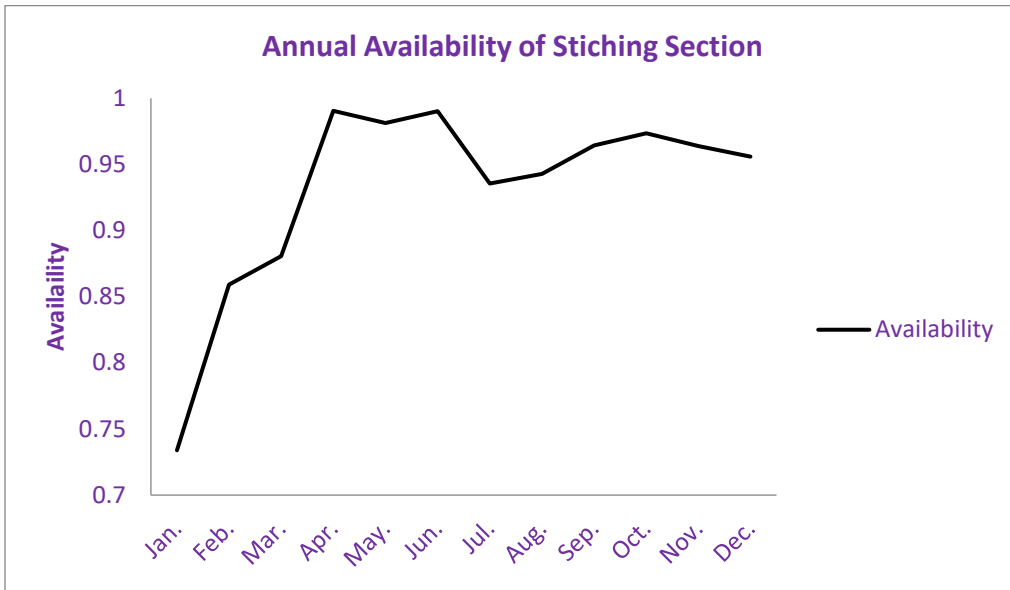


Figure 5-6 Annual Availability of stitching section

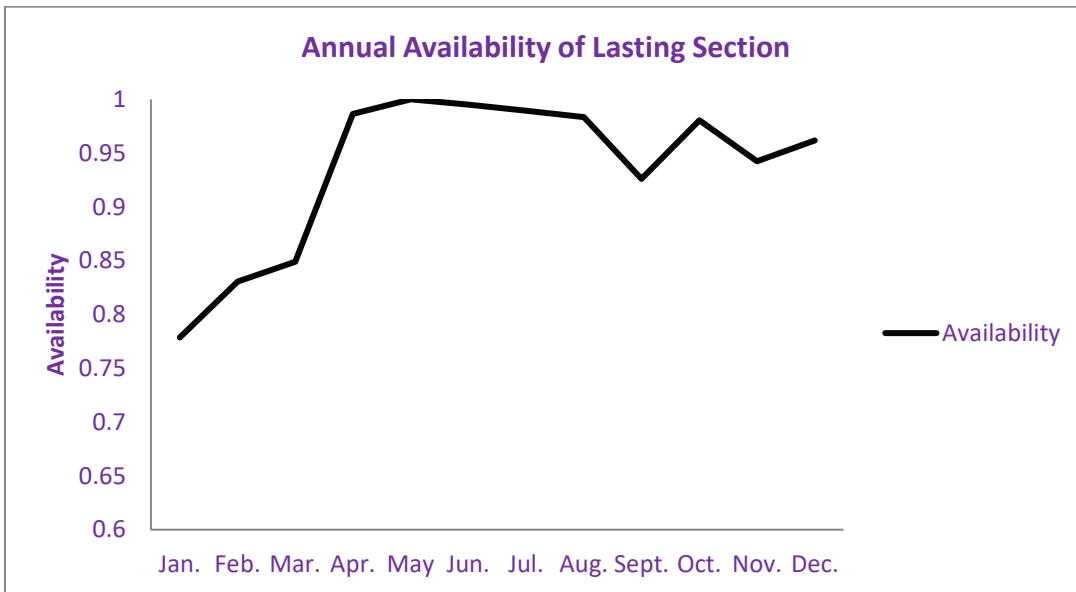


Figure 5-7 Annual Availability of stitching section

5.6.2 Performance Rate

The performance takes into account anything that causes the manufacturing process to run at less than the maximum possible capacity when it is running. During a period of time, such as a day, week, or month, as demonstrated in a formula (3)

$$Performance = \frac{\text{Actual Capacity}}{\text{Designed (Installed capacity)}} \dots\dots (3)$$

Table 5-9 Annual Performance of ASSC

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Designed(Installed) Capacity(000)	230	220	230	230	210	230	220	230	230	240	230	230
Actual Production	73,364	65,606	65,606	28,464	10,747	60,526	45,903	73,577	53,172	63,079	30,326	95,869
Performance	32	30	29	12	5	26	21	32	23	26	13	42

5.6.3 Quality Rate

Is this the typical level of products produced? Standards as compared to products that do not meet them the requirements(Wahyudin et al., 2019)

$$Quality Rate = \frac{\text{Processed Amount} - (\text{defect})}{\text{Processed Amont}} * 100\% \dots\dots (4)$$

Table 5-10 Annual Quality for ASSC

Month	Jan	Feb	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Defect	340	9247	397	3810	10103	8165	9305	468	6054	6805	4703	4713
Rework	261	8016	394	3810	9966	8116	9256	235	6012	6656	4515	4666
Rejected	5	54	3	0	137	49	49	52	42	149	188	47
Total Product	73,364	65,606	65,606	28,464	10,747	60,526	45,903	73,577	53,172	63,079	30,326	95,806
Quality	99.54	85.91	99.39	86.61	5.99	86.51	79.73	99.36	88.61	89.21	84.49	95.08

OEE on the basis of an equation

$$OEE = Availability * Performance Rate * Quality Rate$$

Table 5-11 Annual OEE for ASSC

Month	Availability	Performance	Quality	OEE
-------	--------------	-------------	---------	-----

Jan.	78%	32%	100%	25%
Feb.	83%	30%	86%	21%
Mar.	85%	29%	99%	24%
Apr.	99%	12%	87%	11%
May	100%	5%	6%	0%
Jun.	100%	26%	87%	23%
Jul.	99%	21%	80%	16%
Aug.	98%	32%	99%	31%
Sept.	93%	23%	89%	19%
Oct.	98%	26%	89%	23%
Nov.	94%	13%	84%	10%
Dec.	96%	42%	95%	38%

OEE identifies the percentage of manufacturing time that is truly productive. An OEE score of 100% means the manufacturing is only Good Parts, as fast as possible, with no Stop Time. In the language of OEE that means 100% Quality (only Good Parts), 100% Performance (as fast as possible), and 100% Availability (no Stop Time). From the above OEE analysis the average OEE is 20% and this implies that the case company is not productive the aim of this research is improving the performance by implementing lean tools. OEE is the single best metric for identifying losses and eliminating wastes and improving the productivity of manufacturing equipment.

5.7 Root cause analysis for Low productivity of ASSC

Following the research, general issues arose in each section, the cause for low productivity of the plant is incremental of downtime at each section. The following figure illustrates that the possible cause of a plant effect on low productivity.

The main cause for low productivity of the case company are quality, human, maintenance, raw material, PDC and planning .To improve the productivity of the plant manpower should be high productive, the wastage of the process must fall with in international acceptance range, the firm should have scheduled preventive maintenance, the organization should culture a team work so as to exceed the customer expectations.

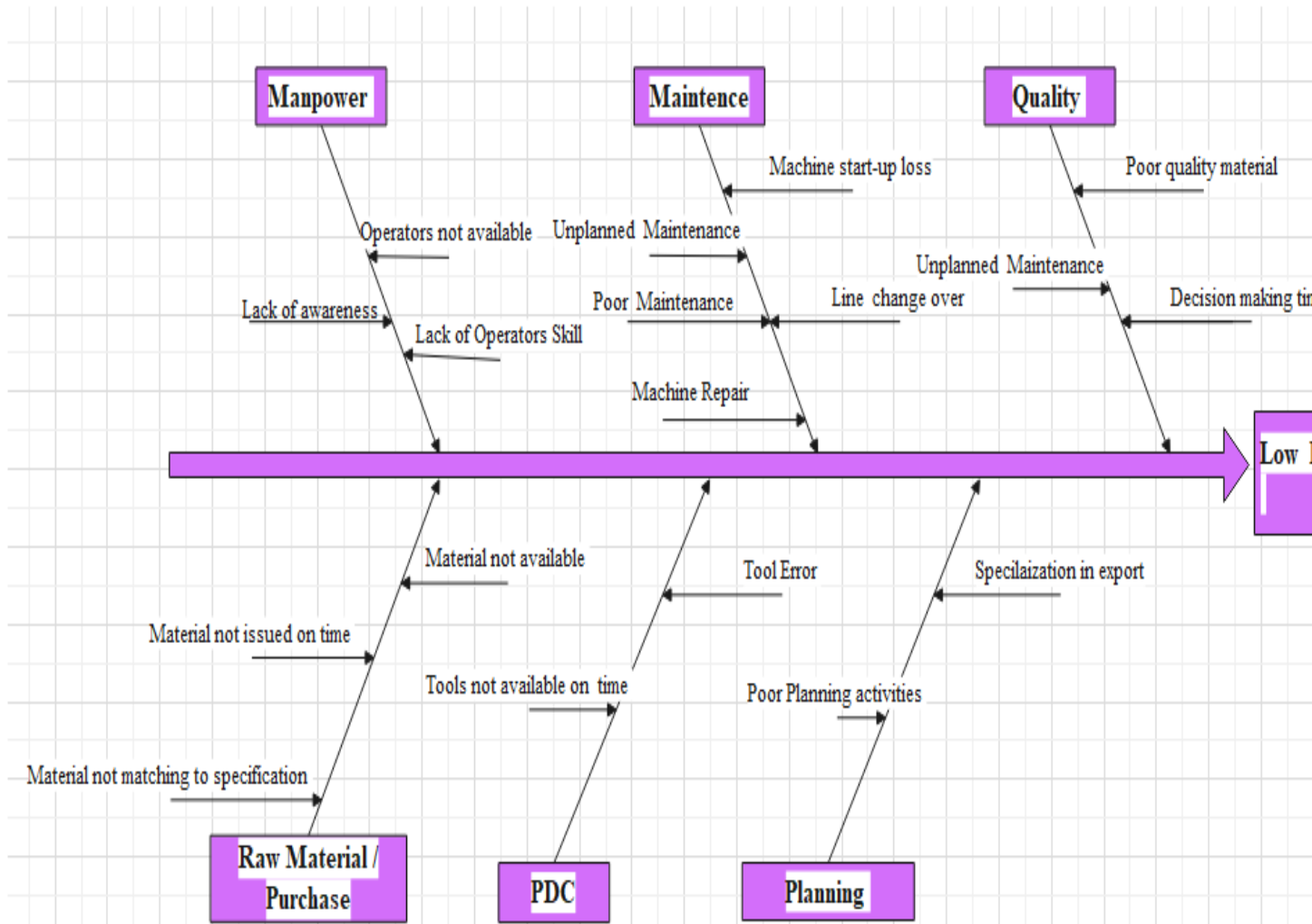


Figure 5-8 Cause and effect diagram for low Productivity

5.8 Measuring Labor productivity

Labor productivity is calculated as the ratio of daily average commodity output to available daily average work force. The following is an estimation of the factory's labor productivity is:

$$\text{Labor productivity} = \frac{\text{daily average commodity output}}{\text{available daily average work force}}$$

$$\text{daily average commodity output} = \frac{\sum \text{Annual Actual production}}{\sum \text{Workingday}} = \frac{666,239 \text{ Pair of shoe}}{273 \text{ days}}$$

$$\text{Labor productivity} = \frac{\text{daily average commodity output}}{\text{available daily average work force}}$$

$$= \frac{2440.4}{720}$$

$$\text{Labor productivity} = 3.389 \text{ pair of shoe/shift/worker}$$

The international benchmark for shoe manufacturing Labor productivity is 16pairs/shift/person, but due to the productivity factors listed below, factory labor productivity is below this level.

The reasons behind low labor productivity of the case company are summarized as follows:-

- Quality Issues: - under quality of raw material affect the workers' productivity.
- Inadequate skills:-This complicates things for manufacturers who want to hire skilled workers but end up with the environment cannot supply skill manpower.
- Regular Training: as a culture the industry provide training at the entrance it lack on job training as a result the operator can't cope up with the surrounding and their productivity became decline.
- Machine failure : the machine fails but it lack preventive maintenance
- Poor Leadership: if the leadership has a means to control the absenteeism rate, then the labor productivity became increase.

5.9 Absenteeism

The factory available time is = 7.75 hr. The average workforce per day is 557

Total human hour = average worker*working hour = $557*7.75=4,316.75$ hours per shift/day

Annual absence time= number of working hours per day* number of absents per annum
 $= 7.75 \text{ hours per day} * 7044 = 54,591 \text{hr.}$

The annual human hour is equal to the number of working hours per day multiplied by the average number of workers multiplied by the total number of working day.

The annual human hour = $7.75 * 557 * 276 = 1,191,423.00 \text{hr.}$

$$\text{Absenteeism} = \frac{\text{Annual absence time}}{\text{annual human hour}} * 100 = 4.58\%$$

The company's absenteeism rate is 4.58 percent, as calculated above, but the factory's goal is 1.5.

The reason for high absenteeism rate are listed as follows

- There is a lack of proper issue management.
- HRM needs to take a close look at the situation; management can make a big difference.
- Because of insufficient salary levels, the money lost by a worker who stays at home is insignificant.
- This is often linked to conditions in which employees' primary job pay is so low that they need to work a second job to supplement their income.
- Absenteeism is ingrained in the local community. This can happen in mining communities, for example.

5.10 Current value stream mapping (VSM)

Information related to production line for SAWA Lafrica (Gent's shoe) from receiving raw material to delivery of the product such as production time, inventory storages,

inspections, rework loops, number of workers and operational hours per day were collected and documented in the following table. The selected sample from export is SAWA Lafrica is selected because other than any export product the company has export the item repeatedly. The production work order comes from SARL SAWA FRANCE at the letter dated on 22/08/2020, a total batch number of 300 with different shoe size from 36 to 46 .The work order stayed in the cutting section from 24/08/20 to 25/08/20, it stayed in stock from 25/08/20 to 19/09/20 , in stitching section from 19/09/20 to 21/9/20 then finally to the lasting and finishing section from 23/9/20 to 24/9/20, it stayed in stock from 24/9/20 to 08/10/20 .

The current VSM production line point out the different stages whose bring the different values. These values were brought by different stages which were points out in present VSM. This is a map that is going to show how the value stream is at the process at this time. All data to build the VSM were collected and documented in table 5.12 and to draw appropriate data from the current VSM in the

In drawing the VSM the researcher use time study this time study defining the task to be performed and assigning the worker are the first two steps in a time study. Calculating the cycle time and rating the worker's output determining the amount of cycles to be observed computing the regular time

Cycle time characterizes the time that an employee wants to finish the given operation. Lead time measures the time that the company wants to manufacture the product, from the procurement of raw materials to its delivery to the clients.

To draw the completion of current VSM of SAWA Lafrica shoe production line, a timeline was added at the bottom of the map recording the VD and NVD time were recorded and documented in table 5.13.

Table 5-12 Manufacturing lead time of SAWA Lafrica

Times	Cutting(sec)			Sock Lining preparation (sec)			Insole preparation(sec)			Stitching(sec)			Lasting(sec)		
	D/T	C/T	U/T (%)	D/T	C/T	U/T (%)	D/T	C/T	U/T (%)	D/T	C/T	U/T(%)	D/T	C/T	U/T(%)
1st	238	647	63	165	246	33	166	222	25	1182	3919	70	408	1655	75
2nd	237	646	63	165	246	33	167	222	25	1172	3920	70	406	1655	75
3rd	239	648	63	165	246	33	166	222	25	1192	3920	70	408	1655	75

Note: Skiving machine speed:1400RPM,Tape Attaching machine speed:1620RPM, Degree Trimming Machine speed : 2770RPM,Line trimming machine speed : 2760RPM,Hammering machine speed : 2770RPM, eyeleting machine speed: 900RPM, splitting machine speed : 915RPM, Head Traveling machine speed :1400RPM, cutting Machine speed :1360RPM, Toe lasting machine speed :2800RPM , roughing machine : 2800RPM, Heel seat lasting machine : 1425RPM and brushing machine speed: 1390RPM

The D/T, C/T and U/T of SAWA Lafrica were documented in table 5.12 In this production line the stage of cutting, sock Lining preparation, out sole preparation, stitching and lasting were mainly accountable for D/T. In the stage of cutting, average U/T was 63% and C/T was 643 sec. In the stage of sock lining preparation average U/T was 33% and C/T was 246 sec. In the stage of in sole preparation, average U/T was 25% and C/T was 222 sec. In the stage of stitching, average U/T was 70% and C/T was 3919 sec and in the stage of lasting average U/T was 75% and C/T was 1655sec. The percentage of obtainable time for machine work or processing of desire product was known as the U/T. By observing the U/T of different unit stage of production line, it can be assumed line efficiency of the whole production line. At current state, the U/T of SAWA Lafrica product varies from 25% (In sole preparation) to 75% (lasting stage). By this study it was tried to increase the U/T in the future state as well as to reduce the D/T and to reduce the ultimate lead time.

Table 5-13 Current lead time of the product SAWA Lafric

Processing Stages	Average VD Time (Sec)	Average NVD Time (Sec)
Receiving Inventory	0	2400
Cutting	433	214
Sock Lining preparation	111	136
Insole preparation	191	30
Stitching	3029	890
Lasting and Finishing	1011	645
Shipping inventory	0	52144
Total	4,775.00	56,459.00
Percentage	7.79%	92.20%

The VD and NVD time of different processing stages for the production of SAWA Lafrica were documented in table 5.11. At current state, there were no VD time except NVD lime in the stages of receiving inventory and shipping inventory but in this process line, this NVD lime or these stages were required for the production of SAWA Lafrica. In this SAWA Lafrica production, the total VD time were 4,775.00 sec (7.79%) and the total NVD time were 56,459.00sec (92.2%). By this study, it was attempted to increase the percentage of VD time by reducing the NVD time with the proper implementation of lean tools.

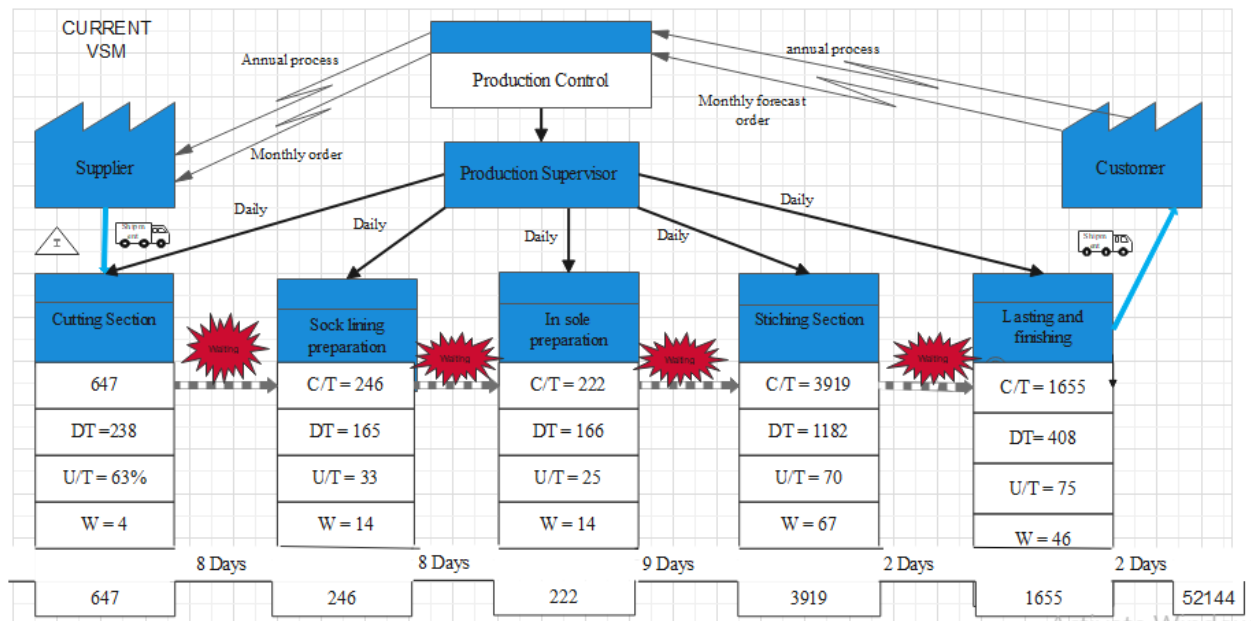


Figure 5-9 Current VSM for SAWA Lafric

Throughout the current VSM the whole processing system of the production line were represented with the flow of order, raw materials, labor, information, and VD & NVD times. It helps to draw the required processing stage like cutting, sock lining preparation, out sole preparation, stitching section & lasting and finishing required labor, C/T, U/T, C/O and batch size. By observing the current scenario of about processing line, it can be known like as what number of labor is needed at different processing unit? How much VD & NVD time is present? Where & what kind of improvement should be done?

At current VSM, for the production of SAWA Lafric was controlled by production manager, assistant manager and supervisor. In this production line, the production starts by

taking the order of production from the customers In order to achieve the customer demand the vital raw materials were collected from the different suppliers. These required raw materials were transported in the raw materials inventory which was the first stage for the production SAWA Lafric that followed by cutting, sock lining preparation, out sole preparation, stitching section & lasting and finishing and shipment of finished goods. As observed from the current VSM of the production of SAWA Lafric , diverse types of NVD activities were present in the flow of process line at different stages. The diverse types of bottlenecks at different processing stages were identified and quantified. The Up time (U/T) of cutting, sock lining preparation, out sole preparation, stitching section & lasting and finishing machine were consecutively 63%, 33 %, 25% ,70% and 75%. At present state of this processing line over the different stages total labor was 145. After the implementation of lean tools it was expected that U/T could be improved and total labor could be minimized.

5.10.1 Current Takt Time Analysis

It is the unit of time in which a product must be produced in order to match the rate at which that product is needed. (MA & NA, 2018)

The studied production line runs for one shift per day, each shift was for 27,900sec excluding lunch time and planned downtime; therefore, the available time for the run of the studied production line was 55,800sec with the daily customer demand of the year 2020 is 3971pair of shoes. Takt time is considered as the heartbeat of any process line. By this way, the present takt time of studied production line was 14.05sec i.e. it took 14.05sec to produce a single case of shoe production. By this study, it was tried to reduce the present takt time with the proper implementation of lean tools.

$$\text{Takt time} = \text{Available Time} / \text{Customer Demand}$$

Current Takt time of SAWA Lafrica shoe production line:

- ✚ Working shift per day = 2 shift
- ✚ One shift = 7.75 hours or 27900 Sec
- ✚ Two shift time = 15.5 hours or 55,800 Sec
- ✚ Total change over time = 1 hour or 3600 sec Lunchtime = 30 minutes or 1800 Sec
- ✚ Daily customer demand = 4100 pair Takt time = $55800/3971 = 14.05\text{sec/pair}$

5.10.2 Current process cycle efficiency Analysis (PCE)

PCE is calculated as a percentage of the ratio of VD time to lead time, with lead time equaling the amount of VD and NVD time. On the production line, the VD and NVD times were discovered to 16,351.33sec & 87,625.79 sec respectively and the lead time was 103,977.12sec. Throughout this report, the aim was to strengthen the current PCE by implementing lean tools.

$$PCE = VD\ Time / Lead\ Time * 100$$

$$\text{Process Cycle Efficiency (PCE)} = \text{Value Added time} / \text{Lead time} \times 100 = 15.73\%$$

$$PCE = 15.73\%$$

According to this figures, 15.73 % of the overall lead time is spent adding value to the commodity, while the remaining 84.27% is spent in wastage in downtime, defective product & transportation. The minimum theoretical lead time is the total process time. This is only possible if we can get all of our systems to work together. The PCE this process could be considered as the below of internationally comparative level 25% (Abu et al., 2017).

5.11 Overview of the future VSM

The future state map is a visionary map drawn to propose proposals for the Formwork product only by considering the proposed improvement ideas. Many lean manufacturing methods are adopted to decrease lead time, cycle time and increase output. As discussed in the literature review for manufacturing cycle time the clock starts when work begins on request and finishes when the piece is complete for delivery. Thus, in order to minimize and eliminate wastes in ASSC some of the major counter measures or improvement opportunities are proposed PCE will be strengthened at an international competitive level after the introduction of lean tools, according to the results. Based on careful observation of the production process, brainstorming with the experts of the company, and previous research works, it is estimated that the NVD period for raw material inventory and shoe production measured and can be reduced. The following improvement for the current VSM is pr

Table 5-14 propose for improvement for the current VSM

Wastes	Improvement strategies
Excess Inventory	1. Minimize Lead Time poor process flow work procedure and skill
Waiting	1. Measure the production waiting time 2. Preventive maintenance for machines 3. implementation (Use different boxes to identify the material and easy to get, Use separate space to collect the un operational machinery from the floor and easy accessible for operator and material) 4. Minimize change over time by implementation 5S
Defect	1. Using Standard procedure 2. Developing first product check in order to reduce the existence of defects and reworks that comes by group.
Rework	1. use standard for raw material quality & awareness on cost of quality 2. develop skill & regular training ,quality document 3. commitment from management
Transportation	1. Change work place arrangements (21.35% of waste in transportation due to poor shop floor) 2. 5S implementation

With the involvement of lean tools, it was predicted that a number of labor could be reduced from shoe processing line. The unnecessary motion of labor in the processing line was also considered as the manufacturing waste proposed by machineries layout by rearranging the machines layout. The expected numbers of eliminated labor were documented in the table 5-15.

Table 5-15 Present and expected Labor of in the shoe production line

Name of stages	No of labor at current state			No of labor at future state		
	skilled	Semiskilled	unskilled	skilled	semiskilled	Unskilled
Cutting	2	1	1	1	1	1

Sock Lining Preparation	3	5	6	1	2	3
Insole Preparation	3	5	6	1	3	4
Stitching	28	10	29	19	6	19
Lasting & Finishing	17	15	14	15	13	11
Total	53	36	56	37	25	38

At present state, it was seen that throughout the different processing stages of SAWA Lafrica shoe production line, total labor were 145 where skilled , Semiskilled and unskilled were 53, 36 and 56 respectively. At future state, if the lean tools will implement, it was expected that different types of bottlenecks and NVD activities will be reduced thus the present number of labor will also be reduced from 142 to 99 where skilled, semiskilled and unskilled were 37, 25 and 38 respectively. Because of a number of unwanted labors were involved to manage the different types of bottlenecks and NVD activities.

5.12 Future SAWA Lafrica production line

In the future VSM, after a deep brainstorming and an intense observation in SAWA Lafrica the VD and NVD time were calculated and documented in table 5-16.

Table 5-16 Future state VD and NVD time analysis of SAWA Lafric shoe product

Processing Stages	Average VD Time (Sec)	Average NVD Time(Sec)
Receiving Inventory	0	960 (60%)
Cutting	433	107 (50%)
Sock Lining preparation	111	68 (50%)
Insole preparation	191	30
Stitching	3029	223 (75%)

Lasting and Finishing	1011	161 (75%)
Shipping inventory	0	22,584 (50%)
Total	4775	23,174
Percentage	17.08%	82.92%

It was expected, after the implementation of lean tools the current state NVD times could be reduced at 59%. In this study, based on intense observation, brainstorming and previous regarding studies it was assumed that the NVD time of receiving stage of could be reduced at least 60% (960sec), the NVD time of cutting stage could be also be reduced at least 50% (107 sec) and the NVD time of Sock Lining preparation stage could be also be reduced 50% (68 sec). The NVD time of stitching could be reduced to 75% (223Sec), Lasting and finishing could be reduced 75%(161Sec) from the current state and in the future state these NVD times could be 960 sec, 107sec, 68Sec, 30Sec, 223Sec, 161Sec and 22,584Sec which could be seen in table 5.13 The Fig 5.10 was the future VSM of shoe production line.

5.12.1 Future process cycle efficiency Analysis (PCE)

PCE is calculated as a percentage of the ratio of VD time to lead time, with lead time equaling the amount of VD and NVD time. On the production line, the VD and NVD times were discovered to be 4,775sec and 23,174sec the lead time was 27,949seconds. Throughout this report, the aim was to strengthen the current PCE by implementing lean tools such as VSM, Pareto analysis, Pareto map.

Future PCE of shoe production line:

- In the shoe production line, Value Added time = 4,775Sec
- Non Value Added time = 23,174sec

$$\begin{aligned} \text{Expected Lead time} &= \text{Value Added time} + \text{Non Value Added time} = 4,775\text{sec} + 23,174\text{sec} \\ &= 27,949\text{seconds} \end{aligned}$$

Process Cycle Efficiency (PCE) = Value Added time/ Lead time x 100 = 17.08% which is considered as the internationally competitive level 25%

5.12.2 Future takt time

The present takt time of the production line was 7.20 sec per case production and it was expected that after the adoption of lean tools and SS methodologies this could be reduced. i.e

$$\text{Takt time} = \text{Available Time} / \text{Customer Demand}$$

Future Takt time of SAWA Lafrica shoe production line:

- Working shift per day = 2 shift
- One shift = 7.75 hours or 27900 Sec
- Two shift time = 15.5 hours or 55,800 Sec

Total change over time = 1 hour or 3600 sec Lunchtime = 30 minutes or 1800 Sec

Daily customer demand = 5000 pair Takt time = $55800 / 5000 = 11.16 \text{sec/pair}$

The present takt time of court shoe production line was 7.20 sec per case production and it was expected that after the adoption of lean tools and SS methodologies this could be reduced to 7.002 sec per case production. So, it seems that the lean tools and SS methodologies could bring the revolution beyond the speed of production of any production line.

Table 5-17 Future state Down Time (D/T), Cycle Time (C/T) and Up Time (U/T) data of SAWA Lafrica

Cutting(sec)			Sock Lining preparation (sec)			Insole preparation(sec)			Stitching(sec)			Lasting(sec)		
D/T	C/T	U/T (%)	D/T	C/T	U/T (%)	D/T	C/T	U/T (%)	D/T	C/T	U/T (%)	D/T	C/T	U/T (%)
120	540	78	83	179	54	222	166	25	591	3252	82	204	1655	83

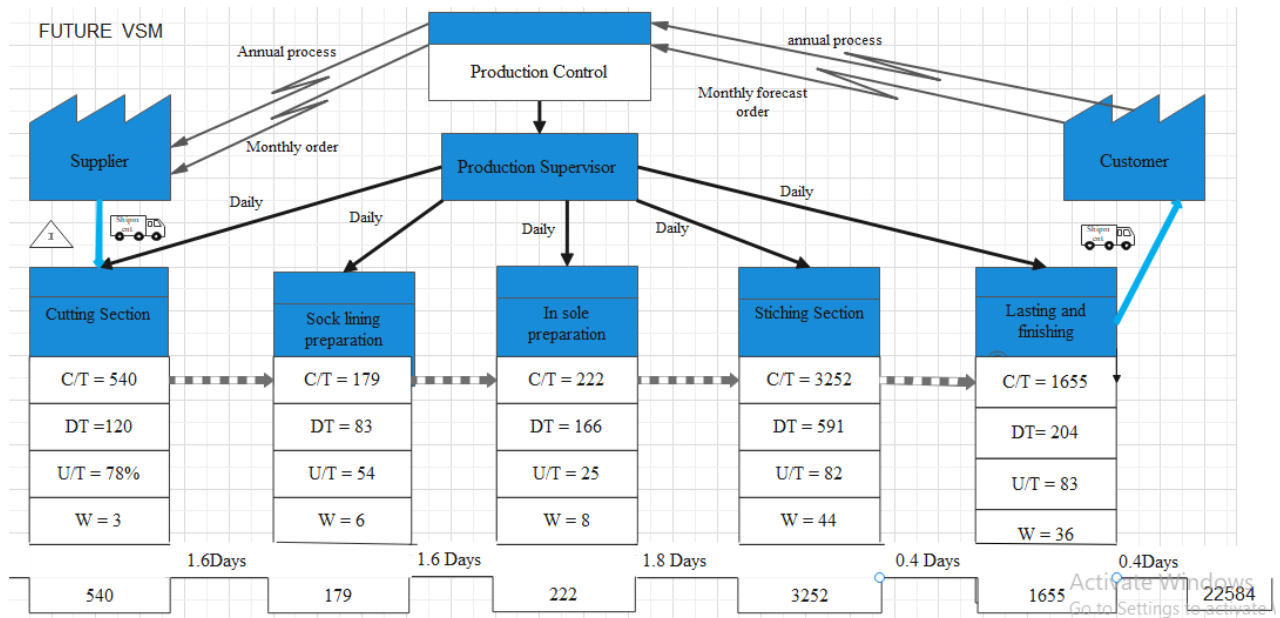


Figure 5-10 Future VSM for SAWA Lafric

The basic components of future VSM were production control, customers, production supervisor, suppliers, transportation, different stages of processing line like as receiving inventory, cutting, Sock Lining preparation, out sole Preparation, Stitching, Lasting & finishing and shipment inventory.

The production starts with taking the order from customer by telephone or email. Then the required raw materials were collected from the suppliers. Finally raw materials were transformed into different section of the production and the final product receiving inventory stage to shipment stage.

In this future VSM the basic promising changes were the reduction of total number of labor which was observed at every processing stage, reduction of NVD time, improved up time (U/T) which was also seen at every processing stage of production line. In the future state, if the lean tools will implement, it was expected that different types of bottlenecks and NVD activities will be reduced thus the present number of labor will also be reduced from 145 to 100 where skilled, semiskilled and unskilled were 53, 36 and 56 respectively. After the implementation of lean tools it was expected 45 labors could be reduced could be reserved for other jobs. The U/T cutting, Sock Lining preparation, Out sole Preparation,

Stitching, Lasting & finishing could be consecutively 78%, 54%,25% , 82% and 83% respectively but at current state the U/T of cutting, Sock Lining preparation, Out sole Preparation, Stitching ,Lasting & finishing were consecutively 63%, 33%, 25% ,70% and 75%respectively.

5.13 Interview Analysis

During Anbessa shoe factory observation and taken an interview with different departments in the factory that of the lean cultures associated with product development center (PDC), sales & marketing, production department, quality, system, compliance & kaizen in relation with waste reduction and also integrate with purchasing and distribution including human resource department for enhancing performance with skilled manpower and to become competitive in the international market.

5.13.1 Lean Maturity (PDC)

In product development center (PDC) idea for new product is first comes from marketing, sales & customer requests are changed to prototype and the next stage is development & the product is evaluated in marketing and sales department. To sustain these steps by giving continuous training in relation with productivity improvements, specific product orientation, customer expectation, increasing quality level to meet customers' needs. Nevertheless, due to cost in branding the exporter are branded in their name rather than in the manufacturers name Anbessa and the resource are not using breakthrough solutions.

Table 5-18 Rating of Lean maturity response to PDC

Sr. No	Parameters	rating
1	Customer expectation	2
2	breakthrough solutions vs. incremental improvement	2
3	Innovative process	1
4	Benchmarking	2
5	work study	2
6	VSM	1
7	lead time & wastage	1

As a result of limited resources, skill and technology accessibility they are not using an innovative processes instead we are using reverse engineering and this makes the industry using approaches in products, idea, process and previous work done. Healthy benchmarking approach will deliver 196 design / annual standard to the market. Due to this the industry focus only on time study for new products but they limited in method study with the problems facing not to work on method study are skill limitation , lack of knowledge on the property of leather , minimum experience of the workforce in the sector. Therefore, Time study did at initial process, design productivity evaluations, commercialization in pilot production stages. At this stages the value added activities & non value added activity analysis are not clearly started rather in design productivity we evaluating the non-value added activities and lack in exporting in other brands, skill, information and technology gap, system is very poor and not organized, under material quality, marketing, social compliance, government practically not supporting the sector.

A total of seven maturity evaluation criterion was raised and discussed .None of the parameters are found to be in an acceptance / best practice, four of the seven parameters are require improvement and three of the two parameters are require introduction

5.13.2 Sales and Marketing

In the Sales & Marketing department we focus on Customer Satisfaction and Customer Collaboration During customer satisfaction they identify their customers starting from planning identifying & knowing customer is mandatory so as to achieve our goal.

Table 5-19 Rating of Lean maturity response to Sales and Marketing

Customer Satisfaction

Sr. No	Parameters	rating
1	Identify primary customer	3
2	customer satisfaction survey	2

Customer Collaboration

Sr. No	Parameters	rating
1	a team of customers and company	2
2	sharing of resources	1

3	customer complaints handling mechanism	2
4	response to the complaints	2
5	root causes of customers' complaints	2

3	sharing of Benefit	1
4	working together in product design and marketing activities	2

Our customer in local markets are low income & middle income we are around 42 shops in local market and with related to export market we plan to open show room in Kenya, South Africa and Nigeria for export markets usually our product incur low price with high quality so customers are countries all over the world except china because China is the potential exporter in the world.

In relation with customer satisfaction survey for local market we use our shop as a tool to survey we distribute and analyze questionnaire either quarterly or annually and for potential local buyers like BJI, Harrer Beer, Waliya intergroup and Meta Abbo marketing department sent a questionnaire to survey their level of satisfactory . As a drawback the industry don't have any sharing resource instead we simply upload our products in web address so as to look the product to the customers and also we don't work together in product design and marketing activities rather receiving comments from the customers and make correction accordingly.

A total of nine maturity evaluation criterion was raised and discussed out of nine five questions were assessed on customer satisfaction and four were prepared to assess customer collaboration. From customer satisfaction the company Identify primary customer is found to be in an acceptance / best practice, four of the seven parameters are require improvement. From customer collaboration none of the parameters are found to be

in an acceptance / best practice, two of the four parameters are needs improvement and three of the two parameters are needs introduction.

5.13.3 Lean Maturity on production

The lean cultures associated with Production the order quantity is released from 10,000 pairs/day to 11,000 pairs/day & we produce these order quantity in +10% of this order quantity. Based on the customer demand the planning & the production department produce according to the plan to meet the delivery date. The current production quantity of the branches is 3,500Pairs/ day & including this factory it produces 4,100Pairs / day. Monthly the production quantity is 94,000pairs but the installed capacity is 10,000pairs/day. The capacity of the machine for this light shoe is 1000pairs/day and the total production became 5100 pairs/ day & the remaining 4900pairs/day either doubling this light shoe making machine or used other technique.

Scheduled maintenance of machine is not practiced rather we use breakdown machine maintenance activities, these may cause increase the downtime caused by machine failure.

Table 5-20 Rating of Lean maturity response to Production

Sr. No	Parameters	Level
1	production of goods in quantities equal to customer orders	1
2	production plans to meet delivery date	2
3	production quantity	1
4	machine maintenance	1
5	work study	2
6	VSM	1
7	lead time & wastage	1
8	Reduction of machine setup time	1
9	Effective 5S activity using checklist, symbols for communication.	2
10	shop floor layout & proper usage	2
11	spotted errors are treated as an opportunity to improve	2
12	company apply the time study	3
13	apply the value stream mapping so as to reduce lead time in production	1

Secondly the substandard raw material result in increasing larger setup time in stitching & lasting .To simplify this problem the four department (Quality, production , maintenance & PDC)work on this specific job break down by listing technical issue, manpower allocation or any other issues to minimize setup time. they also establish 5S , audited & maintained in cutting department but in stitching are not started because of the reason there is stock problem .Marketing /customer release in +10% for long period of time this additional products became large and create problem in stock. Therefore by setting production standard first, Standard minute value (SMV) from PDC and second taking international benchmark example the benchmark standard in cutting 2800stroke, Stitching section 15 pairs/ person, lasting 25pair/person & we evaluate the performance according to this standard based on their skill rate.

A total of thirteen maturity evaluation criterion was raised and discussed .One of the parameters are found to be in an acceptance / best practice, five of the thirteen parameters are require improvement and three of the seven parameters are require introduction.

5.13.4 Lean Maturity on Quality

The lean cultures associated with Quality, System and Compliance & Kaizen the product in the industry is push type and all the raw material will be ready for the next day.

Table 5-21 Rating of Lean maturity response to Quality

Sr. No	Parameters	Level
1	efforts to identify and eliminate all forms of waste	2
2	efforts used to make it quick and easy to identify abnormalities	1
3	On-Time Delivery	1
4	quality at the source	3
5	Raw material, kanbans	3
6	Organization of Finished inventories	2
7	Standardized work	2
8	Pull Systems	3
9	Maintenance Programs	1

10	efforts to identify Muri	3
11	value streams	1
12	Effective 5S activity using checklist, symbols for communication.	2
13	Changeover/set-up times	1
14	Layout for Flow	1
15	Multi-skilled operators (utility Team)	3
16	manage and reduce the scrap & wastes	1

During quality assurance we assured machine, manpower and process. The case company also focuses on different wastes and its elimination or reduction processes in relation with waiting, over processing, over production, transportation and other related wastes but they lack focusing on root cause analysis to eliminates wastes .Therefore, if problems occur we are traceability checking mechanism and worked with kanabans system (Bill card) starting from raw material to final.

We are work in standard in different perspective quality standard if a produced product didn't meet quality standard it will not pass to the next section, capacity standard means for example for the cutting department the capacity of the cutter per head already stated if it will not pass to the next section. Our quality standards are raw material, process, finished shoe, packing. Our production & quality capacity is based on benchmark not directly with takt time and they don't have a value stream mapping rather implementing 5S and Kaizen before two year and also re- implemented under evaluation system.

A total of sixteen maturity evaluation criterion was raised and discussed .Five of the parameters are found to be in an acceptance / best practice, four of the sixteen parameters are require improvement and seven of the parameters are require introduction.

5.13.5 Lean Maturity on purchasing and distribution

During Purchasing and Distribution, the company considers on Supplier Collaboration and Supplier Coordination to strengthen their integration with suppliers and they hold safety stock six months for imported materials but for local market only holds for fifteen days.

Table 5-22 Rating of Lean maturity response to Purchasing and distribution

Sr. No	Parameters	Level
1	orders raw material in required quantity	3
2	evaluates supplier performance	2
3	value stream mapping so as to reduce lead time	2
4	company and suppliers are working as a team	1
5	company and suppliers sharing resources	1
6	company and suppliers share costs and mutual benefits from joint improvement	1
7	company and suppliers exchange important business information at strategic level	3
8	company and suppliers urgently inform each other when contingencies occur	3

We strictly evaluate supplier performance based on price and they don't have quality problem because most of our suppliers are from Italy and they meet the requirement. In local market the source for our sole the company needs 30 days and leather 20 days. For imported material our safety stock is for 6 months and we plan to get Foreign exchange from government every 3 or 4 months putting this in to consideration to minimize lead time.

A total of eight maturity evaluation criterion was raised and discussed. Three of the parameters are found to be in an acceptance / best practice, two of the eight parameters are require improvement and three of the sixteen parameters are require introduction

5.13.6 Lean Maturity on Human Resource

In relation with Human Resource the company not conducts formal employee satisfaction survey but the company allocate budget for production employees for new coming employees and we have employee compliance file & employee having any complain with our service give us comments and implementing employee upgrading system if they satisfy the criteria.

A total of fourteen maturity evaluation criterion was raised and discussed .Three of the parameters are found to be in an acceptance / best practice, six of the fourteen parameters are require improvement and five of the fourteen parameters are require introduction.

Table 5-23 Rating of Lean maturity response to Human Resource

Sr. No	Parameters	Level
1	formal employee satisfaction survey	1
2	allocate & use/implement significant share of budget for training & for capacity building	3
3	address employees' dissatisfaction	2
4	opportunities for employees with outstanding performance	1
5	benefit packages for its employees	2
6	ergonomically designed work stations and comfortable air conditioning system	2
7	emergency evacuation plan with emergency exits	2
8	Institution supply & train how to use it appropriate personal protective equipment	2
9	first aid and/or other health care services in work place & train how to use it	3
10	Availability of separate (women /male) bathrooms, hand wash, locker rooms	3
11	Support for cross cutting issues, fund raising, sport festivals, periodic get-together parties prevail	1
12	bring the opinion of the customers to the Institution	2
13	Employees give constructive suggestions to the Institution	1
14	Level of staff turnover	1

5.14 Results and findings of poor productivity

The major issues are outlined in this section, which are divided into two categories: internal and external. Internal problems are issues that a company should overcome on its own by using its own capabilities and resources to enhance its operational performance.

5.14.1 Issues at the firm's or company's stage

For ease of management, the problems are classified under the case company's major processes these are discussed as follows

➤ **Production section**

- ✚ High manufacturing costs; rework costs, non-optimal resource utilization, Low output of managers in quality management and no encouraging workers towards productivity. There is a high rate of defect rate of 9.629%.
- ✚ Poor and disorganized production plan: no systematic method of authorizing, documenting, and recording the various stages of plans in such a way that they can be used as feedback for assessing and tracking results, as well as taking corrective action.
- ✚ Owing to a lack of proper maintenance, system breakdown, and power outages, there is a high rate of downtime 3.28%, excess inventory of, 14.93%.
- ✚ Poor plant layout the cutting & stitching sections are located in different floor. This result in enhance transportation wastage i.e. 21.35% of waste in transportation due to poor shop floor
- ✚ Communication breakdown with other agencies, such as sales and distribution, procurement, and material stock management.
- ✚ Low labor productivity, absenteeism rate of case company 3.389pair/shoe/shift/worker, and 4.58 percent respectively.
- ✚ The average OEE is 20% and this implies that the case company is not productive the aim of this research is improving the productivity by implementing lean tools.

➤ **Product development section**

- ✚ There is no known method for conducting fashion forecasting by considering competitors from various regions of the world.
- ✚ Due to limited resources, skill and technology accessibility they are not using an innovative processes instead they are used reverse engineering.

- ✚ Due to skill limitation and work experience of the workforce the department uses time study other than work study.

➤ **Sales and Marketing process problems**

- ✚ Owing to high production costs, they are not price competitive in international market.
- ✚ No means to survey customer satisfaction level for export market
- ✚ The customer and the industry don't have any sharing of resource and database.
- ✚ Weak distribution system management: high inventory hold-up - finished products stock, resulting in capital constraints, obsolete (damage, faulty, or despair) stock in each retail store, low annual sale results, and high selling and distribution costs
- ✚ Lack of market assessment for exports local customer needs

➤ **Purchasing and Distribution process problems**

- ✚ Delay in delivery time for export orders
- ✚ Poor inventory management with retail shops and warehouses
- ✚ Stick on limited number of suppliers they are updates themselves related to the market.
- ✚ Lacks measuring the performance of the suppliers

➤ **Human Resources problems**

- ✚ Employee dissatisfaction (unsatisfactory pay, no schooling fee, and no way of identifying skill gap & give training accordingly, no house allowances) reduces labor productivity.
- ✚ Skill enhancement trainings are not delivered on a regular basis in a planned and recorded manner, such as by creating appropriate training records such as a list of defined training topics that occur as a result of actual skill gap audits and training reports. The training effort does not involve management; instead, it focuses on roles such as operator or supervisor.
- ✚ Lack of varied and up-to-date training programs
- ✚ poor execution of training plans; and poor management and administration skills

5.14.2 External or national level problems

These are usually sector-level issues that cannot be addressed solely by the company, necessitating integrated national or level solutions. There are some of them:

- ✚ A shortage of skilled workers
- ✚ A shortage of foreign currency
- ✚ RMs is costly, and there is a wide variety of prices for finished leather, imported accessories, and components.
- ✚ Owing to a long procurement lead time and a scarcity of processed leather, there will be a delay in delivery.
- ✚ The derogatory image of Ethiopia and "made in Ethiopia shoes" makes foreign marketing of Anbessa shoes difficult.
- ✚ The firm's activities are not coordinated with those of other companies, raw material suppliers, and supporting institutions, both public and private, that operate in different segments of the value chain. This is a prerequisite for serving the export market.
- ✚ Lack of subcontracting, as well as a lack of sharing of resources and ideas among businesses.
- ✚ Owing to a lack of information system, there is insufficient supply chain management even within the company (poor coordination and linkage between departments).

5.15 Summary of finding

Despite the fact that there are internal/firm level and external problems, the study's emphasis is on firm level issues because these issues can be addressed by the firm using its own potentials, tools, and relevant methods to enhance organizational efficiency.

External issues, on the other hand, necessitate the involvement of various bodies – government, organizations, and individuals.

The intervention areas are all linked in some way to lead time, process cycle efficiency, employee satisfaction, quality management, and customer satisfaction issues, which are all

problems with overall organizational performance. To solve such a problem, a complete performance improvement model proposed.

Table 5-24 Improvement of Current performance & Proposed performance using Lean Tools

Lean Tools	Current (Existing) situation	Future(Proposed) situation
PCE	7.79%	17.05%
Takt Time	14.05Sec/Pair	11.16Sec/Pair
Lead Time	61,234Sec	27,949Sec.

CHAPTER SIX

6 6. PROPOSED THE FUTURE STATES OF SHOE PRODUCTION LINE

6.1 INTRODUCTION

Continuous updating is not only expected to build a significant source of competitive advantage in today's era of rapid technological developments, but it is also seen as a necessity for the survival of today's competitive global market . As a result, increasing process cycle efficiency & decrease a lead time is a key strategy for staying competitive. A proposed state of shoe production line is proposed based on real facts to increase process efficiency.

6.2 Development of future states of shoe production Line Criteria

Based on the case study and literature review, certain requirements are considered when designing the future states of shoe production line are addressing the potential root cause of low productivity problems; being a quality improvement tool; providing a clearly established wastage minimization tool; versatility to extend from sample production to all type of model production , flexibility to extend from the operation to the firm stage, including anyone from top management to low-level workers.

6.3 Proposed Model

Much of the research work regarding Lean maturity and firm success is based only on the relationship between the variables (types of integrations and the firm performance) .However, it's also important to look at it from the perspective of the issues and continual improvement on productivity and proposing solution.

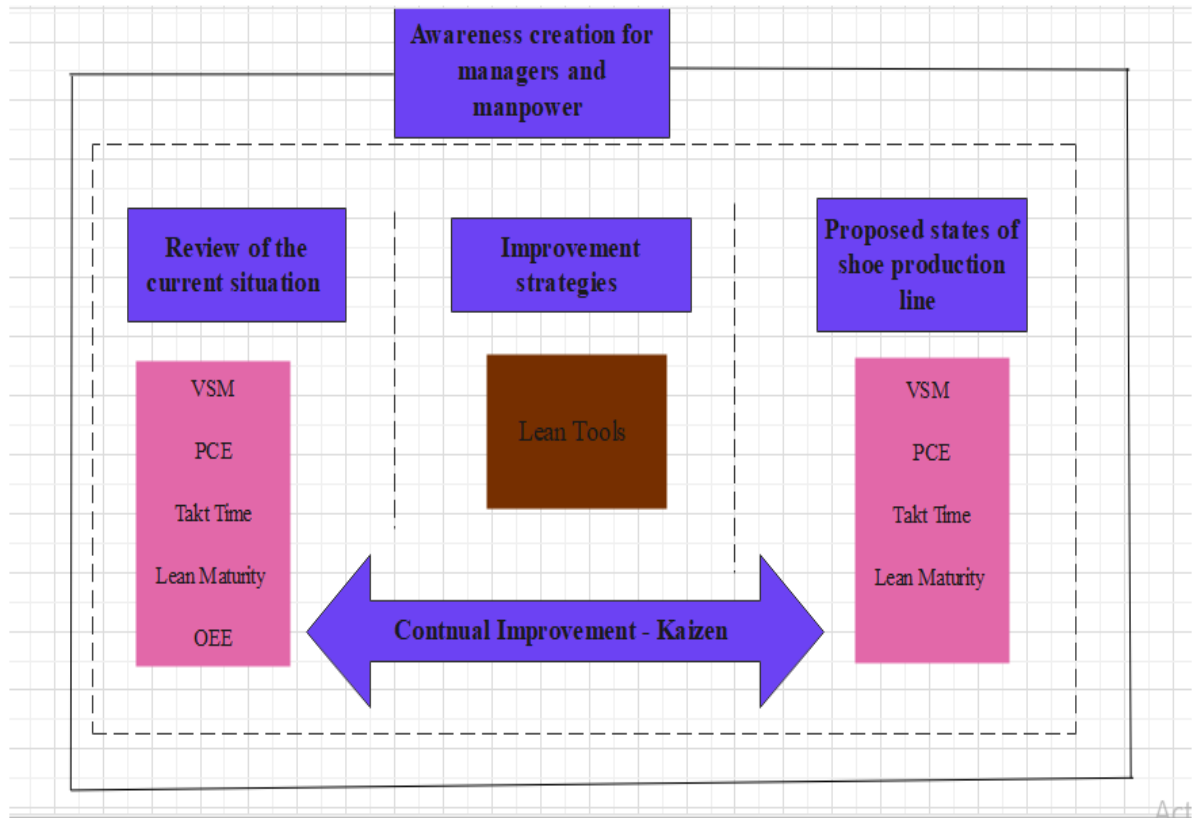


Figure 6-1 Performance Improvement Model

6.4 Model description

The following section discussed the model and how its enhance the performance of the case study

6.4.1 Awareness creation for management & Manpower

One of the most serious issues confronting most shoe businesses is a lack of suitably qualified management and personnel. The issue is that most businesses are too small to run their own training programs for both management and employees. There is no longer a pool of trained people from which to recruit as a result of the decline in manufacturing activity by large shoe making groups.

The management and workers of the industry's training must be a collaborative effort. The industries should collaborate to promote the formation of training organizations and to ensure their ongoing funding. The branding of the exporting market is determined by the

name of the customer this implies that to maintain brand recognition the industry should allocate budget of 3.5-4 percent of turnover for advertisement.

Wide open plan offices with different roles clustered together, such as the sales office next to the purchasing office, which is next to the production planning department, etc., are almost only found in companies with well-controlled and highly efficient administration functions. This has a number of advantages: It removes many of the half-jobs that occur on the outskirts of each department, enhances coordination, and boosts productivity. However during the site visit the researcher notices that even though their office are close to each other but there is a problem of coordination between sales and production section.

Once awareness created by the management it should be transferred to manpower by forming a team.. The team reports every activities to the management and this team is responsible for a variety of tasks, including forming sub-teams, attending daily meetings, taking regular training prepared by the management , discussed on how to minimize wastes ,how to draw VSM for all types of model so as to minimize lead time, enhance process cycle efficiency and awareness creation for exceeding customer quality and the management preparing rewards for those who achieve greater success within the subgroup and as a team in general

Inside the plant, the team comprises a multidisciplinary working group. Production staff, product development section, quality controllers, system and compliance staff, planning staff and technicians are among the members of this small working group. The team will last as long as the factory is in operation, but the members will rotate at a set interval determined by the team.

6.4.2 Review of current Situation

The production processes are analyzed, the value added times, non-value added times at all process section , the lead times, PCE are registered, and the plant's ability is determined during this step. Furthermore, waste or modifications from the manufacturing process are discovered. As a result, it is suggested that the VSM tool be used.

6.4.3 Improvement Strategies

All businesses should strive to improve the skills of their existing workforce while also attempting to train new employees to an adequate level. Overall, the chances of finding workers who have already been trained are slim.

In order to eliminate NVD operations and waste some enhancement techniques are emerging, such as hiring skill manpower, giving on job training , continuous improvement, and incorporating 5s implementation into the production management system and Change work place arrangements. One of the strategies used in improving productivity used in this research is lean maturity. The following assumptions are used to develop a lean maturity assessment (Kapanowski, 2015)

Color code for the maturity level for each code is represents as shown below:

- Green: Above industry baseline
- Yellow: At or near industry baseline
- Red: Below industry baseline

Table 6-1 Existing company Lean maturity Level

Coloring	Description	value	
	Below industry baseline	0 up to 1	
	at or near industry baseline	1 up to 2	
	Above industry baseline	2 up to 3	
Lean Maturity Assessment			
Company : Anbessa Shoe share company			
Key Elements	Level 1	Level 2	Level 3
	Basic Company	Average Company	Our Best Company
Leadership and working culture			
Company Vision and Administration process deployment	Company vision is not readily visible or known by employees and improvement in the administrative are not linked with lean enterprise.	Company mission, vision, values, guiding principles, core beliefs, etc. are consistent and visible on internal and external documents as appropriate	Leading organizations have regular employee participation and interpret vision as it applies to their work. Administrative teams are utilizing lean tools to communicate with management.
Continual Improvement Activities	No mechanism or time for individual involvement in process improvement.	Mechanism for change has been put in place and all individuals have some experience of the continual improvement process	Improvements happens routinely with employees actively participate in making improvements to their own and other areas.

Customer Satisfaction and Collaboration	Customer satisfaction and input is measured as a lagging indicator in terms of sales volume, complaints, and unsolicited input	Customers are surveyed on basic elements of satisfaction and establishing service levels through identifying the root cause analysis.	Customer compliance, monitoring and control of performance based on scores, and formal customer satisfaction survey reviews are done
Customer Coordination (COR)	Customer coordination and input is measured as a lagging indicator in terms of when contingency occur	Customers are surveyed on basic elements of coordination and establishing service levels through identifying the root cause analysis for the contingency.	Customer and the company exchange information at operational & strategic level & identifying & solving compliance through identifying the root cause analysis for the contingency .
Supplier Collaboration and Collaboration	Supplier Collaboration and input is measured as a lagging indicator in terms of performance	Supplier are surveyed on basic performance measurement	Supplier are surveyed on basic performance measurement and share resources like database, IT network, equipment
Supplier Coordination (COR)	Supplier coordination and input is measured as a lagging indicator in terms of when contingency occur performance	Suppliers are surveyed on basic elements of coordination and establishing service levels through identifying the root cause analysis for the contingency.	supplier and the company exchange information at operational & strategic level & identifying & jointly forecast customer demand
Communication	Not consistently delivered in timely, accurate, frequent, or convenient format	Communication is frequent and planned, but still not regularly achieving timely, accurate, or	Effective Communication planning, tracking, and improving is a regular part of the company culture

		convenient format for key stakeholders	
Supplier Alignment and Development	The supplier relationship is limited to purchasing, receiving inspection and price negotiations.	Some communication has started with key suppliers. Samples are shared to validate incoming quality.	Through evaluating the supplier's performance giving training in lean basics. Customer and Supplier are working together in continuous improvement activities.
Training	Training events are based on employee availability and HR capacity; training rollout is not aligned with training needs requirements and is evaluation of training does not measure skill transfer	Training has pre- and post-test measures, has some basis in training needs analysis is largely theory based	Training is based on solicited analysis of business needs which are included both theoretical and practical activities
Lean tools associated with Production and Quality culture			
Production plan and its standardized work	With some work instruction for Certain process	Based on the customer demand the planning department plans & produces according the work instructions exists throughout the industry to meet the delivery date.	Some processes have been mapped utilizing Lean tools. Standard work exists on those processes.

innovative processes	Processes have evolved over time. No visual representation of innovative processes	Processes have evolved using reverse engineering processes	design development using innovative processes
Work Study	Designed have evolved traditional way. No visual representation of time study & work study	Designed have evolved design software. Using time study .	Designed have evolved design software. Using work study .
Value Stream Mapping	Processes have evolved over time. No visual representation of VAD stages & NVAD stages	Some processes have flow maps or diagrams and can show some improvements from the tool.	Current State & Future Maps have been created and are used to drive some improvements.
Health, Safety and Environment			
Ergonomics / Job Safety	Zero or little metrics but not safety focus; issue recurring	Some metrics but not safety focus; issue recurring	Full metrics tracking issues, full problem resolution; Some issues but non-quick resolution
Waste reduction and replenishment system	no waste/defect tracking replenishment mechanisms exists.	Defect tracking exists primarily at higher level and Little focus on environment	Wastes/defects are tracked at the department level. Basic analysis with some improvements. Green environment focus in mission, vision, and metrics

Flow System / Kanban	No flow exist from order release to shipping. Process has back & forth steps.	Some processes have flow maps/diagrams and can show some improvements from the tool.	All key processes have been streamlined utilizing flow tools. WIP have been implemented, backflows are measured and reduced through continuous improvements
Pull System / Kanban	Orders are placed and work orders are released to manufacturing.	Some finished goods are produced based on "Best Guess". Kanban cards are utilized for supplies	kanabans cards are used in manufacturing.
Total Productive Maintenance (TPM)	No maintenance program exists. Machines/Equipment is repaired at breakdown.	Some machines/equipment has PM checks. Uptime increases cannot be attributed to PM checks.	PM process is designed to check thought has gone into daily, weekly and monthly base.
Change Over/ Set -up	Some knowledge exists concerning set-up times but nothing is documented.	Set-up time is measured on key equipment through runtime or downtime.	Set-up time is measured correctly (Corp forms) on key equipment with analysis leading to improvements.
5S - Work Place Organization	Work space is not organized	Work space is organized and clean. 5S has not been implemented.	Level 3 on the 5S audit.

6.4.4 **Proposed states of shoe production Line**

After analysing the current VSM the NVD and wastes are minimized the future VSM will be proposed This VSM will have low lead time The production processes are analysed, the value added times , non-value added times at all process section , the lead times, PCE are registered, the plant's ability is determined during this step and lean maturity are assess for different section and summarized as three sections; Leadership and working culture, Lean tools associated with Production, Quality culture and Health, Safety and Environment . Furthermore, waste or modifications from the manufacturing process are discovered.

Table 6-2 Propose company Lean maturity Level

Lean Maturity Assessment			
Company : Anbessa Shoe share company			
Key Elements	Level 1	Level 2	Level 3
	Basic Company	Average Company	Our Best Company
Leadership and working culture			
Company Vision and Administration process deployment	Company vision is not readily Visible or known by employees and improvement in the administrative are not linked with lean enterprise.	Company mission, vision, values, guiding principles, core beliefs, etc. are consistent and visible on internal and external documents as appropriate	Leading organizations have regular employee participation and interpret vision as it applies to their work. Administrative teams are utilizing lean tools to communicate with management.
Continual Improvement Activities	No mechanism or time for individual involvement in process improvement.	Mechanism for change has been put in place and all individuals have some experience of the continual improvement process	Improvements happens routinely with employees actively participate in making improvements to their own and other areas.
Customer Satisfaction and Collaboration	Customer satisfaction and input is measured as a lagging	Customers are surveyed on basic elements of satisfaction and establishing service levels through identifying the root cause analysis .	Customer compliance, monitoring and control of

	indicator in terms of sales volume, complaints, and unsolicited input		performance based on scores, and formal customer satisfaction survey reviews are done
Customer Coordination (COR)	Customer coordination and input is measured as a lagging indicator in terms of when contingency occur	Customers are surveyed on basic elements of coordination and establishing service levels through identifying the root cause analysis for the contingency .	Customer and the company exchange information at operational & strategic level & identifying & solving compliance through identifying the root cause analysis for the contingency .
Supplier Collaboration and Collaboration	Supplier Collaboration and input is measured as a lagging indicator in terms of performance	Supplier are surveyed on basic performance measurement	Supplier are surveyed on basic performance measurement and share resources like database, IT network, equipment
Supplier Coordination (COR)	Supplier coordination and input is measured as a lagging indicator in terms of when	suppliers are surveyed on basic elements of coordination and establishing service levels through identifying the root cause analysis for the contingency .	supplier and the company exchange information at operational & strategic level & identifying & jointly forecast customer demand

	contingency occur performance		
Communication	Not consistently delivered in timely, accurate, frequent, or convenient format	Communication is frequent and planned, but still not regularly achieving timely, accurate, or convenient format for key stakeholders	Effective Communication planning, tracking, and improving is a regular part of the company culture
Supplier Alignment and Development	The supplier relationship is limited to purchasing, receiving inspection and price negotiations.	Some communication has Started with key suppliers. Samples are shared to validate incoming quality.	Through evaluating the supplier's performance giving training in lean basics. Customer and Supplier are working together in continuous improvement activities.
Training	Training events are based on employee availability and HR capacity; training rollout is not aligned with training needs requirements and is evaluation of training does not measure skill transfer	Training has pre- and post-test measures, has some basis in training needs analysis is largely theory based	Training is based on solicited analysis of business needs which are included both theoretical and practical activities
Lean tools associated with Production and Quality culture			
Production plan and its standardized work	With some work instruction for Certain process	Based on the customer demand the planning department plans & produces according the	Some processes have been

		work instructions exists Throughout the industry to meet the delivery date.	mapped utilizing Lean tools. Standard work exists on those processes.
innovative processes	Processes have evolved over time. No visual representation of innovative processes	Processes have evolved using reverse engineering processes	design development using innovative processes
Work Study	Designed have evolved traditional way. No visual representation of time study & work study	Designed have evolved design software. Using time study.	Designed have evolved design software. Using work study .
Value Stream Mapping	Processes have evolved over Time. No visual representation of VAD stages & NVAD stages	Some processes have flow maps or diagrams and can show some Improvements from the tool.	Current State & Future Maps have been created and are used to drive some improvements.
Health, Safety and Environment			
Ergonomics / Job Safety	Zero or little metrics but not safety focus; issue recurring	Some metrics but not safety focus; issue recurring	Full metrics tracking issues, full problem resolution; Some issues but non-quick resolution
Waste reduction and replenishment system	no waste/defect tracking replenishment mechanisms exists.	Defect tracking exists primarily at higher level and Little focus	Wastes/defects are tracked at the department level. Basic

		on environment	analysis with some improvements. Green environment focus in mission, vision, and metrics
Flow System / Kanban	No flow exists from order release to shipping. Process has back & forth steps.	Some processes have flow maps/diagrams and can show some Improvements from the tool.	All key processes have been streamlined utilizing flow tools. WIP have been implemented, backflows are measured and reduced through continuous improvements
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5S - Work Place Organization	Work space is not organized	Work space is organized and clean. 5S has not been implemented.	Level 3 on the 5S audit.

6.4.5 Continual Improvement-Kaizen

This step encourages a philosophy of continuous development and the continuous improvement of manufacturing processes. The Kaizen tool was proposed as a means of accomplishing this. The aim of Kaizen is to eradicate exceptional changes discovered through Kaizen events.

CHAPTER SEVEN

7 CONCLUSION, RECOMMENDATION AND FUTURE WORK

7.1 Conclusion

The challenges of the ASSC in terms of productivity is summarized as follows:

- i. The primary challenge in case company is shortage of input (components and accessories – mainly imported): Most of these materials are imported from China, turkey, Vietnam, Brazil, etc, there is a lack of infrastructure for knowledge exchange and material movement communication systems, transportation, port issues and high demurrage cost .
- ii. Lack of Integration: Most companies only have a "companywide image" rather than a "country image," resulting in a disintegrated industrial structure. Because of a lack of confidence, there was almost no horizontal linkage between businesses. The international sector, on the other hand, compelled local businesses to band together. The footwear industry has recently formed an association that might be able to assist them in resolving some of their issues.
- iii. Poor Production: poor preparation and management of production, as well as low productivity (due to a lack of awareness and skills in the jobs performed).
- iv. Marketing: insufficient marketing knowledge and delivery system issues
- v. Bad supply chain management has a huge effect on a company's business efficiency. The marketing, planning, and production roles have a shaky relationship. It is difficult to meet customer needs with this poor connection, particularly in terms of price and delivery time.
- vi. The relatively low quality of domestic leather used in the industry (high quality leather is mainly for export) and the high cost of imported inputs are the two key factors affecting the competitiveness of leather footwear.
- vii. Due to a time constraint, the analysis focuses on Anbessa Shoe Sc. It is important to see the effect of the model by applying it in other factories.

7.2 Recommendation

It is recommended that some skilled manpower be hired and the existing operator should be trained and create awareness related with quality product to be competitive in international market, especially for stitching, lasting, and finishing machines. Prior to making the operator and assistant operator capable of reducing the maintenance time, an efficient training program should be organized.

From the interview the following are noticed

- i. Lack proper negotiations with the supplier. Every purchase is a trade-off between getting the best immediate price and ensuring a stable long-term supply chain.
- ii. The sales are highly dependent on limited supplier they, should avoid being reliant on a single country for your supplies. It's important to be aware of what's available on the global market.
- iii. The supplier for medium size production & small size productions are the same. The sales should be Choose suppliers that are the right size. Go to a medium-scale supplier if you can position medium-sized orders. A small supplier will overcharge you; a large supplier will dismiss your business as insignificant, particularly when dealing with small end-of-season orders.
- iv. Be realistic about quality; it's important to realize that certain raw hides and skins aren't capable of producing excellent leather.
- v. Actually an industry takes 6 month to produce a new model from design stage to bulk production but internationally accepted time is takes 60 working days .
- vi. It is common for cutters to be paid an incentive for cutting both economically and quickly, and cutter incentives should usually place a greater emphasis on material conservation than on cutting quickly. However the industry payment system is based on attendance not performance based.
- vii. The introduction of computerized stitching machines increases machine efficiency by 30%.But the company uses manual stitching machines.

- viii. if the industry and the supplier have common database and other means to share resource , then Supplier collaboration with the case company increase and as a result productivity will be enhanced .
- ix. To reduce excess inventory minimize the 10% allowance factor in production which makes the FG inventory become enlarged and create stock problem.
- x. If schedule for preventive maintenance implemented the waiting time due to machine failure became minimized.
- xi. To minimize downtime due to poor quality of leather the quality personnel from the ASSC quality assured the quality before shipping the leather from tanning industry .
- xii. If the payment system is based on performance, then the active employee became satisfied and works for better performance and the passive employee became activated to assure their salary.
- xiii. 5S implementation is effective when it is understood and driven by people at all levels. Hence a team comprising of top to ground level people is created for effective implementation.

7.3 Future Work

- i. Identifying additional performance indicators which are not considered in the study due to data & Time shortage.
- ii. 2. Implementing the model on operational level considering specific product model family in the production and other process in the factory.
- iii. 3. The study focus on Anbessa shoes Sc. due to time constraint, so that it is necessary to see the impact of the model by implementing in other factories.

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APPENDIX-1



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I am conducting research at Ethiopian leather footwear manufacturing companies, entitled "Productivity Improvement of Anbessa shoe S.C through Lean Tools." for the fulfillment of a master's degree in Industrial engineering from Addis Ababa University Institute of technology, school of Mechanical and industrial Engineering.

The aim of the interview is, to identify factors that hinder the productivity of the case company. I would like to appreciate and express my gratitude in assisting me in completing

the attached interview questions .Your response is very crucial to the success of the survey. All information will be treated in the highest confidential way and the respondent's name will not be revealed.

For further information you can contact using the above-mentioned address. Thank you for your committed cooperation, time and consideration!!!

I. Preliminary Information

Respondent Information

- 6 Your current position in the company_____
- 7 Years of work experience in the company_____
- 8 Qualification level (highest) _____
- 9 Gender_____

II. The criteria in lean cultures associated with Sales & Marketing

5. Customer Satisfaction (CSA)

- 5.1. Does the company identify its primary customer? Please explain
- 5.2 Does the company have formal customer satisfaction survey? Please explain
5. 3 Does your company value addition exceed customers 'expectation? Please explain
5. 4 Does the company timely respond when Products fail? Please explain
5. 5 Does the company have customer complaints handling mechanism? Please explain
5. 6 Does the company have documented customer complaints? Please explain
- 5.7 Does the company discuss the complaints of the customers with all concerned personnel of the company? Please explain
5. 8 Does the company give fast response to the complaints as per the standard and/or procedure? Please explain
5. 9 Does the company follow up the customers' satisfaction after correction and corrective action is taken? Please explain

5. 10 Does the company assess the root causes of customers' complaints? Please explain

5. 11 Does the company take proactive measures to eliminate common causes of customer complaints? Please explain

6. Customer Collaboration (CCL)

6.1 How is working team of your company and customers so as to improve the performance of the company ?

6.2 Does your company and customers share resources (e.g., database, IT network, equipment)? Please explain

6.3 Does your company and customers share costs and mutual benefits from the output? Please explain

6.4 Does your company and customers work together in product design and marketing activities? Please explain

7. Customer Coordination (COR)

7.1 Does your company and customers exchange important business information at strategic level? Please explain

7.2 Does your company and customers coordinate and exchange information at operational level? Please explain

7.3 Does your company and customers urgently inform each other when contingencies occur? Please explain

7.4 Does your company and customers jointly resolve upfront problems or contingencies, effectively? Please explain



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III. Preliminary Information

Respondent Information

10 Your current position in the company_____

11 Years of work experience in the company_____

12 Qualification level (highest) _____

13 Gender_____

IV. The criteria in lean cultures

14 The lean cultures associated Production (PDT)

14.7 D

discuss your company produces goods in quantities equal to customer orders.

14.8 D

describe your company plans production to finish on delivery date.

14.9 D

discuss your company levels production quantity

14.10 E

explain your company reduces machine setup time.

14.11 D

discuss your company effective machine maintenance with employees' participation.

14.12 D

discuss your company effective 5S activity using checklist, symbols for communication.

14.13 E

explain your company appropriate shop floor layout & proper usage

14.14 D

Discuss in your company nobody hides faults; spotted errors are treated as an opportunity to improve

14.15

Discuss in your company apply the time study in production

14.16 D

Discuss if your company apply the value stream mapping so as to reduce lead time in production



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V. Preliminary Information

Respondent Information

15 Your current position in the company_____

16 Years of work experience in the company_____

17 Qualification level (highest) _____

18 Gender_____

VI. The criteria in lean cultures

19 The lean cultures **associated with Quality**

19.7

D

describe all efforts to identify and eliminate all forms of waste on the shop floor?

(Muda)

19.7.1 8 Waste Reduction (efforts used to make it quick and easy to identify abnormalities)

19.7.2 Zero shipping errors; when problems do arise root cause analysis eliminates them as they occur. (On-Time Delivery)

19.7.3 Understanding of "quality at the source" and to never pass a defect to the next operation.(Quality)

19.7.4 Raw material, kanbans and work-in-process inventories have clear locations, amounts are defined and there is a clear rationale for these levels(Raw Material)

19.7.5 Organization of Finished inventories. There is a clear understanding of how much finished inventory is on-hand and why it exists. (Finished Goods)

19.8

D

describe all efforts to identify and eliminate all forms of unevenness, fluctuation and variation on the shop floor(Mura)

- 19.8.1 Understanding of Standard work to do a job and ways for improving standard work to meet changes in takt time. Staffing and standardized work is intentionally adjusted as demand changes. (Standardized work)
- 19.8.2 Information and materials are pulled through the entire supply chain based on real customer demand..(Pull Systems)
- 19.8.3 System for synchronizing flow of material and information to meet internal and external customer needs.(Synchronization)
- 19.8.4 Visual production control system is in place to level, sequence and control production regardless of volume or mix.(Level Loading)
- 19.8.5 Effectiveness of equipment preventative maintenance programs that involve operator. Infrequency or non-existent Breakdowns and minor/major stoppages .(Maintenance Programs)
- Describe all efforts to identify and eliminate all forms of Overburdening people and machines on the shop floor (Muri)
- 19.8.6 Visual controls in place to indicate abnormal situations in real time; action response and escalation processes in place to quickly control abnormalities. Employees can easily see through good visual management to identify exceptions.(Visual Performance Feedback)
- 19.8.7 The value streams have been mapped and are understood from ideation to cash and information is readily shared across departments. (value streams)
- 19.8.8 5S has evolved to become part of the culture; it's used to reduce waste. 5S actions focus more on making it easier to see interruptions to flow and identify abnormalities, more so than housekeeping. There is evidence that these systems are reviewed and improved upon regularly. 5S activities are owned and managed by employees who see real benefits in using those practices.(5S)
- 19.8.9 Understanding of approaches to reduce setup times .(Changeover/set-up times)
- 19.8.10Flow is more than just producing component parts in a single cell; ideally a complete product is manufactured in the cell, ready to go to the customer. Work area layouts promote flow of material and information and minimize transit and other forms of waste.(Layout for Flow)

19.8.11 Multi-skilled operators perform work based on standardized work practices that ensure balanced work and an ability to meet customer demand. Associates frequently rotate to keep skills fresh. (Cross-Training)



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I am conducting research at Ethiopian leather footwear manufacturing companies, entitled “Productivity Improvement of Anbessa shoe S.C through Lean Tools.” for the fulfillment of a master’s degree in Industrial engineering from Addis Ababa University Institute of technology, school of Mechanical and industrial Engineering.

The aim of the interview is, to identify factors that hinder the productivity of the case company .I would like to appreciate and express my gratitude in assisting me in completes the attached interview questions .Your response is very crucial to the success of the survey. All information will be treated in the highest confidential way and the respondent’s name will not be revealed.

For further information you can contact using the above-mentioned address. Thank you for your committed cooperation, time and consideration!!!

VII. Preliminary Information

Respondent Information

20 Your current position in the company_____

21 Years of work experience in the company_____

22 Qualification level (highest) _____

23 Gender_____

VIII. The criteria in lean cultures

24 The lean cultures associated **Purchasing**

24.7

P

urchasing and Distribution

5.1.1 Is your company orders raw material in required quantity? Please explain

5.1.2 Is your Company strictly evaluates supplier performance? Please explain

5.1.3 Does your Company evaluate value stream mapping so as to reduce lead time?

Please explain

Supplier Collaboration (SCL)

24.7.1 Is your company and suppliers are working as a team to improve the productivity of your company? Please explain

24.7.2 Is your company and suppliers share resources (e.g., database, IT network, equipment)? Please explain

24.7.3 Is your company and suppliers share costs and mutual benefits from joint improvement? Please explain

24.8

S

Supplier Coordination (SOR)

24.8.1 Is your company and suppliers exchange important business information at strategic level? Please explain

24.8.2 Are your company and suppliers coordinate and exchange information at operational level? Please explain.

24.8.3 Is your company and suppliers urgently inform each other when contingencies occur? Please explain.

24.8.4 Is your company and suppliers jointly resolve upfront problems or contingencies, effectively? Please explain.

24.8.5 Is your company and suppliers jointly forecast customer demand as well as plan production and sales? Please explain.



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Mechanical Engineering Department

Graduate Program in Industrial Engineering

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IX. Preliminary Information

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26 Years of work experience in the company_____

27 Qualification level (highest) _____

28 Gender_____

X. The criteria in lean cultures

29 The lean cultures associated Product Development Center

6.1 Describe processes to validate new product (or service) development and launch in your company.

6.2 How do you foster an understanding of customer expectations within your total workforce?

6.3 What processes do you have in place at the highest level to foster breakthrough solutions vs. incremental improvement to meet and/or stay ahead of customer expectations in your company?

6.4 What innovative processes and/or lessons learned methods are used to reduce cost and increase value to the customer in your company?

6.6 What is your approach to benchmarking?

6.7 Does your company works a time study for new products & the next section (production) works according to the time study? Please explain

6.8 Does your company listed the value added activities & non value added activity analysis? Please explain

6.9

D

oes your company update the value stream mapping so that to minimize lead time? Please explain

6.10

D

oes Your Company work as a team so that to minimize lead time & wastage? Please explain



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Respondent Information

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31 Years of work experience in the company_____

32 Qualification level (highest) _____

33 Gender_____

XII. The criteria in lean cultures

34 The lean cultures associated with **Human Resource**

6.1 Employee Satisfaction

6.1.1 Does the company conduct formal employee satisfaction survey? Please explain

6.1.2 Does the company allocate & use/implement significant share of budget for training & for capacity building? Please explain

6.1.3 Does the company address employees' dissatisfaction? Please explain

6.1.4 Does the Company provide growth opportunities for employees with outstanding performance? Please explain

6.1.4 Does the company provide benefit packages for its employees? Please explain

6.1.5 Does the company have an ergonomically designed work stations and comfortable air conditioning system ? Please explain

6.1.6 Does the company have suitable arm chairs/tables/cabinet for the workers? Please explain

6.1.7 Does the company have sufficient space for the movement of materials and workers? Please explain

6.1.8 Does the company have Institution have emergency evacuation plan with emergency exits

? Please explain

6.1. 9 Does the Institution supply & train how to use it appropriate personal protective equipment? Please explain

6.1.10 Does the Institution have first aid and/or other health care services in work place & train how to use it ? Please explain

6.1.11 Does the Institution have fire protection & control equipment facilities and training how to use? Please explain

6.1.12 Availability of separate (women /male) bathrooms, hand wash, locker rooms, etc prevail for employee? Please explain

6.1.13 Does the Institution "Support for cross cutting issues, fund raising, sport festivals, periodic get-together parties prevail? Please explain

6.1.14 Does Employees bring the opinion of the customers to the Institution? Please explain

6.1.15 Does the Employees give constructive suggestions to the Institution? Please explain

6.1.16 Level of staff turnover in the Institution in the last 3 years

)