

# エチオピアの革靴の製造工程の品質評価と改善の分析

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## Analysis of In-Process Quality Performance and Improvement of Ethiopian Leather Footwear Industries

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### Abstract

The objective of this study is to analyze the current situation of Ethiopian leather footwear industries on the quality and productivity performance and to propose the way of improvement ideas on how to minimize defect rate and productivity improvement. The scope of this study is limited to the internal performance analysis of Ethiopian leather industries by taking a case company. Data analysis is conducted for cutting, stitching, lasting and finishing sections of shoe processing. Input data are collected using both primary and secondary data collection methodology such as different reports of case company and informal discussion with company staffs, reviewing literatures etc., research methodology used to conduct this study are mainly quality control tools. Finally, the importance of conducting future studies to solve the external problems of this firm which affecting Ethiopian leather footwear products are forwarded as recommendations.

**Keywords:** *In-process quality & productivity analysis, Ethiopian leather footwear industries, Benchmark, Defect rate*

## 1. INTRODUCTION

Nowadays due to agricultural lead industry economic policy and different governmental incentives, Ethiopia's footwear industry is becoming a promising manufacturing sector by exporting footwears to the international market. However, this sector is facing many struggles to be able to compete in the international market. Among the many reasons of this competitiveness problems are basically classified as internal and external factors. Moreover, based on different literatures Ethiopia is the home for Africa's biggest

and world's fifth livestock with approximate quantity i.e. 54 million cattle's, 25.5 million sheep's, 24 million goats, 7 million donkeys, 2 million horses and 1 million camels. But the economical contribution of this sector to the country's economy is not yet as it should to be.

Nowadays Ethiopian economic policy agriculture leads to industry development strategy. Hence the number of Ethiopian footwear industry is significantly increasing from time to time. As Ethiopia is the home of abundant sources of African largest population of livestock's, cheap

labor force and government's motivation by providing different incentives for those who invest in this sector now local and international investor are investing in footwear industries. According to the Ethiopian Leather Development Institute (LIDI, there are currently 29 tanneries and 21 medium and large-scale footwear manufacturers operating in the country. Problems of all Ethiopian footwear companies are similar. Hence this study is focused on Sheba leather industry as case study which is one of the big Ethiopian shoe companies.

In-Process quality performance is concerned more about evaluating and analyzing internal processing factors to minimize reject rate and rework rate of products. It could be process production inspection, material inspection or product inspection. In-process quality control are inspecting of products performed with regard to the specifications during production process.

sometimes known as inter operation process.

## 2. DATA ANALYSIS AND RESULT DISCUSSION

The analysis of this study is conducted based on the collected inputs statically by using different quality control tools. For this part four main shoe processing sections (cutting, stitching, lasting and finishing) are taken as study area on what is the current performance of in-process quality and productivity to investigate whether the daily output is stable in terms of quality and productivity or not as is discussed with two cases in Fig.1 and Fig.2.

### 2.1. Sectional Analysis of Quality and Productivity

All in four sections productivity are analyzed in this manner taking data of yearly, monthly and 90 days. According to the analysis using control charts in all sections the daily output is not stable as Fig.1 and Fig.2 show zigzag line.

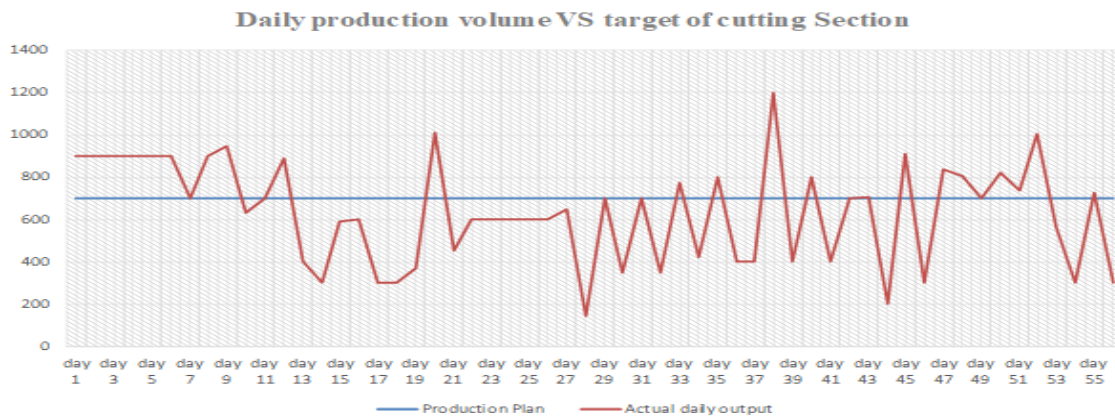


Fig.1 Production volume VS plan of cutting section based on sample data

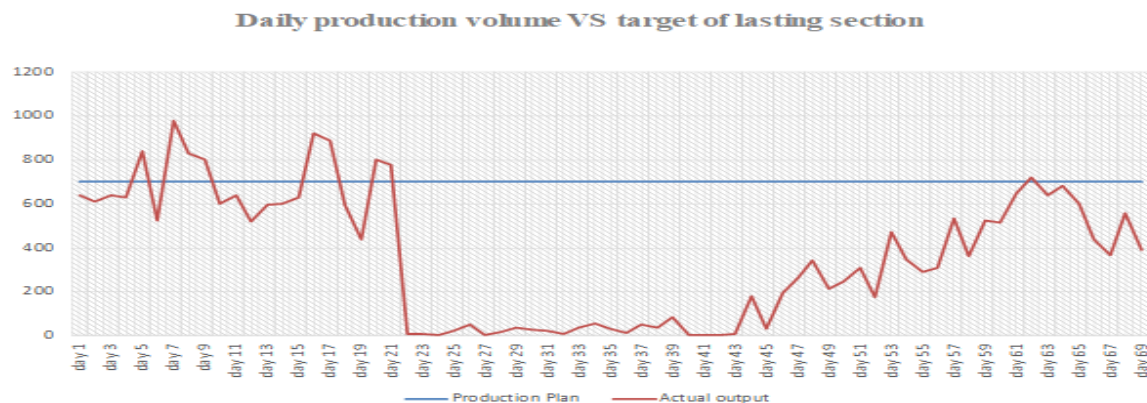


Fig.2 Production volume VS plan of lasting section based on sample data

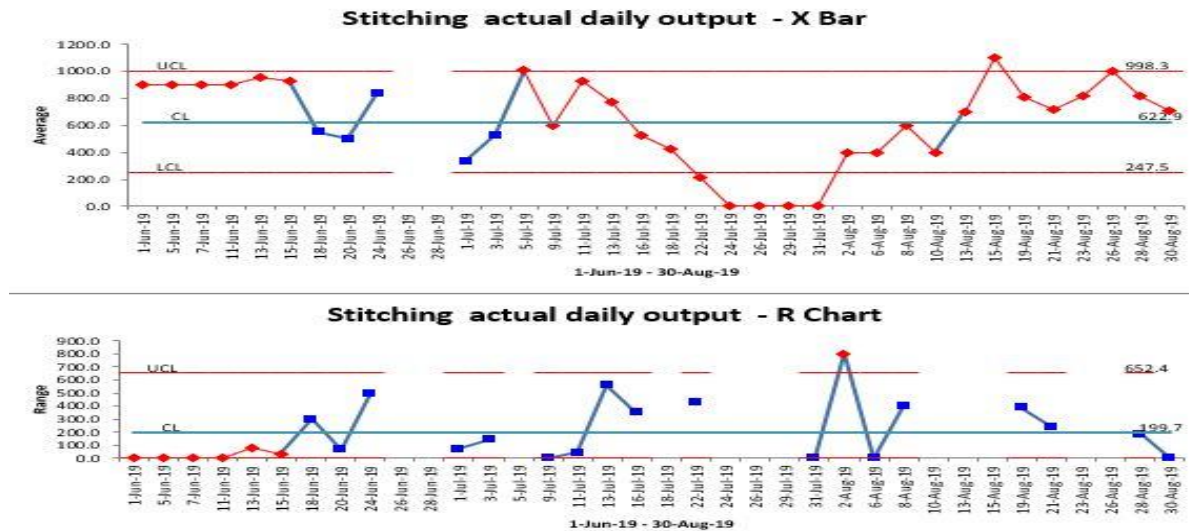


Fig.3 X bar and R chart of stitching section daily output

Stitching: starting from the definition stitching is the attachment of different components of upper part of shoe based on the design. After shoe components are cut and carefully organized such as marking to make ready for stitching, component transferred to stitching department. Though cutting section also needs attentions on leather consumption, paring and die size, stitching section needs high skill and concentration. Because of the involvement of high manpower in this section is may occur high rework rate and reject rate, unless assigning of highly skilled and trained well employees is required. the control chart below shows the actual daily production volume of stitching section. The same situation with cutting, lasting and finishing sections in this section also the point of each production output is not continuous and many points are below central limit. drawing X-bar and R chart is used to answer minimum of the following questions such as (1.)(Fig.3). Is the process stable over time? (2.) What is the effect of the process change on the output (3.) How to know if the process become unstable or performance changes overtime. There for both the mean/X-bar/ and Variance R chart are out of control. The process is not stable with time (day) variations.

## 2.2. Overall Analysis of Quality and Productivity

As Fig.4 shows the total production volume of 90 days is summarized and it shows comparing to the international benchmark and internal plan the actual outputs are low. Moreove overall performance on productivity, quality and estimated cost of defective products could calculate. As the average monthly plan and performance shows the production plan is around 14,450 pair of shoes whereas the achievement is 8905 pair of shoes which is total average monthly performance is 62.1 %. the constraints of this data recording mechanism it is not convenient to calculate cost of each section of rework and reject cost separately, however the total estimated cost be calculating by using the following formula.

$Tcx_{1y_1} = (\text{total cost of reworks in work station 1}) + (\text{total cost of rejected in work station 1})$

$Tcx_{11} = (Nr_{j1} * Ucr_{j1}) + (Nre_1 * Ucre_1)$

Substituting  $(Nr_{j1} * Ucr_{j1})$  by  $x_1$  and  $(Nre_1 * Ucre_1)$  by  $y_1$

$Tcx_{1y_1} = x_1 + y_1$  (1)

Total defects cost of work station 2:  $Tcx_{2y_2} = (\text{total}$

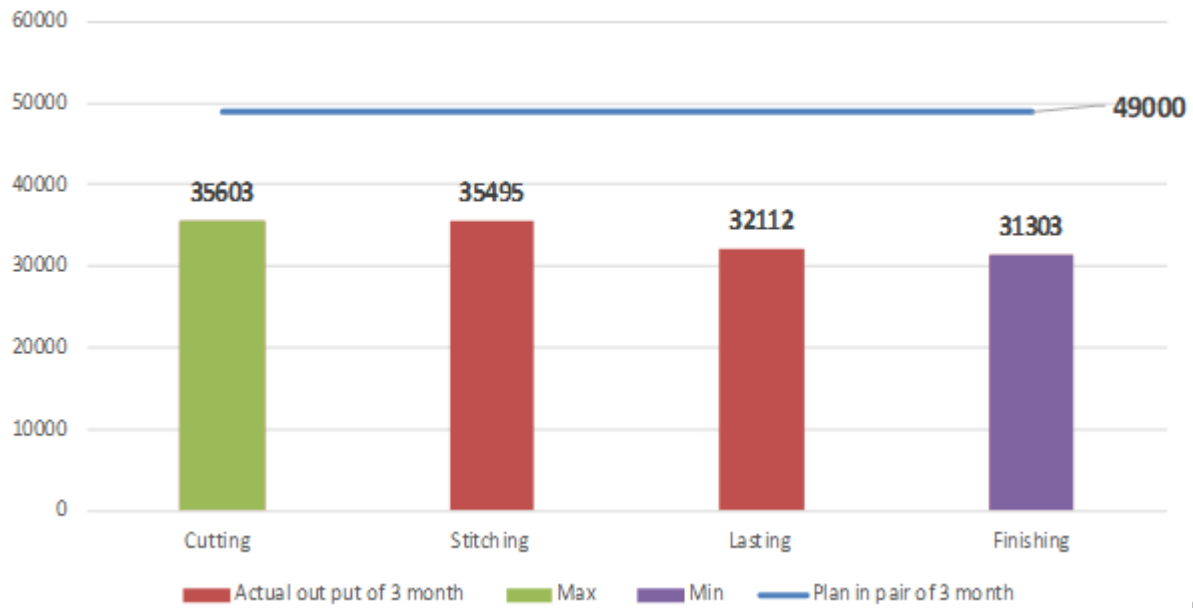


Fig.4 Total sectional output VS total target of 3 months sample data

Table 1 Sample data of shoe production volume and defect rate

Month	Production plan	Production volume	Production ratio (%)	% of rework	% of reject	Amount of rework	Amount of reject
2019							
Jan	14400	9321	64.7	2.7%	0.4%	251.7	37.3
Feb	14400	7234	50.2	2.9%	0.4%	209.8	29.0
Mar	14400	7749	53.8	3.6%	0.5%	279.0	38.7
Apr	15000	9143	61.0	5.1%	0.5%	466.3	43.9
May	13200	11551	87.5	3.2%	0.5%	369.6	52.0
June	15300	8432	55.1	3.8%	0.3%	320.4	25.3
Average	14450	8905	62.1	3.6%	0.4%	251.7	37.3

cost of reworks in work station 2) + (total cost of rejected in work station 2)

$$T_{cx_2y_2} = (N_{rj2} * U_{c_{rj2}}) + (N_{re2} * U_{c_{re2}})$$

Substituting  $(N_{rj2} * U_{c_{rj2}})$  by  $x_2$  and  $(N_{re2} * U_{c_{re2}})$  by  $y_2$

$$T_{cx_2y_2} = x_2 + y_2 \quad (2)$$

Total defects cost of work station n:  $T_{cx_ny_n}$  = (total

rejects in work station n)

$$T_{cx_ny_n} = (N_{rjn} * U_{c_{rjn}}) + (N_{ren} * U_{c_{ren}})$$

Substituting  $(N_{rjn} * U_{c_{rjn}})$  by  $x_n$  and  $(N_{ren} * U_{c_{ren}})$  by  $y_n$

$$T_{cx_ny_n} = x_n + y_n \quad (3)$$

Therefore the estimation of over all reject and rework cost/item is the sum of Eq. (1) +

Eq. (2) + ... + Eq. (3).

$$T_{CXY} = (x_1 + y_1) + (x_2 + y_2) + \dots + (x_n + y_n) \quad (4)$$

$$T_{CXY} = \sum_{i=1}^n x_i + \sum_{i=1}^n y_i \quad (5)$$

### 3. CONCLUSION

In fact, the challenges in Ethiopian footwear leather industries are mainly categorized as external factors and internal factors such as political instability, supply chain, quality of input material, level of shoe technology, skilled manpower, machine types, government's market policy etc. however the study of this study mainly focused on analysis of in-process quality and productivity statues and improvement ideas for Ethiopian leather footwear industries. As the result of the study on the case company the defect rate is more than 3% and low productivity comparing to international benchmark and internal plan with actual production performance 62.1%. For product defect rate analysis quality control charts were used, hence the result shows processes in all sections (cutting, stitching, lasting, finishing) are not controlled.

Though the concept of shoe production is wide term and needs detail investigation of quality and statues from many Ethiopian footwear companies, this study was about the in-process quality and productivity performance. Therefore, this study is expected to help other researchers to study about the major factors for low quality and productivity of Ethiopian footwear industries and external factors affecting for this manufacturing sector.

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