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PRODUCTIVITY IMPROVEMENT BY USING WORK MEASUREMENT METHOD CASE OF ETHIOPIAN LASTING AND FINISHING SECTION OF SHOE FACTORY

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Keywords:

Productivity improvement; Lasting and finishing shoe section; Work measurement; Time and motion study.

A B S T R A C T

Industrial development strategy of Ethiopia is depend on labor intensive industrialization systems. Shoe factories one types of textiles factories which participate on economic of the country, but it not generate high productivity due to inefficient way of doing of the work. In lasting and finishing section of the shoe factory has a problems which related with the lack of work measurement method among the other existing department of the company. In case of problems in lasting and finishing section the productivity of the case company is affected, by existence of ineffective time, high fatigue of workers, and unwanted motion/movements of workers during process. In order to compete with other company, make a good working conditions of the workers and satisfy their customers; it needs to solve those problems by using work measurement method. In lasting and finishing section of shoe factory to increase their productivity through reducing: ineffective time, improper way doing of the workers and unwanted movement of the workers. However, the issues of work measurement method related are unsolved problems with in Ethiopian lasting and finishing section of shoe factory. Therefore, the main objectives of this study is to improve the productivity of Ethiopian lasting and finishing section of shoe factory by using work measurement method (method of doing work, movement distance with time), taking one of the shoe factory as a case study. From case company gathered processing time, distance movement, between workers and conveyor, distance between consecutive operation and time between consecutive operations with identifying working conditions of the workers during work their work on the on the existed system. Depend on collected data identified effective and ineffective time, movement distance with time of movement and unwanted movement distance with time. Then, reduce ineffective time, unwanted motion, change working conditions of the workers to reduce distance movement around working area. This research proved case company can be increase daily production from 734pairs/day to 764 pair/day of shoe with making good working conditions of the workers.

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1. INTRODUCTION

1.1 Literature Review

As the result of development of technology and globalization, worldwide business create highly competitiveness (Gezahegn, 2016). In order to compete it produce product which relatively more efficiently than their competitors (Birkinesh, 2012), the production of lather products as long tradition in Ethiopia (Deborah, 2016). Lather industries has a large labor extensive, create opportunities to be globally competitive and saving of capital with giving especial attention and expanded in Ethiopia (Gezahegn T. D., 2014), (Bewuket, 2018). Also Ethiopian shoe industries are the place were of intensive labor is existed (Tetsushi, 2006). In shoe industries of Ethiopia it needs improvement, because it is a major area of economic activities (Boresa, 2007). Productivity is a quantitative relationship between production and resource and also the ration output in to input (Amol, 2016), Productivity is generating high income and value added for organization and workers (Rahul, 2016)

Productivity improvement is one of the basic strategies to encourage to excellence of the factory and it used to achieve good operational performance and financial. It increase satisfaction of customers and reduce time and cost to develop production (Naveen). Also according to Naveen estates that improvement can be act in the form of elimination unnecessary activities, simplifying the process, optimizing the system and reducing ineffective time. Any industries improve their productivity in order to eliminating some causes and production time that affect profit of that industry. To in enhance productivity in shoe making industry, it carried out in details of working system (Parthiban, 2014),also in order to compete the competitors, the firms has to increase productivity to meet the customer's needs.

Work measurement: Is concerned investigating and eliminating production loss time and improve the workers ways of doing job and work measurement (motion and time study) techniques are uses as a best way of improving productivity in many companies (Mohd, 2005).

Basic procedure of work measurement

Some procedures are there in work measurement method (George, 1992)

Select: - the work to be studied

Record: - all the relevant data relating to the circumstance in which the work is being done, the methods and the elements of activity in them.

Examine: - the recorded data and the detailed breakdown critically to insure that the most effective methods and motions are being used and that unproductive and foreign elements are separated from productive elements.

Measure: - the quantity of work involved in each element, in terms of time, using the appropriate work measurement techniques.

Compile:- the standard time for the operation which in the case of stop watch time study will includes time allowance to cover relaxation, personal needs etc.

Define: - precisely the series of activities and methods of operation for which the time has been compiled and issue the time as standard for the activities and methods specified.

Work measurement categories in to time study and motion study (Singh, 2016) are shown on figure 1.

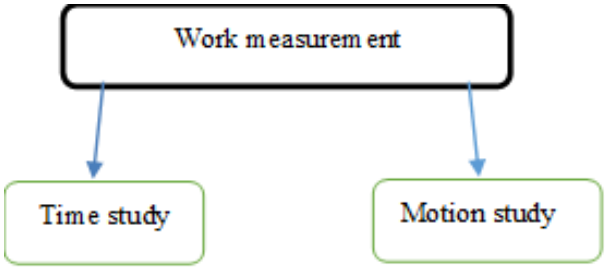


Figure 1. Work measurement categories

Motion and time study

(Mohd, 2005) 'Motion and time study is defined as a scientific analysis method designed to determine the best way to execute the repetitive task and to measure the time spent by an average worker to complete a given task in a fixed workplace' 'and The aim of the motion and time study is to improve productivity and effectiveness of work place

The Standard time for the proposed method is calculated by stop watch time study (George, 1992) according to the following steps:

1. Selecting the job for the Time study.

2. Obtaining and Recording information:-The information is recorded using flow process chart and a data collection table prepared for this study as shown in table 1.

3. Defining the elements

4. Measure time duration for each element and asses the Rating factor.

Assumption is taken for performance rating. As per this system, the time study observer assigns rating for criteria of particular task and establishes the rating.

5. The Normal time is calculated using the following formula.

Normal time = cycle time *rating factor

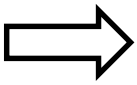
6. Allowances are given to the normal time calculated above. The allowances are given by considering different

kinds of allowances as mentioned in the literature review. Relaxation allowance (personal needs, basic fatigue) and Contingency allowance are allowance which has a great role in the calculating standard time

7. Then the standard time is calculated using the following formula:

$$ST = NT (1+Allowances)$$

Table 1. American Society of Mechanical Engineers (ASME) flow process symbols

Symbol	Name	Meaning
	Operation	A complex action or process (possibly described elsewhere), often changing something.
	Transport	Movement of people or things. May be accompanied by a distance measurement.
	Delay	Idle time of people or machines, or temporary storage of materials.
	Storage	It occurs when an object is kept under control such that its withdrawal requires authorization. Longer-term storage of materials or other items.
	Inspection	Checking/ examining of items and comparing with standard to ensure correct quality or quantity.

2. PROBLEM STATEMENT

Majority of Ethiopian foot wear producers are unable to produce and prepare according to the requirements, because of less quantity, quality, time and ineffective method of doing the work (Gezahegn T. D., 2014). According to (Boresa, 2007), In order to compete with global market, produce product which has high quality, low cost and satisfy customers by eliminating or reducing those productivity problems (Nallusamy, 2015).Ethiopia shoe factory lasting and finishing section impacted their productivity and fatigue of the workers due to lack of work measurement (motion and time) principles suffer from competing in global market. The main problem in those company is demonstrated by a process having unwanted motion, ineffective time and improper working condition of workers. Working condition of the shoe factory is difficult for labors (Organization, 2014), also doing a long period of time with moving different distance around working area throughout working hours, in case of this results it impact both workers and productivity of the company. In shoe industries of Ethiopia it needs improvement, because it is a major area of economic activities. In shoe factory there is internal productivity factors, those are productive activities, and time spend productive system, also total ineffective time is caused by inefficient method of manufacturing or operation and unsatisfactory of the workers (Nallusamy, 2015) (Bewuket, 2018). In industries workers suffered by different problems because of inappropriate working conditions of the systems (Labour, 2019). Companies considering only on their product rather than workers working conditions (Singh, 2016), also there is no consideration on ineffective time during process (George, 1992) and there is no identifiable ineffective time, process and delay time and there is no workers consideration on working condition (Hyun-Jong, 2017). Reports of the case company shows the problem along work measurement on shoe factory lasting and finishing shoe section has movement distance 20.83%, repetitive motion 12.5% and workers fatigue 16.67%. due to this there is high repetitive movement, high distance between working area and conveyor, excess of ineffective time, high fatigue of workers, which results increase movement time with ineffective time, increase fatigue of workers and also decrease the competiveness of the factories with other factories. In order to overcome those problems which facing in the lasting and finishing shoe section by changing working conditions of workers and reducing the distance of movement with considering the standard working area of the workers and time standard of the process.

2.1 Objectives of the study

General objective of the study

the main objective this research is to study factors affect the productivity and also improve the productivity of shoe factory through Work measurement method on the lasting and finishing shoe section.

Specific objective of the study

In order to achieve the general objective which stated above, the following specific objectives are will included.

- To analyzing the existing works measurement of the shoe factory.
- To reduce distance movement of workers in lasting and finishing shoe section.
- To reduce ineffective time associated with lasting and finishing shoe section.
- To reduce workers fatigue
- To set standard time for proposed system.

3. METHODOLOGY

3.1 Data Collection

The instruments engaged in order to collect primary data is structured questionnaires and personal interviews. In addition, secondary data will also be collected from profiles of the footwear industries, documents, existing literature on work measurement method from relevant books, articles and journals; reports and data from previously worked researches.

Research framework is shown on Figure 2.

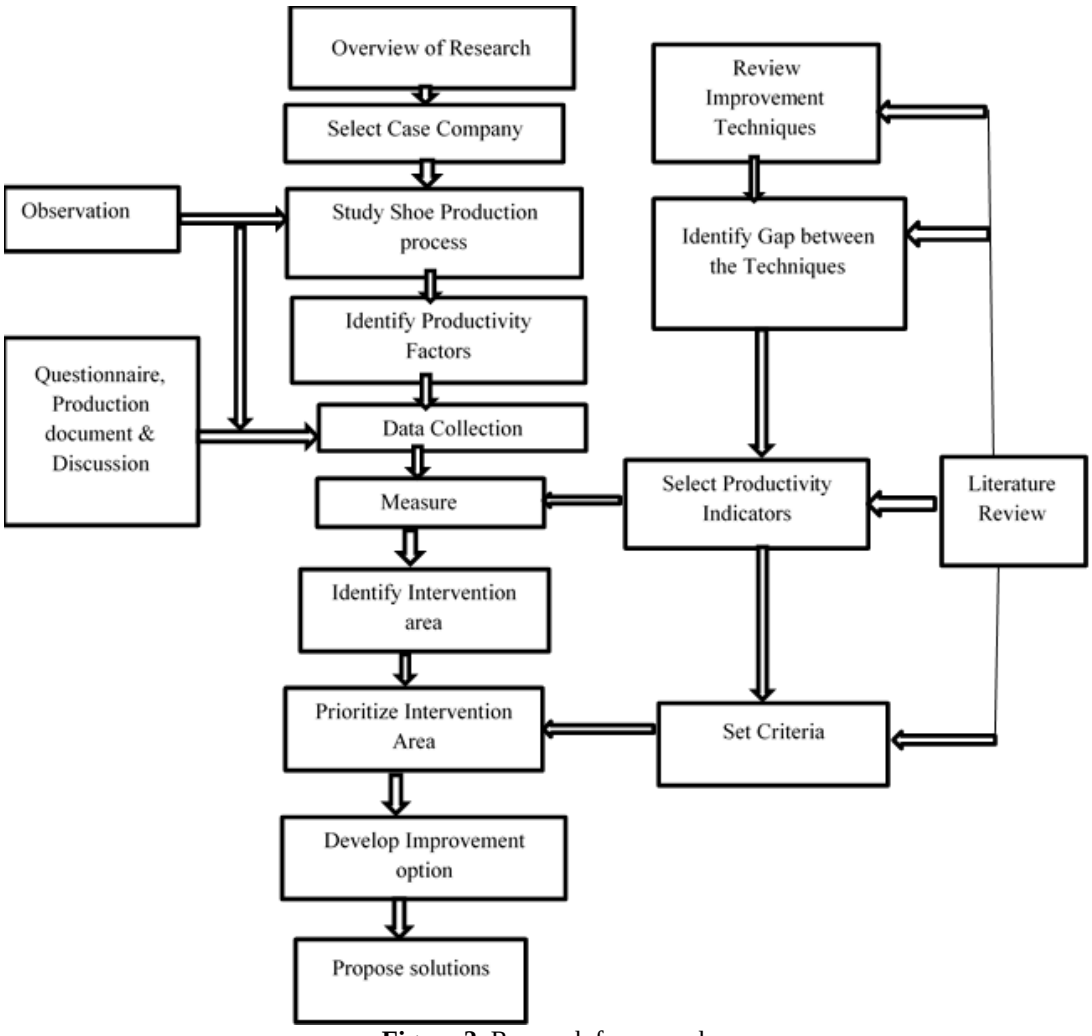


Figure 2. Research framework

Data Analysis Equipment and Tools

The tools used for the data analysis are flow process chart for both the existing & the proposed methods, standard time development called stop watch time study and also In addition to the tools mentioned above different equipment's are used for performing this study. The equipment includes: stop watch for recording time data, Microsoft excel and calculator.

4. EXISTING SYSTEM OF LASTING AND FINISHING SHOE SECTION

Lasting and Finishing: In this process, upper is further shaped in the form of shoe. There are various construction process in lasting to make the shoe like stuck on, stobel, string lasting etc. Finishing is the process to enhance the appearance of the shoe, special waxes, creams, crayons, solvents etc. are used. And also packing process on this section, it is the shoe lift is

inserted in the shoes to maintain the shape of the finished shoes. After this operation, the finished shoes are kept in the boxes.

In the lasting and finishing section conveyor has a great role in material transportation. The study covers all the above process which process in production shoe of lasting and finishing section.

The problem observed in the existing system;-

- Moving long distance
- Wastage of time by searching of tools or material.
- Improper working condition of the workers
- The speed of conveyor and workers not matched together.

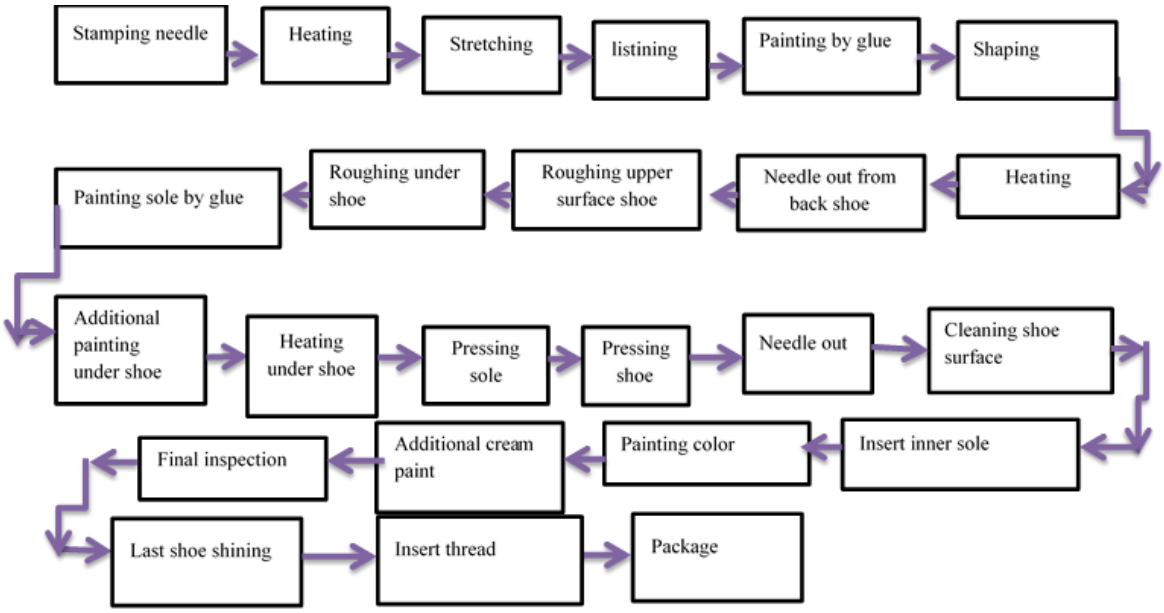


Figure 3. Flow process of lasting and finishing shoe section

Existing distance of consecutive operations, number of workers and time between processes are shown in table 2.

Existing workers movement time and distance of working area from conveyor are shown in table 3.

Existing allowance is shown in table 4.

Existing rating factor is shown in table 5.

Existing process recorded cycle time is shown in table 6.

Table 1. Distance of consecutive operation, number of workers and time between processes.

Elements of work	Symbol	Distance (m)	Time (H:M:Sec)	Number of labor
Stamping		2.5	00:05:00	1
Heating		0.25	00:00:04	1
Stretching		1	00:01:30	1
Listening		0.15	00:00:02	1
Painting		2.5	00:10:00	1
Shaping		0.5	00:05:00	1
Heating		0	00:05:22	1
Needle out		0.50	00:00:35	1
Rough upper shoe		0.25	00:00:16	1

Rough under shoe						0.47	00:00:33	1
Painting sole						0.15	00:00:02	1
Additional painting under sole						2.5	00:10:00	2
Heating under sole						0.3	00:00:05	1
Pressing sole						0.15	00:00:02	1
Pressing shoe						0.15	00:00:02	1
Take out needle						0.15	00:00:02	1
Cleaning surface						0.225	00:00:03	2
Insert insole						0.15	00:00:02	2
Painting color						0.15	00:00:02	2
Additional painting cream						1	00:01:30	1
Final inspection						0.15	00:00:02	1
Last shoe shining						0.225	00:00:03	1
Insert thread						0.15	00:00:02	5
Package						0.15	00:00:03	3
Total						13.72	00:42:26	34

Table 3. Movement time and distance of working area from conveyor

Operations	Movement time (H:M:Sec)	Distance from conveyor (M)
Stamping	00:00:15	1.20
Heating	00:00:20	1.60
Stretching	00:00:15	1.20
Listening	00:00:09	0.8
Painting by glue	00:00:09	1.80
Shaping	00:00:10	0.6
Heating	0	1.20
Needle out	00:00:09	1
Rough upper shoe surface	00:00:15	1.40
Rough under shoe	00:00:14	1.30
Painting sole	00:00:09	1.20
Additional painting under shoe	00:00:06	1
Heating under shoe	0	1
Pressing sole	00:00:04	0.9
Pressing shoe	00:00:04	0.9
Take out needle	00:00:05	1
Cleaning shoe surface	00:00:20	1.20
Insert insole	00:00:09	1
Painting color	00:00:08	0.95
Additional painting cream	00:00:11	1
Final inspection	00:00:08	0.8
Last shoe shining	00:00:08	0.8
Insert thread	00:00:11	1
Package	00:00:8	0.8
Total	00:03:48	25.65

Table 4. Existing allowances

Work elements	Relaxation allowance %		Contingency allowance %	Total %
	Personal needs	Basic fatigue		
Stamping	5	5	5	15
Heating	7	5	5	17
Stretching	7	5	5	17
Listening	6	5	5	16
Painting by glue	5	5	5	15
Shaping	7	5	5	17
Heating	7	5	5	17
Needle out	5	5	5	15
Rough upper shoe surface	5	5	5	15
Rough under shoe	5	5	5	15
Painting sole	5	5	5	15
Additional painting under shoe	5	5	5	15
Heating under shoe	5	5	5	15
Pressing sole	7	5	5	17
Pressing shoe	7	5	5	17
Take out needle	7	5	5	17
Cleaning shoe surface	5	5	5	15
Insert insole	5	5	5	15
Painting color	5	5	5	15
Additional painting cream	5	5	5	15
Final inspection	5	5	5	15
Last shoe shining	5	5	5	15
Insert thread		5	5	15
Package	5	5	5	15

Table 5. Exist rating factor

Types of operation	**Rating factor**
Stamping	0.8
Heating	1.2
Stretching	1.2
Listening	1
Painting by glue	1
Shaping	1.2
Heating	0.8
Needle out	0.8
Rough upper shoe surface	1
Rough under shoe	1
Painting sole	1
Additional painting under shoe	1
Heating under shoe	0.8
Pressing sole	1.2
Pressing shoe	1.2
Take out needle	0.8
Cleaning shoe surface	1
Insert insole	1
Painting color	0.8
Additional painting cream	0.8
Final inspection	1.2
Last shoe shining	1
Insert thread	0.8
Package	1

Table 6. Process recorded cycle time of exists

Time Study Sheet										
Production of shoe						Time Study Observer Moti M				
Operation - lasting and finishing shoes section						Date .11-12/8/2019 E,C				
No. of Cycles- 24										
Standard Time Found- 22.23min										
Element Description (operations)	Observed time (stop watch Reading) (Sec)					Average observed Time (Sec)	Rating Factor	Normal Time (sec)	Allowance	Standard Time (Sec)
	1	2	3	4	5					
Stamping	25.7	23.8	23.7	23.8	32.5	25.9	0.8	20.72	0.15	23.828
Heating	30.02	21.6	26. 3	24.1	23.3	25.06	1.2	30.072	0.17	35.18
Stretching	45.02	45.28	45.04	45.09	45.02	45.09	1.2	54.108	0.17	63.30
Listening	58.4	50.2	94.0	75.2	59.3	67.4	1	67.4	0.16	78.18
Painting by glue	25.6	25.8	46.4	36.8	42.3	35.38	1	35.38	0.15	40.68
Shaping	16.9	37.3	21.2	17.5	20.5	22.68	1.2	27.216	0.15	31.29
Heating	321.5	322	322.02	322	322.4	322	0.8	257.6	0.17	301.39
Needle out	24.8	22.3	22.8	26.4	24.2	24.1	0.8	19.28	0.15	22.17
Rough upper shoe surface	42.7	31.7	36.6	35.8	32.4	35.84	1	35.84	0.15	41.21
Rough under shoe	30.4	29.1	28	30.6	28.7	29.36	1	29.36	0.15	33.76
Painting sole	41.8	43.6	40.8	42.3	41.2	41.94	1	41.94	0.15	48.23
Additional painting under shoe	18.3	19.2	20.3	20.8	19.2	19.56	1	19.56	0.15	22.49
Heating under shoe	219.8	220.5	219.9	220.8	219	220	0.8	176	0.15	202.4
Pressing sole	14.5	14.2	14	13.5	13.8	14	1.2	16.8	0.17	19.65
Pressing shoe	14	13.8	13.5	14.5	14.2	14	1.2	16.8	0.17	19.65
Take out needle	13.5	14.8	15.6	15.2	15.9	15	0.8	12	0.17	14.04
Cleaning surface shoe	57.8	58.2	56.9	59.2	57.9	58	1	58	0.15	66.7
Insert inner sole	18.1	20.3	20.7	19.7	16.2	19	1	19	0.15	21.85
Painting color	21.2	21	20	21	21.8	21	0.8	16.8	0.15	19.32
Additional cream painting	37.3	40.3	42.8	41.5	38.1	40	0.8	32	0.15	36.8
Final inspection	52.5	37.6	50	33.6	26.3	40	1.2	48	0.15	55.2
Last shoe shining	22.8	22.4	17	19.9	17.9	20	1	20	0.15	23
Insert thread shoe	60.2	35.5	58.9	45.2	55.2	51	0.8	40.8	0.15	46.92
Package	58.6	59.2	60.2	57.5	54.5	58	1	58	0.15	66.7
Total						1264.31 (00:21:43)	23.6	1134.028 (00:18:54)	3.73	**1333.93**

Generally the existing systems of producing one pair of shoes are:

Total number of labor = 34

Total process = 24

Total distance between consecutive operation = 13.72m

Total movement time = 00:03:48

Total distance between working area and conveyor =25.65m

Total standard time = 1333.93sec = **22.23min**

In one hour one operator produces 2.699pair/hr., then in one hour the total workers produces:

2.699* 34 = **91.768pair/hr.**

In working hour (8hr) it produces:

91.768pair/hr. * 8hr = **734 pair of shoes**

5. RESULT AND DISCUSSIONS

5.1 Consideration during propose

There are some consideration during propose a new method of the process from the existing system. Those considerations are:

- Taking the safety of the workers first.
- Without affecting quality of the product.
- Keep the standard time of the specific operation.
- Enough space for movement which related with workers body posture.
- Without affecting the competitive system of the company with others.
- Keeping the international allowance time of the workers.

When it measure the movement time, cycle time, distance between working area and conveyor and consecutive operation, first share experience about work measurement method (repetitive movement, motion, method of doing work) for the workers at the time of doing their work and also it compare the working system by changing their method of working.

5.2. Existence system with proposed distance and time of consecutive operation system with labor

Table 7. Both exist and proposed distance and time of consecutive operation system with labor

Elements of work	Symbol	Exist distance (m)	Proposed distance (m)	Exist Time (H:M:Sec)	Proposed time Between consecutive operation	Exist labor
Stamping		2.5	**1.5**	00:05:00	**00:03:00**	1
Heating		0.25	0.25	00:00:04	00:00:04	1
Stretching		1	1	00:01:30	00:01:30	1
Listening		0.15	0.15	00:00:02	00:00:02	1
Painting		2.5	2.5	00:10:00	00:10:00	1
Shaping		0.5	0.5	00:05:00	00:05:00	1
Heating		0	0	00:05:22	00:05:22	1
Needle out		0.50	0.50	00:00:35	00:00:35	1
Rough upper shoe		0.25	0.25	00:00:16	00:00:16	1
Rough under shoe		0.47	0.47	00:00:33	00:00:33	1
Painting sole		0.15	0.15	00:00:02	00:00:02	1
Additional painting under sole		2.5	2.5	00:10:00	00:10:00	2
Heating under sole		0.3	0.3	00:00:05	00:00:05	1
Pressing sole		0.15	0.15	00:00:02	00:00:02	1
Pressing shoe		0.15	0.15	00:00:02	00:00:02	1
Take out needle		0.15	0.15	00:00:02	00:00:02	1
Cleaning surface		0.225	0.225	00:00:03	00:00:03	2
Insert insole		0.15	0.15	00:00:02	00:00:02	2
Painting color		0.15	0.15	00:00:02	00:00:02	2
Additional painting cream		1	1	00:01:30	00:01:30	1
Final inspection		0.15	0.15	00:00:02	00:00:02	1
Last shoe shining		0.225	0.225	00:00:03	00:00:03	1
Insert thread		0.15	0.15	00:00:02	00:00:02	5
Package		0.15	0.15	00:00:03	00:00:03	3
Total		13.72	12.72	00:42:26	00:40:26	34

Reduced distance between consecutive operation is => 13.72m – 12.72m =**1m**

Reduced time between consecutive operation is => 00:42:26 – 00:40:26 = **2min**

5.3 Existing operation time, workers movement and distance of working area from conveyor with proposed system

Table 8. Existing operation time, workers movement and distance of working area from conveyor with proposed system

Operations	Movement time (H:M:Sec)		Distance from conveyor (m)		Difference Exist - proposed	
	Exist	Proposed	Exist	Proposed	Movement Time	Distance from conveyor (M)
Stamping	00:00:15	00:00:13	1.20	1	00:00:02	0.2
Heating	00:00:20	00:00:10	1.60	0.8	00:00:10	0.8
Stretching	00:00:15	00:00:15	1.20	1.20	0	0
Listening	00:00:09	00:00:09	0.8	0.8	0	0
Painting by glue	00:00:09	00:00:05	1.80	0.9	00:00:04	0.9
Shaping	00:00:10	00:00:10	0.6	0.6	0	0
Heating	0	0	1.20	1.20	0	0
Needle out	00:00:09	00:00:07	1	0.8	00:00:02	0.2
Rough upper shoe surface	00:00:15	00:00:11	1.40	1	00:00:04	0.4
Rough under shoe	00:00:14	00:00:08	1.30	0.8	00:00:06	0.5
Painting sole	00:00:9	00:00:9	1.20	1.20	0	0
Additional painting under shoe	00:00:06	00:00:06	1	1	0	0
Heating under shoe	0	0	1	1	0	0
Pressing sole	00:00:04	00:00:04	0.9	0.9	0	0
Pressing shoe	00:00:04	00:00:04	0.9	0.9	0	0
Take out needle	00:00:05	00:00:05	1	1	0	0
Cleaning shoe surface	00:00:20	00:00:13	1.20	0.8	00:00:07	0.4
Insert insole	00:00:09	00:00:07	1	0.8	00:00:02	0.2
Painting color	00:00:08	00:00:08	0.95	0.95	0	0
Additional painting cream	00:00:11	00:00:07	1	0.8	00:00:04	0.2
Final inspection	00:00:08	00:00:08	0.8	0.8	0	0
Last shoe shining	00:00:08	00:00:8	0.8	0.8	0	0
Insert thread	00:00:12	00:00:07	1	1	00:00:05	0
Package	00:00:08	00:00:8	0.8	0.8	0	0
Total	00:03:48	00:03:02	25.65	21.85	00:00:46	3.8

Total exist movement time – total proposed movement time

00:03:48 – 00:03:02= **00: 00:46**.

Total exist distance of working area from conveyor – proposed distance

25.65m – 21.85m = **3.8m**

Generally reducing the total distance of working area from conveyor by **3.8m**, then the movement time is also reduced by **46sec**.

5.3.1 Comparison of existing and proposed distance and time from conveyor by graph

Comparison is shown on figures 4 and 5.

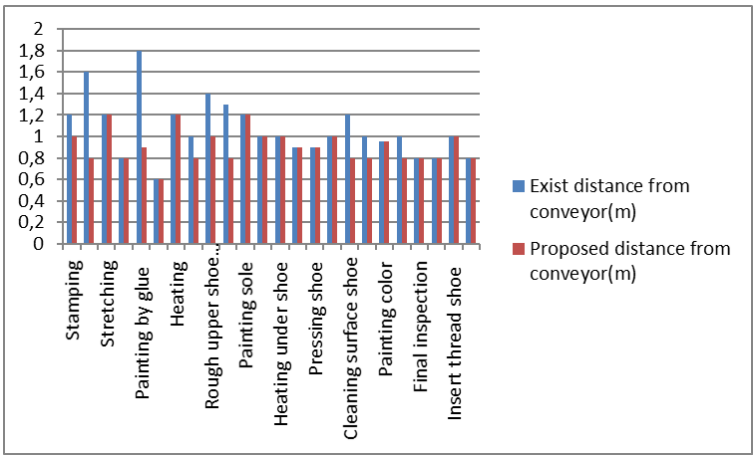


Figure 4. Comparison of existing and proposed distance from conveyor

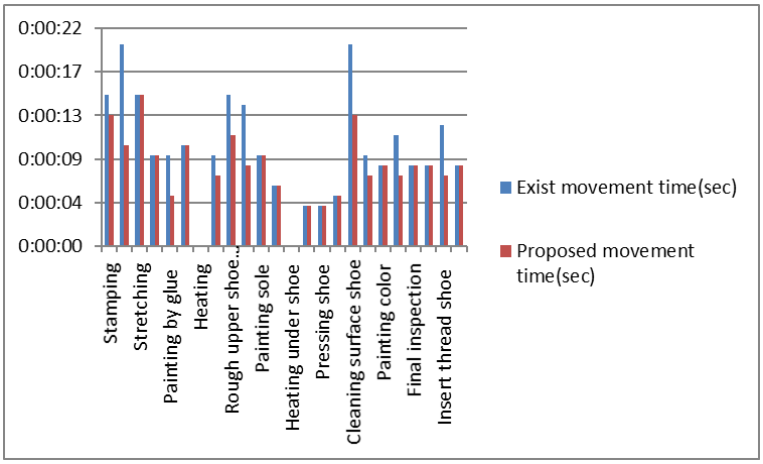


Figure 5. Comparison of existing and proposed movement time from conveyor

From the existing system: - 3.8m and 46sec is reduced

5.4 Proposed process recorded cycle time

To calculate average cycle time, normal time and standard time we use the following formula

Average observed time = summation of each cycle time / number of cycle

Normal time = Average observed time *rating factor

Standard time = Normal time (1+Allowance)

Table 9. Proposed process recorded cycle time

Time Study Sheet										
Product; **local police shoe**.						Time Study Observer Moti,M				
Operation No; lasting and finishing shoes section						Date 6/8/2019				
No. of Cycles 24										
Standard Time Found 21.358 min										
Element Description	Observed time (stop watch Reading) (Sec)					Average observed Time (Sec)	Rating Factor	Normal Time (sec)	Allow ance	Standard Time (sec)
	1	2	3	4	5					
Stamping	24.3	22.5	23.05	23.02	26.63	23.9	0.8	19.12	0.15	21.98
Heating	13	16.7	14.5	15.3	15.8	15.06	1.2	18.072	0.17	21.14
Stretching	45.02	45.28	45.04	45.09	45.02	45.09	1.2	54.108	0.17	63.30
Listening	58.4	50.2	94.0	75.2	59.3	67.4	1	67.4	0.16	78.18
Painting by glue	32.2	30.8	33.2	29.5	31.2	31.38	1	31.38	0.15	36.08
Shaping	16.9	37.3	21.2	17.5	20.5	22.68	1.2	27.216	0.15	31.29
Heating	321.5	322	322.02	322	322.48	322	0.8	257.6	0.17	301.39
Needle out	20.8	24.2	21.5	22.5	21.5	22.1	0.8	17.68	0.15	20.33
Rough upper shoe surface	32.8	33.4	30.8	29.7	32.5	31.84	1	31.84	0.15	36.61
Rough under shoe	19	24.5	26.2	25.6	21.5	23.36	1	23.36	0.15	26.86
Painting sole	41.8	43.6	40.8	42.3	41.2	41.94	1	41.94	0.15	48.23
Additional painting under shoe	18.3	19.2	20.3	20.8	19.2	19.56	1	19.56	0.15	22.49
Heating under shoe	219.8	220.5	219.9	220.8	219	220	0.8	176	0.15	202.4
Pressing sole	14.5	14.2	14	13.5	13.8	14	1.2	16.8	0.17	19.65
Pressing shoe	14	13.8	13.5	14.5	14.2	14	1.2	16.8	0.17	19.65
Take out needle	13.5	14.8	15.6	15.2	15.9	15	0.8	12	0.17	14.04
Cleaning surface shoe	48.2	50.5	51.2	51.8	53.3	51	1	51	0.15	58.65
Insert inner sole	16.1	18.6	15.8	16.6	17.9	17	1	17	0.15	19.55

Painting color	21.2	21	20	21	21.8	21	0.8	16.8	0.15	19.32
Additional cream painting	34.6	38.2	35.7	36.6	17.9	36	0.8	28.8	0.15	33.12
Final inspection	52.5	37.6	50	33.6	26.3	40	1.2	48	0.15	55.2
Last shoe shining	22.8	22.4	17	19.9	17.9	20	1	20	0.15	23
Insert thread shoe	42.7	48.2	44.7	46.9	47.5	46	0.8	36.8	0.15	42.32
Package	58.6	59.2	60.2	57.5	54.5	58	1	58	0.15	66.7
Total						1264.31	23.6	1107.276	3.73	**1281.48**

The difference between the exist standard time and proposed standard time is;

1333.93sec - 1281.48sec = **52.45sec**

Proposed standard time = 1281.48sec *1min/60sec =**21.358min** for pair shoe

In one hour = 1pair*60min / 21.358 =**2.809pair/hr.** for single operator

It produce in working day =2.809*34 *8 = **764pairs/day**
Produces shoes in per day is increased from 734 pair/day to 764 pair /day

The difference between the existing producing and proposed volume in per day is;

Proposed – exist

764pair/day -734pairs/day =**30pair/day**

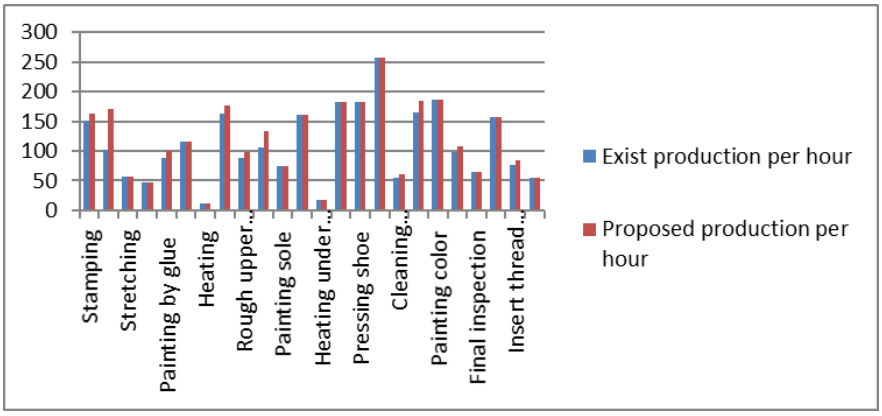


Figure 1. Amount of produced shoe in each operation in a given standard time of both exists and proposed

Generalize the total improvements:

Reduced distance between consecutive operation is => 13.72m – 12.72m =**1m**

Reduced time between consecutive operation is => 00:42:26 – 00:40:26 = **2min**

Reduced the total distance of working area from conveyor by **3.8m**, and the movement time is also reduced by **46sec**.

Reduced standard time from 22.23min to 21.358min by **0.874min** difference.

Increased the amount of shoes produced per day from 734pairs/day to 764 pairs /day by **30pairs/day** difference.

6. CONCLUSION

Due to requirement of productivity improvement of Ethiopian lasting and finishing section of shoe factory, this study give a solution for the exits problems in order to compete with nationally and internationally competence with generating high productivity, making good working condition for workers and satisfying their customers. This research is improved the productivity by conducting work measurement method on the lasting and finishing shoes section, the following can be concluded from the result of the study. Distance between consecutive operation is reduced by 1m, total time between consecutive operation is reduced by 2min or (120sec), distance between working area and conveyor is reduced by 3.8m, the total movement time is reduced by 0.7667min or (46sec), the standard time reduced by 0.874min or (52.45sec), the amount of shoes produced is increased by 30 pair/day on the exist daily production. In general, from this study it can conclude the movement distance of the workers reduced, ineffective time in the

process also reduced and total daily production of the factory increased from 734pairs /day to 764 pairs/day shoes.

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