

# ENHANCEMENT OF LABOUR PRODUCTIVITY IN A TYRE THREAD MANUFACTURING COMPANY THROUGH TIME STUDY

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## ABSTRACT

*The manufacturing industries have incredible contribution in the global economic growth and it has wide acknowledgment in the area of poverty mitigation. The manufacturing sector is also considered as one of the significant economic contributor in the world for the past 100 years. The first phase of our paper contains the literature review which concludes that heightening of productivity is an important factor for manufacturing industries to survive and to attain breakthroughs. Certain key factors were also found that affects the labor productivity particularly in a manufacturing company. The next phase introduces time study, a tool to establish standard time for the processes including cycle time from observation with the allowance and rating factors. By using time study as tool, non-value added time can be recognized and eliminated; thereby productivity can be improved. The key product manufactured was identified which contributes maximum to the output of the company and the standard time was calculated for the manufacturing of the product by conducting time study of the whole process. The result shows that the productivity can be improved to about 52.01% by implementing the evolved standard time. The labor productivity in a rubber thread manufacturing company can be improved through systematic observation, process chart and stopwatch time study. Further studies comprise of simulating the process times using different performance factors of labour.*

**Keywords:** *Labour productivity, Standard time, Manufacturing sector, Time study.*

## I. INTRODUCTION

The productivity is defined as relation between the output and the input of a production process. The labor productivity as a partial productivity index typically describes the relation of the output of a process to the used capacity given in time units or the number of persons involved. Productivity growth is essential not only to increase output, but also to improve the competitiveness of an industry both in the domestic and international markets. The choice between them depends on the purpose of productivity measurement and, in many instances, on the availability of data.

One of the oldest tools used by industrial engineers in work measurements is time study and specifically stopwatch time study. Time study that originated by Taylor and developed by Gilbreths was used mainly for determining time standards and motion study. According to Rice (1977), over 89 percents of the companies that perform work measurement used time study. In manufacturing industries, especially for industries that implement 90 percents of manual production time study is very crucial. For example, manufacturing plant management need time standards, even before production starts, to determine how many people to hire, how many machines to buy, how fast to move conveyers, how to divide work among employees, and how much the product will cost; after production starts, to determine how much cost reduction will return, who works the hardest, and perhaps who should earn more money; and after production finish, the data are used as reference for bidding new projects and procurement. Time study can reduce and control costs, improve working conditions and environment and motivate people.

## II. LITERATURE REVIEW

Time study is one of the oldest fundamental method ever used whose results in increased productivity. Since the research are focus on the time study from all aspects, so the history of the time study must be analysis and how it develop into the most useful tools in manufacturing industry. Most of the source used for the studied comes from a reliable and trustworthy source. The sources include articles, journals and books. There actually more than one technique mention in this thesis but the research only focuses on one method only. The method is stopwatch time study and it had been chosen because it suitable with the industry in the case studies. Any of the work-measurement techniques represent a better way to establish fair production standard. All of these techniques are based on facts. All establish an allowed time standards for performing a given task, with due allowance for fatigue and for personal and unavoidable delays. Accurately establish time standards make it possible to produce more within a given plant, increasing the efficiency of the equipment and the operating personnel. Poorly established standards, although better than no standards at all, lead to high costs, labour dissension and possibly even the failure of the enterprise.

## III. DATA COLLECTION AND PROBLEM DEFINITION

### 3.1 Methodology of Data Collection

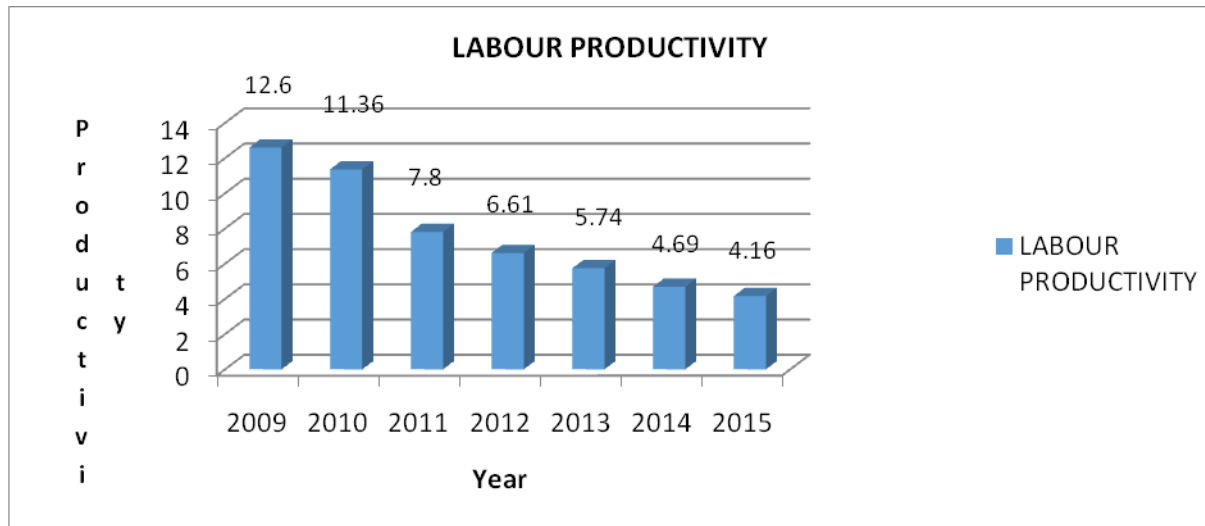
For the purpose of study data has been collected both from primary and secondary sources

- ❖ Primary data: Data are collected through direct interview with officials of KEL and through keen observation.
- ❖ Secondary data: Data are collected from departmental manuals, past records and from company's website- [www.rubbermark.com](http://www.rubbermark.com)

**Table1 : Annual output and consumption of resources**

YEAR	LABOUR (IN LAKHS)	MATERIAL (IN LAKHS)	TOTAL INPUT (IN LAKHS)	TOTAL OUTPUT (IN LAKHS)
2009	9.54	35.15	77.29	120.25
2010	10.2	38.45	90.23	115.89
2011	12.5	40.78	79.59	98.45
2012	14.2	41.98	80.82	93.87
2013	16.8	45.12	84.12	96.54
2014	17.9	47.98	74.58	84.12
2015	19.7	49.50	74.02	82.13

From Table 1, it is possible to calculate the partial productivities and total productivity. Calculated labour productivity is illustrated in following figure:



Graph 1: Labour productivity for past 7 years

The productivity which is the measurement of the efficiency with which resources are converted to products within a deadline and a given quality standard is showing a decreasing trend. Labour productivity is decreasing from 12.6 to 4.16 for the last 6 years. Labor productivity is contributing least to the total productivity and also there is no standard time for each work. So calculation of standard time for each job is needed to increase the productivity to an extent. Also it need to identify the factors affecting productivity of the firm and there arises the need of improvements.

Table 2: Sample work norm of the industry

PRODUCT	WORK NORM (2012) (in hours)	REVISED NORM (2015) (in hours)
PCT SPL	5.18	5.65
PCT PRM	4.12	4.54
PCT SLR	4.54	4.87
CT SPL	3.25	3.52
CT PRM	2.87	3.28
CT STD	3.31	3.67
CT CLA	3.51	3.98
CT RT	3.67	3.89

One of the main reason for the decline the labor productivity is the work norm which were fixed without conducting any work measurement. That means work norm is fixing only on the basis of the negotiation between the trade unions and the management. Therefore it is necessary to conduct work measurements techniques in order to find the standard time for each work element. Work measurement is the application of techniques developed to estimate the time needed by qualified and adequately motivated workers to perform a



specified task at a specified level of performance. The amount of time that a job takes may be needed for cost collection production scheduling and evaluation of alternatives.

The work norm present in the industry is revising every three years without any scientific work measurement. This is one of the main reason for the decline in the labour productivity. So it is required to analyze the processes in the manufacturing of PCT SPL. The research methodology adopted is given below:

**IV. DATA ANALYSIS**

**4.1 Identification of Key Product**

In order to identify the key products pareto analysis carried out. Data regarding the pareto analysis is shown below:

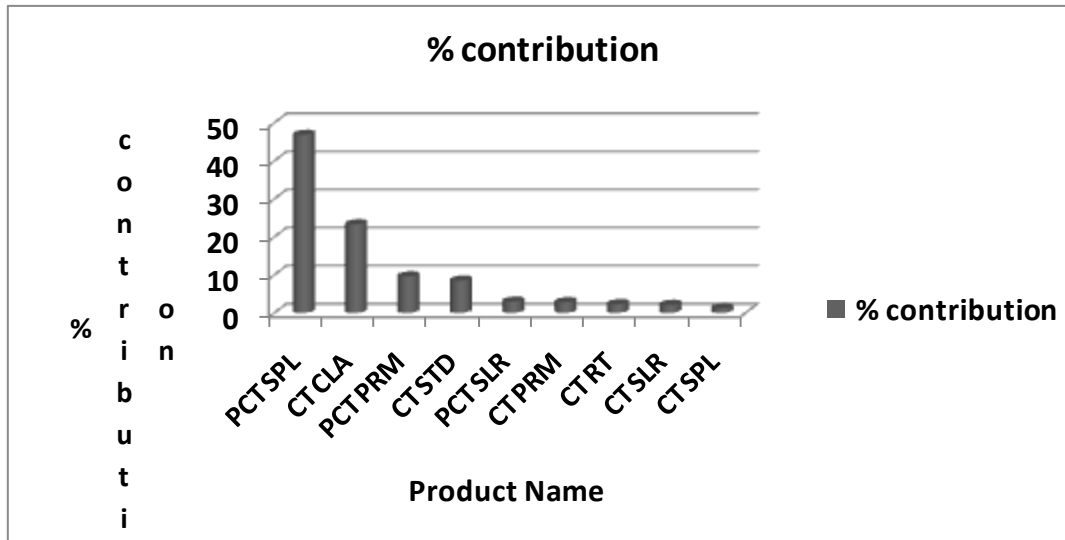
**4.1.1 PARETO ANALYSIS**

In order to conduct a pareto analysis details regarding company’s monthly production for the past year and the contribution from each item has been taken from that usage value of each item has been calculated. Contribution is the difference between selling price and variable cost production of one unit.

After identifying the total contribution per month of all products they are arranged in the descending order of their contribution, the results of the analysis is tabulated in Table

Table 3 : Total contribution per month of all products arranged in the descending order of their contribution

ITEMS (PRODUCTS)	TOTAL CONTRIBUTION (Rs)	PARETO ANALYSIS (% CONTRIBUTION)	CUMULATIVE %
PCT SPL	93184	46.8	46.8
CT CLA	19132	23.3	70.1
PCT PRM	5892	9.6	79.7
CT STD	2580	8.5	88.2
PCT SLR	5736	2.96	91.1
CT PRM	4344	2.8	93.9
CT RT	17024	2.3	96.2
CT SLR	46532	2.1	98.3
CT SPL	4592	1.2	99.5



Graph 2:

Graphical representation of percentage contribution

Pareto analysis shows that PCT SPL thread account for the A item. Because of the huge time involved in any work measurement projects it has been decided to conduct a work measurement only to the key product which in this case is PCT SPL.

All the manufacturing process required to produce key product are studied in detail. The flow chart of all the operations are shown in chart 2;

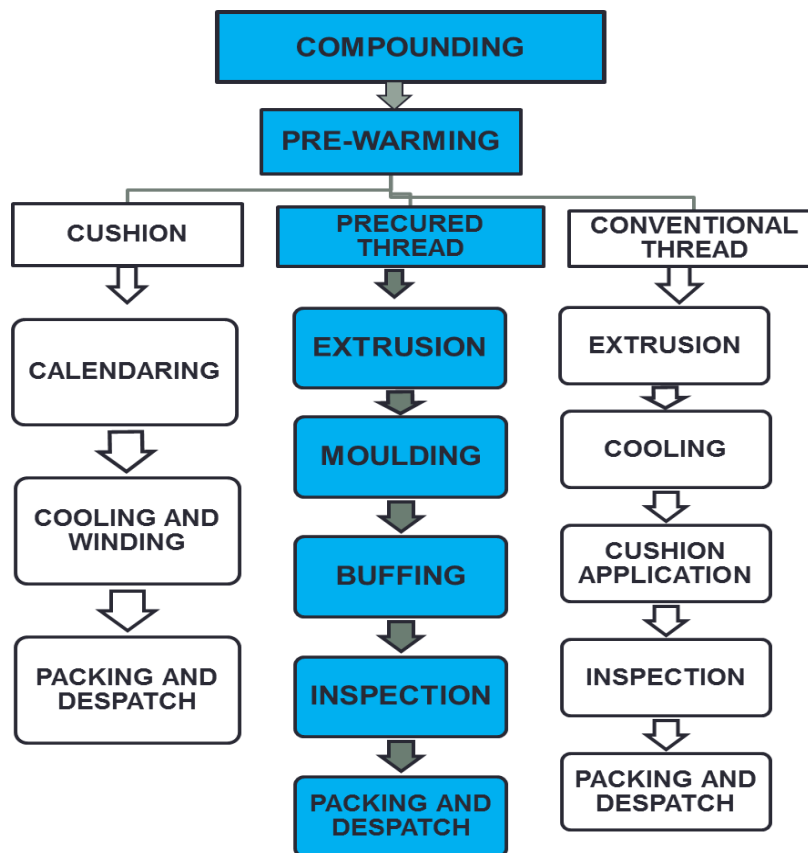


Chart 2: Flowchart of Tread manufacturing



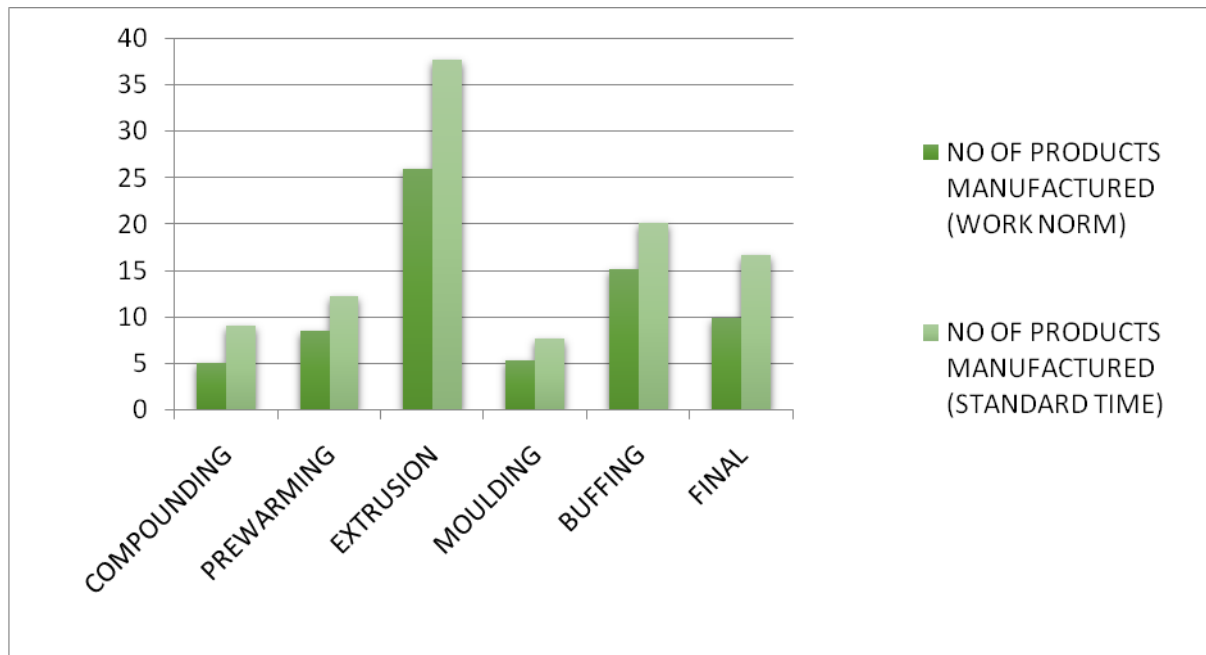
The standard time obtained for all operations are summarized in table 4. Also percentage increase in number of products manufactured according to standard time compared to work norm for key product PCT SPL is illustrated in table 5. Study of all the different manufacturing processes of thread results to an average increase of 52.01% on theoretical calculation.

**Table 4: Standard time obtained through calculations**

Steps in thread manufacturing	Work Norm (minutes)	Evolved standard time (minutes)
COMPOUNDING	95.21	75.35
PREWARMING	73.87	58.632
EXTRUSION	37.45	28.4676
MOULDING	95.46	84.348
BUFFING	30.05	23.889
PACKING	5.89	4.956
Total Time	337.93	275.64

**Table 5: Percentage increase in manufacturing process**

Steps in thread manufacturing	No: of product that can be manufactured in a shift according to the current work norm	No: of product that can be manufactured in a shift according to the evolved standard time	Percentage increase in the manufacturing process (percentage)
COMPOUNDING	4.01	6.36	58.60%
PREWARMING	5.54	8.18	47.65%
EXTRUSION	11.9	15.335	28.86%
MOULDING	3.25	5.69	75.07%
BUFFING	15.12	20.09	32.87%
FINAL	9.84	16.641	69.11%



**Graph 3: Graphical representation of number of products that can be manufactured with existing norm and calculated time.**

## V. CONCLUSION

The standard time calculated is found to be less than the work norm followed in the company. On theoretical calculation an average increase of 52.01% is obtained in labour productivity. This project identified how simple methods can be used to improve work and work process in the industry. The project identified the current methods used using flow process charts and how long each component takes. By making simple changes to the process, it can reduce the time taken for each component to improve the flow and speed up the process. Importantly, the costs and benefits of increased production rate have also been calculated which predict by making those changes that output can be increased dramatically.

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