DOI:10.21276/sjeat.2017.2.3.5

**Saudi Journal of Engineering and Technology**
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

**ISSN 2415-6272 (Print)**
**ISSN 2415-6264 (Online)**

**Original Research Article**

# Productivity Improvement in Micro and Small Enterprise Producing Exercise-Notebook: A Case Study

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**Abstract:** Micro and Small Enterprises (MSEs) have potential to improve both productivity and quality. MSEs can adapt any change easily because of their dynamic nature. Productivity and Quality improvement programs in Medium and Large Manufacturing Units have proved their significance. In India, MSEs play a vital role for economical growth of the country. But micro and small industries have limited resources to implement development programs. Process improvement principles and philosophy applicable to medium and large industries are so universal that these can be applied with or without modification in their inherent character to Micro and Small Enterprises. The purpose of this paper is to identify the areas of improvement in small process industry of producing Exercise Notebook by analyzing its batch production so that productivity and quality enhancement programs can lead to financial benefits. Some tools and techniques such as Benchmarking, Standardization, Kaizen, 5S, Lean Practices, Time-Motion study and Low cost automation has been considered to site operational improvements in this labour intensive industry.
**Keywords:** Micro and Small Enterprises, Lean Practices, Time-Motion study, Standardisation, Productivity Improvement.

## INTRODUCTION

Book-binding industry which had flourished for more than six decades finds it difficult to survive today due to a number of problems. With the opening of new markets in neighboring states like Punjab, Rajasthan and Uttar-Pardesh, our products lost many of their major markets with the result that the profitability of these binding units have reduced. Majority of the binding units are still small in size with limited financial resources and hence they will not be able to withstand the stress and strain for a long period and will be forced to discontinue and close down in the immediate future. This work addresses strategies, techniques and tools for productivity and quality management as well as improvement in manufacturing and inspection and repair establishments. Hence an attempt is made to identify the problems and constraints facing the book- binding industry in Haryana.

## PROBLEM IDENTIFICATION

Present study was carried out in a SMEs unit manufacturing exercise notebook at District Jind in Haryana (India). The products of the unit are various types of exercise notebooks used for study purpose in schools, colleges etc. Various operations that are done in the unit are cutting, ruling, stacking, folding, creasing etc.

Use of obsolete technology is the main constraint faced by the sample unit under study. The level of technology is outdated. The unit under study continues to be family concerns and is not properly organized. Sentiments to maintain the unit is the only motive force in maintaining the unit and in current case it may be seen that the family members themselves constitute the labour force of this single small unit. The notable change that has taken place over the years is the partial replacement of it through machine. On account of the use of outdated machines, their cost of production is high and the quality is inferior as compared to large-scale units. Existing binding unit also do not care about the changing tastes and fashions of the people. Accordingly modernization and rationalization are urgently required in these binding units. This technological stagnation can be removed only through technological improvement by producing competitive products (qualitatively), by reducing cost of production. This binding unit must improve itself by

taking up new product lines in response to the changes in attitudes and fashions of the people.

In this book-binding industry there is no well defined organization pattern or structure. It belongs to the unorganized sector. There is no classification of workers into skilled and unskilled workers following rigid rules. The proprietor does most of the administration work by himself. Family members themselves collect the raw materials, make necessary arrangements, supervise and do the labour work too.

Initial observations showed very low productivity and quality of exercise notebook in manufacturing unit. So there was a great need to improve the productivity by reduction of losses due to inefficient plant layout and improper management activities [1]. The adoption of project was done by selecting time and motion study methodology for solving the internal issues. As the initial observation showed very poor results and the staff and management was willing to improve the productivity and was cooperative in implementing the change, so a small scale industry was chosen for exhaustive study on implementing time and motion study [2]. The Exercise Manufacturing units are considered as paper converting industries. Machinery equipments used in such industries are available in a wide range that varies from manual to fully automated means of production. To distinguish the level of automation in Micro, Small, Medium and Large enterprises; a basic list of machinery equipments used in a micro scale industry type is shown in Table 1.

**Table-1: List of Machinery Equipment for Micro Scale Unit**

| Sl. No. | Description | Type | Specification | Set |
|---|---|---|---|---|
| 1 | Disk Ruling/Lining Machine | Powered | 36.900 Inch | 1 |
| 2 | Cardboard and Paper Cutting Machine | Powered | 18,26,32,36,42,48,52 Inch | 1 |
| 3 | Wire Stitching Machine | Manual | 5/16,7/16,9/16,11/16 Inch | 1 |
| 4 | Hand Press Machine (Screw type) | Manual | 10×15,12×18, 15×20 Inch | 1 |
| 5 | Perforating Machine | Manual | 18,24 Inch | 1 |
| 6 | Punching Machine | Manual | Number Punch | 1 |

**Analyzing Problem of Low Productivity of Exercise Notebook Utilizing Time and Motion Study**

The formal approval from the owner of the industry is necessary to initiate the project, as without their backing it was never possible to involve people and implement suggestions. The low productivity problem of exercise notebook was studied in depth. Time and motion study shows high level of time taken and high distance travelling.

Exercise books and registers sometimes referred to as long note books and are available in the market in various sizes, shapes with varying number of pages both ruled and plain and having various types of covers viz. paperbound, board and white card and plastic sheet covers with spiral binding. The exercise book sand register are made in different sizes suiting to their intended application. Their sizes vary according to the requirement.

The process of the exercise notebook manufacturing is studied in depth and on the basis of that a process flow diagram (Figure 1) is made to understand the process.

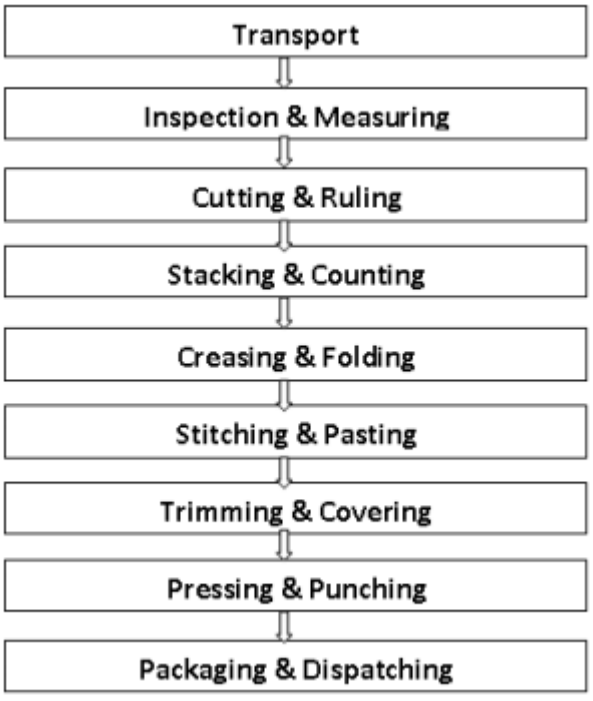


**Fig-1: Process Flow Diagram**

Now to understand the process thoroughly, a high level SIPOC (Supplier, Input, Process, Output, Customer) diagram [3] (Figure 2).

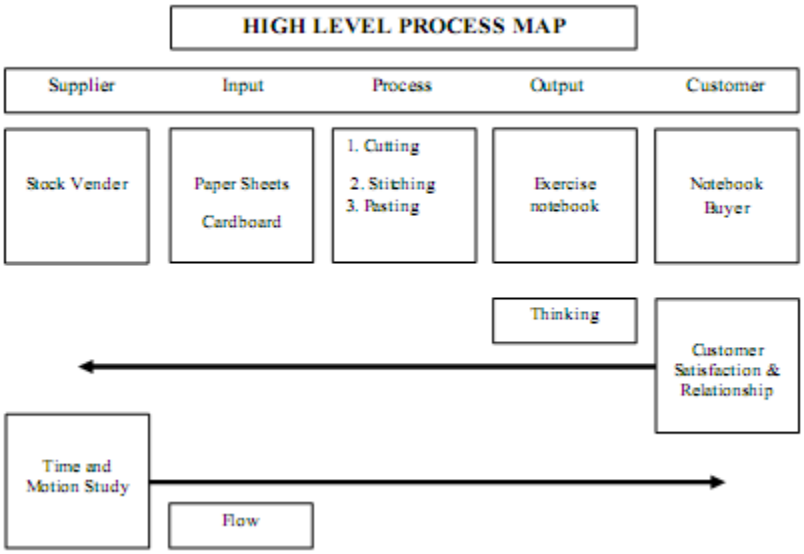


**Fig-2: High Level SIPOC diagram**

The layout of the company is made on the basis of current position of the machines being used and it is also shown below ( Figure 3). Company layout shows the positions of various equipment in working environment of the firm. This helps in understanding the different machine cells and the work movement at different work places. It is identified that the non productive movements in the plant cause low productivity and also leads to increase in production time. Hence there is rise in labour cost also the unstandardized raw material and unskilled labour causes the quality reduction of products which causes customer dissatisfaction.

Data collection for the monthly production is taken for six months and observed that there is average production of 7.6 thousand notebooks per month (Figure 4).

**Time and Motion Study**

A sample size of 1000 exercise notebooks is taken and Time and motion study of the process is done and shown in figure 5.

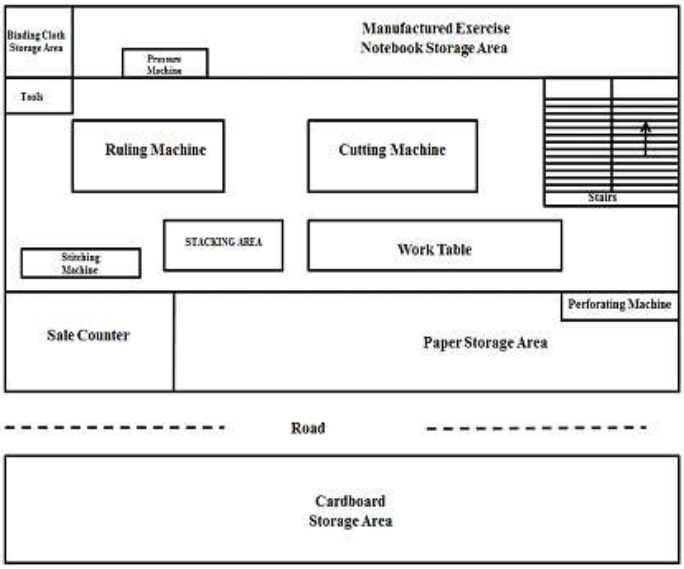


**Fig-3: Layout of Company**

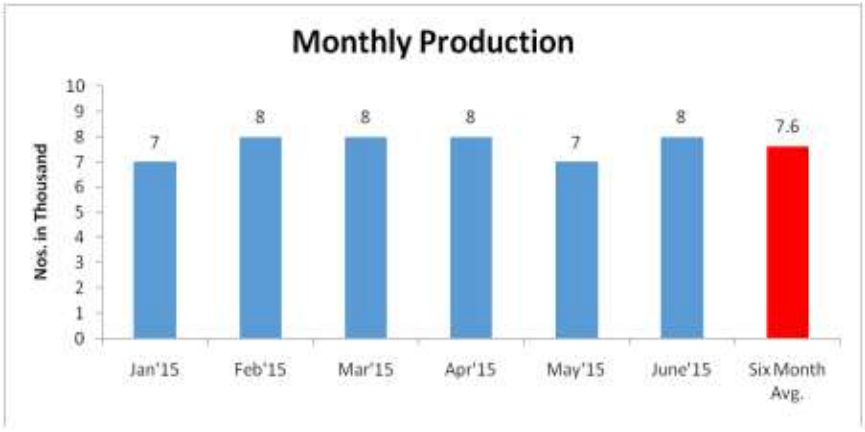


**Fig-4: Monthly Production**

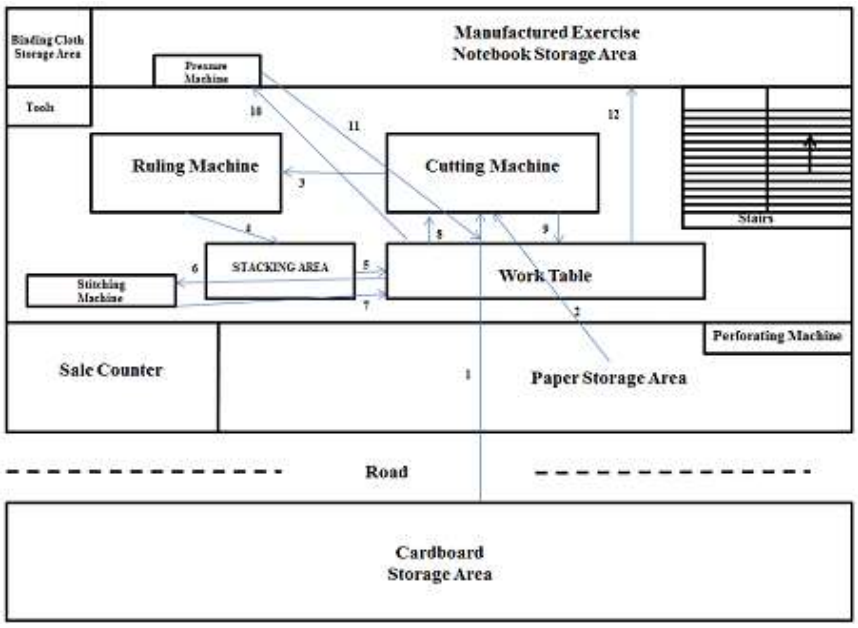


**Fig-5: Motion study**

Every motion is denoted by an individual number and shown in above figure 5. Operations with their individual number, transportation time, operation time, distance travelled are noted down and filled in the format drawn especially for this is shown in table 2.

**Table-2: Details of Operation with Transportation time, Operation time, Distance**

| S. No | Operation | Transportation Time (Min.) | Operation Time (Min.) | Distance (ft) |
|---|---|---|---|---|
| 1 | Transportation of cardboard from storage area to cutting machine and cutting | 25 | 40 | 40 |
| 2 | Transportation of paper from storage area to cutting machine and cutting | 25 | 40 | 30 |
| 3 | Transportation of paper from cutting station to ruling station | 15 | 105 | 15 |
| 4 | Transportation of paper from ruling station to stacking area | 15 | 30 | 10 |
| 5 | Transportation of paper from stacking area to working table (Counting, Creasing & Folding) | 15 | 170 | 08 |
| 6 | Transportation of paper from working table to stiching station | 15 | 35 | 10 |

| | | | | |
|---|---|---|---|---|
| 7 | Transportation of paper from stitching station to working table (Pasting) | 15 | 30 | 10 |
| 8 | Transportation of paper from working table to cutting machine(Trimming) | 20 | 30 | 08 |
| 9 | Transportation of paper from cutting station to working table(Covering) | 20 | 40 | 08 |
| 10 | Transportation of paper from working table to pressing machine(Pressing) | 20 | 40 | 30 |
| 11 | Transportation of paper pressing machine to working station (Punching) | 20 | 30 | 30 |
| 12 | Transportation of note book to storage area | 20 | 30 | 25 |

On the basis of this study, total transportation time came out to be 225 minutes and operation time came out to be 620 Min. The distance covered to make 1000 exercise notebooks is also noted down and came out to be 224 ft.

The study shows high transportation time and high distance to be covered for manufacturing of the exercise notebooks. The 6 month average shows 7.6 thousand exercise notebook production. The average transportation time for 6 month data came out to be 1710 Min. and the average distance covered came out to be 1702.4 ft. and average operation time for 6 month avg. came out to be 4712 Min.

The problem with the company is poor lay out of the shop floor area due to which high transportation time and distance.

**Improvement**

The need for new layout is felt and after doing brainstorming with the employees of the company, a new layout is finalized and implemented on the shop floor to improve the productivity of the exercise notebook.

The new layout is shown in figure 6 and again a time and motion study analysis of the new layout implemented on the shop floor (Figure 7).

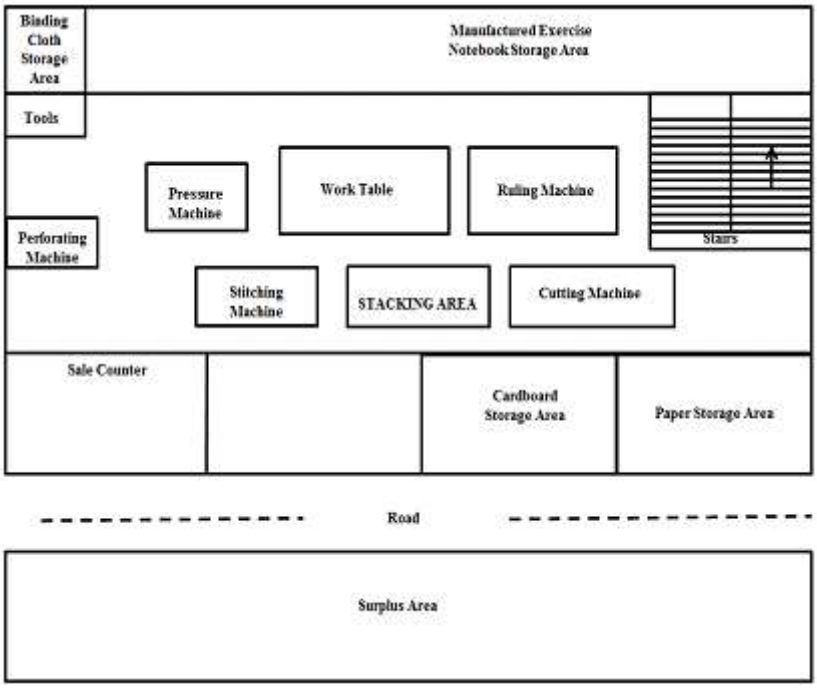


**Fig-6: New Layout**

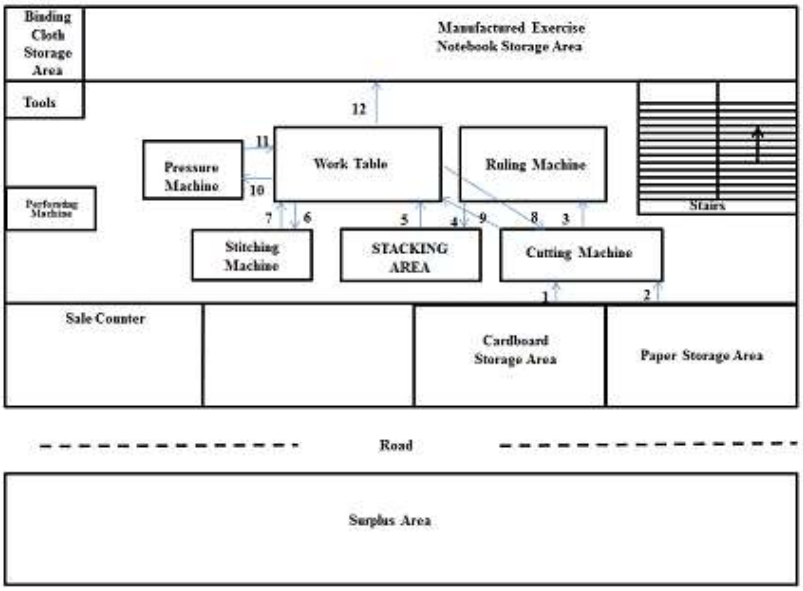


**Fig-7: Motion study**

For recording and timing an activity, micro motion study is the best suited technique to use [4]. This is a lay down of practices proposed to segregate the individual actions in a groups of factions or micro-actions (called Therbligs) and the study of such progress assists to find for an operator one best pattern of movements that consumes less time and requires less effort to accomplish the task.

**RESULTS AND DISCUSSIONS**

Every motion is denoted by an individual number and shown in figure 7. Operations with their individual number, transportation time, operation time, distance travelled are noted down and filled in the format drawn especially for this is shown in table 3.

**Table-3: Details of Operation with Transportation time, Operation time, Distance after Improvement**

| S. No | Operation | Transportation Time (Min) | Operation Time | Distance (ft) |
|---|---|---|---|---|
| 1 | Transportation of cardboard from storage area to cutting machine and cutting | 14 | 40 | 16 |
| 2 | Transportation of paper from storage area to cutting machine and cutting | 14 | 40 | 16 |
| 3 | Transportation of paper from cutting station to ruling station | 13 | 105 | 15 |
| 4 | Transportation of paper from ruling station to stacking area | 13 | 30 | 15 |
| 5 | Transportation of paper from stacking area to working table (Counting, Creasing & Folding) | 13 | 170 | 15 |
| 6 | Transportation of paper from working table to stiching station | 13 | 35 | 15 |
| 7 | Transportation of paper from stitching station to working table(Pasting) | 13 | 30 | 15 |
| 8 | Transportation of paper from working table to cutting machine(Trimming) | 16 | 30 | 20 |
| 9 | Transportation of paper from cutting station to working table(Covering) | 16 | 40 | 20 |
| 10 | Transportation of paper from working table to pressing machine(Pressing) | 11 | 40 | 11 |
| 11 | Transportation of paper pressing machine to working station(Punching | 11 | 30 | 11 |
| 12 | Transportation of note book to storage area | 11 | 30 | 12 |

On the basis of this study, total transportation time came out to be 158 minutes and operation time came out to be 620 minutes.

The distance covered to make 1000 exercise notebooks is also noted down and came out to be 181 ft.

- Transportation time reduced from 225 minutes to 158 minutes (29.77% Improvement)
- Distance travelled by the work in between the work-stations is reduced from 224 feet to 181 feet (19.2% Improvement).
- Monthly production average has been increased from 7.6 (six month average) to 9.2 (Five month average) (21% Improvement) Figure 8 and 9.
- Overall, production of the company has been increased by 1600 exercise notebook by utilizing the same machines and manpower.

Being a manual process, operation time can be optimized by implementing semi-automation machine in the company.

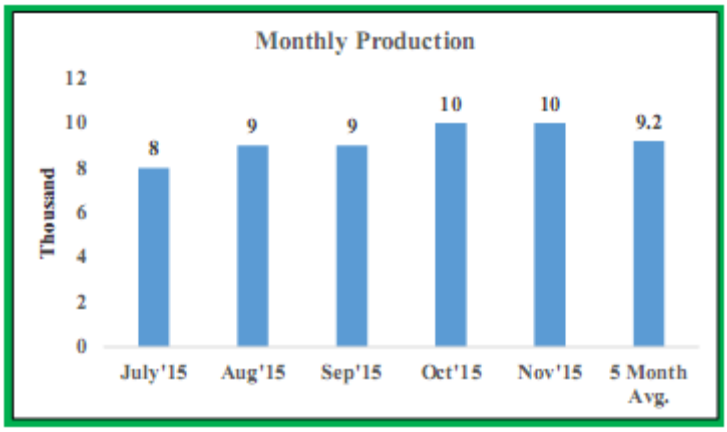


**Fig-8: Improvements in Monthly Production**

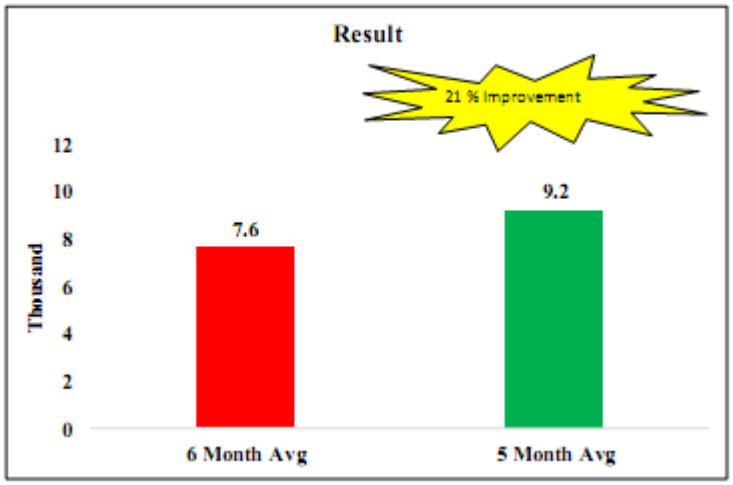


**Fig-9: Improvements in Average Production**

With the help of time and motion study performed in floor layout, result shows reduced in transportation time by 29.77% and non productive motion for part placement in between various machines by 19.2% results in increased productivity.

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