# Case Study: Achieving Productivity Improvement through restructuring Shop Floor Layout and implementing 5S

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**Abstract - The present case study deals with studying how properly realigning shop floor can help to improve manufacturing productivity. The study also try to uncover relation between facility layout and productivity. Also the research try to affirm whether proper layout really supports proper implementation and maintenance of 5S. The study is done with the confidence that it would provide proper guidance so as to how productivity improvement can be achieved through realigning layout, which also facilitates proper implementation of 5S. Therefore Technical/Engineering details as well as products are kept confidential and only management perspective is tried to be explored. Traditional Operation Research tools like time and motion study is also used for the research.**

**Key Words: Productivity, Layout, Material Handling and 5S.**

## I. INTRODUCTION

The case study deals with achieving productivity improvement through realignment of the shop i.e Assembly department for minimizing movement loss, to avoid inventory pile up, for efficient utilization of the floor space, for eliminating model mix up problem, to provide proper gangways, to increase space for finished goods and to free up the space at the main assembly shop for other use which was unnecessarily consumed due the uneven arrangement of the assembly line and to making it easier for employees to implement and maintain 5S. As improper layout is also a big hindrance in proper implementation of 5S.

## II. LITERATURE REVIEW

Toyota Production System (TPS) by merging the skill of master craftsmen with the knowledge of Ejji Toyota and Taiichi Ohnos for the first time in 1990, Womack, Jones and Roos famous book wrote about the Lean Manufacturing concept. All service or production industries can implement Lean Manufacturing to reduce & eliminate waste in a manner that is simple, feasible, reliable, cost effective and synergistic with other programs [1].

5S represents Japanese words that describe the steps of a workplace organization process. English equivalent words are shown in parenthesis

1. Seiri (Sort)
2. Seiton (Straighten, Set)
3. Seiso (Shine, Sweep)
4. Seiketsu (Standardize)
5. Shitsuke (Sustain)

In simple terms, the five S methodology helps a workplace remove items that are no longer needed (sort), organize the items to optimize efficiency and flow (straighten), clean the area in order to more easily identify problems (shine), implement color coding and labels to stay consistent with other areas (standardize) and develop behaviours that keep the workplace organized over the long term (sustain) [2].

Time motion studies were first described in the early 20th century in industrial engineering, referring to a quantitative data collection method where an external observer captured detailed data on the duration and movements required to accomplish a specific task, coupled with an analysis focused on improving efficiency [3].

Again, Facilities layout is the arrangement of areas within a facility (Russell et al. 2000). Facility layout defined as the physical arrangement of everything needed for the product or service, including machines, personnel, raw materials, and finished goods. The criteria for a good layout necessarily relate to people (personnel and customers), materials (raw, finished, and in process), machines, and their interactions. Consequently, facilities layout design is an important industrial issue as it directly and indirectly minimizes the total cost of products. It lends a helping hand against competition and increases the Company productivity, Sha et al. (2001) as quoted by Ibrahim Rawabdeh et al. (2006), business performance, Canon and Williamson (1998) as quoted by Ibrahim Rawabdeh et al. (2006), the effective utilization of manpower, space and

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infrastructure, as well as the wellbeing and morale of the worker (Gopalakrishnan et al. 2003) [4].

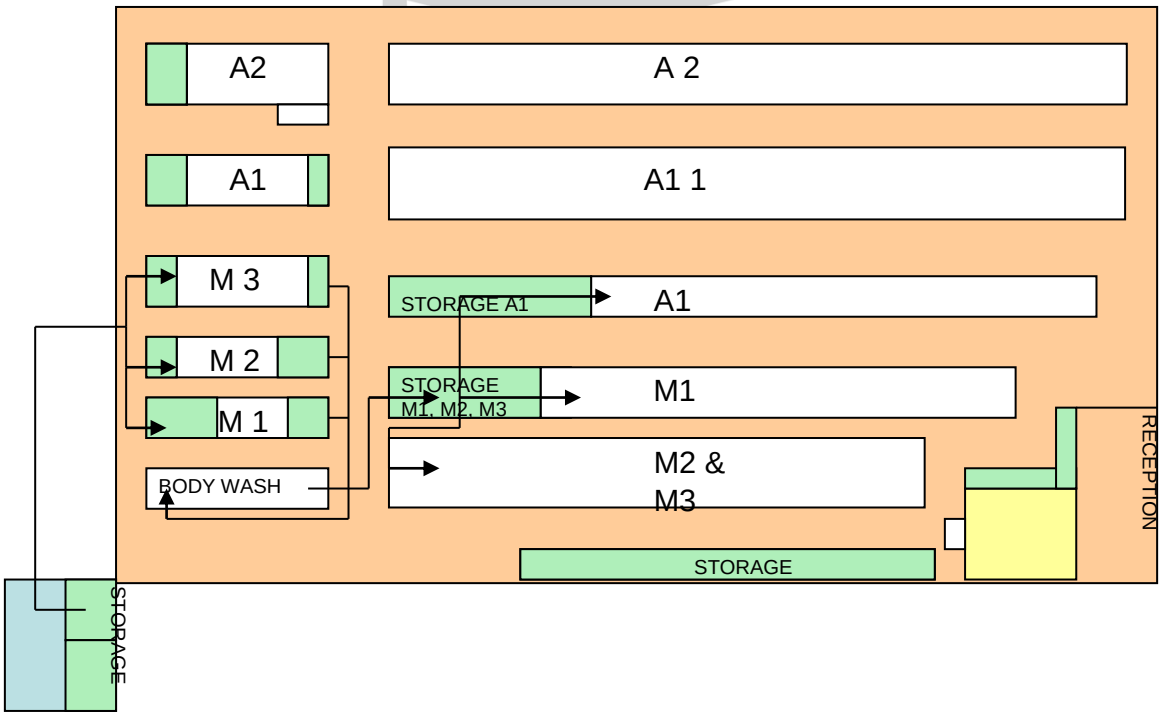
## III. OBJECTIVES

- To reduce the inventory piling.
- To align the starting & the ending points of the assembly line.
- To reduce the handling of the materials.
- To maintain accessibility & controlled supervision.
- Streamline the flow of materials.
- Effective utilization of men, equipment and cubic space.

## IV. RESEARCH DESIGN

In depth Case study research based upon practical implementation and outcome observation. The basic tool used is Kaizen (Continual improvement), Gemba walks (On sight Visual Inspection), Time Study and Motion Study to find out the problems and understanding possible solution.

### 1.6.1 Previous layout of M & A Model:




**Interpretation:** In the figure above the previous Layout of M and A models Assembly before modification is shown.

### 1.6.2 Modified layout of M & A Model:

## V. LIMITATIONS OF THE STUDY

1. The name of the company is kept confidential.
2. The operations on the assembly line are not shown to keep the confidentiality of the operations.
3. Confidentiality of the data.
4. Limited duration.

The case study is published with the confidence that it would highlight how productivity improvement can be achieved through realigning layout, which also facilitates proper implementation of 5S. Therefore Technical/Engineering details as well as products are kept confidential and only management perspective is tried to be explored.

## VI. DATA ANALYSIS AND INTERPRETATION

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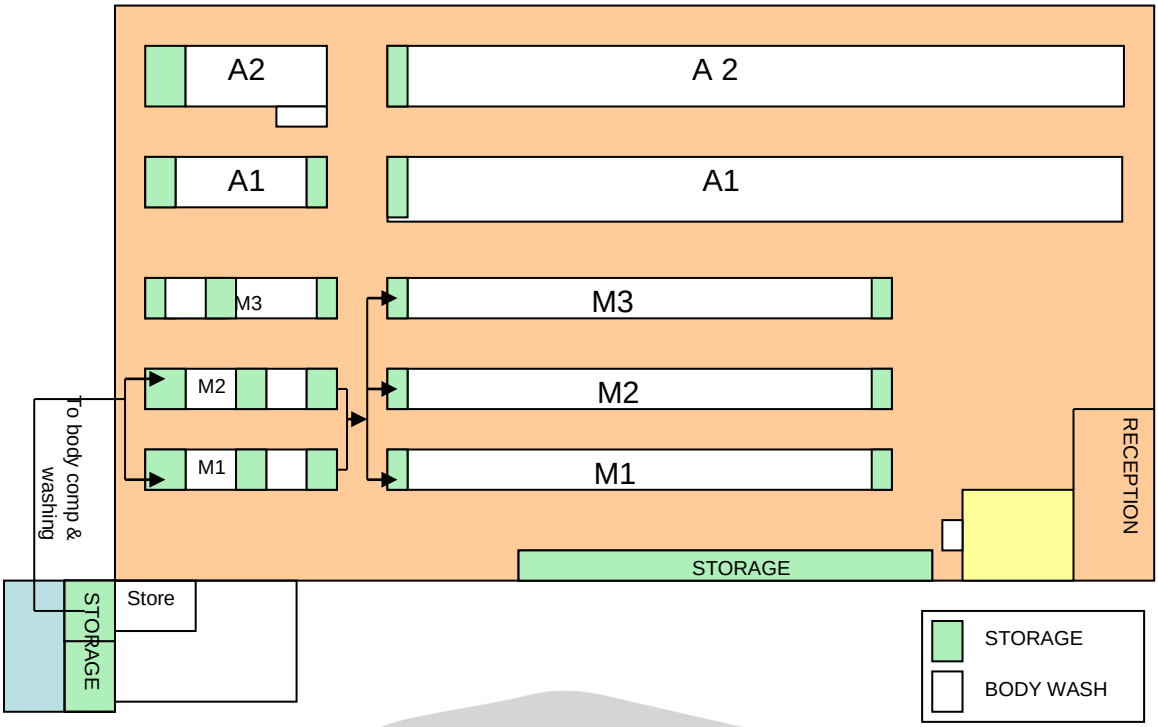



**Interpretation:** This Diagram shows modified Layout of M & A Models.

**Supporting Data Calculations**

**1.6.3 Time and Motion Study:**

1. Average Walking Speed of Men = 82m/min.
2. Walking Speed of men with load = 49.2m/min, i.e. 0.82m/sec.
3. Distance and Travel Time:

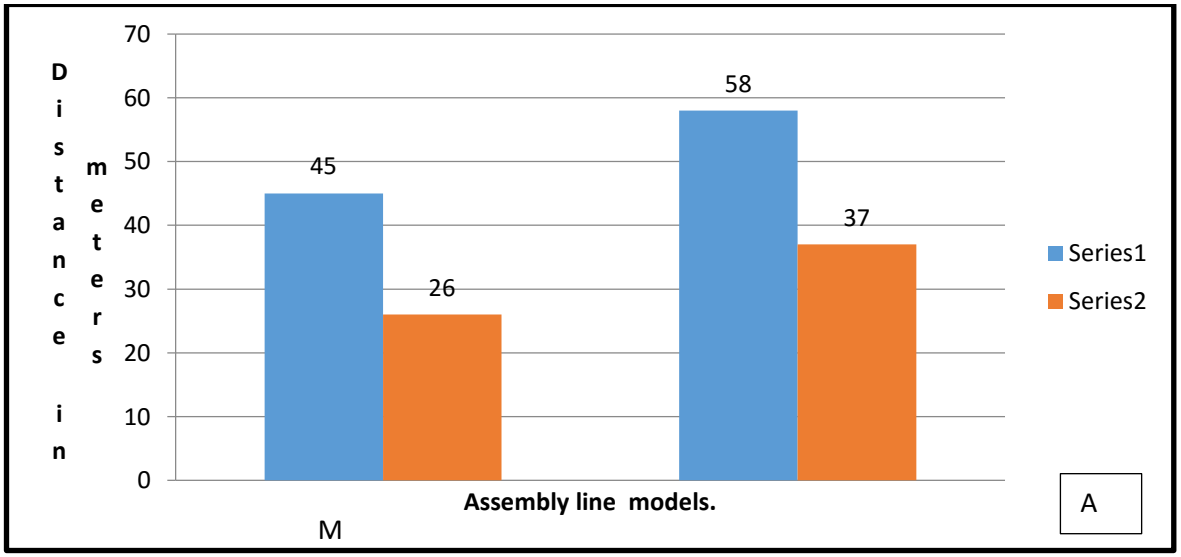
Sample Calculations for time:

a. Walking Speed of men with load = 49.2m/min, i.e. 0.82m/sec.

| Sr.no. | Assembly Line. | Previous Distance. | Reduced Distance. | Previous Time | Reduced Time. |
|---|---|---|---|---|---|
| 1 | Model M | 45m | 26m | 54.87sec | 31.70sec |
| 2 | Model A | 58m | 37m | 70.73sec | 45.12sec |

b. Therefore 45m/(0.82m/sec) = 54.87sec.

### 1.6.4 Distance Chart:

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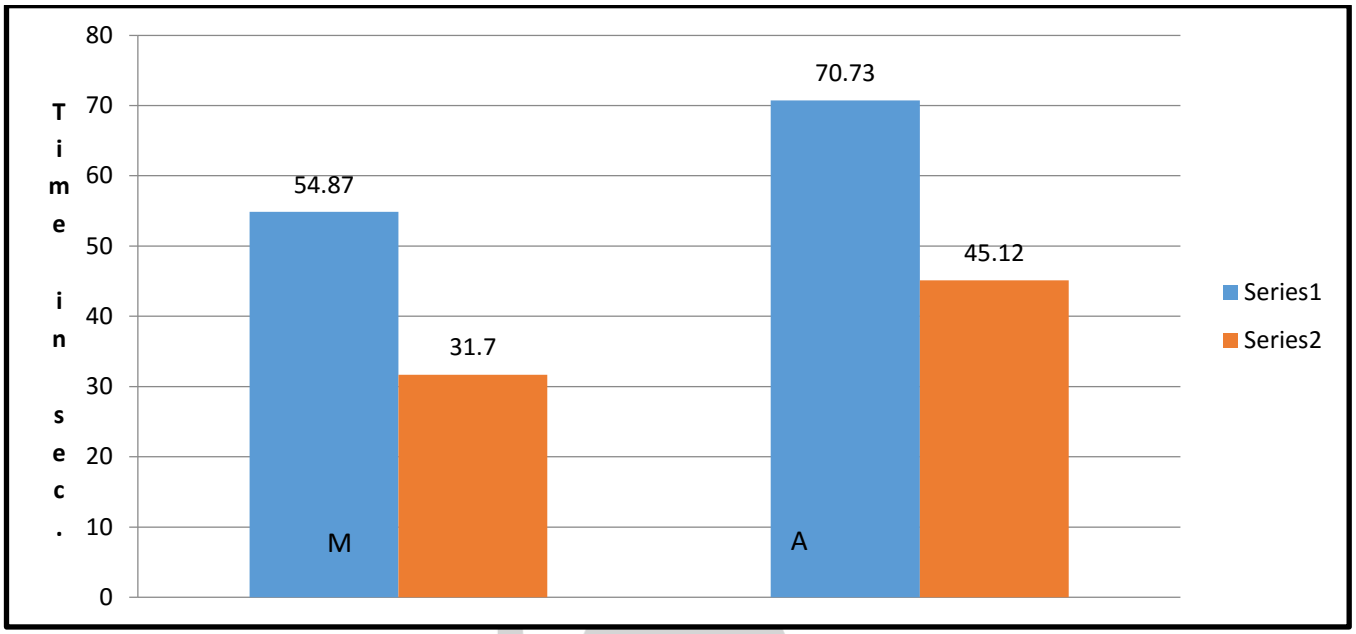
**Interpretation:**

The distance for the movement of M assembly models from storage up to M assembly line is reduced by 19m i.e. by 42.22%. The distance for the movement of A assembly models from storage up to A assembly line is reduced by 27m i.e. by 46.55%.

### 1.6.5 Time Chart:

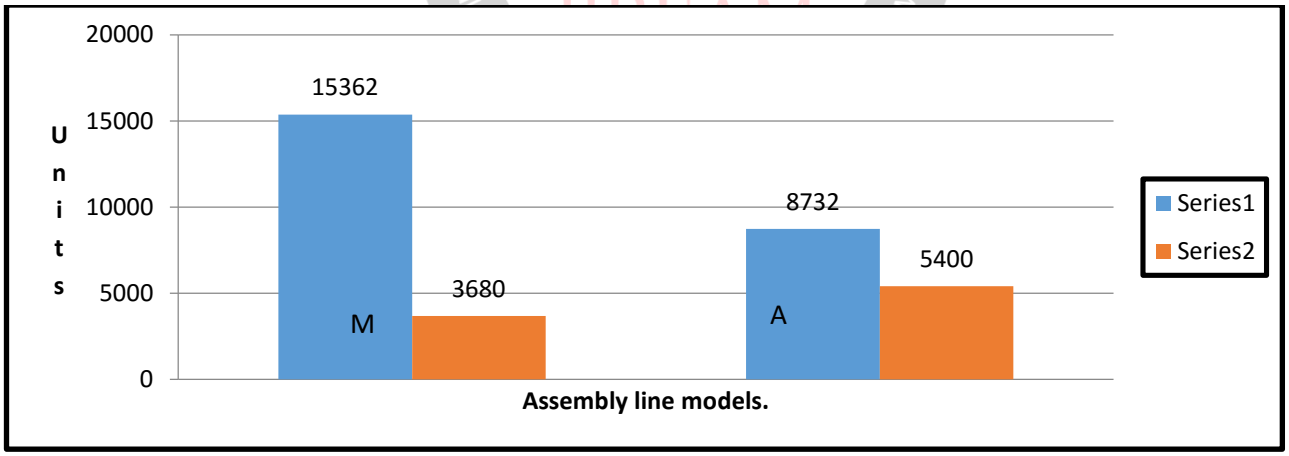



**Interpretation:**

The time required for the movement of M assembly models from storage up to M assembly line is reduced by 27.17sec i.e. by 46.15%.The time required for the movement of A assembly models from storage up to A assembly line is reduced by 25.61 i.e. by 36.20%.

**1.6.6 Inventory Chart:**

| Assembly line. | Previous | Reduced |
|---|---|---|
| M | 15362nos. | 3680nos. |
| A | 8732nos | 5400nos. |




**Interpretation:**

The inventory storage of M assembly line is reduced by 11682nos i.e. by 76%. The inventory storage of A assembly line is reduced by 3332nos i.e. by 38.15%.

**1.6.7 Chart for floor space consumed by the inventory:**

| Assembly line. | Previous | Reduced |
|---|---|---|
| M & A | 20sq.m. | 6.24sq.m. |

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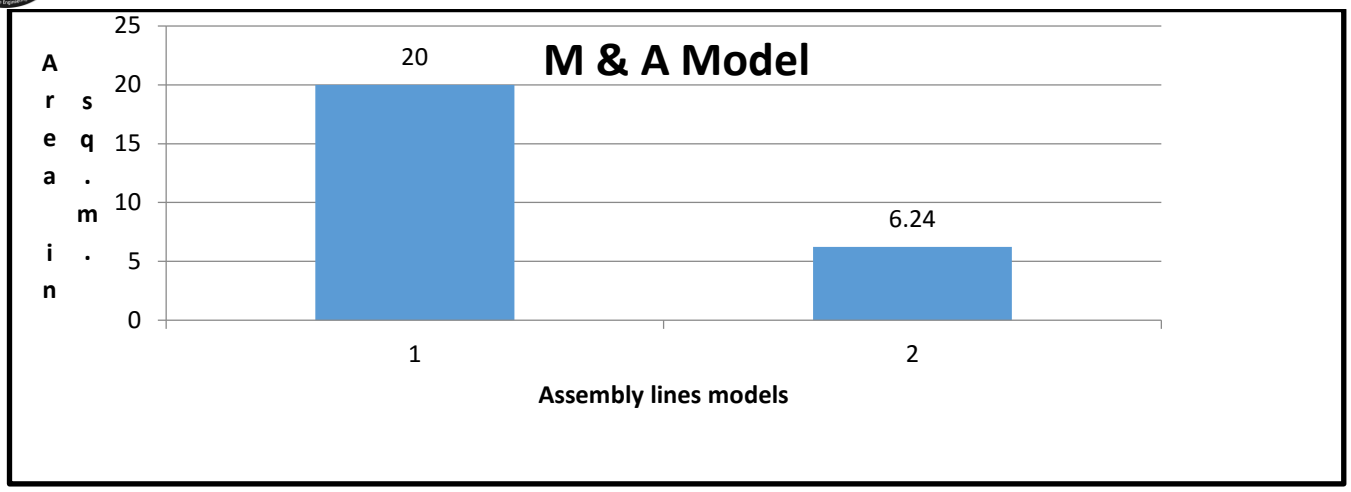


**Interpretation:**

The inventory storage space gets reduced from 20 sq.m to 6.24 sq.m. The inventory storage space of M & A assembly line is reduced by 13.76sq.m. i.e. by 68.8%.

**1.7 Other Factors affecting Layout realignment:**

- Stock after body comp i.e. stock for assembly.
- Chances of Pillars obstructing the material flow.
- Space between the lines for movement of man & materials.
- Employee's resistance to accept the change.
- Quality problems of components that can affect the material flow to Main assembly shop.
- Communication between body comp section & Main assembly shop.

## VII. OUTCOME

- **Reduction in movement loss: -** The movement of the material was reduced.
- **Reduction in Inventory: -** Fewer inventories than previous.
- **Storage as per requirement:-** Stock after body comp now can be stored only as per requirement of the main assembly shop.
- **Efficient utilization of floor space: -** Less floor space consumption than previous. **Elimination of model mixing problem: -** Due to fewer inventories there is less scope for the model mixing problem. So there is less scope for loss of searching time.
- **Proper alignment of the assembly lines: -** The starting & the ending points of the assembly line are now properly aligned & the gangway markings are now even.
- **More space for finished goods: -** Now there is much of space available for the finished goods storage.
- **Space for resting of employees: -** Space is available for installation of resting benches for employees during tea or lunch break. Now the employees need not to take a rest near to work areas as the special benches are provided for sitting.
- **Uni-directional flow: -** As now there is no separate line for body washing, there is no back tracking. Hence now there is unidirectional flow system.
- **Flexibility: -** Due to the modification in the layout there is a better communication between Main assembly shop & body comp section. So the flexibility in terms of the model changes can be easily achieved.
- **Maintaining '5S':-** Now it has become easy for the employees to implement & maintain '5S'.

## VIII. CONCLUSION

From the case study it can be concluded that properly planned layout helps to properly implement 5S and attain higher productivity levels. Thus proper layout facilitates elimination of many wastages due to physical movement of shop floor employees as well as it helps to reduce the wastages caused because of material handling and storage and helps to smoothen production run. Thus it can be concluded that for proper improving productivity the companies need to pay attention to the company layout. The study confirms the relationship between company layout and productivity. The case study also highlights that without proper layout it is difficult to implement and maintain 5S.

## REFERENCES

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