

Requirement of Proper Plant Layout for Improving Productivity in SMEs

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ABSTRACT

The market is getting increasingly competitive where industries are required to continuously improve their technology and process. Small and medium enterprises (SMEs) play a vital role in modern economies as they not only play a significant role in providing job opportunities but also support to large scale market demand of different commodities. So they must have to be competitive in productivity so that they can make them relevant to the market. The plant layout improvement using systematic layout planning pattern theory approach is considered as a promising tool for productivity improvement. However, its adoption in SMEs is relatively slower than the larger organizations and this case has more relevance with developing countries. In this paper, an SME of gears manufacturing industry engaged in continuous improvement of plant has been taken where the objective was to improve productivity.

Keywords: Layout, Improvement, Planning, Operations.

I. INTRODUCTION

Plant layout is defined as the framework or the planning for the installation of machineries, devices or other objects required for the production process under the conditions of the structure and the existing building so that the production becomes safe and highly efficient. The machining arrangement should be such that it will reduce slack time of flow of raw materials, semi-finished materials and reduce the idle time of the machines. The ultimate goal is to increase productivity, i.e. to increase number of products produce per unit time. This critical layout planning is obtained by adopting Systematic Layout Planning Pattern (SLP) in production process. Now many SMEs are adopting critical layout planning to increase productivity and this will meet the requirements for the market demand. The Systematic Layout Planning Pattern (SLP) is also an approach based on Analytical Hierarchy Process (AHP). Moreover, there must be a match of balance between production line and delivery line to reduce the transferring time and the waiting time. The Systematic Layout Planning Pattern can reduce the cost and the waste in production resources so that the area of the factory can be maximized and the working place becomes suitable for the efficient working.

II. LITERATURE REVIEW

Improvements in productivity can be achieved by the systematic arranging of operating procedures and practices in the organization. It can be stated that small and medium enterprises (SMEs) can achieve improved productivity, high product quality and high level of customer satisfaction by implementing Systematic Layout Planning Pattern (SLP) in their production layout. The systematic layout planning (SLP) is a great tool used to arrange a production place in a plant by locating two areas with high frequency and logical relationships close to each other. The process permits the quickest material flow in processing of raw materials at the lowest cost and least amount of handling time. It is an organized way to layout planning. It involves of procedures, based on conventions for identifying, rating, and visualizing the elements involved in planning a layout.

At present there are several methods for plant layout design such as systematic layout planning (SLP), Linear Programming Process (LPP), Algorithms, and Arena simulation can apply to design plant. Yujieet *al.* Studied SLP method to design the overall layout of log yards, the result showed the good workflow and was possible rearrangement plant layout undersignificance Plant layout analysis and design for multi-product line production has been studied by Jaturachat *etal.* . This work was carried out to investigate the suitable plant layout design for denture manufacturing. The suitable plant layout models were designed and compared the efficiency of each plant by adjacency-based scoring. Moreover, line balancing was done to allocate human resource by using simulation programming to find the increasing productivity of the new improvement layout. These thus reflect the importance of the plant layout design to bring about an increase in productivities. According to study of manufacturing process, it was found that long distance could be reduced for moving material from assembly line and the problem about unless area could be solved .the way to improve plant to apply SLP method to make the flow continually by arranging the important sequence of the manufacturing. Then the relationship of each activity in closeness area was considered to make the relationship of activity. So good plant layout will give good productivity of SMEs.

III. IMPORTANCE OF PLANT LAYOUT

- 1) It is long term commitment
- 2) It facilitates the production process, minimises material handling time and cost and allows flexibility of operations
- 3) It facilitates easy production flow, makes economic use of the building, promotes effective utilisation of manpower and provides for employees convenience, safety, comfort at work, maximum exposure to natural light and ventilation
- 4) It effects the flow of materials and processes, labour efficiency, supervision and control, use of space and expansion possibilities.

IV. CASE STUDY

A Gear manufacturing ABC company at Howrah district of West Bengal, India having total workers 40 and yearly turnover of around Rs.0.6 crore, suffers in material handling and productivity of their product.

Below shown arrangement of different machines which are in line for manufacturing gear of ABC company.

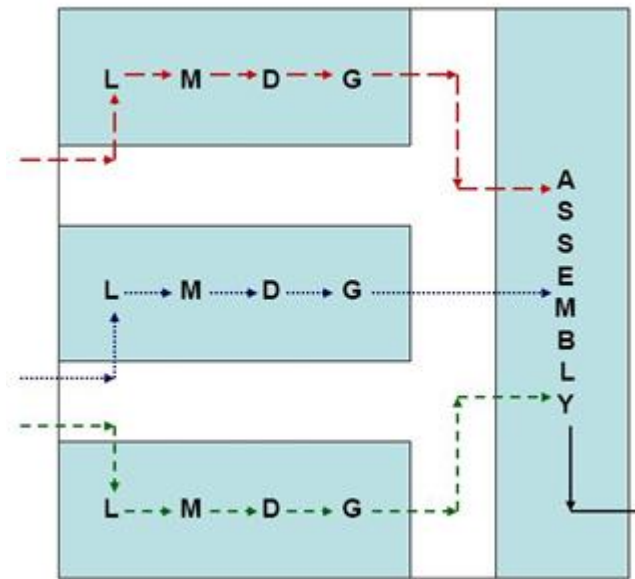


Fig. – 1 Product Layout

L – lathe, M – milling, D – drilling, G – gear cutting

In this gears production layout the machines are arranged in line layout or AKA flow. It is mass production layout where production volume is high. It is more efficient but less flexible than functional layout. Investment in specialised capital equipment is high, so a reliable and steady demand is required. It is very sensitive to machine breakdown or disruption to material supply.

V. THE REQUIREMENT OF IMPROVEMENT OF PRODUCTIVITY:

To increase flexibility some standby machines are to be arranged. To improve steady demand proper marketing is necessary. Disruption of material flow can be avoided by providing automatic machines.

VI. ANALYSIS

The problems of gear manufacturing company is productivity. This problem is due to lack of planned plant layout. In case study we see that the machines are arranged in line. If one machine is out of order then production of this line is disrupted and semi-finished to be transferred another line. It will take more time to transfer the materials from one machine to another, which hampered the productivity. So properly designed plant layout gives the good productivity.

VII. METHODOLOGY

The problems of the manufacturing company can be minimised by effectively utilising the space to minimise material handling cost. Old (not used) machines should be rejected from the workplace. Suitable Plant Layout Process should be adopted as indicated in the analysis of this paper. To get best result Systematic Plant Layout (SLP) should be adopted

Functional Layout

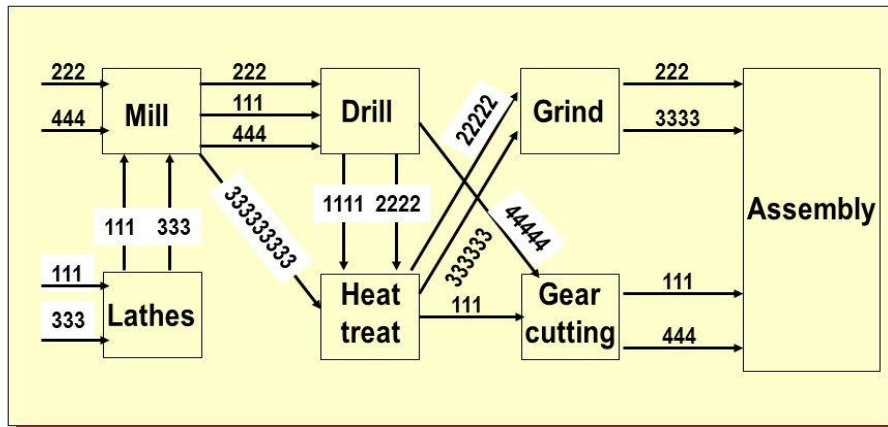


Figure 2: Flow chart for Process sequence

Above shown a plant layout where 111,222,333 & 444 are the raw materials for different types of gear of gear manufacturing which indicate various sequence of operation and machining arrangement of a Gear manufacturing company. Here the machines are arranged in a group. Lathe group, milling group, drilling group, heat treatment plant, and gear cutting according to design requirement and market need of different product which can be produced by applying SLP. However the initial invest is high but it is suitable for mass production and to fulfill the variable market demand.

VIII. PROPOSED MODEL

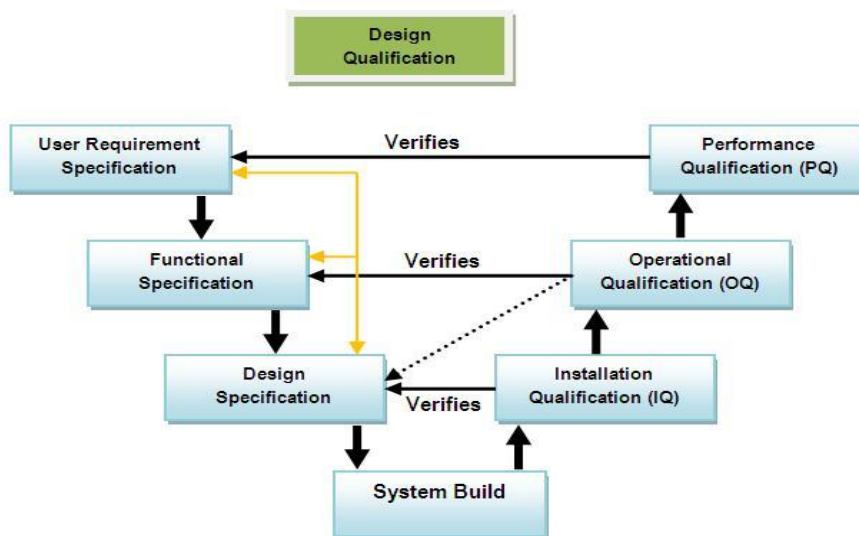


Fig. 3 Proposed Model

The above model gives the universal idea of plant layout according to specifications and may solve the different problems of SMEs. Final products are produced according to user requirement specification. To get final product according to specification work should be divided into functional specification and according to function various operation should be designed. According to design specification all systems are installed with automated as well as manual plant layout. This gives the universal system of the plant.

In figure user requirement specification (customer requirement) is the main criterion which links with functional specification and design specification. To fulfil the customer requirement productivity performance qualification, productivity operational qualification and productivity installation qualification of the system should be designed. All functions of the system are internally related.

IX. CONCLUSION

Systematic layout planning (SLP), Algorithms, and Arena simulation can be very useful to design plant layout. The proposed model is very helpful to design a universal plant layout operated by manually or automatically. This model considers the actual requirement of the users which helps the plant designer for designing layout of plant. This scientific process reduces the cost of product and increase the productivity of the product. In methodology, it has been shown by various sequence of operation of gear manufacturing and machining arrangement which reduces materials flow delay time. To get better productivity, flow of materials and processes, employee's convenience, safety, comfort at work, maximum exposure to natural light and ventilation are also keep in mind which gives good plant layout. So problems of ABC gear manufacturing may be solved by providing functional layout in place of line layout with the help of proposed model as suggested in fig.3.

REFERENCES:

- [1] "Vinod arya ,Increased Productivity and Planning By Improved Plant Layout Using Systematic Layout Planning at NCRM Division, Bhushan Steels Ltd. Khopoli, Mumbai ." International journal of innovations in Engineering and Technology, 2013
- [2] J. Simcharoen, Improving the Efficiency of Production Line in Cosmetic Factory by Modifying Layout Planning and Balancing Proudction Line, an undergraduate project for Bachelor of Engineering, Faculty of Engineering, Eastern Asia University
- [3] P. Jaturachat, N. Charoenchai, and K. Leksakul“ Plant layout analysis and design for multi-products line production,” IE-Network conference,2007, pp.844-849.
- [4] Prochanmarn, N. Suwadee, and C. Chonthicha “Using Promodel as simulation tools to assist plant layout design and planning case study plastic packaging factory,” Songklanakarin Journal of Science and Technology vol 30, 2008, pp. 117-123.
- [5] "Stefan Bock , Kai Hoberg ,Detailed layout planning for irregularly-shaped machineswith transportation path design." European Journal of Operational Research , 2007: 693–718
- [6] S.K. Deb “Computerized Plant Layout Design using Hydrid Methodology under manufacturing Environment,” IE(I) Journal-PR vol 85, 2005, pp. 46-51.

- [7] S. Yookkasemwong, S. Pitchaya-anankul and AreeratBussarakamwadee, "Process Improvement for increasing efficiency of Cable Box Process, a project for Bachelor's degree in Industrial Engineering, School of Engineering," King Mongkut's University of Technology Thonburi, 2005.
- [8] "D. P. Van Donk And G. Gaalman, Food Safety And Hygiene systematic Layout Planning Of Food Processes." Chemical Engineering Research and Design, 2004
- [9] Y. Lin, and W. Li, "Study on the use of SLP in Planning and Designing of Steel Distribution Center," Chinese and Foreign Architecture, 2007, pp. 124-127.
- [10] Y. Zhu, and F. Wang, "Study on the General Plane of Log Yards Based on Systematic Layout Planning," *IEEE. Computer Society*, vol.4, 2009, pp. 92-95