Chapter 9

RESULT AND CONCLUSION

9.1 Result

Redesign of a plant layout for increasing the productivity is achieved through integrating key areas of inventory management, cellular manufacturing, layout planning, simulation and optimization. The overall results of the research work are summarized here.

1. Inventory Management:

Analysis of the organization’s current purchasing practices reveals that the organization is purchasing much more than the requirement resulting in higher inventory cost. To lower the inventory costs, the scientific inventory control techniques are applied at initial stages to classify the inventory items. The calculations showed that, following the simple Economic ordering Quantity technique, the total inventory cost can be reduced by 25%.

Lot sizing techniques such as Lot for Lot, Periodic Order Quantity, Least Unit Cost, Least Total Cost, and Least Period Cost are also applied. When one technique is minimizing the ordering cost, the other is minimizing the inventory carrying cost. But Wagner Whiting algorithm proves to be the best solution as it balances the ordering cost and carrying cost in such way that the overall inventory cost can be reduced by 33%.

2. Clustering:
Clustering techniques groups the machines and components within a plant in such a way that each cell acts as an independent unit. In current situation, 26 component families are to be processed through 13 processes distributed at three different locations. Hence concept of cellular manufacturing is applied in a broader way. Thorough analysis of existing clustering techniques underlines the need of a simple and effective clustering algorithm.

A new algorithm is developed based of the manufacturing processes required by each component. The algorithm is validated by applying it to 30 benchmark problems presented in literature. The performance of the algorithm is evaluated by means of performance measures such as number of exceptional elements, machine utilization, grouping efficiency. In 13 cases the proposed algorithm is equally competent with the existing clustering techniques. In 12 cases, it shows improvement in every performance measure whereas in 5 cases, the algorithm shows improvement in one measure at the cost of reduction in another measure.

The validation of the proposed algorithm made it suitable candidate for application in current situation. Initially, processes and locations are grouped as per the availability of the process at the location. Then components and processes are grouped as per the manufacturing sequence of the components. In both the cases, the clustering is done initially by Rank order clustering and then by proposed Lead Component Method. Then the groups are assigned to locations by formulating assignment problem. When existing machine set ups at existing locations is considered, the group with ROC shows better machine utilization whereas the group with LCM shows reduction in exceptional elements. When redistribution of available machines is considered, both the algorithms do not present any exceptional element but group with LCM shows better machine utilization. It also reduces the transportation occurrences from 109 to 77 i.e. need for transportation is reduced by 29%.

3. Plant Layout Generation

Hundreds of layouts can be generated by various combinations. But considering the space and flow constraints, 7 layouts are generated based on flow process chart, relationship diagram, flow patterns, simulated annealing, and minimum spanning tree algorithm.
4. Simulation

These generated layouts are simulated for 1 week using WITNESS simulation software. The simulation results show that every layout suggested is capable of achieving the required target production though minimum spanning tree layout completes the production cycle in minimum time of 7535 seconds. It also proves itself better on the basis of other time based parameters such as % busy and idle time of each department, % busy and idle time of each path, average processing time.

5. Evaluation using AHP-TOPSIS

Simulation compares the layout on the basis of time and distance criteria. Hence other criteria such as area utilization, flexibility, travel, and other departmental issues are taken into consideration. A hierarchy of criteria and sub criteria is developed and priorities are defined using Analytical Hierarchy Process to find the relative worth of each criterion. Actual value of each criterion for each alternative is used to form initial TOPSIS matrix. The rankings are determined by further TOPSIS calculation. The layout generated using minimum spanning tree algorithm is the best considering all the criteria which is in line with the simulation results.

Figure 9.1 summarizes the overall work done and results.
Figure 9.1: Summary of Techniques Used In Thesis
9.2 Conclusion

: Redesigning a layout is not an isolated activity. When a plant layout is to be redesigned, many problem areas need to be taken into consideration.

In this research work, such problem areas are identified, analyzed and a satisfactory integrated solution to these problems is provided. Integration of scientific inventory control techniques and systematic layout planning procedure supported by newly developed clustering algorithm resulted in achieving the desired objective of increased productivity. The study also showed that optimum use of available resources helps to boost up the productivity.