SOME ASPECTS OF FACILITY LAYOUT TO INCREASE PRODUCTION OF A COMPANY AND PROVIDE BETTER SERVICE TO THE CUSTOMER

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ABSTRACT

Facility planning is concerned with the design, layout, and accommodation of people, machines and activities of a system or enterprise within a physical spatial environment. Facility planning is very important in a manufacturing process due to their effect in achieving an efficient product flow. It is estimated that between 20% to 55% of the Indirect Operating expenses in manufacturing is related to material handling. This cost can be reduced until 30% through an effective facility planning. Proper analysis of facility layout design could improve the performance of production line such as decrease bottleneck rate, minimize material handling cost, reduces idle time, raise the efficiency and utilization of labour, equipment and space. Here, Design facilities layout is focused by discussing the traditional and computer aided methods for facilities planning by discussing service support and analytical facilities location methods.

Key words: Facility concept, simulation and layout design.

INTRODUCTION

Layout decisions entail determining the placement of departments, work groups within the departments, workstations, machines, and stock-holding points within a production facility. The objective is to arrange these elements in a way that ensures a smooth work flow (in a factory) or a particular traffic pattern (in a service organization). In general, the inputs to the layout decision are as follows: 1. Specification of the objectives and corresponding criteria to be used to evaluate the design. The amount of space required, and the distance that must be traveled between elements in the layout, are common basic criteria. 2. Estimates of product or service demand on the system. 3. Processing requirements in terms of number of operations and amount of flow between the elements in the layout. 4. Space requirements for the elements in the layout. 5. Space availability within the facility itself, or if this is a new facility, possible building configurations.

The design of a facility is a process that is becoming more and more difficult with the globalization of the workplace. The process implies taking into account several variables that will determine whether the organization succeeds and stay in business or not. The facility design process can greatly affect costs, both fixed and variable. For instance, depending on the product and type of production or service taking place, transportation costs alone can total as much as 25% of the product’s selling price. The authors omit a cost that is becoming more and more important: costs associated to environmental regulations and costly fines for non compliance with them. Two factors that affect location decisions: (a) Country Decision, (b) Region/Community Decisions. There are so many sub-factors have been included in this two factors. Covering all of these factors in one single study is a hard-to-accomplish task, based on the wealth of information, and conditions and regulations that change constantly. In this study, focus is given to the following technical issues: (i) Building and Utility Requirements (ii) Processing Equipment and Tooling (iii) Raw Materials (iv) Transportation and Distribution.

Business process reengineering has provided extensive opportunities for industrial engineers to provide the skills and techniques required for business restructuring (Kress, 1974 and Clover, 1979). Traditional systematic facilities planning have been restructured as strategic facilities planning (SFP) that supports a company’s competitiveness (Smith, 1981; Schmenner, 1982 and Emory, 1985). Facilities design includes all the inputs that result in a company’s physical assets. These assets provide the operational capacity of the organization. Facilities design is a complex management task, with an array of multiple and often conflicting inputs that generate the value of products customers buy (Chase, 1985 and Sule, 1988). Facilities Manager can often revert to reactive maintenance practices and end up constantly playing catch up. This results in circumstances where issues cannot be rectified easily, or cost effectively, or within an acceptable time frame (Vonderembse and White, 1994 and Heizer and Render, 1995). Lack of focus on technical issues and maintenance can also be one of the quickest ways of ensuring a Facilities Management internal or external relationship is affected, an external contract is not renewed or even cancelled. The management of technical issues in facilities is becoming less straightforward as the level and integration of technology in buildings increases and the extent and complexity of relevant legislation and regulation grows.

Different heuristic approaches to a real facility layout problem have been discussed in the journal (Heizer and Render, 1995; Tompkins et al., 1996 and Pinto and Shayan, 2007). A number of parameters of interest are employed in different application of service in different area. Those are conformed and collected the chose of variable for...
facility location have been collected from (Tompkins et al., 1996; Pinto and Shayan, 2007 and Amine et al., 2007). After getting all the concept from the referred journal this paper is finalized on the basis of their aspects and a fundamental logic to design facility layout for manufacturing and industrial application.

**Plant location:** The location of plant can have a crucial effect on the profitability of a project and the scope for future expansion. The principal factors to be considered for selection of a suitable site are: Location, with respect to - The Marketing Area, Raw Material Supply, Transport Facilities, Availability of Labour, Availability of Utilities, Water, Fuel, Power, Environmental Impact, Local Community Considerations, Climate Political Strategic Considerations. The economic construction and efficient operation of a process unit will depend on how well the plant and equipment specified on the process flow sheet is laid out. Factors for plant layout are: - Economic considerations, construction and operating costs, the process requirements, convenience of operation convenience of maintenance, safety Future expansion. The cost of construction can be minimized by adopting a layout that gives the shortest run of connecting pipe between equipment, and at least amount of structural steel work. However, this will not necessarily be the best arrangement for operation and maintenance. Operations Equipment that needs to have frequent attention should be located convenient to the control room. Valves, sample points, and instruments should be located at convenient positions and heights. Sufficient working space and headroom must be provided to allow easy access to equipment. Maintenance Heat exchangers need to be sited so that the tube bundles can be easily withdrawn for cleaning and tube replacement. Vessels that require frequent replacement of catalyst or packing should be located on the outside of buildings. Equipment that requires dismantling for maintenance, such as compressors and large pumps, should be placed under cover. Safety Blast walls may be needed to isolate potentially hazardous equipment, and confine the effects of an explosion. At least two escape routes for operators must be provided from each level in process buildings. Plant expansion Equipment should be located so that it can be conveniently tied in with any future expansion of the process. Space should be left on pipe alleys for future needs, and service pipes oversized to allow for future requirements. Modular construction In recent years there has been a move to assemble sections of plant at the plant manufacturer’s site. These modules will include the equipment, structural steel, piping and instrumentation. The modules are then transported to the plant site, by road or sea. A well designed plant layout is one that can be beneficial in achieving the following objectives: Proper and efficient utilization of available floor space, Transportation of work from one point to another point without any delay, Proper utilization of production capacity, Reduce material handling costs, Utilize labour efficiently, Reduce accidents, Provide for volume and product flexibility, Provide ease of supervision and control, Provide for employee safety and health, Allow easy maintenance of machines and plant. Improve productivity (Figure 1-3).

**Tools for improvement of design quality:** Management tools have become a common part of Executives’ lives. Whether trying to increase revenues, innovate, improve quality, increase efficiencies or plan for the future, executives have looked for tools to help them. The current environment of globalization and economic turbulence has increased the challenges executives face and, therefore, the need to find the right tools to meet these challenges. To do this successfully, executives must be more knowledgeable than ever as they sort through the options and select the right management tools for their companies. The selection process itself can be as complicated as the business issues they need to solve. They must choose the tools that will best help them make business decisions that lead to enhanced processes, products and services—and result in superior performance and profits. Successful use of such tools requires an understanding of the strengths and weaknesses of each tool as well as an ability to creatively integrate the right tools, in the right way, at the right time. The secret is not in discovering one magic device, but in learning which mechanism to use, and how and when to use it. In the absence of objective data, groundless hype makes choosing and using management tools a dangerous game of chance.

**Benchmarking:** Benchmarking improves performance by identifying and applying best demonstrated practices to operations and sales. Managers compare the performance of their products or processes externally with those of competitors and best-in-class companies and internally with other operations within their own firms that perform similar activities. The objective of Benchmarking is to find examples of superior performance and to understand the processes and practices driving that performance. Companies then improve their performance by tailoring and incorporating these best practices into their own operations—not by imitating, but by innovating.

**Reengineering:** Business Process Reengineering involves the radical redesign of core business processes to achieve dramatic improvements in productivity, cycle times and quality. In Business Process Reengineering, companies start with a blank sheet of paper and rethink existing processes to deliver more value to the customer. They typically adopt a new value system that places increased emphasis on customer needs. Companies reduce organizational layers and eliminate
unproductive activities in two key areas. First, they redesign functional organizations into cross-functional teams. Second, they use technology to improve data dissemination and decision making. Reengineering can reduce cycle time and improve quality (Fig. 4).

**Multi-objective facility layout:** The facility layout problem has traditionally been formulated as a quadratic assignment problem (QAP). This formulation assigns ‘n’ (equal-sized) facilities to ‘n’ mutually exclusive sites (locations). The distance between various locations is measured by a rectilinear distance. Note that the QAP is a special case of the facility layout problem because it assumes all facilities have equal areas, the distance from one site to another can be predetermined, and that all locations are fixed and known a priori. Therefore, the QAP approach is not an application for facility layout problems with unequal-sized facilities. However, the MOFL problem often involves non-commensurate and conflicting objectives. These objectives can be classified into two categories, conflicting and congruent ones. For example, conflicting objectives aim at minimization of total flow cost and maximization of total closeness rating, whereas congruent objectives aim at minimization of distance-based cost of several attributes, namely flow, closeness rating, hazardous movements, etc. Moreover, generation and evaluation of the various efficient solutions to the MOFL problem is difficult because of the lack of a suitable measure for effectiveness.

**Probabilistic modeling in a facility layout:** Traditional facility layout research ignores workflow congestion and tends to focus on distance-based transportation cost. Recently many authors have identified workflow congestion as a major concern in a facility layout, yet few analytical models have been proposed. This paper attempts to address this concern in the following way. First, we formalize the concept of workflow congestion, which incorporates a variety of workflow interruptions. We establish a probabilistic model for workflow interruptions and develop a method for evaluating the expected travel time through an aisle. We then formulate the facility layout problem as one for minimizing the total expected travel time, i.e., we focus on alleviating workflow congestion. A solution approach based on “sliding bottleneck paths” is presented along with an example and computational results. Traditional facility layout research normally ignores workflow interruptions, for example, interaction between material-handling equipment. This assumption assumes that aisles are wide enough such that material handling equipment will never encounter any interruptions. Commonly, however, this is not the case as aisle space is unproductive space. Focusing on space efficiency, many planners provide insufficient aisle width. Workflow congestion occurring on narrow aisle results in immediate safety problems: “damaged uprights, damaged vehicles and damaged workers. In addition, frequent workflow interruptions indicate inefficient material handling. Several authors have recognized workflow congestion in material handling systems and observed considerable lost vehicle time due to congestion (Fig 5 and 6).

**Modeling Of Workflow Congestion:** Workflow congestion is a phenomenon which prevents vehicles from travelling freely. Actually a variety of workflow interruptions could cause workflow congestion. Consequently, it is necessary to intensify the understanding of workflow interruptions in order to capture workflow congestion properly. First of all, we define workflow interruption as: Workflow interruption is an event in which a vehicle is forced to slow down or make a full stop. The different types of workflow interruptions include:

1. Intersection interruption
2. Vehicle interruption
3. Pedestrian interruption
4. Pickup/drop-off interruption

**RESULTS AND DISCUSSION**

It would be strategically advantageous to organisations if they could predict the behaviour of the new systems meant to replace existing legacy ones. In fact, these organisations could tackle possible performance problems of the new systems before they become operational. This paper describes how a capacity planning and performance analysis method for the migration of legacy systems can be used to predict such behavior. The paper describes the process of constructing, validating and deploying a simulation model. Peculiarities of the legacy system migration that affects the simulation process are presented through the use of a case study. Finally, guidelines to perform similar simulation studies are also provided. During the life cycle of a software system it is customary to carry out capacity planning and performance analysis, not only to evaluate the system’s environment but also to plan its operation.

**The Simulation Process:** The submission of a synthetic workload to a simulation model provides a mean to predict the behaviour of a target system. Therefore, we need a way to specify and to execute this simulation model of the target system’s computing environment. Simulators, such as SMPL and SES/Workbench, provide constructors to specify models, as they also implement techniques to execute the models. The simulation process for performance evaluation of a target system is shown in the activity diagram. The challenging task in the simulation process is the production of a valid model. The model is mainly built in the Modeling activity where it is specified. In the Simulation activity the model is executed, producing simulation results. The Validation activity is based on a comparison of the simulation results with the results produced in the Experimentation activity. If
the simulation and experimental results are similar enough, the model can be classified as valid. Otherwise, the Modelling refinement activity may be required to produce simulation results that correspond more closely to the experimental results. Once the model is validated, the Prediction activity is executed producing the simulation results that describe the predicted behavior of the target system. Although the simulation process of a target system is very similar to a typical and generic simulation process but their activities are different. For instance, the Modeling, experimentation, and prediction activities are performed based on a synthetic workload of the target system. In fact, the simulation model produced in the Modelling activity and the experiment scenarios used in the experimentation activity are derived from the synthetic workload. Moreover, the synthetic workload is used as it is in the Prediction activity (Fig. 7 and 8).

CONCLUSION
Designing and setting up a manufacturing facility is a very complex task that requires a thorough understanding of the environment. Deep knowledge is essential because of many factors involved in the process as possible is required to make sound decisions and to produce the desired outcome. The problem involves a lot of variables to be considered by those trying to establish a manufacturing plant. Principles and practice of the planning of facility layout and material handling equipment for manufacturing and service systems. Topics include analytical approaches in site location, facility layout, material handling, and storage systems. The extension of this work is to measure production of the manufacturing industry or to test the supply lead time in the service enterprise by applying method study and work measurement on the in-house parameter.

REFERENCES
Fig. 3. Final test with OM tools

Center-of-Gravity With OM Tools

Load-Distance With OM Tools

Fig. 4. Floor plan of a restaurant to provide better service

Fig. 5. Design of better line layout in a manufacturing industry

Fig. 6. Honda assembly line

Fig. 7. Simulation Process flow chart

Fig. 8. Plan for a sales office