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A review of procedural approaches available for handling the layout problems

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Abstract

The productivity of any industry is directly affected by its layout on the shop floor. Layout is the arrangement of the resources/machines/activities available on the shop floor in such a way to get the maximized production. There are various approaches used to solve a layout problem. In the present research paper various procedural approaches (i.e. Immer's Basic Layout Planning Steps, Nadler's Ideal Systems Approach, Apple's Plant Layout Procedure, Systematic Layout Planning By Muther and Reed's Plant Layout Procedure) have been analyzed and briefly discussed.

Keywords: Productivity; layout planning; procedural approaches.

1. Introduction

Facility layout planning is the arrangement of available facilities on shop floor to get the maximum output from them. These facilities may me machines, workers, rooms, etc.[1]. All the available resources must be properly laid out on shop floor for getting enhanced production [2-4]. Shayan and Chittilappilly [5] defined the facility layout problem as an optimization problem that tries to make layouts more efficient by taking into account various interactions between facilities and material handling systems while designing layouts. According to Sharma and Singhal [6,7] facilities design is the organization of industries' physical assets to promote the efficient use of resources such as people, material, equipment, and energy. In this paper evaluation based on material handling cost is discussed. A facility layout planning was about arranging the physical departments or machines within a facility to help the facility work in a productive way [8-10]. A poor layout can lead to accumulation of work in process inventory, overloading of material handling system, inefficient setups and longer queues. Jannat, et al. [11] said , whether facilities layout of manufacturing system is reasonable or not, it not only directly affects the production efficiency and production cost, but also affects production cycle. Facility layout is an important decision as it represents long-term commitment. Every Industry wants to design a layout, which

should provide the optimum relationship among output, floor area and manufacturing process. Facility layout planning intends to facilitates the production process, minimizes material handling time and cost, and allows flexibility of operations, easy production flow, makes economic use of the building, promotes effective utilization of manpower, and provides employee's safety, comfort at work, maximum exposure to natural light and ventilation [12].

In the present research paper various procedural approaches have been analyzed and discussed briefly. The paper is organized as: Section 1 demonstrates the introduction part, various procedural approaches discussed in section 2 followed by conclusion in section 3.

2. Facility layout solution procedures

A variety of alternatives procedures/ techniques exists that can be used to develop the layout of facility. Following are the some Procedures/Techniques [13,14]:

- Apple's Plant Layout Procedure
- Immer's Basic Layout Planning Steps
- Nadler's Ideal Systems Approach
- Systematic Layout Planning By Muther
- Reed's Plant Layout Procedure

2.1 Apple's Plant Layout Procedure

Apple developed a sequence of twenty steps which he recommended be used when aiming to construct a plant layout. According to Apple the steps do not necessarily have to be performed in the order that it is given, since the design of every layout project is unique. The steps are as follows:

i. Procure the basic data.

ii. Analyze the basic data.

iii. Design the productive process.

iv. Plan the material flow pattern.

v. Consider the general material handling plan.

vi. Calculate equipment requirements.

vii. Plan individual workstations.

viii. Select specific material handling equipment.

ix. Coordinate groups of related operations.

x. Design activity interrelationships.

xi. Determine storage requirements.

xii. Plan service and auxiliary activities.

xiii. Determine space requirements.

xiv. Allocate activities to total space.

xv. Consider building types.

xvi. Construct master layout.

xvii. Evaluate, adjust and check the layout with the appropriate persons.

xviii. Obtain approvals.

xix. Install the layout.

xx. Follow up on implementation of the layout.

2.2 Immer's Basic Layout Planning Steps

This approach, entailing the basic steps in the analysis of a layout, Immer stated that, "This analysis should be composed of three simple steps, which can be applied to any type of layout problem." The following are the three steps:

i. Put the problem on paper.

ii. Show lines of flow.

iii. Convert flow lines to machine lines.

This approach by Immer focuses on and thus works best, when have an existing layout that needs to be improved or adjusted to meet new objectives and requirements. It does not make provision for the planning of new facilities.

2.3 Nadler's Ideal Systems Approach

The ideal systems approach should rather be seen as a philosophy than an approach. When Nadler presented this approach, it was meant for designing work systems, but it is vastly relevant to facilities planning. Nadler's approach follows the sequence below:

i. Aim for the "theoretical ideal system."

ii. Conceptualize the "ultimate ideal system."

iii. Design the "technologically workable ideal system."

iv. Install the "recommended system."

2.4 Systematic Layout Planning By Muther

This layout procedure that was developed by Muther in 1973is very popular and is frequently

used. It is also in short referred to as SLP. This process requires the facility planner to develop many different charts and diagrams. This can be seen as an advantage of this process since people tend to understand a process more easily if they can visualize it. The charts and diagrams that are constructed during this procedure, as well as the function of each, are listed below [5,6]:

- *From-to chart:* used to quantitatively measure flows in terms of the amount moved between departments.
- *Activity relationship chart:* determine the relationship between departments.
- *Relationship diagram*: positions activities where they are actually located in a two-dimensional space.
- *Space relationship diagram*: same as relationship diagram, only with the space of each department included.

Following are the steps of Systematic Layout Planning:

i. Data collection.

ii. Generate relationship diagram from the analysis of 'from to chart' and 'activity relationship chart'.

iii. Generate space relationship diagram by analysis of 'space requirements' and 'space available'.

iv. Develop alternative layouts by considering 'practical limitations' and 'constraints'.

v. Evaluate the alternative layouts and select the best one.

2.5 Reed's Plant Layout Procedure

Reed developed few steps, which he referred as a 'systematic plan of attack", to be used for the planning and preparation of a facility's layout. Ten steps are listed below:

i. Analyze the product or products to be produced.

ii. Determine the process required to manufacture the product.

iii. Prepare layout planning charts.

iv. Determine workstations.

v. Analyze storage area requirements.

vi. Establish minimum aisle widths.

vii. Establish office requirements.

viii. Consider personnel facilities and services.

ix. Survey plant services.

x. Provide for future expansion.

Among these layout procedures most commonly used is Muther's Systematic Layout Planning. It is the simplest one and easily understandable method.

3. Conclusions

Facility layout is the arrangement of the resources available on the shop floor in such a way to get the maximized production from them. There are various solution approaches available to handle a layout problem. In the present research paper five procedural approaches (i.e. Immer's Basic Layout Planning Steps, Nadler's Ideal Systems Approach, Apple's Plant Layout Procedure, Systematic Layout Planning By Muther and Reed's Plant Layout Procedure) have been analyzed and briefly discussed.

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