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Discovered Inefficiencies in Material Handling and Alternatives for Their Improvement in a Ginning Machine Manufacturing Company

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Abstract:

The highly competitive environment, linked to the globalization phenomena, demands from companies more agility, better performance and the constant search for cost reduction. Achieving success in the global market has required a fundamental shift in the way business is conducted and has dramatically affected virtually every aspect of process industry. The internal manufacturing process and supporting infrastructure should be such that it can compete successfully in global markets with better flexibility and delivery. The paper deals with a case study of ginning machine manufacturing company, some changes in the internal materials handling system has been suggested, which leads to increase the material flow efficiency.

Key words: internal manufacturing process, materials handling, efficiency

1. Introduction

The function of material handling is to move the right material to the right place, at the right time, in the right amount, in sequence and in the right position or condition in order to achieve minimum production cost. The principles of material handling and control systems must be understood. Material handling system (MHS) design has a direct influence on the logistics cost. Therefore, how to improve the efficiency of material handling system gets more and more people's attention. The handling is costly and adds nothing to the value of the product. Therefore, there should ideally be no handling at all. Unfortunately this is not possible. A more realistic aim would move material by the most appropriate method and equipment at the lowest possible cost.

This aim may be met with:

- Reducing material handling.
- Improving the efficiency of handling.
- Making the correct choice of material handling equipments.

Material handling can be broadly defined as all movement of materials in a manufacturing environment. Materials handling accounts for a significant portion of the total production cost. Workers and materials have to travel long distances in the course of the manufacturing process; this leads to loss of time and energy and nothing is added to the value of the product. Through effective plant layout analysis and design, much material handling operations can be reduced or eliminated. The choice of material handling methods and equipment is an integral part of the plant layout design. In many factories either the initial layout was not well thought out or, as the enterprise expanded or changed some of its products or processes, extra machines, equipment or offices were added wherever space could be found. In other cases temporary arrangements may have been made to cope with an emergency situation, such as the sudden increase in demand for certain product; but then these arrangements remain on a permanent basis even if the situation that provoked them subsequently changes. The equipment selection problem is the key, because excellent performance and suitable equipment can make the material handling easier.

2. Literature Review

In order to validate the study, a literature search was done. Material handling makes production flow possible as it gives dynamism to static elements such as material, products, equipments, layout and human resources [1]. Despite its importance material handling is a topic that frequently is treated superficially by the companies [2]. An important proportion of manufacturing expenses can be attributed to material handling and the most critical material handling decisions in this area are the arrangement and design of material flow patterns. [3].

An important aspect of any production system is the design of a material handling system (MHS) which integrates the production operations [4].

The storage and handling of goods are essential among the set of logistics activities, and their costs can absorb 12% to 40% of its costs. In addition, the MHIA estimates that 20% to 25% of manufacturing costs are associated to handling. Material handling accounts for 30–75% of the total cost of a product along the production chain, and efficient material handling can be responsible for reducing the manufacturing system operations cost by 15–30% [5].

A key factor in material handling system design process is the selection and configuration of equipment for material transportation [6]. In order to improve the performance of internal material handling process, it is important to consider both human and technical factors [7].

There exists a large amount of information about logistics and material handling in general and it is fairly easy to find connections and useful data. Every search that was made offered a large amount of articles; a few fairly relevant, although not a single article highlighted the exact same problem that this work is covering. A large amount of articles focused on the material handling and how it is possible to decrease the material handling activities through the improvement of facility layouts. The factor that most articles had in common was how to decrease movements within a company since this is according to most investigated articles not a value adding activity

2.1. Objective

The present study had as its objective is to improve the efficiency of material handling system. To reach this objective, the following specific objectives were established: (i) Gather data to establish a baseline and data for further analysis. (ii) Perform analysis on data to detect connections between different factors and (iii) develop alternatives for improvements.

3. Methodology

The studied company selected for present study was founded in 1985 has different units in its campus. The company is manufacturing ginning machine and various types of agricultural products. During study of manufacturing unit of ginning machine it was found that there were much inefficiency related to material flow and overall material handling system.

3.1. Data Collection

The data collecting procedure is performed through various measurements, interviews and other types of observations. By gathering data that has the ability to be measured a type of “baseline” can be established and used for further analysis; this baseline can be used to display the situation before any changes were done to it. By gathering the relevant data an understanding is developed. All of the gathered data, the expected information and the deviations are documented thoroughly so that it can be used properly further in the process. By searching for the non-value adding activities data concerning the inefficiencies could be gathered. The inefficiencies concerning the case company can be seen below;

3.1.1. Long Transports

The waste concerning the off-loading of material is associated with the interim storage of goods. Because there is not enough off-loading space at one of the sites, the goods get offloaded at the opposite side of the building as shown in the facility layout below. This results in long, unnecessary transportation on a daily bases and could be avoided by rearranging the off-loading sites to allow more space for interim storage. The placement of shelves and the way they are adapted to material sizes also contribute to waste. Material is often stored in shelves far away from their area of usage and requires the forklift drivers and the service personnel to frequently pass long distances in order to fetch material. As shown in figure off loading sites are at a long distance from production site.

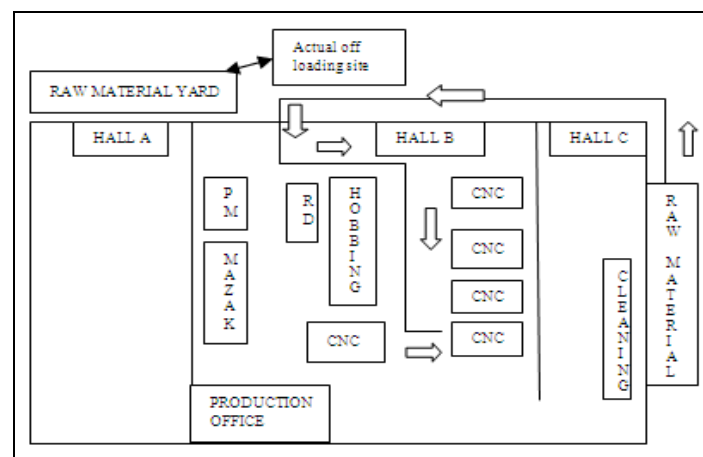


Figure 1: Facility Layout

3.1.2. Overwork

Because a very wide range of material sizes and weights are used at studied company it is important to consider what type of transportation equipment to use for each material type. It is necessary to avoid using equipment that is more complicated, heavier and takes more time to use. For example it is unnecessary to use a forklift to deliver lighter material located roughly few meters away in such case pallet truck can be used as shown in figure.



Figure 2: Pallet and Pallet Truck Can Be Used For Lighter Material Movement

3.1.3. Unnecessary Movements

Heavy and uncomfortable procedures such as the ones performed by the service staff when fetching material will eventually affect the productivity and the quality. By offering the service staff forklift possibilities the unnecessary body movements can be avoided, which in the long run will increase the efficiency of the service staff and lower the risks for body



Figure 3: Movement of Heavy Frames

3.1.4. Wait

The waste concerning waiting is associated with the time that is gone to waste while waiting for the service personnel to resupply the production stations. The requirement for material is extensive, but because of the lack of space in the area around the production stations not much material can be stationed there. The service personnel move all material manually or with the help of a crane, this forces them to wait when material from shelves needs to be extracted.

3.1.5. Unutilized creativity

This can be directed to the service personnel that are willing to take a forklift license to be able to work faster and easier. Company can achieve a higher productivity and eliminate a lot of the waiting time by doing so. Also there is unknown creativity within the team that could be used to the benefit of the company.

3.2. Analysis of Data

The analysis will show connections between different factors and can show how these factors affect one and other. By having an understanding of how factors affect each other and the results negatively, simplifies the pursuit for the root cause. By analyzing the observations and other information gathered, the causes for errors can be found. A supporting tool in this phase is the Cause and Effect Diagram (Fishbone diagram) that highlights the errors and the causes of them. By highlighting the errors and the causes of them it is easy to rewind the error back to its root cause, by having the root cause visible a company can in an easier way focus resources towards creating solutions for specific problems. A list of existing problems found by using the Cause and Effect Diagram.

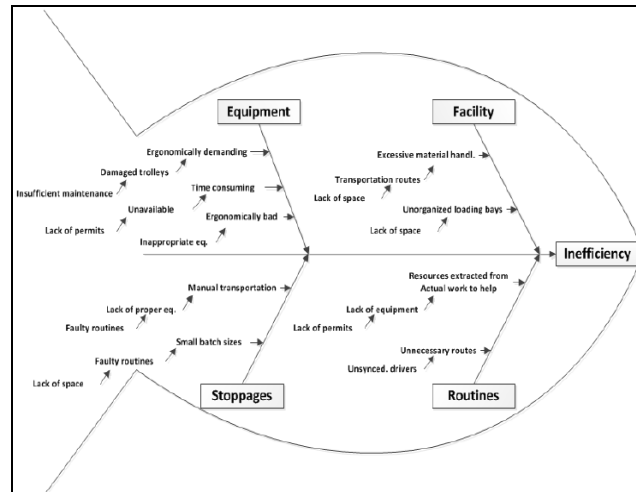


Figure 4: Cause and Effect Diagram (Inefficiencies)

The categories that are used in this Cause and effect diagram are:

3.2.1. Facility

One of the categories in the diagram is “facility” and is concerning the excessive material handling that is occurring because of the long and unnecessary transportation routes and unorganized loading bays. Material locations are not well planned to fit the material handling in an optimum way which causes longer distance tours than necessary and only contributes with wasteful activities.

3.2.2. Equipment & Stoppages

The equipments used for transporting material within the facility is often outdated and is not as efficient as it could be. The main concern regarding this area is the equipment that is used by the service staff that provides the production stations with materials. At the moment the material is transported using a pallet truck which takes more time and causes wear on the staff conducting the work.

3.2.3. Routines

No maps have been developed that displays the internal transports. At the moment there are no set routines to follow. The off-loading procedure is confusing and often the responsible staffs are not present when the truck arrives.

3.3. Discovered Inefficiencies

The discovered inefficiencies will provide assistance when developing improvement alternatives in the next step. One of the main objectives of the improvement alternatives must be to provide solutions for the inefficiencies stated below.

- Material locations and shelves are not well organized.
- Long transportation distances from loading bays to material locations.
- Lack of appropriate equipment for material handling.
- Lack of awareness in material handling staff.
- Lack of space surrounding production stations.
- Lack of space at loading bays.
- Lack of management - material handling staff
- Lack of communication devices – material handling staff
- Lack of space to expand business

3.4. Develop Alternatives

The alternatives have been developed to offer the company several options. By making sure that the alternatives cover all the discovered issues it will simplify the choosing process for the company. The following improvement alternatives have been created. They are placed separately and can be combined if necessary

- Modification of shelves within the facility.
- Highlight the minor inefficiency causes that occur at the moment. By studying the routines and the inefficiency patterns the company can focus on synchronizing the routines so that no unnecessary material handling is occurring. By highlighting the minor inefficiency causes and making slight modifications the company can save time and resources that could be used for other purposes
- Change the material handling equipments. Provide the material handling staff with an modern material handling equipments such as advance forklift truck.

- One of the alternatives is to modify the entire facility layout.
- Improve the communication between the service staff by providing sufficient communications equipments, for example some intercom system in the shape of headset so that it can work in loud environments and doesn't require the use of hands to operate.

4. Conclusion

During the study of inefficiencies in manufacturing plant, existing processes are examined critically. It is observed that the company is not using appropriate equipments and layout and there is scope for improvement. Various study techniques are applied and cause and effect diagram has been prepared. With the help of recorded observation and discussion with concerned personnel of the company, alternatives are suggested.

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