

Improving Material Handling Efficiency in a Ginning Machine Manufacturing Company

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Abstract – In the last several years material handling has become a new, complex, and rapidly evolving science. Material handling cannot be avoided in logistics, but can certainly be reduced to minimum levels. 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 paper deals with a case study of ginning machine manufacturing company. The purpose of the work is to locate and identify the wasteful activities regarding the material handling, and to streamline the activities to reach a minimum of material handling.

Keywords –: Logistic, materials handling, efficiency, logistic cost.

I. INTRODUCTION

More and more organizations worldwide want to develop products for global markets. At the same time, they need to make their products available in the global market to be competitive. One of today's trends to solve this problem of making products in the global market is by involving logistics to manage complex distribution requirements. Organizations have developed strategic alliances with companies all over the world to manage their logistics operations. Logistics is all about getting the right product to the right place at the right time to the right person for the least cost [1]. Material handling can be defined as: "art and science of conveying, elevating, positioning, transporting, packaging and storing of materials Starting from the time, the raw material enters the mill gate and goes out of the mill gate in the form of finished products; it is handled at all stages within mill boundaries such as within and between raw material stores, various section of production department, machine to machine and finished product [2]. A material may be handled even 50 times or more before it changes to finished product. It has been estimated that average material handling cost is roughly 10-30% of the total production cost depending upon product to process. By saving in the material handling cost, the cost of production can be reduced considerably [3]. Material handling involves the movement of materials, manually or mechanically in batches or one item at a time within the plant. The movement may be horizontal, vertical or the combination of these two. Material movement adds to the cost but not to the product value. The ideal mill would have an absolute minimum of materials handling and more use of mechanical material handling equipments.[4] The shortage of labour and increasing wages cost demand the most efficient use of labour. There are basically two functions of material handling section:

1. To select production machinery and assist in plant layout so as to eliminate as far as possible the need of material handling.

2. To choose most appropriate material handling equipment which is safe and can fulfill material handling requirements at the minimum possible overall cost.

Material handling system provides transportation and storage of materials, components and assemblies. Material handling activities start with unloading of goods from delivery transportation, the goods then passed into storage ,onto machining, assembly, testing, storage, packaging, storage and finally loading onto transport. Each of these stages of the

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process requires a slightly different design of handling equipment and some processes integration of multiple items of handling equipment.

II. LITERATURE REVIEW

Literature review performed in order to put the theoretical background needed for this case study in context. It is necessary to find out what literatures that exist and already is known within the area of the study. Moreover it is of interest to investigate methods and research strategies that already has been applied in order to avoid any replication of things that already exist. A literature review can also supply the researcher with theoretical backgrounds that is relevant of the specific area of interest.

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 [5]. In a typical manufacturing plant material handling accounts for 25% of all employees, 55% of all company space, 87% of the production time, and 15-75% of the total cost of a product [6]. Therefore, material handling is certainly on of the first places to look for effective utilization of workforce and facility space, reducing production lead times, improving efficiency of material flow, increasing productivity, and reducing the total cost.

Materials handling involves the moving of materials through the operations within an organization. It moves materials from one operation to the next, and also moves materials picked from stores to the point where they are needed. The aim of materials handling is to give efficient movements, with short journeys, using appropriate equipment, with little damage, and using special packaging and handling where needed. This might even lead to changing the factory layout to improve the material handling situation [7]. Inefficient Material Handling Symptoms are Aisles are cluttered, over handling of products, dock confusion in loading/unloading, too much manual labour, lack of gravity flow movement, poor use of skilled labour, stock out on parts and supplies, lack of standardization, high loss and damage, excess scrap, flow inefficiencies, confusing products storage, too much walking, excessive indirect and labour cost, idle cube storage, excessive long hauls, dirty facilities and excess amounts of employees [8].

III. METHODOLOGY

The objective of present study is to improve the efficiency of material handling system. The company selected for present study was established 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 many inefficiencies related to material flow and overall material handling system. To reach this given objective, the following specific methodology was adopted: (i) Define purpose ii) Gather data to establish a baseline and data for further analysis. (iii) Perform analysis on data to detect connections between different factors and Discover inefficiencies.

A) Purpose:

The purpose is to achieve a higher efficiency regarding the material handling process through removing non-value adding activities. Since material handling in itself is considered a non- value adding activity, the purpose is to decrease the amount of material handling and simplify the actual handling of the material. To achieve this it is important to locate the most serious issues affecting the material handling together with the smaller issues that prevent the efficiency from increasing.

B) Data Gathering:

A qualitative analysis means that an understanding is developed for the chosen subject through different forms of data

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collection methods. Instead of using the quantitative method that contains numbers and measurable data, the data that is used in qualitative research is gathered through observations, discussions, interviews etc. 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.

Long transports:

Long and unnecessary transports should be avoided to the most possible extent because transportation is not value adding and can also affect the condition of goods. Long distance transports can be avoided by placing processes closer to each other.

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 due to lack of space at the off loading sites sometimes materials are off loaded at some other place which is at a long distance from production site.

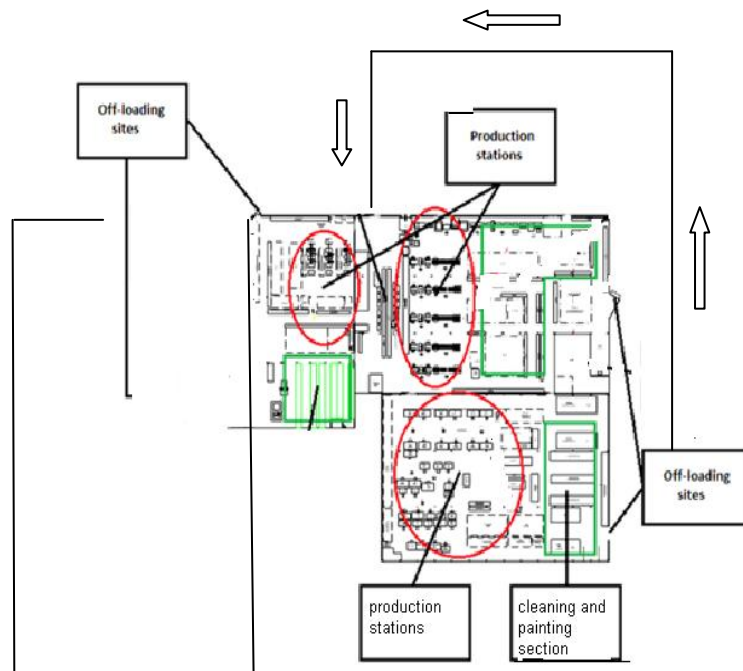


Figure 1 Facility Layout

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Overwork:

Today, unnecessary processes are conducted everyday within companies; often the same work can be done using more simple and less complicated tools. This is something that costs money and in some cases time. Planning these processes will ensure a company to avoid overwork when more simple work could perform the task. 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 initially finished gears are kept directly on the pallet instead they can be kept on trolley used for gear transport. This will save time in loading these gears from pallet to gear trolleys used for gear transport.



Figure 2 Finished gears kept directly on pallet.

Unnecessary movements:

Unnecessary movements by employees that affect health, safety and is time consuming shall be eliminated as much as possible. These movements can be anything from heavy lifts to long walking distances which can potentially affect the employer negatively and not only the employee. By handling the material manually there can also be a potential risk for damaged goods. 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 Unnecessary body movements

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Wait:

When time is not optimally organized waiting time occurs, this can be the result of numerous reasons e.g. the waiting for material, stoppages in the production or insufficient maintenance. Since time can be directly translated into money it is important to put focus on this area to avoid inefficient time. 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.

Unutilized creativity:

In every company with employees there also are skills to be found, a company needs to take advantage of these skills and the creativity of its employees to make sure that they are not missing out on ideas and knowledge. 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.

C) Analysis of gathered 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*.

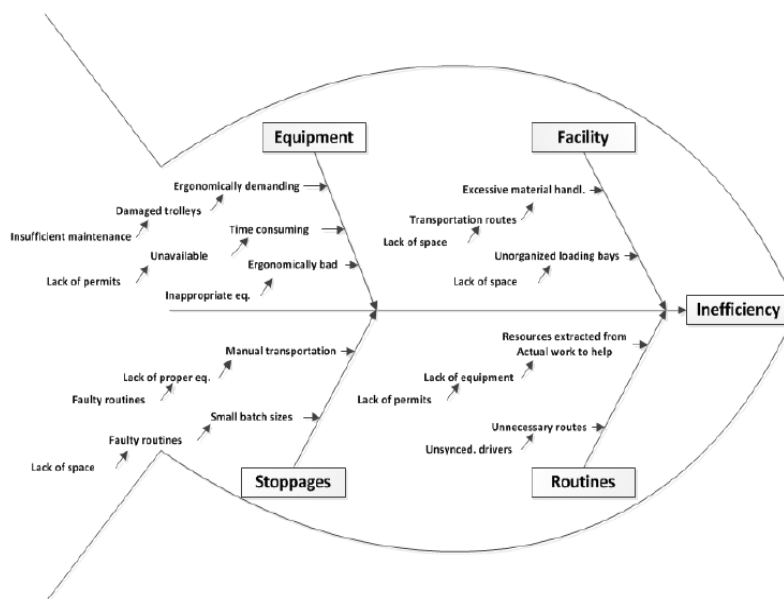


Figure 4 Cause and Effect Diagram (Inefficiencies)

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

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.

Equipment & Stoppages:

The equipments used for transporting material within the facility are often outdated and are 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.

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.

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

Developing alternatives for improvement:

The alternatives have been developed to offer the company several options and have been divided in a list from low cost to high cost for implementation. These alternatives were chosen since they were the most logical ones after the use of Fishbone diagram. By making sure that the alternatives cover all the discovered issues it will simplify the choosing process for the company and enables a cost-effectiveness analysis to be conducted. 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 a 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.

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IV. RESULTS AND DISCUSSIONS

The Purpose to decrease the material handling was defined in the first step. The result of *step one* was the developed plan which enabled the data gathering. In *step two* the plan was set in motion and the data gathered. This data provided the user with insight In *step three* where the data was analysed and the Cause and Effect Diagram was developed which discovered inefficiencies connected to the facility, equipment, work routines and material handling routines and at the last, improvement alternatives were developed .

V. CONCLUSION

The study enables the responsible staff to discover the issues concerning the material flow efficiency, to analyze them and in a later stage a development and implementation of an improvement can be conducted. The decision maker can make a cost effective decision to enhance the company performance. In this case it was discovered that a problem areas are the lack of space in different areas of the company and also lack of appropriate equipment for material handling. I would recommend the company to implement the improvement suggestion that is included in this paper or to construct a new layout to create more space and that fits the transportation devices better.

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