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REDESIGN OF WORK FLOW IN LOADING AND PACKING SECTIONS OF A SHEET METAL PROCESSING INDUSTRY

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ABSTRACT

Lean manufacturing approach focus in eliminating the wastes in the process. One of the Lean tools called "Value stream mapping" is used. current work flow in the industrial sections is drafted using value stream mapping for identification of wastes in the process and the current state map is drawn. It is then analyzed and value added and non value adding activities are found. The factors affecting the present work flow are identified and based on that a new work flow is proposed. The constraints in implementing the proposed work flow are identified and stated. The waste reduction methodologies are formulated using Deterministic job flow and facility layout design approaches. Thus the necessary changes can be implemented for the profitable existence and increased customer delight.

KEYWORDS: Lean manufacturing, value stream mapping, waste reduction, job flow, facility layout design.

INTRODUCTION

A workflow consists of a sequence of associated steps. It is a depiction of a succession of operations, acknowledged as work of a person, a group of persons. Workflow may be seen as any abstraction of real work. For control purposes, workflow may be a sight on real work under a chosen aspect, serving as a virtual representation of actual work. The flow being described may refer to a document or product that is being transferred from one stair to another. A workflow is a model to represent actual work for additional assessment, e.g., for relating a consistently repeatable progression of operations. More abstractly, a workflow is a pattern of activity enabled by a systematic organization of resources, defined roles and mass, energy and information flows, into a work process that can be documented and learned. Workflows are designed to achieve processing intents of some sort, such as physical transformation, service provision, or information processing.

Lean manufacturing, lean enterprise or lean production often simply "Lean" is a production practice that considers the disbursement of resources for any goal other than the creation of value for the end customer to be wasteful, and thus an intention for elimination. Working from the perception of the customer who consumes a product or service "value" is defined as any action or process that a customer would be prepared to pay for. Lean is centered on preserving value with fewer jobs.

While the elimination of waste may seem like a simple and clear subject it is noticeable that waste is often very conservatively identified. This then hugely reduces the potential of such an aim. The elimination of waste is the goal of Lean. The ever finer clarification of waste is key to establishing distinctions between value-adding activity, waste and non-value-adding work. Non-value adding work is waste that must be done under the present work conditions. One key is to measure, or estimate, the size of these wastes, to demonstrate the effect of the changes achieved and therefore the movement toward the goal.

The original seven wastes are:

- Transport (moving products that are not actually required to perform the processing)
- Inventory (all components, work in process and finished product not being processed)
- Motion (people or equipment moving or walking more than is required to perform the processing)
- Waiting (waiting for the next production step)
- Overproduction (production ahead of demand)
- Over Processing (resulting from poor tool or product design creating activity)

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- Defects (the effort involved in inspecting for and fixing defects

Lean manufacturing is a variation on the theme of efficiency based on optimizing flow. It is a present-day instance of the recurring theme in human history toward increasing efficiency, decreasing waste and using empirical methods to decide what matters rather than uncritically accepting pre-existing ideas. The goal of Lean then becomes the creation and maintenance of a production system which runs repetitively, day after day, week after week in a manner identical to the previous time period.

Value stream mapping is a lean manufacturing technique used to analyze and design the flow of materials and information required to bring a product or service to a consumer. At Toyota, where the technique originated it is known as "material and information flow mapping". It can be applied to nearly any value chain.

Implementation of value stream mapping is done by first Identifying the target product, product family or service. On the shop floor a current state value stream map, which shows the current steps, delays, and information flows required to deliver the target product or service is drawn. This may be a production flow (raw materials to consumer) or a design flow (concept to launch). There are standard symbols for representing supply chain entities. Assess the current state value stream map in terms of creating flow by eliminating waste. Draw a future state value stream map. Work toward the future state condition.

ANALYSIS OF WORK FLOW

Existing Work Flow

The company manufactures products with high degree of customization in complete knock down (CKD) format. In the existing system to produce a required quantity of CKD product, each of the components required for the product are processed in shop floor as a batch and kept as Work In Progress Inventory. The components are loaded and sent to the paint shop. In the paint shop, the pre-processing is done and ordered color coat is given.

The processed components are unloaded and kept in trolleys. The packaging process starts only after all the components required for the entire lot of products is painted. All the components required a product taken from the WIP inventory kept in trolleys and moved to packing machine manually. Sub assembly for certain components is done. The cartons required for the CKD set are taken from packaging materials inventory and kept in packaging floor. Finally the components of the CKD are kept in carton, sealed and sent to finished goods inventory. This process is repeated for entire batch of products.

The work flow based on the activities is mapped as shown in the above figure. Single headed arrows represent one directional flow and double headed arrows represent to and fro movement between the activities.

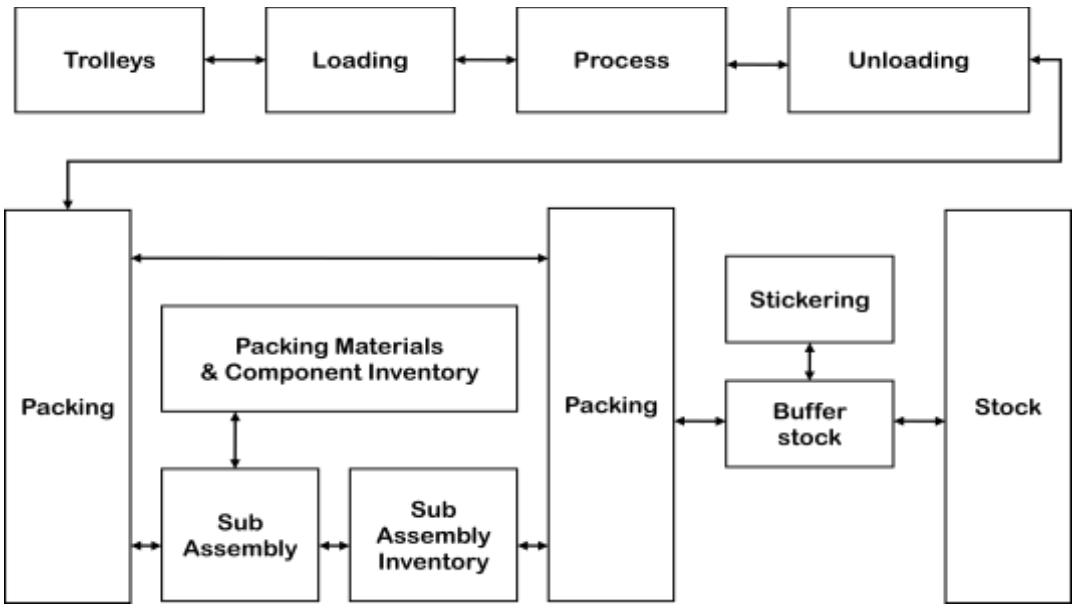

Figure 1: Existing Work Flow

Analysis

Various products are manufactured in the industry. The products are highly flexible and their color can be customized based upon the customer order. 4DFCM-four draw filing cabinet is chosen for the analysis because

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it is the most run Product in the industry and has maximum number of sub assemblies so optimizing it will level out the work flow for other products also.

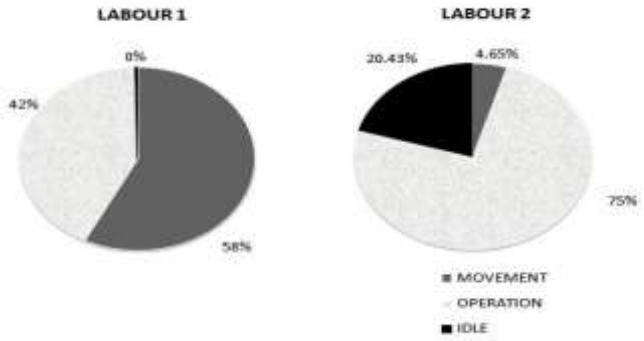

Figure 2: Packing Time Analysis

The activities involved from loading to dispatch of the product comprising loading, processing, unloading, sub assembly and packing are tabulated. Packing time analysis and operator fatigue analysis are carried out using the data tabulated.

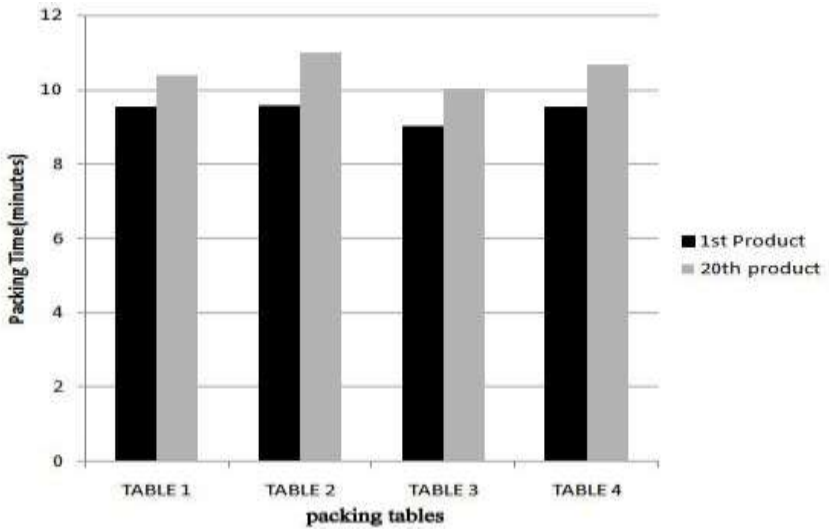

Figure 3: Packing Time Analysis

Value Stream Mapping

The value stream map of the present work flow is made and shown in the fig. below. Value map for batch of hundred 4DFCM products is made. The value stream is taken for loading of the components in the paint shop to dispatch of the product. The value and non value adding activities are separated and consolidated and their total time is calculated.

Value adding time is 1625 minutes and Non value adding time is 435 minutes. Variation occurs at loading causes Delay in packing. Variability in loading conditions affects work pace. Paint shop is not utilized at its maximum. There is a Inconsistency in cycle times. Parallel functioning in the packing area not possible. Movement and idle time is more. Excess work force needed. Large volume of work in progress (WIP) inventory lying in shop floor consumes lot of work space.

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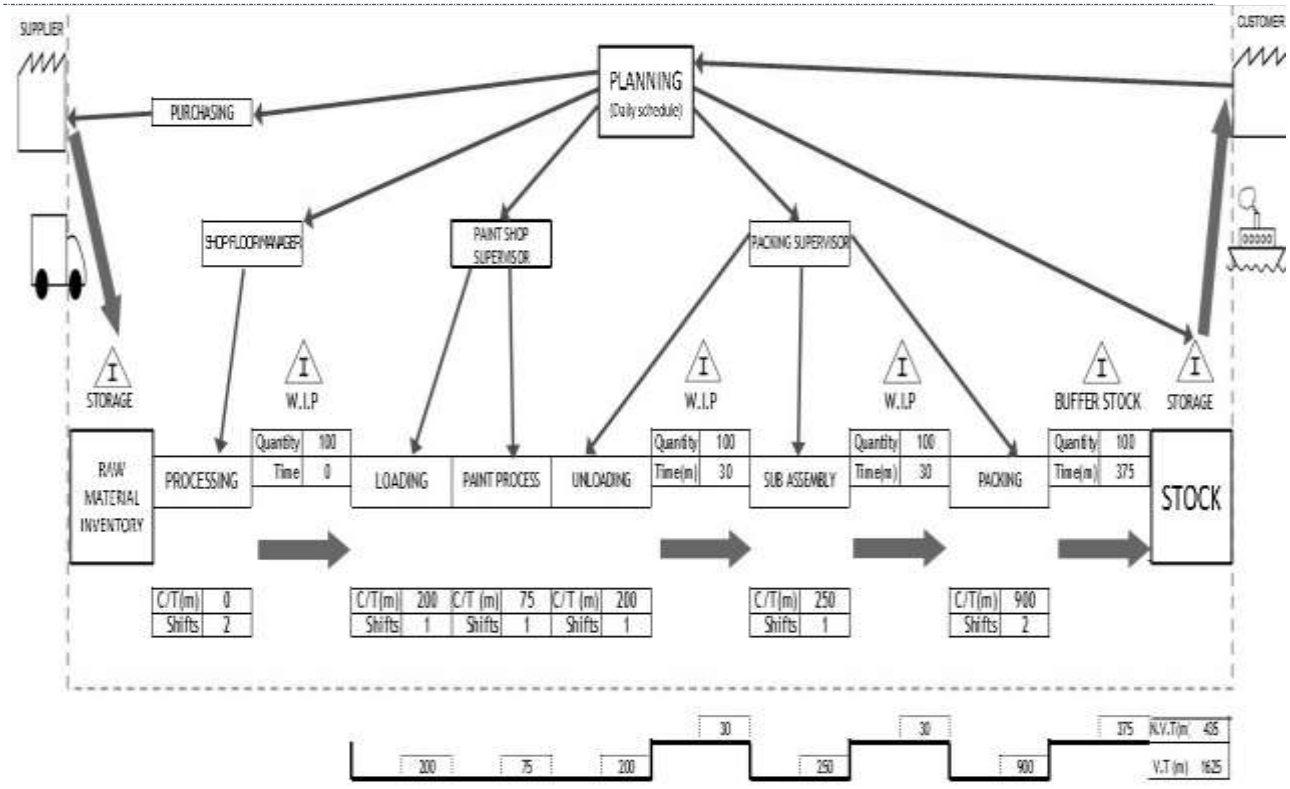

Figure 4: Present Value Stream Map

RESULT AND DISCUSSION

Redisgned work flow

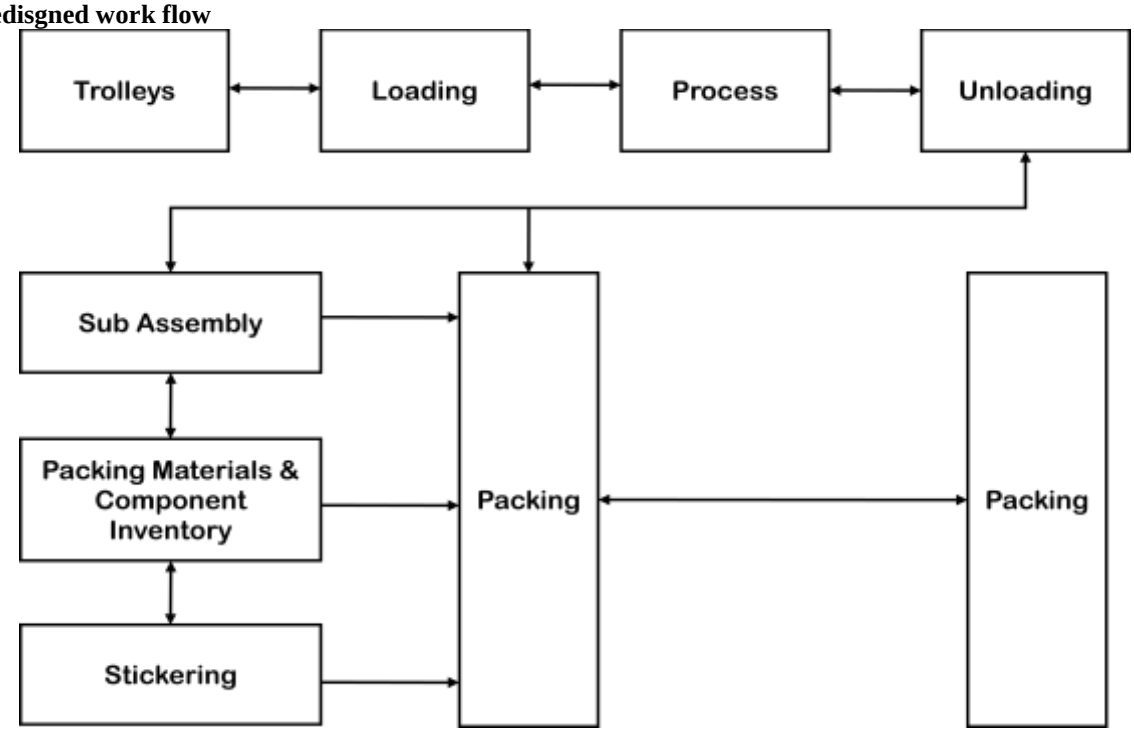

Figure 5: Proposed Work Flow

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Methodology

The identified wastes in the current work flow are idle time during packing, excess movement and Excess W.I.P The present work flow is in a stochastic manner i.e. the component's loading sequence in the paint shop conveyor varies depending on the availability. In order to eliminate the wastes and achieve the objective the flow has to be converted in to a Deterministic manner. The proposed work flow can be achieved by certain methodologies. The constraints for developing the model are also indentified and stated. The methodologies for implementing the projected work flow are set loading-in loading section and Online packing-in packing section.

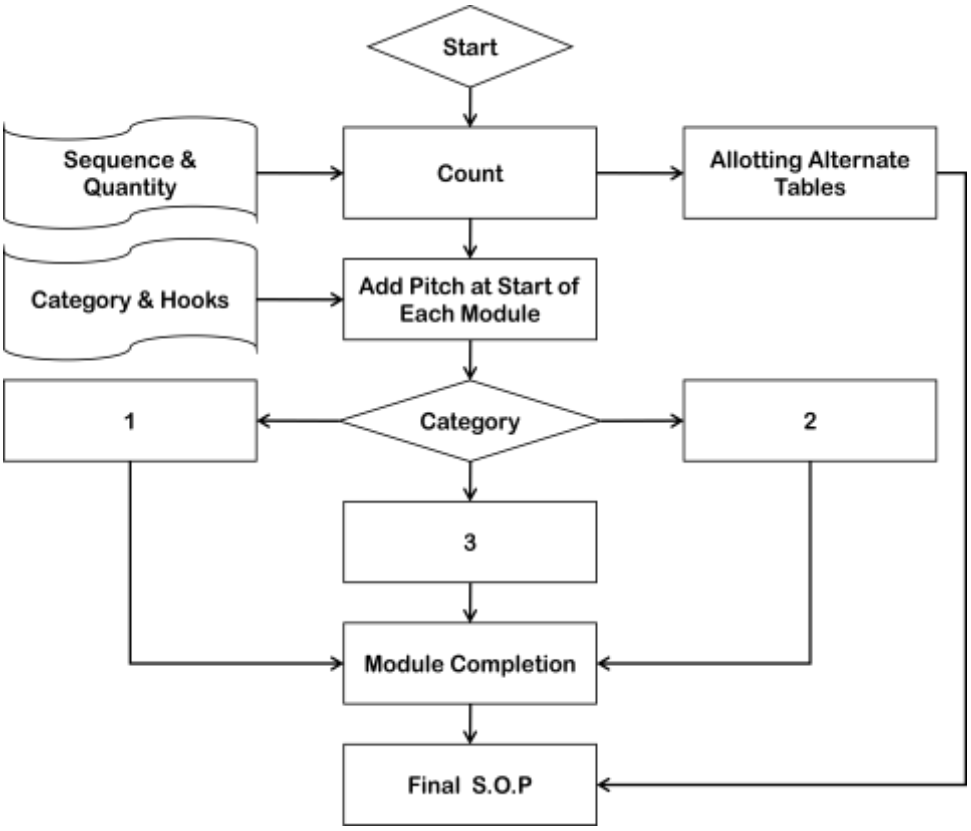

Figure 6: Redesigned Work Flow Process Chart

Set loading

The variables are chosen based upon the following conditions. The number of sets has been chosen as two as the possibility of handling number of sets in the packing area has been identified as two. The number of loading tables is chosen as two as there are two sets and limited space availability for more than two loading tables. The packing sequence is constant. It is predetermined to match with the packing standards. The loading sequence is done to match with the packing sequence. According to height the components they are segregated into three categories.

In the first category one single component can be hanged in the conveyor. In the second category two pieces of similar component can be hanged in the conveyor without any hindrance. In the third category three pieces of similar component can be hanged in the conveyor without any hindrance. Similarly according to the width of the component the number of hooks required is specified.

The non value activities stated in the present value stream map are eliminated through lean approach and proposed work flow is drawn. This work flow can be achieved by modifying the activities in loading and packing using lean tools.

Standard Operating Procedure (S.O.P) is developed in the following steps. The sequence and number of components required for two sets is formulated. The components are categorized based and the height and the number of hooks based on the width also specified. These two are collaborated to get a S.O.P.

The product 4DFCM four draw filing cabinets taken for present state analysis are also taken here for developing the S.O.P. Similarly S.O.P for major products is developed. The next step would be designing the facility for online packing and line balancing.

Online packing

The set of components coming in conveyor after processing is packed in a synchronous manner so that Cycle time is reduced, WIP inventory is reduced, Human fatigue due to excess movement is reduced and Mismatch of components is reduced. The Constrains for implementing online packing are Number of packing tables, Available space, Available time and Subassembly activities.

CONCLUSION

The wastes in the present work flow are identified using lean tool of value stream mapping. The waste reduction methodologies are formulated. Thus the necessary changes can be implemented for the profitable existence and increased customer delight.

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