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ADAPTATION OF JIT PHYLOSOPHY AND KANBAN TECHNIQUE TO A SMALL-SIZED MANUFACTURING FIRM; A PROJECT MANAGEMENT APPROACH

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ABSTRACT

In this study, a project management approach is used, in order to implement some elements of the Just-In-Time philosophy to a small-sized manufacturing firm. The objective of this applied research was to overcome some of the problems that most of small firms are facing when implementing JIT, such problems are : lack of materials and human resources, high employees turnover, lack of influence over suppliers, etc. In order to overcome those obstacles, a project management approach was used. As a result of this project, productivity and quality went up, and lead time went down from six to less then two months.

KEYWORDS:

JIT, Kanban, Production management, Project management

INTRODUCTION

In the competitive world markets today, manufacturing firms are conscious that survival is predicated upon a commitment towards continual process and product improvement. JIT philosophy can assist companies in this regard (and Mejabi and Wasserman, 1992). Successful JIT implementation can be accomplished by organizations implementing the following eight basic elements : focused factory, group technology, reduced set-up times, total preventive maintenance, cross-trained employees, uniform work load, JIT delivery of purchased parts and Kanban, (Nellemann and Smith, 1982). Quality is considered implicitly. Earlier works have shown that small-sized manufacturing firm have difficulties implementing all JIT elements due to their small-size : less than hundred employees, less than 5 million dollars sales per year, owned and managed by one or two partners, etc. Temponi and Pandya (1995) acknowledge that small manufacturing firms may not hold sufficient influence over suppliers and they lack resources to make required changes in plant layout, set-up time reduction, cross-training for employees that may quit for better wage elsewhere, etc. In other words, small companies cannot afford JIT due to high up-front costs and to the fact that a JIT implementation program has to be harvested over an extended period of time. So a complete analysis of each JIT element should be done in order to find a way to adopt to the firm situation. This paper discusses the strategy used to adapt the JIT elements to the reality of a small manufacturing firm.

SYSTEM DESCRIPTION

The company under study produces a variety of numerically controlled bagging machines for loose materials like peat moss, wood shavings, ashes, etc. Their best selling model necessitates about 1200 different parts to be assembled. Most of the parts are made within the company which also produces custom machines to meet any particular needs. Lately, new competitors have entered the market. The company has to adopt a continuous improvement strategy in order to become a world class manufacturer and to face the coming competition.

The company has the following characteristics which are common to many small businesses:

1. make to order policy for a highly variable and almost unpredictable demand for their products;
2. high shop floor employees turnover, results of hiring and firing policy and minimum wage salary;
3. sales less than four millions dollars a year;
4. less than fifty employees in high season and twenty in low season;
5. lack of internal resources, especially in production management.

Facing these problems, employees cross-training, formation and auto-control in quality and TPM policy were not affordable for the firm. To overcome the problem, it was decided to divide the product into nine subsystems. Each subsystem has its own bill of materials and routing file. A CPM called SSCPM, was developed for each subsystem were each step of the production flow was represented by an activity on the SSCPM.

PROPOSED STRATEGY

The strategy presented here tries to do two things. First, it gives the entreprise a new structure for its products which is simple and flexible to work with. Second, a production planning method based on a project management approach that will keep the number of projects at a manageable level. The steps of the strategy are as follow:

1. Standardization and Use of CAD system at the design step and
2. Products Modular B.O.M.(bill of materials)
3. CPM representing tasks and parts routing: Main and Subsystems CPM
4. Motion and Time Study, and Plant Layout
5. Production Planning strategy: CONWIP
6. Implementation

Standardization and use of CAD system

A parts and subsystems standardization project was done in order to reduce the inventory level especially on the shop floor (WIP) and also to establish a reliable system of part codification and traceability.

Drawings of machine's components were not available. Parts were copied from a machine on the shop floor in its finishing stage when no drawings are available. Also, this situation caused a lot of trouble when a customer needed a replacement part for a machine.. So CAD workstations were implemented and all machine's parts were coded and a drawing of each was saved, including dimensions and tolerances.

Bill of Materials

Here, a modular BOM was proposed. Each machine was divided into 9 modules. A module represents important and independent subsystem of the machine. This structure allows the design engineer to add options when required by a given customer to its respective BOM. The BOM for the assembly calls each subsystem. The main BOM of the bagging machine calls for the hydraulic system, the electrical system, the press subassembly, the automatic bag placement (option), ... , as illustrated by Figure 1. Some subsystems are common to many types of products.

Critical Path Method

Each subsystem was divided into projects. Around 60 projects represented the important assembly activities on a bagging machine. These projects were placed on a CPM network. The critical activities were identified based on activities' time collected. Critical path of each SSCPM was found. A foreman has the responsibility of controlling the completion of the activities of a given

SSCPM. The nine SSCPM represented the nine activities on the main CPM (MCPM), Figure 2, which was controlled by the coordinator of the project, the production manager.

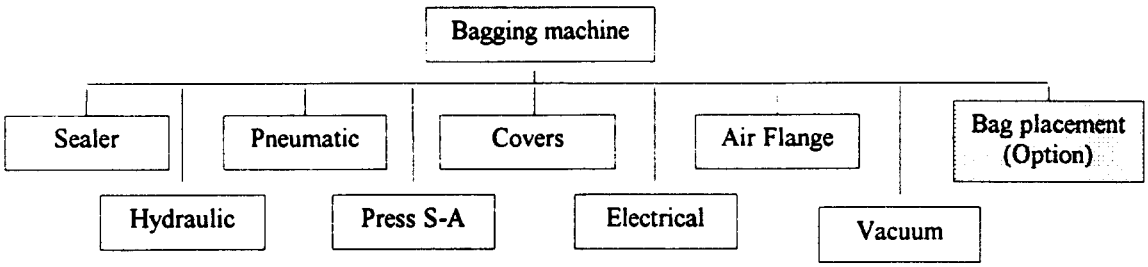

Fig. 1 Main Bill of Material (First level).

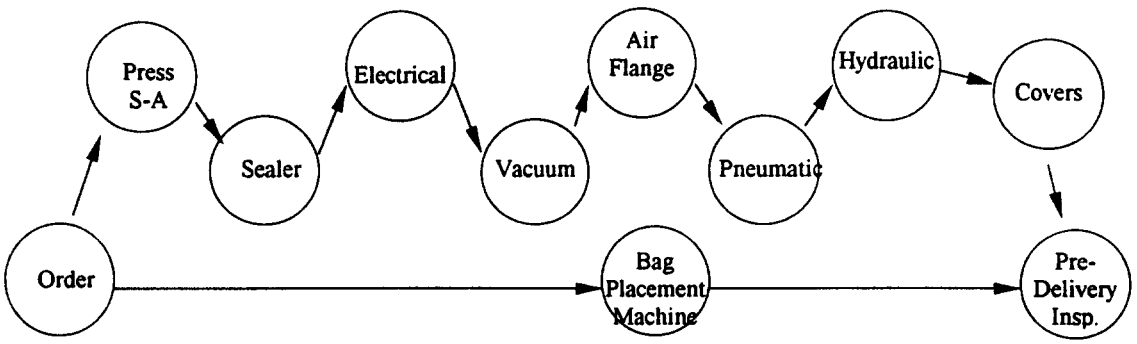

Fig. 2 Main CPM.

Time study and Plant layout

At first, we suggested a complete time study for every part but it was found unrealistic because of the time, cost and the lack of employees cooperation. To get a good estimate of times, only the major projects were evaluated with a travel sheet. Those times give a better idea of the time required to complete a project, and help establishing lead time for a machine assembly and determining critical activities.

On the existing layout, welders were working right next to the paint-shop area. Also, some machines were located in hard to reach places. The plant layout was modified to improve circulation of product, reduce the distance traveled in a day by workers and to address the concern with the paint area for security reason. The new layout also defined zones for the WIP to improve visibility of the inventory and the time needed to find a part.

Production planning: CONWIP

The proposed production planning uses a kanban for each projects. When an order arrives, the assembly department pulls the work from the other departments using kanbans. The work within departments is pushed as usual. The kanban becomes the work order for the supervisor in charge of a department. Figure 3 shows the circulation of the subassemblies and the kanbans. Nine Kanbans where designed to pull the production from the nine SSCPM to the main CPM (the assembly area). Foremen were highly trained. This way of doing enables the firm to overcome the employee turnover problem, in the sense that attention was given to the critical activities in each CPM (SSCPM and MCPM).

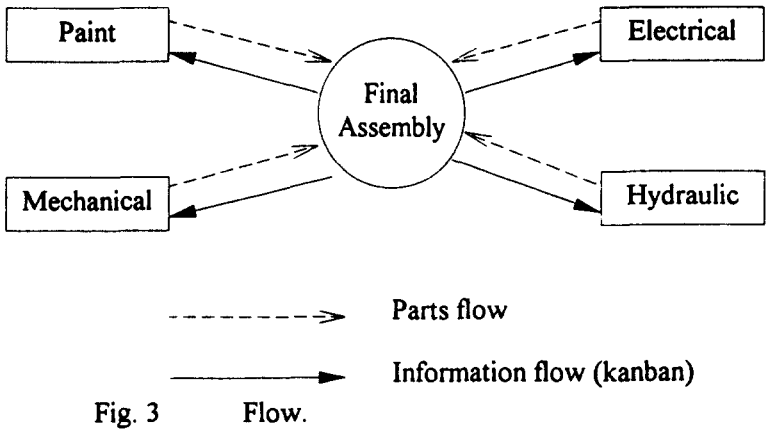

Fig. 3 Flow.

Implementation

This strategy is a first step toward JIT. Actually, only part of the major projects are controlled using kanbans or pull system. This process will be generalized and applied to each department progressively. CPMs were treated and controlled using Microsoft Project software in order to produce a Gantt chart to be used as a template file. Now, each new order starts by creating a new project file. Then, the planner can follow each project. Most importantly, he knows which task is critical for an on-time delivery. He will be able to make sound decisions on where he should assign more workers and update completion time estimate if needed.

CONCLUSIONS AND RECOMMENDATIONS

The most important results of this project were the cut of the lead time from six to less than two months, this was done by controlling critical activities, and the stabilization of the manpower at the level of foremen and production manager. To further improve the company performance, the foremen and new employees should be well cross-trained. Also, a step by step mid-term improvement strategy should be used. Furthermore, efforts should be done in the following areas: ISO-9000 certification, continuous improvement program, SMED, Kaizen and process reengineering.

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