

Discuss the Lean Countermeasures of Commercial Aircraft Production Project Management

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Abstract: The process of the management of commercial aircraft production project is very complicated. Compared with other operations of products' production, commercial aircraft production operations have their own special features. For example, commercial aircraft production and its assembly operations are generally planned production according to customer orders. Besides, production management is mainly based on sorties, in which a large amount of tooling manufacturing support and mutual cooperation are required in the process of the management of production project. The quality requirements are the most stringent in all product production, and the entire commercial aircraft production project management process involves a lot of departments. Although China's commercial aircraft production technology is relatively mature, due to its extremely complex management process, various issues are created inevitably. In this study, author would analyze the demands of commercial aircraft production project management from many aspects, which aims to explore the management plan of lean commercial aircraft production project, thus to promotes the improvement of China's commercial aircraft management level.

1. Introduction

With the rapid development of industry and information technology, the production cycle of commercial aircraft continues to shorten, and the needs of customer are increasingly personalized. In order to maintain market competitive advantages and meet market demands for small batches and multiple models, companies begin to transform to the method of lean production, which urgently need to adopt advanced management methods to improve product quality and reduce costs. As a new modern way of management, lean management has been widely applied in the field of commercial aircraft. However, caused by the insufficient integration of lean management concepts and tools with the aviation industry, there is a large discrepancy between expected goals and actual results. This situation is particularly evident in the cost control of commercial aircraft production projects [1]. For instance, the WBS work breakdown package in the commercial aircraft production plan is not closely integrated with the product configuration information based on M-BOM, which leads to delays in the actual production process and increased costs. Moreover, the project adopts a single-factor control method that results in damage to the production process and insufficient performance guidance, and so on, which urgently require to be further processed and improved.

2. Summary of Lean Management Concept

In lean management, lean can be divided into two meanings including fine and benefit. In this respect, fine represents for perfect, thorough, and high-quality, while benefit has the dual meaning of increasing profits and striving for perfection. This concept was first applied to the first line of commercial aircraft production and generated benefits, and then gradually extended to the upstream, which affected the commercial aircraft enterprise design department, upper management department, and even the supply chain environment of the market of upstream and downstream, thus achieving continuous circulation and development, and finally forming a complete optimization reform process.

According to various current production management standards and regulatory requirements of commercial aircraft manufacturers, lean production project management needs to emphasize organizational management structure, equipment maintenance and inspection management module, personnel management and production training, the construction of production knowledge base and a series of unit contents. Accordingly, it is necessary to divide the production projects, form lean management modules for different production projects, and carry out corresponding management in a targeted manner, so as to maximize the effectiveness and economy of the commercial aircraft production process.

3. The Analysis of Lean Management Requirements for Commercial Aircraft Production Projects

(1) Follow the idea of people-oriented and fully mobilize people's enthusiasm. Lean management has changed from the traditional material-centered management to a "people-centered" management on the contrary, realizing people-oriented business management of commercial aircraft, which is a leap in the understanding of corporate management. First, we must produce high-quality, low-cost commercial aircraft products for customers, and second, we must create comfortable working conditions and environments for employees of commercial aircraft companies.

(2) Customer-centered, this is the cornerstone of lean management. Lean production is center on customers. It focuses on seeking and maintaining a long-term and stable cooperative relationship, and puts long-term benefits first. On the other side, lean management can meet the diversified requirements of the commercial aircraft production market. Produce what is needed, and produce as much as needed, which has effectively improved the economics of commercial aircraft production projects.

(3) The production process implements just-in-time production. Traditional commercial aircraft production management adopts a pushing system, which dynamically collects information and issues production instructions through each production node to schedule production activities, and lead to a relatively low efficiency of production project management. By contrast, lean production uses a pulling system, the core of which is JIT (Just In Time), namely, the required parts and products are produced in the required quantity, which effectively promotes the management effect of commercial aircraft production projects.

(4) High efficiency of production management tools. With the improvement of modern science and technology, commercial aircraft production equipment has also been greatly developed while the level of automated production has been obviously improved. In addition, modern production management theories characterized by informatization and networking are also widely employed [2]. The application of ERP ideas has effectively solved the complex management problems of the production process of commercial aircraft enterprises. This tool is able to organize manufacturing resources around materials, costs, and aims to achieve on-demand production on time. Through the planning of product production time and quantity, the input and output time and quantity of required parts are deduced conversely according to the reverse process sequence, and then the required time to produce the products that are need, the number of parts are determined, which greatly reduces waste of the cost of the commercial aircraft production process, and it is an indispensable key part in lean management.

4. The Development of Lean Management for Commercial Aircraft Production Project

4.1 The reform of the management model

In the process of lean production management of commercial aircraft, it is necessary to grasp multiple goals including construction period, cost and quality, formulate detailed schedule control plan, cost control plan and quality assurance plan before project operation, and adopt different control tools to control their respective goal, which are presented as follows:

(1) Product configuration information in M-BOM. It contains various information in the stage of

product manufacturing, such as the hierarchical structure of product parts, the routes of process and craft, material quotas, working hours quotas, and so on;

(2) Project support tools and technology. Lean production project management system requires specific project tools and technologies to support, such as the technology with the combination of OBS and WBS. Besides, it can establish a responsibility distribution matrix based on product configuration information;

(3) Implementation of lean production management. The core of lean production project management is the hierarchical network integration schedule. Its characteristic is to integrate the traditional schedule, cost and quality plan information into the integrated schedule as much as possible, and then regard it as a single control baseline plan to carry out multiple target monitoring of the projects.

4.2 The optimization of production organization

Different from modular production unit in the traditional sense, the work cell as the primitive of lean production organization not only has the modular characteristics of the group of production unit hardware, but also integrates the process knowledge that is related to the processing nature of the work cell, technology, operators with the materials and logistics control of work cell together, then occupies a certain space and becomes the basic production element of lean production organization, which can further constitute the production line and even the production unit. Such elements are lean teams that have a self-metabolism which is similar to cells, and that is the reason why they are called work cells [3].

With the support of work cell's metadata, the production process of enterprises can be expressed according to work cell, and the process is formed by several working cells through serial, parallel, and failure processing. In addition, the execution of the technological process depends on the successive activation of the work cell objects. The time between activation and deactivation is the actual running time of the work cell. The production plan is issued based on the project management method, and the project mileage is expressed in the work time of work cell, which greatly simplifies the difficulty of production planning and scheduling. For the tasks of work cell, the internal work arrangement of the work cell can be solved by itself on the basis of the effective operation team. The process knowledge and operation skills related to the work cell can also be retrieved through the production cell data center, which stores information of all work cell from units, which includes its process knowledge, and so on. The process knowledge is jointly maintained by the work cell team and the process management department.

4.3 Modern management system

When carrying out the lean production management of commercial aircraft, we must pay attention to the informatization of the system, namely, the digitalization of production management and the informatization of processes. In the process of informatization management of commercial aircraft manufacturers, there are many single application systems, of which PDM/PLM, ERP, MES, CAD/CAM/CAPP, SCM, CRM and OA are relatively important.

Among them, PDM/PLM focuses on the informatization of the product development process, and has good support for product design, process design, maintenance design and related simulation. On the other side, ERP is mainly for human, property, production, supply and marketing, and has good support for resource management and financial processes. Then, for the intermediate manufacturing links, MES is mainly at work. However, due to the vast differences in manufacturing production processes and different enterprises with their own characteristics, MES is difficult to form a unified market-oriented product. After implementation, many MESs differ greatly from the demands of enterprises and cannot satisfy the real needs of enterprises. Commercial aircraft design mainly adopts CAD/CAM/CAE software of CATIA, and CAPP partly uses domestic independent software, such as Golden Leaf CAPP, and so on. The product development process also chooses PDM software, but basically no PLM is adopted in the whole process. According to the concept of PLM and the functions it realizes, PLM greatly expands the original functions of PDM, and essentially provides a collaborative work platform [4].

For this reason, in the process of informatization production project management, the above tools can be rationally used in combination with the actual situation to achieve logically related multiple product data support in the digital management environment, and comprehensively enhance the core competitiveness of commercial aircraft manufacturers.

4. Summary

Lean management is a kind of management concept which is people-oriented, customer-centered, pursuing labor efficiency, implementing just-in-time production, and pursuing perfection. The theoretical framework and connotation of this concept are closely related to commercial aircraft enterprise production project management, and can effectively improve the economic and scientific nature of commercial aircraft production management. Firstly, for commercial aircraft manufacturers, their lean production project management should emphasize two aspects of organization construction and information management, namely, lean production organization and intelligent integration of management models. Secondly, for the environment of production cell, the concept of lean modularity ought to be established while the lean group thought and the modular thought integrate together, and the process optimization and reorganization will be realized by setting the work cell group into a production line. Lastly, for the information environment, a flexible information system is suggested to be established. It uses a single data source to realize collaborative manufacturing, and lays a data foundation for process optimization, thus to promote the sustainable development of commercial aircraft manufacturers.

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