The Model of Planning and Control Based on Networked Production

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Abstract: This paper analyzed the influence of knowledge economy on manufacturing, put forward the running pattern of network-union enterprises; and then put forward a planning and control frame model based on networking production, discussed the characteristic of this model emphatically. The frame model might be taken as the reference of operation under the networked environment of production.

Key words: Networked alliance, Networked production, Production planning and control

1 Introduction

In 21 century, the human society is entering into the epoch of knowledge economy, which’s character is to occupy, configure, produce, allocate and consume the high technology knowledge resource. The following is the influence made to manufacturing by knowledge economy: 1) the transform of production and consume idea; 2) the digitization, intelligentization and distributed-networking of the production design and manufacture process; 3) the globalization and virtualization of the operation and produce activity. Therefore, the enterprise has to keep the competition advantage with adaptability to business environment, creativity and agility. Networked production is a new production model, it utilizes the modern communication technique, quickly configures different resource to realize the agility of manufacture and respond to client requirement in a valid concerted way. Since Professor Zhang Shu put forward the AMI (Automatic Manufacture Island), there are many researches on networked-production inside a single enterprise and among many enterprises in home. These researches almost focused on modeling measure of networked-production system, the construct of information support system and organize regulation; but there is little research on affect to production management model, especially in production planning and control (PPC). So, it’s very important to perfect the operation of networked production and improve the running efficiency of networked alliance by research on planning and control model of networked-production.

2 The running model of networked alliance

Networked alliance is one of organization forms of networked-production and one of key technologies to realize the networked-production. In networked-alliance, the information integration and share provided by network dissevered the “pyramid” organize structure and centralized production planning and control model of traditional manufacturing, compelled the enterprise to reduce the portrait management layer and enlarge transverse combine, and made its organize structure distributed and oblate. All kinds of collaboration between manufacture units or distributed manufacturing faced to produce projects replaced the traditional structure, and networked-alliance extensively integrated the manufacture resource and core competition advantage of different dispersed autonomic manufacture entities to realize the production development and design based on Internet/Intranet, and achieve multi mission different place coordination, perform the heterochthonous synergistic and collaborative production among manufacturing enterprises in project teams.

With engendering the market opportunity and customer customization orders, networked-alliance is
emerged. According to the guidance of the agile manufacture theory, networked-alliance adopts the standard and professional intranet, extranet and information integration common network platform and connects every federal enterprise to compose the networked-production system with distributed network structure. The core enterprise dynamically and mutual-benefitly selects partner enterprises depending on the rule of win-win and contract-net and buildup the virtual enterprise faced the order mission to promptly produce. The running model of networked-alliance enterprises is as the following fig 1.

At first, the chief enterprise that has captured the market opportunity or received the customer customization orders depending on its core competition advantage decompose the production mission into a series of production subtask, which is required by the concerted project time limit, quality and cost etc. These subtasks are promulgated in the tender invitation and bidding contract-net mechanism, and the potential partner enterprises, according to the special requirement and self manufacture resource and capability, confirm the subtask which can be bided and the key factors such as the production lead time and cost. Then according to the indispensable information, the chief enterprises selects the leaguer enterprise in charge of the specified task and consult with them to make the detailed production process schedule plan. Furthermore, the chief enterprise makes sure of the purchase planning of the out purchased components of the production task and selects the suitable supplier; finally the chief enterprise gathers the detailed produce schedule of every subtask and purchase planning of material and out-purchased component, tracks and controls the schedule of production and purchase. Networked alliance can make quick early warning on abnormal event and take corresponding controlling measures to make real-time dynamic dispatch on production schedule.

3 The planning and control model of networked production
3.1 Networked production and their characteristics

According to the theory of agile manufacture, networked production is a new model, which can build
agile valid and reciprocitarian dynamic enterprise alliance to effectively perform the recombination of research, design, production and sale resource and improve the agility and competition capability of enterprise. The goal of networked-production is to utilize the present manufacture resource on different districts and promptly assemble them into a business entity, which is unitiveely superintended with connected by electronic means and beyond the limit of space-time and can fast provide new products with high quality, low cost and short deliver time. The features of networked production are as following:

1) Networking. The information of networked alliance is most transferred and shared by network (Internet/Intranet/Extranet) to perform agile response;

2) Face to customer requirement. Networked-production is motivated by customer requirement and is to prompt meet their needs;

3) Agility. Networked alliance, which can realize the networked production is full of highly opening, adjustability and reconstruction of scale, breaks through the restriction with enterprise’s development exerted by inflexible organization form in traditional production manner and enhances the agility of responding to market;

4) Integration. Networked production not only emphasizes to carry out inside business process reengineering by BPR in order to perform the inside resource integration, but also involves the information flow, material flow and work flow integration among collaborative partners. Networked alliance integrates the design resource, intelligence resource and manufactures resource in different districts and manufacture units by computer net to synergistically operate;

5) Optimization. By utilizing the one-up technologies of collaborative partners, networked alliance performs the optimization of information utilization and optimizes the design, intelligence and manufacture resource among enterprises in order to attain advantage mutual complement and the whole optimization.
3.2 The planning and control model of networked production

Networked production planning and control system structure is composed of organization model, physical structure and logic structure, and its none-local production planning scheduling and control is the management decision problem on tactics layer on production management. The managed objects are stressed on the planning and scheduling of material flow and information flow among each leaguer enterprise. This paper put forward the planning and control model of networked production based on the above analysis, which is followed as fig 2.

With the kernel of manufacture, the core enterprise of the networked alliance firstly receives and analyses the customer order, then decomposes the production customization order by organizing expert system, sets down the production item scheduling, and according to the order deliver time carry out producing among many manufacture enterprises, which prime target is to accomplish the production task under the requirement of prescript deliver time and quality. Afterwards, networked alliance gather the detailed sub-item production schedule, track and control the production schedule, immediately handle the production schedule conflict by negotiating among the leaguer enterprises, make fast early warning on abnormal events and carry out corresponding control measures.

4 The characterization of networked production planning and control

Because the networked production is full of the characters such as dispersedness, integration and autonomy, and it’s production system is complicatedly constituted, the networked production planning and control model is sure to be obviously different from the traditional production planning and control and the model have the following characters.

4.1 Sufficiently utilize the external resource of enterprise

Under the networked production environment, the scope of resource extends into the whole society, so the networked production planning and control model should more openly consider the manufacture resource and look the potential partner enterprises in the whole society as the peripheral organization resource of enterprise or networked alliance. In this model, there are two-decision analysis and optimization selection on utilizing resource. The first one is that during the procedure of scheduling production item planning, the model analyze and decompose the production items, and select the collaborative enterprises for optimization; the second is that after generating the MRP (material requirement planning), the model carry out cost and capability analysis, and carry out the optimization selection of enterprise for external contract engineering. Of course, the model should also carry out the optimization selection for supplier. At the angle of economy, this model strives toward optimizing the
configuration of the whole resource during the networked production.

4.2 Integrated and optimized production planning

Under the networked production environment, when it sets down the production planning, the enterprise consider not only the capability and benefit of its owns, but also the requirement and profit of other collaborative enterprise. Hence, when making plan, this model should synthetically consider the constraint conditions such as manufacture capability, production schedule, material balance and storage capability of the single enterprise and collaborative enterprises, integrate the production schedule of collaborative enterprise and procurement program of suppliers and carry out the optimization configuration of resource in order to seek the optimized production planning.

4.3 Track mechanism facing to process

The traditional management model faces to object and performs the object management; but under the networked production environment, the enterprise is in a fast mutative customization market, and the customization orders received are almost none repetitive items. Furthermore, networked production involves many collaborative enterprises and includes many indefinite factors. So this model does its best to manage the whole process of production item, set up the track-control mechanism facing to process, realize the data collect facing to process. By tracking every production plan, gathering the dynamic datum, monitoring the dispersed networked production environment and carrying out capability trend analysis, resource utilize evaluation and bottleneck task analysis, this model provides the real-time information and analysis report for item management and planning compilation in order to realize the real-time task deployment and control.

4.4 Dynamically negotiation mechanism

During the networked production, the leaguer enterprises and the manufacture resource are dispersed in different areas, so the traditional centralized control model can easily turn into the bottleneck of networked production, and can’t apply with the market and requirement variation. At the same time, in the networked alliance, every leaguer enterprise has the character of dispersal and autonomy, so their autonomic activity must lead to contradiction and conflict. Hence, this model provides a certain negotiation mechanism to make the leaguer enterprises keep independent operation in one hand and join in the simultaneous operation system of networked production in other hand, as can keep independence and negotiation accordant.

5 Conclusions

Under the networked production environment, manufacture enterprise must change the traditional production planning and control means, and transfer the basic management manner of traditional manufacture which’s main goal is to optimize the internal resource of enterprise to networked production planning and control model facing to the whole society resource. This paper analyses the running model of networked alliance enterprises and then puts forward the networked production planning and control model, which’s main characters are analyzed. This model can further perfect the theory and practical system of networked production, but the concrete running mechanism need to be further research.
References


