

Design of Production Management System in ERP of Coal Chemical Industry

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A set of ERP production management system is to be designed for coal chemical enterprises. With the coal chemical enterprise A as an example, it will be designed according to the actual needs of the enterprise A. After the application of ERP management system, the enterprise A is able to comprehensively manage and handle multiple production plans, master real-time production schedule and query production quality and cost, achieving remarkable results. The design of ERP production management system is important to the fine development of coal chemical industry and can effectively improve the internal management level of coal chemical enterprises.

1. Introduction

The popularization and spreading of computer technology and network technology have made the 21st century become the era of network technology, and computer systems and software also have increasingly higher capability of integration, so as to form a high-speed information network that connects with each other, marking the arrival and improvement of the information age. Information technology has been applied in all fields of coal chemical industry worldwide, such as operation, management, production and so on, which has become a key technology of chemical enterprises. In the information service industry, the information construction of coal chemical industry has always received much attention, and from the "6th Five-year Plan", the government has been investing in the information construction of coal chemical enterprises. Since the 1990s, the information industry of coal chemical industry and the coal chemical industry enterprises are actively responding to the trend of informatization of national economy, and constructing the information service system and information network system of chemical industry in a planned and systematic way.

ERP is the abbreviation of enterprise resource planning, which can integrate various information of the enterprise, including capital flow, information flow, resource flow, etc., and then implement integration and management. ERP is an advanced technique and management method, which has been applied in many industries and has received good benefits. In addition to economic benefits, it can also improve the internal management level of enterprises. The ERP of coal chemical enterprises includes production management system, financial system and logistics system, of which the most important is the production management system, and the production management system must reflect the characteristics of coal chemical enterprises, which cannot be designed by reference to the enterprise industry. Therefore, this paper takes the coal chemical enterprise A as an example to design the production management system in the ERP of coal chemical industry.

2. Literature review

Entering the twenty-first Century, with the popularization of computer technology and the popularization of network technology, the functions of computer are improving day by day, the ability of software and system integration is increasing, and the high-speed information network is rapidly connecting. A new era of information technology has come. Information technology has been deeply applied to various fields such as production, management and operation in the world chemical industry, and has become one of the key technologies for various business development. The informatization construction of China's chemical industry

has also been one of the most concerned areas in the information service industry. From "the sixth five-years plan" to "the ninth five-years plan", it has invested nearly 50 million yuan in the period of the period of " the ninth five-years plan ". In the middle and late 90s, with the implementation of the national economic information program in China, China's chemical industry information industry and enterprises are planning and improving the information network and information service system in the industry plan and step by step.

The chemical industry is a basic industry in the national economy, which has a wide variety, complex process, various levels and very strong matching. It occupies an important position in the national economy of our country. Dubi ski and Turek believe that the coal chemical industry as a major branch of the chemical industry occupies a large proportion in the chemical industry (Dubiński and Turek, 2014). However, because of the backward development level, the information application of coal chemical industry in China is still in the initial stage. Although some enterprises' internal information construction has made a little progress, the information level of China's coal chemical industry is still to be further improved. In the study, Li proposed that the new trend of the development of the world chemical industry has provided favourable conditions and opportunities for the leapfrog development of the coal chemical industry in China - the advanced technology and management concept of developed countries, the impetus of the development of domestic and foreign market competition pressure, the expansion of the market field, and so on. A more severe challenge to the development of China's coal chemical industry is put forward (Li et al., 2016). How to integrate the internal resources of the coal industry, realize the sharing and cooperation of the resources, improve the efficiency of production management and the accuracy of business, improve the competitiveness of the enterprises, realize the strategic adjustment and integrate into the world economy, have become an urgent problem to be solved in the coal chemical industry. In the aspect of improving production management level, successful experience and technical methods of developed countries have provided us with useful reference. ERP system is one of the essences of foreign business management technology. In the paper wrote by Huang, ERP (Enterprise Resources Planning, "enterprise resource planning") refers to the realization of the sharing and coordination of the internal resources of the enterprise through information technology and so on. It overcomes the bureaucratic constraints in the enterprise, makes the business processes smooth and seamless, thus improves the efficiency of management and the accuracy of business, and raises the enterprise. Profitability, reduce transaction costs (Huang et al., 2015).

The development of ERP mainly goes through the following stages: first, the order point method: the order point method, produced in the early 1930s, is a kind of inventory control method to control inventory in a statistical way, that is, when the actual inventory is reduced to the order point or not lower than the safety stock, the order quantity is set according to the specified order quantity (David and Ans, 2017). The essence of this method is to replenish stock, have a real stock and safe stock for all kinds of materials in the process of production. As the production goes on, the amount of inventory is gradually consumed. When the stock is reduced to a certain time, the time that the remaining stock can be consumed is equal to the time required by the order, that is, the lead time of the order. At this point, production and purchase orders were issued and replenishment was replenished in time. The biggest defect of the order point method is that the order time is not determined according to the material real need time. Secondly, term MRP (Material Requirement Planning): The term ERP, also known as basic MRP or MRP, was set up in 1960s. It is a production plan and inventory control system (Van et al., 2015). It refers to the amount of material that is needed just in time of need, and in time to manufacture or purchase materials that are not large or numerous. This method is based on the information on the structural relationship between parts and parts of each product, which is made up of the product structure. According to the number of each final product of the main production plan MPS (Master Production Schedule) and the date (that is, the date of delivery) that must be completed, each item is correctly calculated by ERP. The demand of the material is matched with the inventory state data in the inventory record IC (Inventory Control), and the net demand of the material is calculated, and the demand period of the material is calculated by the time reference of the final product delivery. Third, closed loop ERP (Closed-loop MRP): closed loop MRP, which was developed in 1970s, was developed based on time slot MRP (Liu et al., 2015). It refers to the implementation of the material demand plan, the capacity demand plan, the procurement plan and the operation plan. In the process of the operation of the plan, the information from the workshop, the supplier and the plan are balanced and adjusted to make it meet the requirements of the material as far as possible, so that the planning of the main production is coordinated and unified. Fourth, MRP2 (Manufacturing Resource Planning): in 1980s based on closed loop MRP, people integrated production, financial, sales, engineering, procurement and other subsystems into an integrated system (Brisman et al., 2014). From the point of view of the overall optimization by using scientific methods to make effective planning, organization and control of various enterprises' various manufacturing resources, production, supply, marketing and wealth to make them develop harmonized and play a full role. Fifth, ERP (Enterprise Resource Planning): entering 90s, with the further intensification of market competition, the space and scope of enterprise competition are further expanded. In 80s, the main idea of MRP2's main oriented enterprise internal resources comprehensive

plan management has gradually developed into how to use and manage the overall resource management thought in 90s (Xie et al., 2015).

To sum up, the above research work mainly studies the background of ERP in chemical industry and the development process of ERP system, but the research on the design of production management system in coal chemical industry ERP is very few. Therefore, based on the above research status, this paper takes the development and design of production management in the coal chemical industry ERP as the research object. From the management thought of ERP, the system composition and the related theories of production management, this paper discusses and designs a set of system structure suitable for the coal chemical industry ERP. On this basis, the most complicated production management in the coal chemical industry is discussed, the design points and the function composition of the production management system are studied. Finally, the ERP system for the coal chemical enterprises to develop according to their own characteristics is explained.

3. Methods

As shown in Figure 1 and Figure 2, it is the main management process of ERP in coal chemical industry.

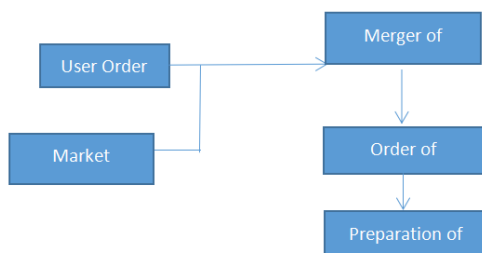


Figure 1: Production planning flow chart

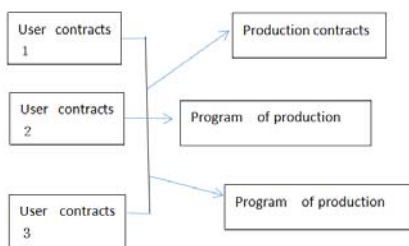


Figure 2: Contract merger process

According to company A's present situation of business process and ideas and principles for the system overall design, we divide the design into four major modules: management system, financial system, production system and quality system. The conceptual hierarchy between ERP is shown in Figure 3.

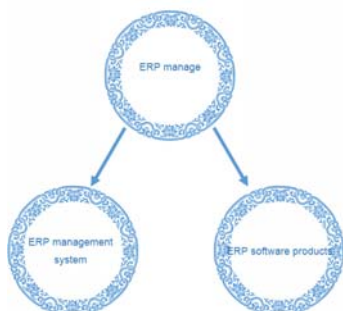


Figure 3: Module diagram between systems

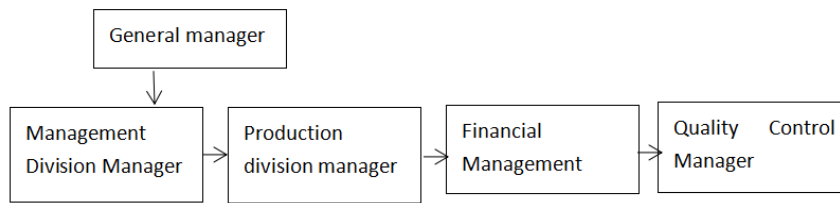


Figure 4: Organizational chart

Combined with the operation characteristics and production characteristics of company A, we develop the system by using the life cycle method. The system can comprehensively manage all completed or ongoing production plans, can handle multiple production plans simultaneously, and can automatically generate material requisition, issue note, material supplementing note, material returning note, while the management personnel can keep track of the progress of ongoing production plans and query the quality and cost of all finished production plans.

The recovery workshop of the chemical company receives the raw gas and enters the blasting section. After the raw gas is cooled by adding ammonia water, the tar is produced and sent to the tube furnace section for further processing. At the same time, the treated gas is sent to the sulfur ammonia section, and the sulfuric acid with the concentration of 4% to 5% is added to produce ammonia sulfate for sale. The gas treated by the sulfur ammonia section is sent to the crude benzene section for further processing, producing light benzene and heavy benzene, and they are respectively sent to the fine benzene section and the comprehensive section for further processing. The gas treated by the crude benzene section is sent to the new desulphurization section for processing. Then sulphur, sodium thiocyanate and sodium thiosulfate are produced for sale, and they are sent to the old desulfurization section for processing. Next the powdered sulfur, sodium thiocyanate and sodium thiosulfate are produced for sale, and they are sent to the potassium ferrocyanide section for processing and then producing potassium ferrocyanide for sale. The tube furnace section receives the tar from the blasting section for further processing. Then, light oil produced is sent to the crude benzene section for further processing; phenol oil produced is sent to the phenol section for further processing; naphthalene oil and washing oil fractions produced are sent to the naphthalene section for further processing; asphalt, modified coal tar pitch, anthracene oil, road binder and clay gun oil produced are used for sale. The phenol section receives phenol oil for processing, and then phenol, technical cresol, m-cresol, o-cresol, xylene, 3,4-xylene and 3,5-xylene are produced for sale. The naphthalene section receives the naphthalene oil and washing oil fractions for processing. Then, technical naphthalene produced is sent to the fine benzene section for further processing (part of it for sale); coarse quinoline and methylnaphthalene produced are sent to the comprehensive section for further processing; washing oil produced is sent to the crude benzene for further section (part of it for sale). The refined naphthalene section receives technical naphthalene for processing, and then the refined naphthalene is produced for sale. After the processing of fine benzene section, benzene, coking toluene, coking xylene and cyclopentadiene are produced for sale, while coumarone fraction and viscosine are sent to the comprehensive section for further processing. The comprehensive section receives the materials from crude benzene section, refined benzene section and naphthalene section, and then refined heavy benzene, light solvent naphtha, liquid coumarone, technical quinoline fraction, isoquinoline fraction, Q-methylnaphthalene fraction, p-methylnaphthalene fraction are produced for sale.

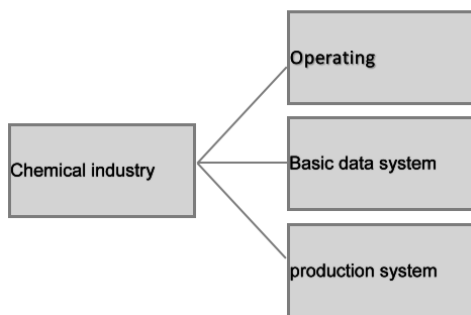


Figure 5: Flow chart of system operation

The system is divided into six functional modules: engineering data management, master production planning, material requirements planning, workshop operational plan, section operation, manager inquiry (Figure 6).

The engineering data management includes BOM (Bill of Material) management, work center management, process route management, production capacity management, and work calendar management.

The production plans are prepared according to two different modes (basing production on sales prospects, basing sales on production). After the approval of the master production planning, it will be incorporated into the workshop production planning, waiting for production. For the treatment of the delay order, the system will automatically include it into the rescheduled production planning for the day, and the production will be prioritized if the material is satisfied.

When the enterprise works out the master production planning (namely requirements planning) for a certain period of time according to the sales order and inventory plan, the material requirements system will calculate out the number and the latest production time of finished products and semi-finished products to be produced, demand quantity and demand time of materials (too early production will increase inventory and lengthen the period of capital occupation) by integrating the existing resources of the enterprise.

The module is to receive the approved master production planning, make daily production planning according to the process route and other information in the workshop, and organize daily production. At the same time, in the production process of the order, the real-time collection of dynamic production information in the workshop can be realized, so as to understand the production progress, timely find problems and solve, and try to make the practical production of workshop close to the planning.

Material requisition operation: The production and material requisition of the section shall be carried out in batches on a daily basis, and the system will automatically allocate the available inventory to the material requisition warehouse according to the principle of "first-in first-out". During the actual requisition of materials, the warehouse keeper shall fill in the actual requisition quantity of materials (the actual quantity of materials distributed may be different from the required quantity of the workshop due to packaging specification and other factors), and complete the material requisition after verification of the recording.

Quality inspection: It includes intermediate quality inspection and warehousing inspection.

Batch No. determination: When the products are delivered to the warehouse, the production batch No. of the products should be determined.

Through the manager inquiry system, the information of stock goods classified statistical table, stock capital statistical table, analytical table for warehouse purchase price of key goods, weekly purchase amount statistical table, monthly purchase amount statistical table, purchasing and ordering price trend chart, market inquiry data analytical table, monthly selling products trend table, weekly selling products trend table, sales order execution statistical table (monthly), monthly sales amount statistical table, weekly sales amount statistical table, product cost table, production planning statistical table under execution (based on products), production planning statistical table under execution (based on completion date), production planning statistical and analytical table that has been completed, etc. can be queried.

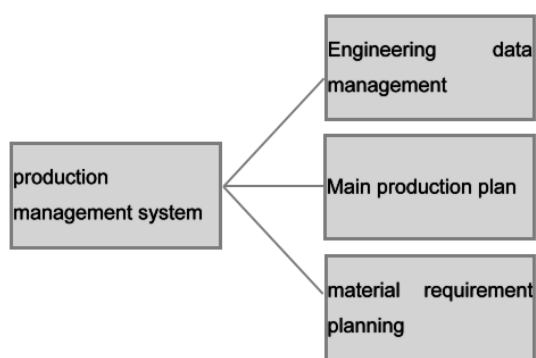


Figure 6: Functional module diagram

4. Results and discussions

In the process of signing of the production contract, it can predict date and batch No. of the products delivered to the user (name). In the process of production, the situation of contract execution can be grasped at any time, thus to provide important guidance to prepare the transportation plan.

According to the variety and quantity of products to be produced, the system will automatically generate the material requisition, and the issue note. According to the current inventory quantity, it will automatically generate the issue note and send it to the warehouse system, inform the warehouse to distribute materials to the designated workshop, and carry out the production, and it will automatically generate the material shortage sheet. According to the current inventory, it will automatically generate the material shortage sheet in this production planning, print the material shortage sheet, and hand it to the purchaser for emergency purchase.

The system can handle the whole package issue, and in the actual production, the batch issue occurs frequently. Therefore, in the actual issue, the goods will be delivered according to the minimum unit, and the remaining materials will be used in the subsequent production.

The system has the function of supplementing, returning of materials. In production, since the loss of production materials may occur due to the quality of materials, operation error of staff, failure of production equipment, etc., it is inevitable to supplement materials. The material supplementing function of this system is simple and convenient. Supplementing materials will increase the cost of the production planning. After the completion of production, the additional materials can be returned, and returning materials will reduce the material cost of the production planning.

5. Conclusion

Taking the coal chemical enterprise A as an example, this paper designs the production management system suitable for the ERP of coal chemical enterprise. The system uses the international advanced management concept, fully combines the needs of production management of enterprise A, fully embodies the characteristics of the coal chemical industry itself, and greatly improves the production management efficiency of enterprise A. Using this system, the enterprise can keep track of the production schedule at any time. This system manages the progress and quality of production in the workshop and the warehousing treatment of finished products in the workshop, which can record the batch No. of the products in batches for quality tracking. After the product inspection, the computer will automatically generate the finished goods warehousing entry and inform the warehouse to receive the goods. At the same time, the quantity and quality of products will be fed back to the workshop management system, so the administrative staff can know the progress and production quality of all production items without needing to visit the production scene. In future development, the enterprises shall continue to follow the ideas of ERP design, fully grasp the principles of ERP design, fully consider the industry characteristics of coal chemical industry itself, and carry out constant exploration and improvement, so as to certainly make further breakthroughs in various technical and non-technical issues, design and improve the complete ERP system that is closely combined with the actual needs of the coal chemical industry.

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