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Erp System Construction for Mining Industry Based on Business Intelligence

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Abstract: This study, in the first, introduces the history and the development trend of ERP system, on the basis of which, analyzes the problems and challenges of the existing ERP system--it is difficult to fulfill the features of the coal industry, metallurgical industry and other mining industries, such as the uncertain production environment, no fixed BOM, inability of production and marketing scheduling and material requirements planning, etc. Then based on the introduction of business intelligence and its development, this study applies to the business intelligence represented by data mining and knowledge discovery, conceives an adaptive planning management mode on the basic of uncertain problems and relative data in the uncertain environment combined with the multi-objective optimization theory and method and explores new ways to research ERP system of mining industry.

Key words: Business intelligence, mining industries, ERP, self-adaptive

INTRODUCTION

With the development of information technology and the advancement of information, the enterprise management ideas keep changing. In the early 1960s, MRP (material requirements planning) was proposed an embryo and was completed until the early 1970s. In the late 1970s, the MRP-based production planning and controlling system appeared as closed-loop MRP, In the early 1980s it developed into MRP-a production and management information system for enterprises. In the early 1990s, according to the development of the prevailing Information Technology and the need of enterprises supply chain management, the American famous IT analyst firm Gartner Group Inc. forecasted the development trends and impending changes of the management information system of manufacturing industry after the information era and proposed ERP (Enterprise Resources Planning). In the 21st century, thanks to the fast development of computer networks , the environment of the production and management has changed tremendously, Gartner Group Inc. proposed another new concept--ERPII which believed that in the 21st century, ERP will be changed dramatically in optimizing the entire supply chain, expanding its range from manufacturing industry to all the other industries and its service from the only large corporations to all types and sizes, from the generic to the specific, from a closed style to an open style and so on, so that ERP would develop into ERPII (Amoako-Gyampah, 2004). ERPII will expand the application area of ERP system from manufacturing industry to coal industry, metallurgical industry and other industries, including the mining industry and will ignite an industry characteristics research climax for ERP system (Greco *et al*., 2010).

PROBLEMS AND CHALLENGES OF THE EXISTING ERP SYSTEM

ERP is a product of modern management ideology which reflects a lot of advanced management ideas in ERP software system, such as agile manufacturing, lean production, concurrent engineering, supply chain management, total quality management, etc.. However, the ERP planning management mode is still the same as that of MRPII system model in the 1980s which still plans by MPS and MRP to calculate the demand of materials, to give the production order and to supplement orders, etc. (Chen, 2001). This way of production plan progressively can be applied to the common stable condition which is deduced by product BOM and process flow with the most simple logic and the help of the compute, as a result it has the following weaknesses (Ma *et al*., 2000):

- MRP algorithm assumes that the lead time is a known fixed value
- The system requires a fixed process route
- The production priorities is arranged based only on the delivery cycle or date
- All work is assumed under the premise of infinite capacity
- Repeat the planning process will take a lot of time, besides it is so difficult to change the related plan

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Currently, ERP system has been widely applied in many industries has, nevertheless, the current ERP system is developed from MRP system and MRPII system which is designed mainly based on the needs of users of MRP system and MRPII system and is mostly applied successfully in discrete manufacturing industries. But there rarely is applicative software system for coal industry, metallurgical industry, petroleum industry, chemical industry and other processing industries, especially for coal, metallurgical and other mining industries, neither is the relative research (Kazemifard *et al*., 2000). Take coal industry as an example, so far no large coal enterprise has successfully implemented ERP system. with the help of Andaxin Company, Yanzhou Mining Group has applied R/3 system of SAP Corporation which has not meet the need of the coal production process and could not complete the main production schedule and production capacity planning according to the dynamic changes in production condition, so that the ultimate results has not achieved the desired goals. The production procedure of process industries, especially the mining industries have great particularity. In the production procedure of mining industries, the inputs are auxiliary materials not the fixed BOM, as a result, MPS and MRP cannot be in accordance with the principle of the existing ERP system. In addition, mining enterprises are typical capital intensive, who `usually keep a 24-hour continuous production to get the highest return in a lower production cost which produce the production an management mode "base sales on production" mode, unlike other industries. Therefore, the main problem of ERP system applied to mining industries is to insure the continuous safe running of the large-scale equipment through the rational production capacity planning and control. However, the production process of mining industries, with much uncertainty, is affected greatly by the natural conditions, on the other side, the current ERP system project management modes are the basis of certain production environment, with the result that the ERP system making project management modes based on the certain production environment cannot meet the needs of mining industries and other process industries (Andrew, 2002).

In a word, from the MRP to MRPII in early 1960s and then to ERP in early 1990s and finally to ERPII meeting enterprises of the competitive and developing needs in 21st century it experienced a long period of more than 40 years. Literally, MRP and ERP are different only in optimizing resource-the later has more types and larger scope and have a same word "PLANNING" which is the core of the whole ERP system. The uncertain production environment of coal, metallurgical and other process industries have seriously restricted the further application of ERP system in mining industries which has become an insurmountable obstacles to the current ERP system.

BUSINESS INTELLIGENCE AND ITS DEVELOPMENT

The composition of business intelligence is very complex. The constituents of the business intelligence system for enterprises, centered around data warehouse system, include source data system and metadata system, data decisive support system, OLAP, the front-end display tools and metadata system, etc. At present, the main BI enterprises include Microsoft, IBM, NCR, Brio, Oracle, Sybase and Business Objects, etc. Some domestic manufacturers, such as Yongyou Com., also has introduced business intelligence products (Corbitt *et al*., 2004). The trend of the development of the business intelligence technology is based on the constant fusion and mutual complementation of Online Analytical Processing of data warehouse and Data Mining.

Depending on the different type of the application of data mining, business intelligence technology can be roughly classified as follows (Back, 2002):

- **Classification model:** The main function of the classification model is assigning business data into different groups according to its attribute. In practical application, the classification model can analyze the attribute of the classified data, find out the attribute model of data and determine the category of each data, so that the model can be used to analyze the given data and to predict the category of the new data (Fernando *et al*., 2004)
- **Associated model:** Association model mainly describes the close degree or relationship of a group of data by the minimum confidence level. The level of the confidence measures the intensity of associated rules
- **Sequence model:** Sequence model mainly analyzes the simultaneous related data in data warehouse to find out the related processing model of the data in a certain period
- **Clustering model:** Clustering model can be adopted when there is no description of the given data or it cannot be classified into any model which classifies the users' data into different groups measuring according to the similarity. The cluster is a collection of the group composed by a series of similar data. The data in the same group are similar but are quite

different between groups. Clustering model is very powerful, whose core is to transform the measurement of some obvious similarity into quantitative tests

Base on the above application models, implementations and algorithms are put forward in the data mining field, as well as the corresponding commercial software and tools:

- **Neural network:** The neural network is on the basis of the mathematical model of self learning. It can analyze a large amount of complex data as well as completing pattern extraction and trend analysis extremely complicated for human brain and other computers

Neural network system consists of Nodes which are a series of processing units similar to the neurons of human brain. These nodes are interconnected with each other through the network, so as to set up the data model if there is a data input.

- **Decision tree:** Decision tree is the process of classifying data through a series of rules, by which data rules can be visualized and the output can be easily understood. For example, in the financial field, the loan object can be divided into two categories-low and high loaning risk. Through the decision tree, we can easily determine the loan applicant belongs to which categories-high risk or low risk

The decision tree is commonly used, because, unlike the uneasily understood neural network it has a higher accuracy and its system also does not need long time processing.

- **Data visualization:** Data warehouse contains a large amount of data and is enriched various data models, the visualization of which needs complex tools. Data mining and data visualization can work well together. In terms of data visualization system itself, due to the large amount of data in the data warehouse it is easy to make analysts at a loss. However, data mining tools can set the effective exploration starting point and representing data by appropriate metaphor to assist the data analysts

- **OLAP:** On Line Analytical Processing (OLAP) mainly analyzes, queries and reports the data by means of multidimensional, unlike the traditional applications of On line Transaction Processing (OLTP) which is mainly used to complete the users' transaction processing, such as civil aviation ticketing system, banking system and so on which usually need a large number of updates and a higher requirement of response time. And OLAP mainly analyzes the users' current and historical data to assist leaders in making decisions, whose typical applications are the analysis and prediction of the credit card risk and the formulation of company marketing strategy, etc. which mainly needs a large number of queries and not so strict with time

At present, the data mining technology is developing. Data mining involves a variety of technology such as mathematical statistics, fuzzy theory, neural network and artificial intelligence, etc. so as to require a higher technical content and a more difficult implementation. In addition, the data mining technology, combined with the visualization technology, geographic information system, statistical analysis system, enriches the function and performance of data mining technique and tools.

With the rapid growth of data size and the increasing difficulty of analysis and decision, beside of more and more of demand of intelligent and automation in analysis and decision, data mining technique and tools will be widely accepted and used. At the same time, pushed by the market, the relevant vendors will invest more in the research of data mining tools. Predictably, the data mining market will flourish in the future.

CONCEPTION OF ADAPTIVE PLANNING MANAGEMENT MODEL

It is the core and difficult part of ERP system of mining industries that the plan can adapt to changes of the external environment accurately and quickly. To solve this problem, we must analyze quantitatively the uncertain problems which could not be analyzed in the past, discover the knowledge unknown before through the existing data to get the optimized solution quickly. The emergence and development of business intelligence provides the means and methods (Lopez-Martin, 2011).

Therefore, guided by the system engineering theory, business intelligence, originated from statistics, machine learning, computer graphics, database, information retrieval, neural network, fuzzy logic, evolutionary computation and characterized by data mining and knowledge discovery, is applied and conceives an adaptive planning management model on the basic of uncertain problems and relative data in the uncertain environment combined with the multi-objective optimization theory and method.

The whole model, based on the uncertain problems in the plan management and related data--business input, adopts the model of the modern data mining tools and methods to get the related parameters and the preliminary solution of the plan management model system.

Sometimes, these parameters and preliminary solution can be directly applied to the business process model to get the final solution.

In most cases, multi-objective optimization model, combined with the business process model and useful business knowledge and aimed at different specific business system, should be set up to optimize the system parameters and finally, feeds back the optimized parameter values into the business system to get the business outputs, so that the adaptive whole project management model can be realized.

CONCLUSION

ERPII is a business strategy and adaption system for the specific industries and fields through supporting and optimizing the collaboration and financial processes inside and between companies to create the value of customers and shareholders. The planning management model of the existing ERP system originated from the manufacturing industry cannot adapt to the features like uncertain production environment nor the non-fixed BOM of the coal, metallurgical and other mining industries. The business intelligence represented by data mining and knowledge discovery provides a new solution to this problem. This paper introduces the business intelligence into the core planning management of ERP system, conceives an adaptive planning management model in the uncertain environment and explores new ways to research ERP system of mining industry.

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