Design of Enterprise Production and Sales measures and Forecast Information System Based on WEB

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Abstract

　　The enterprise supply of raw materials and production, sales, product information integration as a research object, on the basis of J2EE architecture and the Spring framework, building Web Based Enterprise production and distribution and prediction of multi-tier architecture ERP system. First, use spring+hibernate implementation of MVC design mode; and, with mvc mode implementation of J2EE Multi - Application System schema, development function perfect enterprise sales management system; last, use move average law, and Trend Forecast law, and index smooth law, and line type the most Xiaoping method and curve type the most Xiaoping method Five kind of algorithm average to sales accurate real - time forecast, decision sector can developed accurate production plan to effective guidance production job.

Keywords: MVC mode, J2EE framework, enterprise resource planning, sales predict.

1. Introduction

　　Production of the chemical industry is a continuous process industry, production planning, real-time scheduling, real-time monitoring system has a very important position, on a continuous production process-oriented enterprise, guarantee the stable, full capacity production line is the premise and key to decrease the consumption of products, reduce costs and needs of the enterprise safety in production, environmental protection.ERP (Enterprise Resource Planning) as a means of enterprise decision support systems and technology management, has been growing recognition and use of domestic and foreign enterprises [1. 2]. According to statistics, 80% of the world's top 500 companies have implemented erp; erp users in China have exceeded 2000, and sales reached 2000 in 10 billion. According to presentations, in Haicang so far in 1994, the Group adopted ERP systems, with average annual benefits of more than 10 million; bosoar group ERP system, lower product costs 5%-15%, 10% reduction in stock funds-40%, productivity 5%-15%.

　　Sales management in modern enterprise management occupies an important position; a sales management almost determines the level of the enterprise's economic lifeline. With the development of socialist market economy, sales are increasingly important in enterprise production and management activities, production and sales of the product only through in order to realize the value of compensation after the production cost, creating a certain amount of profit. Therefore, enterprises must strengthen the management of sales, market forecasts, hold sales, promote the enterprise organize production and sales by market demand, efforts to reduce sales costs and increase economic efficiency. Based on this, the enterprise must establish a set of sales forecasting, planning, accounting, supervision, control, analysis and decision support capabilities in one sales management system to support enterprises for effective management of sales [3].

　　This article mainly designed and developed a production enterprise based on ERP sales and forecasting system, the whole system is the platform on the Internet, using BS mode while using SQL server, j2ee, mvc technology as a development tool. Finally, in the development and sales management of enterprise ERP system a sales forecast module, and validation.

2. Key Technology and Software Architecture of ERP System
2.1. Key Technology

ERP System Development use the current international popular three layer BS (browser server) structure [4]; we use is by jsp+struts+ejb various components composed of technology; which, JSP and user interactive; Struts responsible for receive from JSP pass come data, will its pass to EJB components, the same time, it can will from database or processing data pass to JSP page; EJB the main responsible for and database interactive, to data increase, and by deleting, and change operation.

2.2. Software Architecture

This system is the use of MVC design patterns[5][6], both models (model) -- A view (view) -- The controller (Controller). It is mandatory to separate the input, processing and output of the application, and Struts is a typical implementation of MVC frameworks, which will be at the front desk of the browser, a middle tier, Controller, and J2EE EJB components that implement the business logic and database links up, will be described separately below.

(1) MVC mode

MVC applications into three parts of the model, view, Controller, as shown in Figure 1:
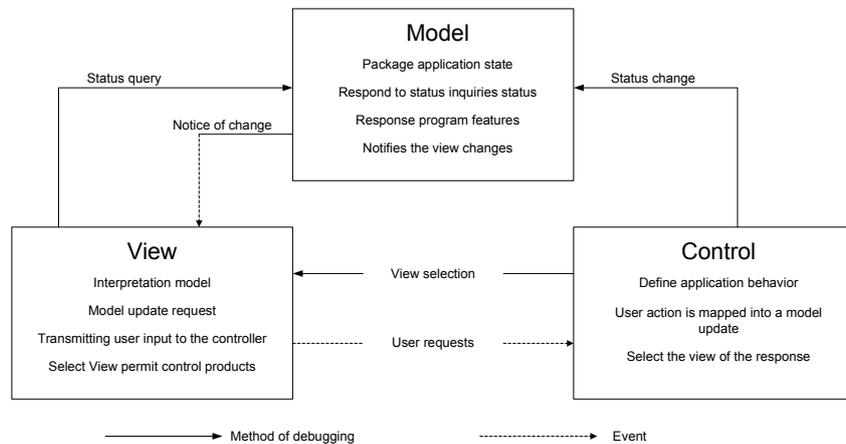

Figure 1. The MVC Pattern of each Part of the Relationship and Function

(2) Struts Framework

Since the beginning of the 90, Struts frame structure was the first to implement the MVC pattern, after nearly 10 years of development, Struts has matured, it has a complete set of software architecture, by Central Control component perfect combination of the various components [6]. Is an essential aspect of business Web site software. The frame structure is shown in Figure 2.
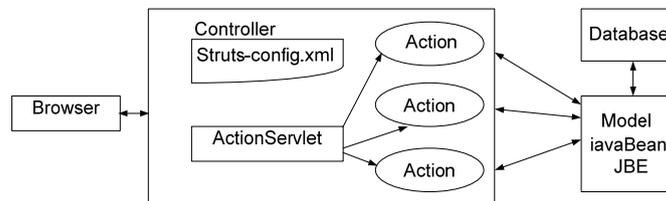

Figure 2. Struts MVC Framework Implemented

a) View: mainly generated by the JSP page complete view, Struts JSP tag libraries provide a rich.

b) Model: represents the application's business logic, model exists in the form of one or more Java Bean.

c) Controller: struts-config through the previous figure, you can see an XML file. XML is associated with the Controller, in Struts, holding the Controller in the MVC role is a servlet which is called actionservlet. Actionservlet is a common control component. The control unit providing handled all HTTP requests sent to the struts entry point. It intercepts and distribute the requests to the appropriate action

d) Process: in Struts, the user's request General to. Do as the name of the requested service. Do requests are links to actionsevlet, actionsevlet under struts-config. In the XML configuration information, the user request is packaged as a form bean with the specified name, and action bean is the form bean to specify the name, by actionbean through the business operations, these struts-config.In the XML configuration. actionsevlet,actionsevlet struts-config is the core - the core of the Struts.

(3) J2EE overview

The $literal platform using multi - layer distributed application model. Application of logic based on their features into multiple components, a variety of components distributed across the different j2ee program depends on the level of machine [7].

Systems Using j2ee - logic layer on the server, using both EJB component as a data - processing components, Enterprise Java Bean referred to as EJB, it runs on EJB server, is a non-visual client call the remote object.EJB has a series of agreements allow itself to be a remote access or install or deploy on a particular server. EJB transaction mechanism provided a very comprehensive, but the downside is that performance degradation associated with the transaction mechanism. EJB support partial application system. In the three different types of enterprise defined in the EJB bean: session bean, entity bean, message - driven bean. General Application Server is EJB server [8].

3. Sales Management System Based on ERP
3.1. Introduction of Sales Management System

Sales management system is an important subsystems of Enterprise Resource Planning (ERP), sales management have a direct impact on the Enterprise Global. Sales are the starting point of business activity, production, finance, personnel, and other management of enterprises has a decisive role. Sales system and directly to customers; the Enterprise window, embodiment of corporate image; it for business decision makers to provide market information and sales; and provide information for the production forecast and production planning system; customer feedback for quality management systems; provide key financial data for the financial system. Sales management system and other subsystems as shown in Figure 3:
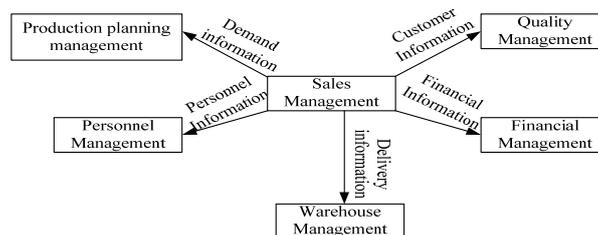

Figure 3. Sales Management System and other Subsystems

3.2. Business Process

The system The main for a chemical sales sector business design, sales The Department of responsible for chemical products sales, customer after know products decision purchase products, can be signed contract, sales sector according to contract content order, customer in contract terminate date to financial sector payment, payment financial sector will customer knot paragraph information to sales sector, sales sector according to knot paragraph single to customer open bill of lading, customer by Bill of Lading to warehouse take of.Sales to

accounting, sales data, sales data from an existing forecast for the next year the sales of the product, for policymakers to give the accurate production planning the production sector. More business processes as shown in Figure 4.

(1) Information flow process : customer order information by sales sector to warehouse management sector, and production plan sector, and purchase sector, the same time the Treasury inventory information pass to sales sector; production plan sector by Issued production plan, will Information pass to production sector, the treasury management sector; purchase sector from sales sector, the treasury management sector access to purchase information; sales sector from financial sector access to customer credit information; sales sector the opening of Bill of Lading to shipping personnel, shipping personnel held bill of lading to the Treasury take delivery of.

(2) Capital flows: The customer is ordering a down payment, contract fees, the cost of the project and other financial sectors; financial sector needs to provide funds for the procurement department, or direct payments to suppliers, purchasing normal to make the purchasing department.

(3) Material flow process: production department of the Treasury under the production plan to provide materials, raw materials, production of customer product and production departments will produce products according to Production Plan storage for shipping; extraction of customers holding bills of lading as scheduled to the treasury products.
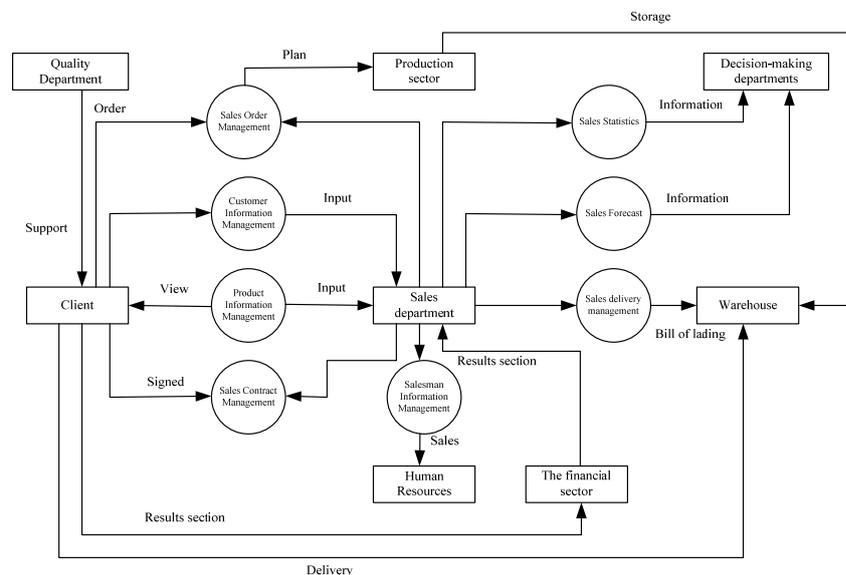

Figure 4. Logistics, Capital Flow and Information Flow Relationship

3.3. System Functions

The whole system design for 8 module: system logs on, the underlying data management, contract management, order management, shipping management, data and statistics, sales forecasting, privileges on the system management module, the underlying data, including product management, customer management and sales management, use of the function module diagram in Figure 5.

Sales management is integration into ERP concept, promoting scientific management, for the management of the implementation of the strategy to provide a better service and support. Supply sales system to complete the following features.

(1) Real - time automatic collection: use of computer technology and communication technologies, will enter the management of Intelligent Instrument - related parameters collection network.

(2) Advanced data management: requested by the user to provide a variety of parameters and historical data, and forms of data reporting, operating records.

(3) Systems with high security and reliability to protect the 100 normal communications, data management and user management strict specifications.

(4) Realization form of a flow chart or chart, you can browse the data in real time or Historical Data.

(5) For User rating system access management mechanism

This system consists of real - time Data Acquisition System and manual entry system, real - time data acquisition from Capture card directly from turning into a relational database in the database in real time.
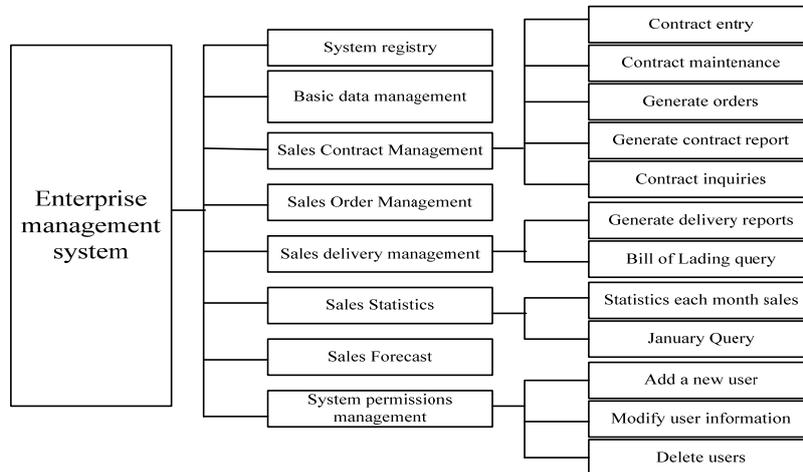

Figure 5. System Function Module

3.4. Development Environment

The Information Technology of project implementation units through the years, have developed a more comprehensive network of systems, including local area networks, ERP systems, and interconnected with the Internet, in the area of production data, enabling dsc (PLC) - Real - time database - database - lan channel. The network topology diagram as shown in figure 6, through a friendly interface and reasonable production and sales data for online publishing, increasing the transparency of production and lay a good foundation for enterprises to.
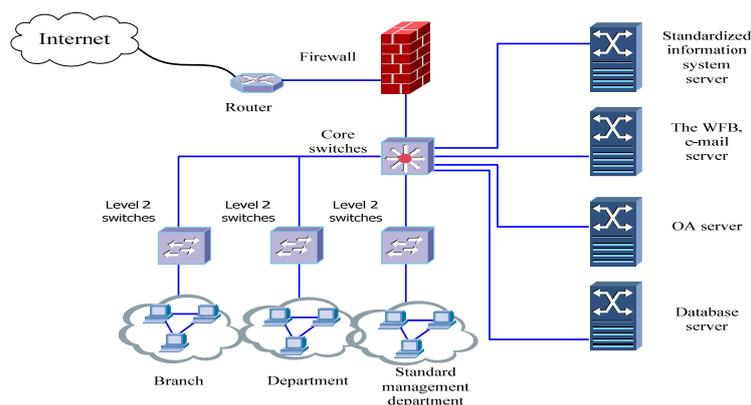

Figure 6. Network Topographies

The system uses the Spring framework mvc design pattern, after research and comparison on the current popular development tools, determine the development environment for:

JDK:Spring+Hibernate; Development environment: NetBean5.5;

The back - end database: SQL Server 2000;

Web server: Tomcat 5.5.1; System platform: Windows xp.

3.5. Realization of ERP Sales Measurement Management System

(1) The main interface of the system

Start the Tomcat server, access http:localhost:8080 sellmanagementlogin.JSP, when user enters a user name and password by calling the login. To judge whether the content entered by the user do the right, the right to enter the main interface of the system main.JSP, as shown in Figure 7.

Figure 7. The System Main Interface

The main interface of the system consists of three functional areas:

a) A function Module button: Choose a different module; click on the modules button, the workspace will enter the corresponding function interface.

b) Workspace: workspace for different modules of functionality, information input, and a list of specific information and records to add, delete, query, the results display area.

c) Other tools: users to log in, shutting down the system and modify their own password feature shortcuts.

(2) Basic data management

a) management of product: When a user enters the main interface of Product Management, as shown in figure 8, you can add products, queries, and product inventory interval queries, to edit, delete, query to the product and import into Excel Table, and if the user wants to print on a query to the data for the report, you will click on " import data into the Excel table " button.

b) Customer information management: Customer information management, and product information management capabilities similar to also add, modify, delete, query in the table and import data to Excel function.

c) Sales information management: Sales member information management and products information management function Similar, the same With add, modify, delete, query and will data import to Excel table in the function, different is the module can be to sales member A years the months sales statistics, user click on the " sales member sales statistics ", in pull list in the Select to statistics year and sales member name, click on the " Statistics ", will by results to column - shaped Figure display.

(3) Sales contract management

When the user clicks on "Management of the sales contract ", you will enter contract_main. JSP page, as shown in Figure 8, you can add to the contract, query, import, Excel Table, for "contract status " for unresolved contract to modify, delete, view the details, and make a new order operation, adding a new contract with a status of "not processed "
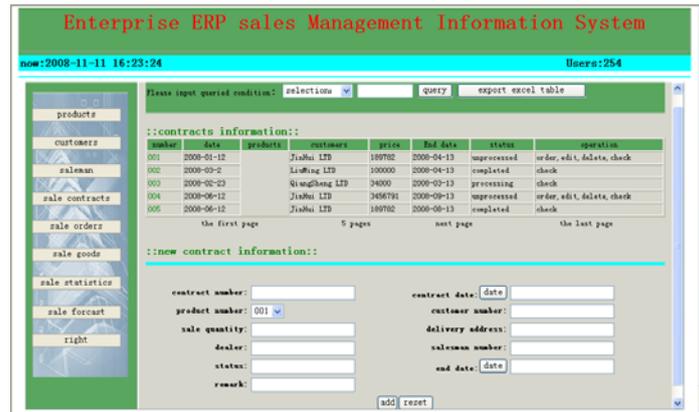
Figure 8. Salesman Sales Statistics

4. Designs of Sales Forecasting System
4.1. Sales Forecasting Process
　　　Sales forecast is to make correct judgments of the product development trends so as to make right production and marketing decisions, through detailed analysis and study of the product requirement based on relevant information. The sales forecasting process shown in Figure 9 can be divided into four basic stages:
　　　(1) In accordance with the needs of the normal management decision-making, determine the objectives and content of the forecast;
　　　(2) complete the statistic Survey, data collection, analysis and judgment and data evaluation and assumptions;
　　　(3) Choose applicable forecast method from the judgments and assumptions, judge the forecast details, and then forecast;
　　　(4) Draw the predicted results, and checks and feedback.
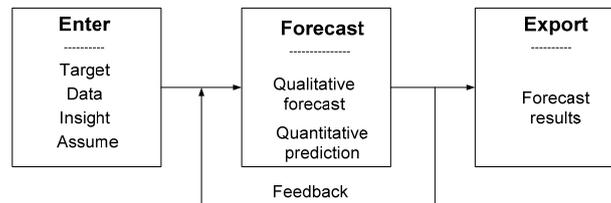

Figure 9. Sales Forecasting Process

4.2. Sales Forecasting Methods
　　　The sales forecast can be conducted by qualitative forecast or quantitative forecast method.
(1) Qualitative forecast
　　　Qualitative forecast is a method in which the qualitative approach is applied to research and determine the developing nature and estimated degree of the future events. This method is mainly based on subjective judgment and intuitive data, and is suitable for products that are initially launched into market and new technologies with few mastered data. Selling qualitative forecast include: typical survey, sample survey method, the direct survey method, the indirect survey method, expert survey.
(2) Quantitative prediction
　　　Quantitative prediction is based on certain statistical information, using various mathematical formulas to predict sales to determine the degree of development of the future events. Quantitative prediction of sales is generally divided into the following five steps:

a) Analyze past data. The changes caused by different factors need to be analyzed and distinguished.
b) Adopt mathematic method for forecasting. Adopt mathematic method to measure future data by using the past analyzed data.
c) Compare the data forecast result with personal intuitive experience. If the predication accuracy is not up to standard, the past analyzed data need to be checked and the forecast method will be changed to forecast again. besides, we can also adopt the mean value of the forecast results by different mathematic method.
d) Consider other significant factors. Mathematical prediction starts from the premise that assume the mathematical model of the historical data continues to exist in the future. Therefore, significant factors non-existent in the past should be considered in the actual work.
e) Application of the predict result. Sales forecasting results are the basis for the preparation of sales plans. In the enterprises basing production on sales prospects, product sales plan directly determine the production and financial plans. If forecast result is satisfactory, the plan should be put into practice. On the contrary, if the predicted result is not satisfactory, countermeasures should be taken immediately to block the prediction.

Sales of quantitative forecasting methods mainly contain moving average method, trend forecasting method, exponential smoothing method, linear least squares method and curve type least squares method.

(a) Moving average method

Moving average method is to make use of the past few years' actual market sales data to calculate the average value and move it back in time as the method to forecast the annual market sales volume. The calculation formula is:

$$\bar{X} = \frac{X_1 + X_2 + X_3 + \cdots + X_{n-1} + X_n}{n} \tag{1}$$

The disadvantage of the moving average method is to average the trend of change in each year, in many cases, may cause large errors.

(b) Trends forecast method

Trend forecasting method is a mathematical method to make use of the actual market sales data in the past few years to observe the development trend of them and forecast objective annual market sales. You can take three, four or five average, depending on the specific circumstances. The disadvantage of trend forecasting method is: in the use of the pre averages and trend averages the recent changes and long-term changes will be in the integration. As a matter of fact, that the impact of recent data and forward data on predicting the future is different.

$$X_n = A + [B \times C] \tag{2}$$

Here A is the last number of the earlier five averages; B represents the anural distance of present year to forecast year; C indicates the last number of the three trend averages.

(c) Exponential smoothing

Exponential smoothing method is to adopt a gradually decaying unequal weighted method to handle all historical data, following the principle of "focus nearly, ignore far "ranging weighted approach to data processing prediction method [9]. Basic formula is:

$$F_{i+1} = \alpha A_i + (1-\alpha)F_i \tag{3}$$

Here i is the current time; α is the exponential smoothing coefficient; A_i is the demand value of i; F_i is the predicted value; F_{i+1} is the i+1 predictive value.

(d) Linear least squares method

Linear least squares method is a mathematical method to obtain a a straight line of tendency changing based on the information of the different periods in the past, so that the

distance of each point of this straight line distance to the corresponding point of the actual data line is the minimum. According to the regression line, the standard formula [10]:

$$na + b\sum x = \sum y_i \qquad (4)$$

$$a\sum x - b\sum x^2 = \sum xy_i \qquad (5)$$

$\sum x$ is a common factor. In order to simplify the calculation, manage to take $\sum x$ as zero. Make n be odd, x = 0 at the middle of the data. The standard formula when $\sum x = 0$ regression line:

$$\begin{cases} \sum y_i = na \\ \sum xy_i = b\sum x^2 \end{cases} \qquad (6)$$

Formula transposition of simultaneous equations can be obtained:

$$\begin{cases} a = \dfrac{\sum y_i}{n} \\ b = \dfrac{\sum xy_i}{\sum x^2} \end{cases} \qquad (7)$$

Obtain a, b, and substitute into the equation to obtain the prediction value.

(e) Curves least squares method

When sales factor is the multi-factor, the sales growth will obey geometric progression, so tendency change line is not a straight line, but a quadratic curve. Curve least squares method is a mathematic method to obtain a tendency change quadratic curve, according to the information of the different periods in the past, so that the distance of each point on the quadratic curve to the corresponding point of the actual data line is minimal. Quadratic curve equation:

$$y = a + bx + cx^2 \qquad (8)$$

Similarly, the deviation adds of i period S:

$$S = \sum_{i=1}^{n}(y_i - y)^2 = \sum_{i=1}^{n}[y_i - (a + bx + cx^2)]^2 \qquad (9)$$

Partial derivative $\dfrac{\partial S}{\partial a}$, $\dfrac{\partial S}{\partial b}$, $\dfrac{\partial S}{\partial c}$. respectively, each equal to zero, and thus obtained:

$$\begin{cases} \sum y_i = na + b\sum x + c\sum x^2 \\ \sum y_i x = a\sum x + b\sum x^2 + c\sum x^3 \\ \sum y_i x^2 = a\sum x^2 + b\sum x^3 + c\sum x^4 \end{cases} \qquad (10)$$

Similarly, if n is odd, and x = 0 is placed in the middle of the data period, then $\sum x = 0$, $\sum x^3 = 0$. thus:

$$\begin{cases} \sum y_i = na + c\sum x^2 \\ \sum y_i x = b\sum x^2 \\ \sum y_i x^2 = a\sum x^2 + c\sum x^4 \end{cases} \qquad (11)$$

To obtain the values of a, b, c, and substitute into the equation $y = a + bx + cx^2$, and obtain the prediction value.

4.3. Application of Sales Forecasting System

Sales forecasting module can predict the next years' product sales of the enterprise XX from 2000 to current year. The forecast for 2000 - 2008 can be considered as a test of the prediction method. This module is to make use of the first nine years sales to predict the tenth year sales, providing five prediction methods, namely: the least squares method of the moving average method, trend forecasting, exponential smoothing, linear least squares method and curve type. If five methods can not achieve good prediction, we can take the average of the five methods as the best value.

Exponential smoothing forecast is used to predict actual sales. α value is 0.2, the actual sales, as shown in Table 1, the predicted results are shown in Figure 10-11.

Table 1. Sales Data

Years									
Sales volume (tons)	1991	1992	1993	1994	1995	1996	1997	1998	1999
Sales volume (tons)	1280	1255	1273	1305	1286	1346	1399	1467	1567
Years	2000	2001	2002	2003	2004	2005	2006	2007	2008
Sales volume (tons)									
Sales volume (tons)	1595	1588	1622	1611	1615	1685	1789	1790	1829

Figure 10. Moving Average Forecast Results

As is shown in the prediction maps: every method's error between the actual sale and forecast sale is on the small side, which can be forecast sales of enterprise products accurately, taking the average value of the forecast results. Sale forecast can help the decision-making departments develop accurate production planning, to guide the production, greatly reduce the backlog of business inventories, promote the rapid flow of corporate funds, and bring good economic benefits for the enterprise.
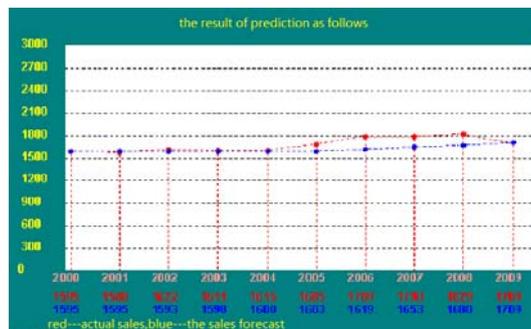

Figure 11. Exponential Smoothing Forecast Results

5. Conclusion

This article uses a chemical plant's supply of raw materials, production and sales of products and seized pounds metering as research object to integrate the information. The PCS, DLC are used to complete plant-wide production, marketing, and measurement of the amount of industrial's real-time monitoring, statistics and analysis by automatic acquisition system, network technology and computer technology, which bring about intelligent data acquisition and analysis and provide a true and reliable data foundation for enterprise ERP data. Meanwhile, publishing the statistical results and a variety of analytical data on the corporate LAN can make production and sales data more accurate, timely and transparent. The establishment of a plant-wide ERP system on the basis of these data provides the basis for scientific decision-making, rational organization of production, and adjustment of product structure. Integration of the ERP concept into enterprises promotes enterprise's scientific management and provides better service and support for the implementation of the enterprise's management strategy.

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