A Business Intelligence System Design Based on ASP Platform

Fengchi Shen, and Rongtao Ding

Abstract—The Informational Infrastructures of small and medium-sized manufacturing enterprises are relatively poor, there are serious shortages of capitals which can be invested in informatization construction, computer hardware and software resources, and human resources. To address the informatization issue in small and medium-sized manufacturing enterprises, and enable them to the application of advanced management thinking and enhance their competitiveness, the paper establish a manufacturing-oriented small and medium-sized enterprises informatization platform based on the ASP business intelligence technology, which effectively improves the scientificity of enterprises decision and management informatization.

Keywords—ASP, business intelligence, data warehouse.

I. INTRODUCTION

SMALL and medium-sized manufacturing enterprises accounts for a most in Zhejiang province which holds a number of block economy areas. Most of the enterprises located in one block are in the same industry chain, along with economic development and the expansion of production scale, these Enterprises need to integrate the various regional manufacturing resources of networked manufacturing system in order to respond quickly to market and the sharing of resources. As the lack of capital, technology and qualified personnel, small and medium-sized manufacturing enterprises can't be independent to the construction, maintenance and management of network-based manufacturing systems. At the same time, in the era of information explosion, the amount of information is doubled in an average every 18 months, but the data currently being used only 5 percent to 10 percent estimated by experts, then how can a large number of data been converted to be reliable, commercialized information to help increasing the profits and market share? Hereby, based on the characteristics and the demand for information of small and medium-sized manufacturing enterprises in Zhejiang Province ,here a new industrial chain model of manufacture/ software / telecom service providers is offered ,that's the ASP model. Fully utilizing the communication conditions of the public Internet, and rapidly establishing a competitive platform based on ASP business intelligence environment on the Internet,and build those like enterprise business intelligence on individualized virtual website of enterprise portal to obtain the ability in rapidly responding to customer demand changes , building up their own core competitive advantage, and breaking through space and geographical constraints, realizing synergies among enterprises, shares and integrations of various social resources, providing high-quality, low-cost products and services for market, thus speeding up informatization process of provincial small and medium-sized manufacturing industry.

II. ASP

ASP (Application Service Provider) means corporation which are providing application system services for commercial and personal customers through the Internet configuration, leasing and management of business applications solutions. ASP is an advanced new services model, it offers small and medium-sized manufacturing enterprises with design, processing, management, marketing and other application software through the Internet, and provides users lacking of design, processing, and management capabilities with corresponding information technology services. The service platform enables enterprises working collaboratively, entrusts providers with the corresponding capacity of production for the provision of product design, preparation of complex parts NC procedures and processes, provision of processing equipment, and manages product data, human resources, projects, distribution, etc., provides product maintenance, system maintenance and other technical supports. Meanwhile, service platform also includes the establishment and maintenance of industry-oriented or enterprise-oriented data centers, the operation and maintenance management service for corporate offices, coordination office systems, as well as web-based training, online mall, online exhibitions and other public technique services. ASP model has been started extensively in the informatization process in the domestic and foreign businesses, which would become the basic model for operating and managing application in China's small and medium-sized manufacturing enterprises, and with which small and medium-sized manufacturing enterprises can achieve the goal of informatization.

III. BUSINESS INTELLIGENCE AND ITS CORE TECHNOLOGY

BI (Business Intelligence) is the process of business information collection, management and analysis, the purpose is to make corporate decision-makers at all levels acquire knowledge or insight, to help them make better decisions for their enterprises. The main principle of its work is carried out by the data extraction, cleansing, clustering, and mining of dialysis treatment to produce the various display data [1]. These data can directly show some management attribute or the laws of the market sought by the analyzer. Enterprises can fully exploit the existing data resources, capture and analyze

information to help enterprise managers to make better business decisions. This can not only be found from witch laws of the market, prediction of the future trend of development, forecasting and monitoring of risks, but also can assist decision-makers to discover new profit growth, and optimize enterprise resources, which will help enterprises to achieve more robust operation and management objectives. Business Intelligence mainly includes the following four core technologies.

1. Data warehouse Technology (DW)

Data Warehouse is a data set which is subject-oriented, integrated, stable, and containing historical data, establishment Data Warehouse which used in supporting management and decision-making is the data base of achieving business intelligence, and which is the accurate summary of the data of long-term corporate affairs. Set up a Data Warehouse is the base of handling massive data. Data Warehouse is the core architecture of Business Intelligence System, which works on the data collection, integration, storage, management, business intelligence deals with the data that has been processed, and making business intelligence can be more deeply focusing on the extraction of information and discovering knowledge. Data Warehouse captures or loads in massive original information for Business intelligence, merges various data sources of data to support enterprise management and commercial decision-making [2].

2. On-Line Analytical Processing Technology (OLAP)

Online analytical processing provides a technical basis for the precise definition of multi-dimensional model and manipulate multidimensional cube. Using the technology can do online analytical processing to data based on multi-dimensional business data in Data Warehouse, generate new business information, and also monitor the effectiveness of business operations in real-time, which makes managers can freely interconnect the business data.

3. Data Mining Technology (DM)

Data mining is a process of mining knowledge that feed the public interest from massive data stored in the Data Warehouse, Data Warehouse or other information Data Warehouse. Use the highest level characteristic of business intelligence of the technology to find previously unknown, understandable information in the massive data and documents to predict future business behaviors.

4. Enterprise Information Portal Technology (EIP)

Enterprise Information Portal technology provides an interface between commercial information and the application software for users and enterprises. Enterprise business information, not only stored in a Data Warehouse, but also distributed in different systems and applications software. Business Intelligence systems collect, organize and integrate enterprise-wide business information through the enterprise information entrance, and offer different users with different access right to information.

IV. ASP PLATFORM BASED BI SYSTEM DESIGN

A. Construction of ASP Platform Architecture

On the basis of the deep study on markets demand and user positioning determination of the ASP platform, ASP Platform software architecture is set up with application integration bus as the hub, Web applications as the launching portal and application services component library as the vector. ASP platform can run in the bottom of different operating systems and middleware, and can use various relational Data Warehouses. It can be integrated with traditional application system links through Web Service. Against the construction of network ASP platform for small and median-sized manufacturing enterprises, it can take full advantage of the public Internet communication to rapidly build up a competitive enterprise information management and e-commerce environment on the Internet, and build internal and external information exchange and resource management , supply chain optimization and electronic transactions of enterprises on the individualized virtual enterprise portal website to obtain the means and ability in response to rapid change of customer demand and build their own core competitive advantage. Specific service projects may include: enterprise diagnosis and management consulting services, implementation services of informatization software for enterprise production resources management, and production processes and product quality control for manufacturing enterprises , product designing and manufacturing digitization, manufacturing enterprise product innovation design knowledge supply systems, ASP model based customer relationship management (CRM) system, ASP model based agile supply chain management (SCM) systems, business e-commerce platform, logistics centre and its information management system, enterprise informationization construction professionals and training services, etc. In addition, it includes system maintenance, including network security, data maintenance, and the resumption of the processing, system privileges management and monitoring, etc. Make use of these services, Enterprise Alliance, supply chain management, virtual enterprise can be built up and implemented on the ASP Platform.

Based on the above analysis, design of the ASP system in the entire wide-area networks is distributed in a 'flat' structure. Each of various sub-centers is an independent platform, which can provide a complete ASP services. It realizes Resources sharing and system integration between sub-centers through directory management and information bus. ASP platform architecture is shown in Fig. 1. From analysis of the topological structure, the system is composed of three-level, the core system is the bottom layer, the physical is our ASP platform, and all applications are built on the basis of the core layer and through the core layer to do the management and publication; application service layer, a purchasable application service for enterprises, provided by third-party software providers, these application services include PDM, CRM, and so on; Enterprise layer is the user of the system, enterprises can customize

application services according to their needs, and in accordance with certain process to compose enterprise informationation systems.
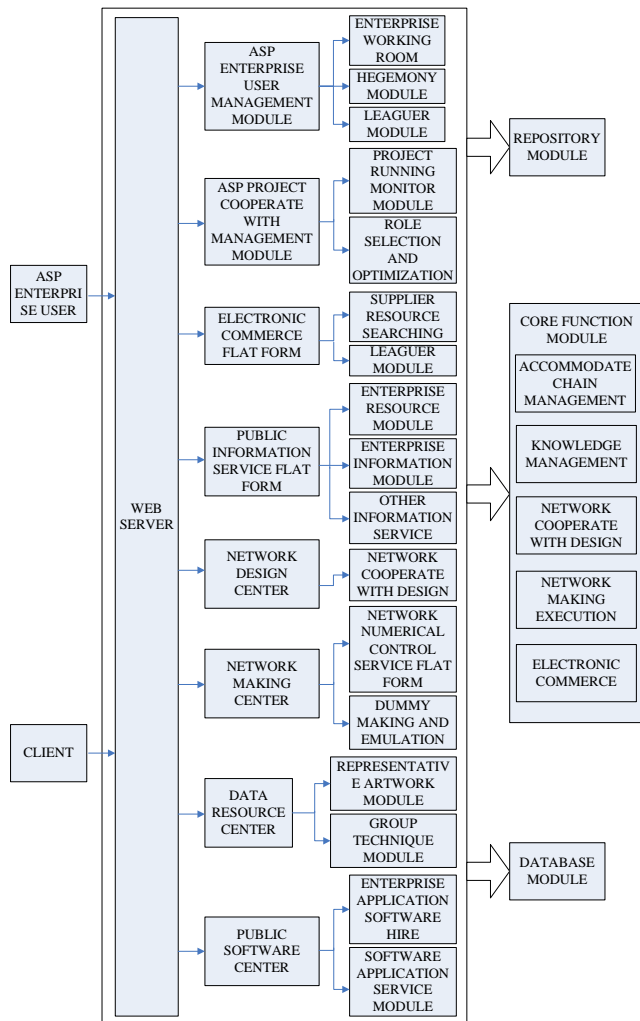

Fig. 1 ASP flat form frame structure

B. BI System Design Structure Based on ASP Platform

ASP platform Based business intelligence system design structure is shown in Fig. 2, which include physical data model design, ETL (extraction, transformation, and loading) design, data mining method design, terminal procedure design (OLAP or EIS), and other steps.
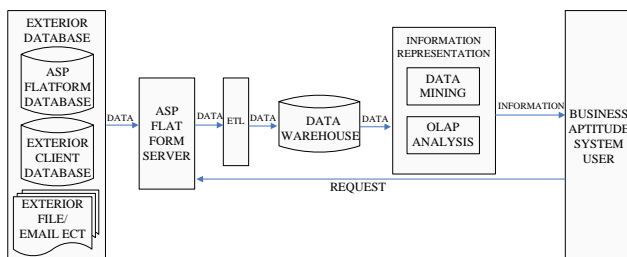

Fig. 2 BI System Design Structure Based on ASP Platform

Entity data model design a functional design for data extraction, transformation and loading.

ETL as the core and soul of Data Warehouse, can integrate and raise the value of data in accordance with the unified rules, is a process responsible for the completion of data conversion from the data source to the target Data Warehouse, and is an important step for the implementation of the Data Warehouse [3]. Business intelligence system must have the ability to extract various types of information and data, and can automatically, regularly extract information from source Data Warehouse in accordance with the characteristics and needs of policy-makers. Data transformation means the transformation from inconsistent data to consistent data under certain rules. Loading is automatically executed on the business intelligence transformation procedures server, loading procedures need to consider the changed projects in the source Data Warehouse since the last information extraction, and treat the loading time error.

Data Mining Methods Design, that is selecting the applicable data mining algorithms in accordance with characteristics of system data, such as the basket of goods analysis, time series analysis, cluster analysis, decision tree method, genetic algorithm, etc., are applicable.

End-user application system design is used to determine what form will be online analytical processing, data mining analysis of the results presented to users.

V. DATA WAREHOUSE

Data Warehouse is the soul of business intelligence, lots of business intelligence works are commenced based on the Data Warehouse. Using Data Warehouse, enterprises can accurately develop a marketing strategy and promotional activities; On the other hand, business intelligence is also a way to enhance the rate of return on Data Warehouse projects investment. Business Intelligence fully uses the results of the analysis of Data Warehouse to make marketing strategies, generate market opportunities, and exchange with customers through sales and service departments, thereby enhance enterprise profits.

A. Data Warehouse Structure

The development of Data Warehouse system will be divided into three vertical levels in this paper: data layer, design layer and application level.The basic architecture is shown in Fig. 3.
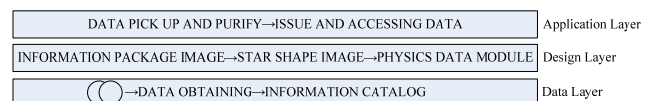

Fig. 3 3 Layers Developing Structure of Data Warehouse System

1. Data Layer

Data layer mainly centers on system managed incidence trend or pattern to organize data on the basis of business needs. It starts from the existing operating system, through visiting and using the metadata in Data Warehouse system, and then completes its metadata collection, sorting and processing, the

storage was designed in a relational Data Warehouse structure which supports query.

2. Design Layer

There are three steps in this layer.: 1)Dominated by user demands, it defines the relationship between the content of theme and test specifications of main performance through information diagram; 2) It establishes star maps which are most suitable for enquiries through using visualization of the data model, to facilitate the rapid response requirements of system users; 3) By the inter-relationship between data and entity ,it designs completely attributed data model, so that it can describe the information packets in maximized breadth and depth.

3. Application Layer

How to effectively extract data in the Data Warehouse, and then allow users to easily access and obtain relevant information through the publication, is the main problem has to be resolved in the Data Warehouse system. It is in fact including the BI-directional data transferring process between Data Warehouse system and end-user tools.

The above three levels in Data Warehouse system development are interrelated. Viewing it in logical relations, the data layer is the basis, the design layer is structural link, and application layer is the specific manifestations.

B. Data Warehouse Design: a CRM Example

1. Conceptual Model Design

It is known from current situation of small and medium-sized manufacturing enterprises. The urgent need of CRM is improving the sharing of customer information, providing customer service pertinently, enhancing brand status and analyzing changing trends in demand to determine stocks. The main analyses can be initially identified are:

(1) characterization of customer group analysis
(2) Customer buying patterns analysis
(3) Customer Classification Analysis
(4) Marketing Plan Analysis
(5) Sales Abnormality Analysis, etc.
(6)Prediction Analysis (Inventory Forecasts, Sales Forecasts)
The data needed in carrying out the above analysis:
(1) Sales data of all branch stores
(2) Inventory data of all branches
(3) customer service information
(4) Products information
(5) Branch stores information, etc.

Therefore, the border of the CRM system includes all sales subsystems, and branches management subsystem and services subsystem. Although systems involved in are in great numbers, but generally they are contained in only two major themes domain: commodities and customers. It is shown in E-R map as Fig. 4.
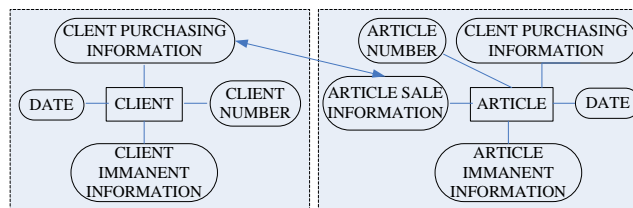

Fig. 4 E-R Map of Commodity and Customer

2. Theme Domain Analysis

Two basic themes domain been identified for the small and medium-sized manufacturing enterprises CRM Data Warehouse design in previous concept model design sect: 'commodity' and 'customer'. It can be considered that theme of 'customer' is not only a most basic business objects in CRM (such as customer purchase records, customer contact records, customer complaint records, customer records and other information is the basic business of enterprises), but also is the most important fields for the decision analysis. So theme of 'customers' is more important in significance and role when compared with another theme. Moreover, enterprises can fully understand each of their customers merely via a theme of 'customer', then provide targeted marketing programs and services as far as possible, and also if the theme of 'customer' the implemented early, it can satisfy the initial requirements of shopping mall operators to establish Data Warehouse as soon as possible. Therefore, theme of 'customers' could be determined to be implemented initially.

3. Granularity Level Partition and Data Partition

CRM Data Warehouse should also be considered the adoption of the dual-level granularity for small and medium-sized manufacturing enterprises, because of a lot of commodities that each of so many customers can buy, and the even more incalculable daily commodity sales data. New records are generated all the time in the operation environment of enterprises, and data enter the theme of 'customers' is very large, therefore multi-level granularity is the best adoption, and it is also needed to take full consideration on characteristics of the contents in the 'customer ' theme and characteristics of data analysis requirements built on the 'customer ' theme, to take detailed selection of partition form of granularity, to set reasonable level of granularity. Such as taking into account the amount of customers purchasing record data is largest, and customer analysis is mainly on the purchasing statistics, as well as the purchasing trend analysis. Therefore, the comprehensive level for the definition of commodity purchase data need to be some more rich, such as: weekly statistical customer purchase data, monthly statistical customer purchase data, as well as seasonally statistical customer purchase data of every commodity (in commodity number), weekly statistical customer purchase data, monthly statistical customer purchase data, as well as seasonally statistical customer purchase data of each category of commodity (in commodity type).

Data Warehouse is designed to support rapid analysis, therefore data organizations is in accordance with the theme of

decision analysis. While considering the data partitioning it should also start from the needs for analysis and treatment as well as taking into account the size of data and other factors. For example, only the purchase volume and purchase amount are the only indexes when doing customer purchase data analysis and inspection in garment enterprises, including the current period purchase volume/ purchase amount, accumulated purchase volume/ purchase amount, purchase volume / purchase amount for the same period last year and the increase or decrease compared etc.. Angles of an analysis on customer purchase situation taken by managers are no more than time, products, regions, clients.

4. Logic Model

Each theme of a Data Warehouse is achieved by a number of tables which are linked together by public key codes of the theme to form a complete theme. The basic theme of the system CRM Data Warehouse is given in the conceptual model design sect. Here is mainly given with mode partitions for various themes, formation of several tables, and determination of the relational modes between the various forms, which also means simple, subject-oriented modes are given to meet the needs of Data Warehouse to facilitate the on-line analytical processing and data mining.

Snowflakes-mode (snowflakes schema) shown in Fig. 5 is given for the CRM customer purchase records, which include: (i) a large and includes a large number of non-redundant data centre table (facts Table): (ii) a group of small subsidiary tables (Victoria table): (iii) data is further decomposed into additional tables due to certain dimensional tables are standardized. This makes the mode map formed to be a map similar to snowflakes.
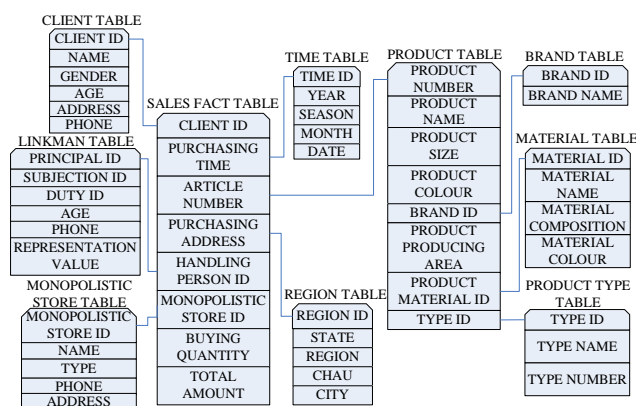

Fig. 5 Snowflakes-mode Logic Model for Customer Purchase Record of the CRM

If the Data Warehouse relates to other facts tables, for instance, the contact record of service, it may be a model of several facts tables sharing one dimensional table, this model is then formed to be a galaxy model or a facts galaxy model.

VI. PLATRORM KEY TECHNOLOGY

On the basis of the deep study on markets demand and user positioning determination of the ASP platform, ASP Platform software architecture is set up with application integration bus as the hub, Web applications as the launching portal and application services component library as the vector, key technologies include:

A. Web-based Application Service launching Portal Technology

1. Information access interface which use unified integrated interface technology. It provides unified information access interface for various information, application services.

2. High-securable, high stable, easy-to-managed network security technologies are including: (i) Network Security, comprehensive consideration of a firewall, virus protection and intrusion detection / vulnerability scanning. (ii) Data Security, such as user data isolation, data archiving / regular backups and disaster recovery. (iii) Authentication, digital signatures, key control, Universal Serial Bus (USB sticks) and etc. (iv) Rights Management, such as business group management, user management and resource management, etc. (v) Concurrency Assurance, supports for multi enterprises users access in concurrence. (vi) Reliability Assurance, the system can do stable operation when a certain degree of latency and packet loss occurred on the Internet. (vii) Load Balancing, the applications system response can satisfy the requirements of timeliness and accuracy when the concurrent request rises.

3. System Configuration Technology gives research on maintaining and configuring functional lists of DNS, directory, permissions, Web servers, application servers, Data Warehouses and directory services, and formulating error response, backup and recovery strategy.

4. Service personalization and standardization issues, it is necessary to meet the user "personality", and also take into account of service "standardization."

B. Web Service-based Component Technology

1. Multi-view information, application service provision component technology creates various "information, services provided" unified multidimensional view spaces for different user needs, multi-level application service mechanism is tailored to meet users needs through different view in this space.

2. Application Service Management Component Library builds the Application Service Management Component Library and achieves customer needs and optimizes configurations. The cruxes are: (i) Based on specific information themes-oriented and specific manufacturing industries-oriented Binding principle, service requests component and specific application service component binding mechanism. (ii) Transparent management

technology for ASP platform application services business processes. (iii) Application service management support tool set, including directory management tools for sharing of information and sharing of resources, product model visualization tools, as well as the basic process management tools for project management and coordination process.

3. Component library which for functional component library technology related to application service provision level doing assessment and control to application service level, including service-level management, user demand management, services situation analysis, as well as services-related incident triggering, information publication and warning.

C. Fast Intergration Technique based on Application Intergration Bus

1. The mechanism of linking all components by the way of messaging, realizes the integration of ASP platform and communication protocol of the application services which has been provided, Data Warehouse layer integration and application layer integration, while enabling ASP platform to support multiple operating systems, multiple Web application model and a variety of software architecture and then ensuring the openness of the ASP platform. Platform systems management technology \ real-time measurement and collection network, system, application reliability, user response time, user operation and so on of performance data.

2. Searching network manufacturing resources, evaluating and selecting of resources for achieving the optimal distribution of customer needs and application resources.

3. Developing a variety of accounting standards, such as by customer volume, flow volume, etc.

4. Providing various forms of online technical support.

VII. CONCLUSION

The informatization of small and medium-sized manufacturing enterprises occupies an important position in the process of informatization promoting the industrialization. And the small and medium-sized manufacturing enterprises have features of disorderly miscellaneous industries, less funding, lack of personnel, etc., so the purchase of information technology software and professional self-development are unrealistic to them. They need an informatized platform which is required to provide the framework of informatization. Establishing an ASP platform based business intelligence system not only can integrate manufacturing resources in the society, but also it can be transformed and applied to enterprises according to the ASP model, it plays a linking role in application connectivity between the informatization manufacturing resources and enterprises and help pushing small and medium-sized manufacturing enterprises informatization construction, and it has general features of

applicability and practicality to the small and medium-sized manufacturing enterprises which are urgent for informatization and business intelligence.

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Fengchi Shen (1957-) is a vice-professor in Zhejiang Vocational College of Commerce.His current research interests are Computer Vocational Technology Teaching and E-commerce (phone: 13606629975, e-mail: hzsfc@126.com).

Rongtao Ding (1973-) is a lecturer in Zhejiang Vocational College of Commerce. His current research interests include intelligent teaching, multimedia technology and E-commerce. His research takes place in several projects (phone: 13018961726, e-mail:rongtaoding@gmail.com)