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A Novel Framework Of Decision Support System Based On ERP

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Abstract : ERP is the software which integrates various sub modules together so that data can be accessed from various locations. It is the package in which accessing of the data is done through single interface. In this paper we proposed about a new framework for decision support system based on the ERP & CRM. Here we also analysis the characteristics of data in the ERP system and address the problem of application of decision support system and suggest the architecture based on ERP system followed by detail interpretation of data acquisition module. Use of cloud technology had increased the accuracy ratio.

Keywords*-decision support system; ERP; data warehouse, Cloud*

1. INTRODUCTION

The implementation of Enterprise Resource Planning (ERP) has been integrating the information effectively between the various functional departments. It provides faultless integration across functional modules and a centralized data repository, along with standardized business processes and data. This type of integration facilitates corporate-wide, global decision-making as it makes it feasible to view, combine, and manipulate data across the organization [17]. The core of the ERP system circulates within the company as well as the management information and control needs of the entire production process, including reducing inventory, labor, and operation costs, improving business processes to enhance operation efficiency and improving customer response [23]. However, *Markus and Robey (1988)* pointed out that although industry specific ERP has already focused on industry characteristics and includes the optimal business operation management model, the promotion of ERP is still significantly related to interaction with the organization [23]. With the increasing functionality and application of ERP system, the quantity of transaction processing data expands so quickly that sometimes it even prevents ERP systems perform effectively. Therefore, large amount of data is abandoned and not made use of rationally. At the same time, the applications of decision support system (DSS) were not satisfaction till now. Key reasons are the deficiency, late updation, incompleteness and inaccuracy of the data that is used in making decisions.

The other key reason behind the ineffectiveness of the DSS in that it does not include the data from the CRM.

CRM has different meanings, it is a business strategy to select and manage customer to optimize long-term value, CRM also is a strategy that increases the importance of relationship marketing and integrates with other organization strategies [13][16][18]. Despite the efforts of CRM on efficiency and affectivity of management decisions, statistics reflect that unreasonable decisions are made by CRM systems; IT experts said errors were caused by incorrect or not enough data [16].

In general there are basically three type of the CRM in the existence. These are operational, collaborative and analytical CRM.

Beyond that CRM often describes a strategic or philosophic approach for managing customers [15]. Hence CRM could be seen from a process oriented, technological, capability-oriented, philosophical, and/or strategic perspective [15]. According to Forrester Research, 57% of business firms cannot justify CRM investments because they cannot measure customer profitability [15]. A CRM security strategy outlines in general terms how an organization will achieve its CRM security objectives [11].

ERP systems provide a wealth of raw materials. How to use the vast amount of data and information resources effectively to support decision-making is an important issue that the information management system is facing [16].

2. ANALYSIS OF ERP SYSTEMS AND THE APPLICATION PROBLEM OF DSS

A. C*haracter of the data in ERP systems and DSS.*

The data that comes from ERP systems gives a comprehensive account of the implementation of enterprise resource planning. But the majority of them are transaction-level data which must be processed and transferred to support decision-making.

The data in ERP systems reflects details of the current daily transaction processing, which has good character of real-time and dynamics. But DSS requires refined, integrated and decision-making subject oriented data. The data in DSS which is rarely updated includes not only the current data but also the historical data.

The quantity of the data that ERP systems produces is so large that it's bound to spend a lot of time and energy to analysis these minutia data in detail, which would affect the efficiency of analysis and make analysts ignore useful information. It's necessary to integrate the detail data in different levels. Otherwise, the large amount of data may not only hold out making policy but also become one of the prime cost of enterprise information.

The databases in ERP systems may be independent subsystems, so the data in them often lack of organization in some degree. Therefore, the data being extracted directly from different modules of ERP systems lacks of a unified format and is heterogeneous, disorderly and unstable, which would lead to the DSS can not afford useful information from a unified point of view to users?

In order to get an accurate scientific decision-making results, the data in support of decision-making must be comprehensive, accurate and stored in appropriate format .It includes not only various departments' data across the enterprise, but also those external data (such as government policy, market information, etc.), historical data, comprehensive data related to production and operations. In general, the more complete the data collection, the more reliable results obtained. Therefore, in order to use the data from ERP systems to support the decision-making, it is necessary to integrate the data from ERP systems with the external data.

B. *The application problem of DSS*

Decision Support Systems (DSS), a type of information system designed to support semi-structured or unstructured managerial activity, are ideally suited to bridge the gap between enterprise systems and decision-makers. Unlike transaction processing or operational systems, DSS incorporate specific capabilities, such as "what-if" processing, optimization, and simulation, to support managers as they wrestle with various types of decisions[5]. Moreover, DSS also store knowledge and methods, and generate new knowledge automatically. It provides the decision maker a new perspective and improve the decision-making accordingly.

As with the deployment of any type of information system, implementing DSS presents a number of challenges. There are not many successful examples of the application. There are many reasons. The following part presents some of the mainly reasons.

The important concern is that the feedback given by the user does not include while making the decision. The traditional DSS has no provision of making the decision having the effect of the CRM.

Most of the traditional DSS is based on a single database system. Some of them even share the same database with transaction management information systems. As the database language's numerical calculation capability is comparatively low, the traditional DSS is weak in expressing and integrating knowledge .So it can only provide the data level supporting for decision-making process. And it's difficult for the traditional DSS to solve the complex semi-structured decision problem. Therefore, the support offered by traditional DSS for decision-making is limited.

DSS takes integrated data as basis. However, the real data, often decentralized and most of which distributed in the heterogeneous data platform, is difficult to be integrated. The lack of adequate data and the lower ability to integrate data also led to unsuccessful applications of traditional DSS.

C. The new technology for DSS

The new technologies that is Data Warehousing (DW), Online Analytical Processing (OLAP) and Data Mining (DM), inaugurate new ways for DSS. These technologies as their own advantage and disadvantages and are not being integrated in order to overcome the various drawbacks. Their combining with each other come into being new DSS form, which is known as data warehouse-based decision support system or new decision support system [21].The new decision support system can solve the drawbacks of traditional decision support system effectively to support decision-making better by providing comprehensive data and effective analytical methods.

Data Warehouse (DW) is for analytical processing, whose data has the characteristics of subject-oriented, integrated, relatively stable, reflecting the historical changes [22]. Data warehousing is a prominent approach to materialized data integration. Data of interest, scattered across multiple heterogeneous sources is integrated into a central database system referred to as the data warehouse.

As the effective integration of the heterogeneous data sources and the data from different time, Data warehouse provides enterprises with an information integrating platform to make the data stored in warehouse more suitable for analysis and assistant the manager more effectively.

OLAP is an important analysis tools in data warehouse system. OLAP provides multidimensional model facing to analysis which adopts multi-dimensional analysis methods, makes use of slicing, dicing, rotating, drilling and other analytical tools, analyses and compare the multi-dimensional data from different angles, lateral and levels so that customers can analyze data in a more natural way.

Data Mining adopts relevant method to analyses the data in Data warehouse ideographically. It also combines with relevant knowledge and rules to find out the cryptic information and get useful knowledge, rules and models. So it can provide the user with intelligent automated assistance.

3. ARCHITECTURE OF NEW FRAMEWORK OF DSS

A. The Existing framework of DSS based on ERP systems

As the data in ERP systems can't be used by DSS to support decision-making directly, in order to use the data effectively, first we should create a data warehouse which is independent of the database in ERP systems, and then integrate the data in ERP systems and other external data related to decision-making into the DW through the data acquisition modules. We also employ OLAP and DM. Then we get the framework of decision support system based on ERP systems which

consists of question integration and interactive systems, data warehouse and its management system, model library and its management system, method base and its management systems, DM, OLAP and data acquisition module. It is divided into five parts such as data sources, data extraction layer, data storage layer, data analysis layer and data interaction layer. It's an overall framework. It is necessary to select appropriate modules according to the complexity of actual situation to develop.

In this framework, the data warehouse and the database in ERP systems are independent. So they can run respectively without disturbing each other. By getting information from data warehouse to support decision-making, it can also prevent transaction processing system from the impact of decision support system. At the same time, the two are also closely linked and ensure data consistency between the two systems through the data acquisition module.

B. Proposed framework of DSS based on ERP System

The new framework having all the functionality of existing system as well as some new features as shown in the figure 1. In this architecture we have enhanced the capabilities of Decision Support System by including the CRM with the ERP and external data sources. As we know that the CRM are based on the customer feedbacks. In the previous systems we know that the feedback was missing so that DSS are not giving the exact results.

The new proposed system employs advanced technologies such as DW, OLAP, DM and CRM, every part of which is interdependent and complement of each other, and bring their own advantages into play by themselves. The system makes good use of the field data of ERP systems and can greatly enhance the accuracy and intelligence of the DSS. The directions of the arrow in Fig.1 show the control flow in the new proposed system.

The system saves a wealth of information from ERP systems, CRM and external data sources into Data Warehouse through the data acquisition module. The data from the Data Warehouse and from the data source get integrates and stores data according to the decision-making subject so as to supply decision-maker with subject-oriented and integrated data. It also can provide simple operational support directly such as on-line analysis and report outputting, and offer OLAP and DM with high quality data resource. Model base and method base provide decision-making with models and methods. Through the combination of the data, models and methods, the system can offer quantitative analysis for aided decision-making. By using the knowledge in knowledge base it can achieve qualitative analysis to support decision-making. Through the OLAP it cans analyses multi- dimensional data so that managers can grasp the current situation and variation trend. DM is the intelligent core of the entire system, which can generate new knowledge and rules to enrich the knowledge in knowledge base so as to provide the necessary solution to the problem. DW provides a broad activity space for data mining. It accomplishes the work such as data collection, integration, storage, management and so on. What the data mining face is preliminary processing data. So data mining can be more focused on the discovery of knowledge. The question integration and interactive system provide integrated and interrelated interface through natural language processing and semantic query between the user and the system.

4. INTRODUCTION OF THE IMPORTANT PARTS OF THE SYSTEM

A. Data Interaction Layer

The question integrated and interactive systems have two functions. First of all, it is responsible or the information exchange between system and users. Through this module, the user input the data and information which is necessary to control decision-making process, and the systems show the final results to the user. On the other hand, it should also deal with the actual decision-making problem, identify, analyze and solve the decision-making problems the user described. It is essentially that the part integrated the model from model base, data in DW as well as the man-machine dialogue according to decision-making problems, compile DSS program, run on a computer, and find the solution of the problem.

B. The Data Sources Layer

In this paper the Data Source is consist of the combination of the data from the three locations.

Firstly the data from the ERP is taken along with the data collected from the CRM of the company integrated with the data from the external data sources like government websites etc. The module should also analyze the structure, sources, reliability and other aspects of the data in order to screening the useful data. The most important function of this part is saving the data in the data source (DS for short) and then this data sources is passed into the next layer of the data extraction having the processes of extraction, checkpoint, and transformation, loading and cleaning. (ECTLC).

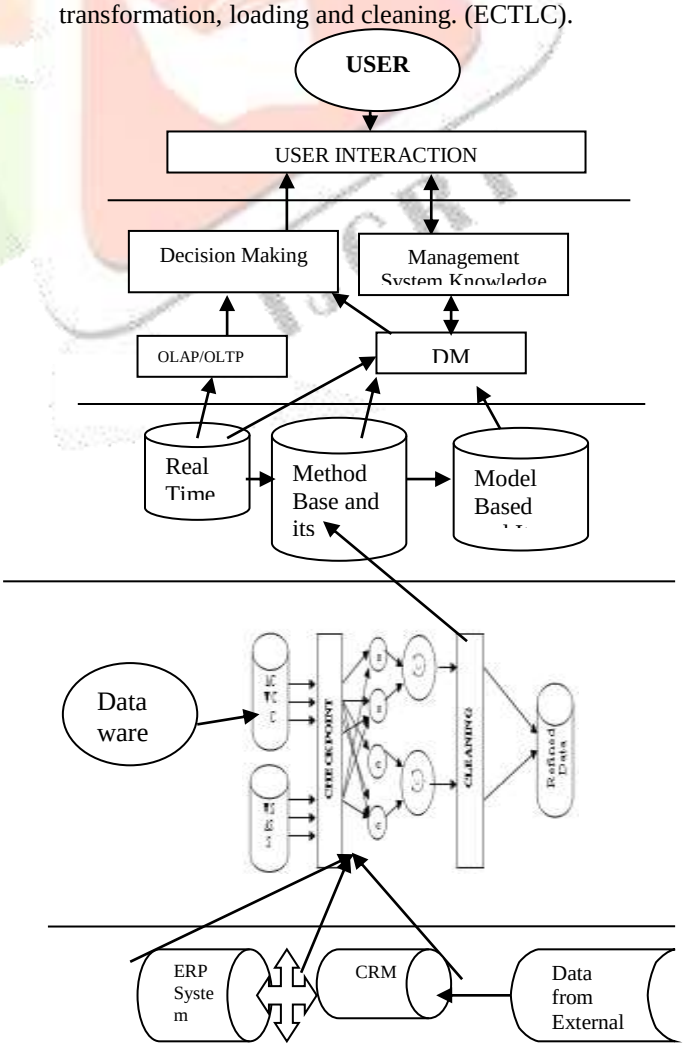

Figure 1. The New framework of DSS based on ERP systems

The data source (DS) is a collection consisted by ERP system database table (EDB for short) CRM and some external data sources such as information obtained from the network, government policies, market information, internal documents and so on (EDS for short). That is,

DS = (EDB, CRM, EDS ...).

B. The Data Extraction Layer

ECTLC is a mapping from the DS to the DW, namely,

ECTLC: DS-> DD

The extraction of the data is done by using the integration of the data coming from the Data source and from the data warehouse. Data integration proceeds in five steps: Data of interest of the company is first extracted from the sources, then it is check by using the checkpoint and then the subsequently transformed is done after this the data is loaded and cleansed, and finally loaded into the data ware-house which in this case we say as the refined data source. Dedicated systems referred to as Extract-Checkpoint-Transform-Load-Cleaning (ECTLC) tools have been built to support these data integration steps. The data warehouse facilitates complex data analyses without placing a burden on the operational source systems that run the day-to-day business. In order to catch up with data changes in the operational sources, the data warehouse is refreshed in a periodic manner, usually on a daily basis. Data warehouse refreshment is typically scheduled for off-peak hours where both, the operational sources and the data warehouse experience low load conditions, e.g. at night-time. In summary, the traditional data warehouse stores historical data as of yesterday while current data is available in the operational systems only. The integration of the database of the CRM helps the DSS to add the feedback and the RFCs generated by the customers. Today's business users, however, demand for up-to-date data analyses to support timely decision making. A workable solution to this challenge is shortening the data warehouse loading cycles. This approach is referred to as near real-time data warehousing ECTLC [9]. In contrast real-time solutions this approach builds on the mature and proven ECTLC system and does not require the re-implementation of the transformation logic. The major challenge of near real-time data warehousing is that data warehouse refreshment can no longer be postponed to off-peak hours. In particular, changes to the operational sources and data warehouse refreshment may happen concurrently, i.e. the ECTLC system cannot assume the source data to remain stable throughout the extraction phase.

It extracts the data in DS and converters the data before saving into the data warehouse. After ECTLC process, scattered data sources were transferred into clean, consistent, decision oriented comprehensive data.

In [7, 8] we proposed an approach to derive ECTLC jobs for incremental loading from given ECTLC jobs for initial loading. We first identified distinguishing characteristics of the ECTLC environment, most notably properties of Change Data Capture mechanism at the sources and properties of the loading facility at the data warehouse. We then adapted change propagation approaches for the maintenance of materialized views to the ECTLC environment. However, data warehouse refreshment anomalies occur irrespective of the actual change propagation approach.

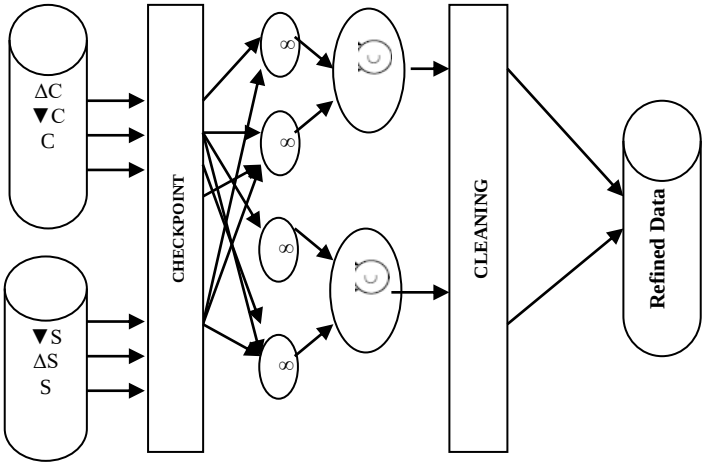

Figure.2 The new logical framework for ECTLC processes

ECTLC process ensures that data and information came from different systems has the consistency and integrity, and be saved into data warehouse as required. Its logical framework diagram is shown in Fig. 2 which describes the framework of general ECTLC processes abstractly. It presents how the data sources (mainly relational database tables in ERP systems) finally flow into the data warehouse or data mart through the data staging area.

5. CONCLUSION

The implementation of ERP systems has brought the enterprise significant benefits as well as generated a lot of business process data. The inclusion of the CRM data along with ERP system, provide good support for decision-making, and improve the accuracy of decision making if used correctly. Therefore like other systems DSS will be also stronger with feedback as a backbone. External resources also play a vital role in making Decision support system more effective and efficient. Further researches may be carried out by breaking CRM system into smaller components as one can analyses each and every component for enhancing the capabilities of Decision support System. It could be a very good mode to help businesses take full advantage of the data in ERP systems to support decision-making and improve the capabilities of decision support system.

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