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Financial System Analysis and Research of OLAP and Data Warehouse Technology

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Abstract: With the continuous development and progress of scientific technology, the computerization of financial are getting more sophisticated while the financial gradually moving to the changes of the financial analysis and management functions. In this transformation, the information system with traditional simple financial accounting oriented obviously cannot meet the new demand. In order to reach auxiliary enterprise management and decision-making on the basis of the accounting data, we need to do some exploration and research for related systems. Today, OLAP and data warehouse technology are getting more and more matures, an important goal is that to do some processing and analysis of enterprise data, thus providing a better, faster and more efficient support, in order to provide a greater competitive advantage for enterprises. So, the OLAP and data warehouse technology is gradually being the first choice for most enterprises. Because of the support of these two technologies, the formation of the financial analysis system with business-oriented provides a good solution for the problems encountered in the work of corporate financial analysis. Based on this, the study do some related research about the financial analysis system based on OLAP and data warehouse technology. First, it has an overview of OLAP and data warehousing and a detailed analysis of the financial analysis system design based on OLAP and data warehouse technology, we hope that it can be a reference to the related business.

Key words: OLAP, data warehouse, financial analysis

INTRODUCTION

Since the reform and opening up in China, coupled with the continued integration of the international, making China's economic development has entered a new historical period, in this era of economic, liberalization and globalization of trade has become a mainstream. In this context, on the one hand, enterprises have more market opportunities, on the other hand, enterprises faced with greater challenges and competitions. These years, computer technology continues to mature and spread, making it a necessity for major companies. In addition to the increase of the degree of automation, making the traditional manual work gradually replaced by the computer which in a certain extent, improve the efficiency of business operations, also reduce the running cost and improvement of the core competitiveness of enterprises. This is particularly reflected in the financial accounting computer applications, many companies have strengthened the improvement of computerization of financial. Financial accounting operation freed.

Such as a petroleum marketing companies which belong to a Natural Gas Company Limited subordinate unit which main work are the sales of refined oil and transporting. The Company and its subsidiaries are using the "Petroleum Finance Management Information System" in conducting financial works which will appear some problems when encountered financial management functions: (1) The report data is too rough, the amount of information is not enough and unable to meet the financial analysis requirements; (2) Accounting data is not concentrated enough, so lack deeply analysis for the global financial; (3) Financial data caliber is very single, then the ability of the compatible the sales data is not good; (4) This class system is typical of transaction-oriented systems and therefore, do not have the online analysis capabilities; (5) The financial analysis should have the flexibility to respond to the requirements, so the original system should have a higher requirement. Over the years, the company improved the finance.

We can see from Fig. 1, the company's financial analysis system "(Financial Analytical System)" are a part of the aforementioned enterprise management information system and it belongs to the most downstream data processing module which related data from other system modules accepted processing and reprocessing, the final analysis. As mankind enters the 21st century, the data warehouse technology has been rapidly develop, the most favorable data technology that online analytical processing (OLAP: On-Line Analytical Process) technology in the continuous development of mature and in many applied also achieved successful results in the field. This study does some research about the application financial analysis system within OLAP and data warehouse technology (Barrios, 2013).

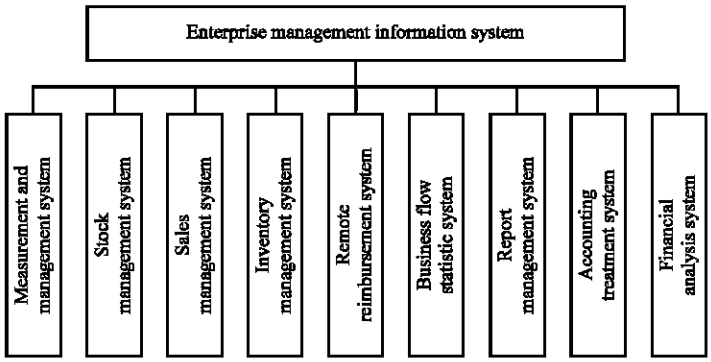

Fig. 1: Location of financial analysis system in a corporate management information system

OVERVIEW OF OLAP AND DATA WAREHOUSING

OLAP: OLAP, online analytical processing technology, English stands for On-Line Analytical Processing, it is a multi-dimensional data analysis techniques usually need to establish the basis of the data warehouse and online data access for a certain theme, processing and analysis, using an intuitive results from a variety of data with multiple dimensions extent presented to the user, in order to deepen the understanding when obtain data for users. OLAP is a gradual mature decision support tool belongs to the information technology field in these years. The goal of the birth of such a decision support means is same to universal decision support system, is about to make the conceal complicated data visualization and concrete. Although we have many decision support technologies in these years in our country but OLAP has its flexible analysis capabilities, intuitive data manipulation and visualization of the results of the expression, so it gain great success. OLAP makes enterprise business management from the front desk to the background of the decision analysis gradually, which alternate the different levels of management to provide a multi-angle and convenient way of exploration enterprise data (Malaainine *et al*., 2013).

Multidimensional belongs to the most critical attribute in the OLAP; this kind of system must be multi-dimensional view of the data analysis for financial work, for example, fully supports with hierarchical dimensions and multiple hierarchical dimensions. But in fact, the multidimensional analysis is still the most effective method of enterprise data analysis which was undoubtedly the OLAP soul resides.

OLAP system should have the capacity of processing and application logic analysis and statistics. Even though the system before will be pre-programmed but that does not mean that the system in advance it will be for all applications defined and the user can define a new application specifically calculated as part of the analysis, according to the actual needs to select the ideal way to the report. In addition to the analysis of the data in OLAP system, the user can also connect other external analysis tools to analyze, For example, the cost allocation, tools, time-series analysis tools, data mining, etc.

Currently, users have a high demand for the rapid response capability of the OLAP, the general system should respond to most analytical needs of users in the five seconds. Once the end user has not receive the response from the system in thirty seconds will be impatient and ultimately the failure of the analysis of the main clues leading to poor quality of the analysis. However, most of the data analysis is very difficult to achieve this speed, it is necessary to provide the relevant technical support, for example, a large number of advance computing, specialized data storage format (Sridhar *et al*., 2012).

No matter how much is the data, where the storage, OLAP system is able to obtain the necessary information and manage a large of information. But we should consider some factors. For example, the available disk space, whether data can be copied and its degree of binding with the data warehouse.

Data warehouse: The concept of the data warehouse comes from the mid-eighties of the last century which firstly appeared in a book "the establishment of a data warehouse" which author is known as "data warehouse Father" William H.Inmon. Since then, humans study, management and analysis about large-scale system become more deep and improvement, coupled with constantly sum up, rich and concentrate enterprise management and decision-making experience, gives data warehouse a very precise definition: Data warehouse is enterprise management and decision-making subject-oriented, integrated, time-related which cannot be modified data collection. Data warehouse does not have strict mathematical theory basis, as well as more mature basic mode, the main bias is engineering and therefore, with a strong engineering. Generally, people are accustomed to analysis it from the technical work, the main three key technical parts are as follows.

Table 1: Comparison between the traditional data financial analysis and data warehouse

Project	Financial analysis of traditional data	Data warehouse technology
Hardware features	Mostly stand-alone or small network version	Network version, accommodate large network environment
Database software	Unipole or common network database	Microsoft SQL server data warehouse
Speed of analysis	Start faster, more data is very slow	Designed to handle large amounts of data design, fast
Analytical conditions	Limited to the three-dimensional within	Can achieve the effect of multidimensional data analysis
Security	Provided by a variety of financial software	Integrated in the Microsoft database and operating system
Results	Fixed statements or simple icon	Dynamic reports and dynamic icons can be used simultaneously
Design ideas	Multi-subsidiary business systems	Demand designed specifically for decision support
Internal structure	a stand-alone or C/S structure	Based on advanced B/S structure
Scalability	Limited to the departmental level	Can be expanded to the various departments of the enterprise
Extensibility	To consider the impact on the business system	Independently of the business system, strong maintainability

Data extraction: Data into the warehouse entrance is data extraction but the data warehouse belonging to independent environment, so their needs through the extraction process to achieve the data source into the data warehouse storage medium. The technology of data extraction mainly related to is nothing more than the interconnect, copy, conversion, incremental, scheduling and monitoring, data warehouse are not required to keep pace with the on-line system, the extraction can be timed just during multiple extraction, should pay attention to the time, the order of these plays a vital role in the effectiveness of the information (Rangoaga *et al*., 2012).

Data storage and management: The real key to the data warehouse was undoubtedly the storage and management of data, its organizational management determines the difference between the traditional databases but also determines the form of the performance of the external data. In order to establish a suitable core data warehouse, we need to discuss the specific products and technologies, that is to say starts with the characteristics of data warehouse technology.

Data performance: Popularly, the data performance is the facade of the data warehouse, the performance is mainly concentrated in the multidimensional analysis, data mining and mathematical statistic and so on and multidimensional analysis was undoubtedly the most important manifestations. These years, the Internet continuous development and expansion, multidimensional analysis tools and pays more attention to provide Web-based front-line analysis of the interface, rather than just simply data posted online (Rangoaga *et al*., 2012).

Compared with data warehouse and the use of financial data analysis from domestic enterprises, has its own characteristics, specifically, as shown in Table 1.

FINANCIAL ANALYSIS SYSTEM RESEARCH BASED ON OLAP AND DATA WAREHOUSE

Architecture design: Hierarchical logical structure consists of three main areas, specifically, as shown in Table 2.

Table 2: Specific content of the logical structure of the hierarchical

Part	Content
Data presentation layer	Data slice
	Data drill
	Data rotation
Data processing layer	Data loading
	Data conversion
	Data extraction
Security management	Permission maintenance
	User management

It can be seen from Table 2, the hierarchical logical structure, the longitudinal direction is divided into a number of separate but the level of convergence, between each focused on the realization of the corresponding functions and the hierarchy between the data level information the exchange and sharing.

The financial analysis system involved in this study, have frequent access requirements and requirements related to client business analysis and processing capacity, in addition to the relevant user application environment is also more concentrated which makes the system should have a good network communication conditions, therefore, is a client/server architecture. The specific contents aspects are as follows.

Firstly, the database server use the large-scale relational database, Sybase SQL Server which provides powerful data storage, transaction processing and access capabilities.

Secondly, the server application development mainly in data modeling based on a relational database for data warehouse multidimensional data manipulation capabilities.

Thirdly, the client mainly uses the professional database front-end development tools (Power builder) to implement the interaction with users and data display (Ameur and Tkiouat, 2012).

Fourth, the client application development using the multi-layer system design, making the business process layer and user interface layer formed between two logically independent, would be a more reasonable distribution of such system functions and also for the system by the C/S converted to B/S provides convenience (Boujenfa and Limani, 2012).

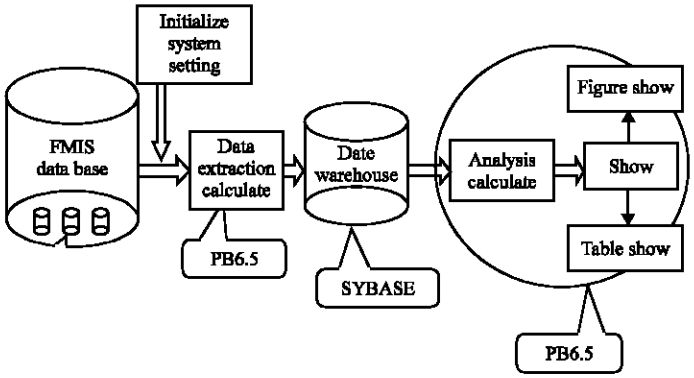

Fig. 2: A process flow schematic diagram of index analysis

Financial analysis model design: For some more stable indicator analysis mode analysis, should draw on the thinking of the storage and management of data warehouse, so as to establish a functional cure data model, this analysis needs, the concrete realization process design shown in Fig. 2.

As shown in Fig. 2, when performing financial analysis, we should begin in the following aspects.

Firstly, we must do initialized and system settings mainly include: (1) The definition of various types of coding dictionary; (2) The definition of analysis projects; (3) The definition of the disjunctive equation; (4) Enter the initial data (Ejiagha *et al*., 2012).

Secondly, the definite disjunctive equation original data should be extracted from subsystem statements subsystem and accounting subsystem of financial management information system to financial analysis within the data warehouse.

Thirdly, in order to meet the analysis of different user selection, we should do further meta data handling and calculation and ultimately the formation of the actual required financial analysis, finally, displayed by analyzing the display module.

People often encounter random data processing in the field of financial management and analysis, for example, the specific treatment of one or a batch of target data, making the transformation as some kind of ideal state, in order to meet the manager-specific decision-making needs. However, in the general case, the data morphology in the financial statements for conventional financial accounting needs and therefore, unable to adapt to such non-predictable handling. Therefore, the design should be designed for the analysis of the data set to the make-up of this type of demand before the related effect. Specific concepts are shown in Fig. 3.

As to Fig. 3, the following aspects should be elaborated: (1) Data, the analysis of data set is not limited to financial data analysis, based on the data level focus can be oriented to solve the various information systems analysis needs; (2) Function data set analysis broken down into smaller direct-to-a particular, known analysis of requirements but rather attempts to provide a model, then the user will be able to operate the model, in order to achieve the related goals of analysis; (3) In this analysis process, the starting end of the analysis is the user, it can be said the system source or the analytical needs of the analyst and the analysis of the final point desired by the user in generating the analysis result.

Data model design: During the data model design we should strive to model intuitive way to express the organizational structure of the data and the relationship, as a next step design and implementation of the foundation which have shown the system specific data structures, the formation of a new the framework of the system data. We can choose between two methods to express it, one is entity-relationship model and the other is the dimensional model, this study choose the second one to express.

Dimension belongs to a physical characteristic and belongs to the main way expression of business information and user access, generally as an angle of the analysis, for example, time, product, place but its analysis of the standard is called the metric. As to a data warehouse, its most concepts are fact data, the dimensional data is only one yards of the fact data. A group of peacekeeping and associated metrics together constitute the factual data. Save-dimensional data table is called dimensional table and save the fact that data is called the fact table, the fact table located in the center surrounded by the relevant categories of peacekeeping, can constitute a joint topology, this logic we relational data warehouse often met and this study just adapt such modeling. The difference between fact data and dimensional data are shown in Table 3.

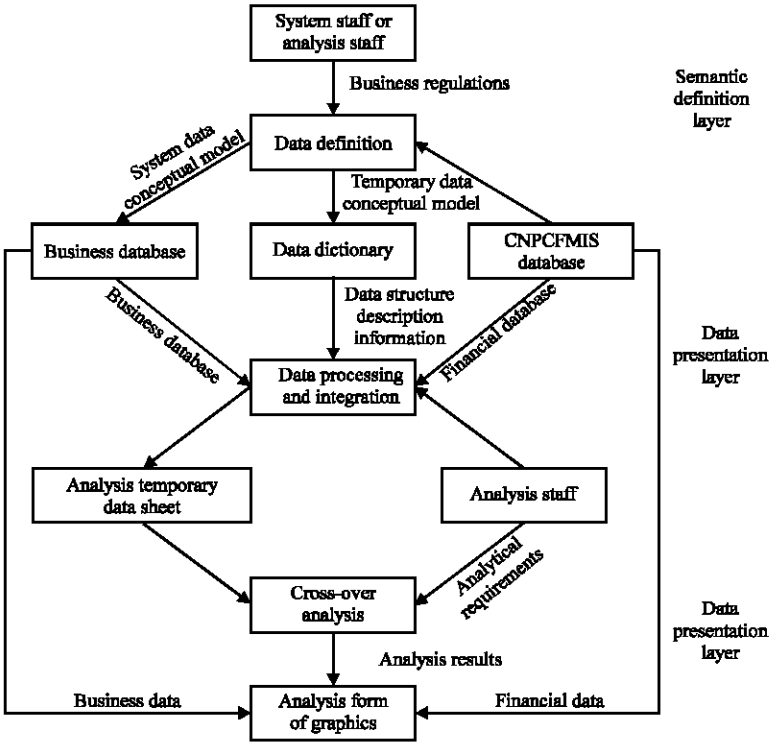

Fig. 3: A process flow of data set analysis

Table 3: Difference between dimensional data and fact data

Contrast entry	Dimensional data	Fact data
Data size	A few lines to hundreds of millions of lines	One hundred trillion rows
Key	A primary key	Multiple foreign keys
Data types	Mostly character data	Data value type data
Changing frequency	Frequent changes in	Do not change

As shown in Fig. 4, star data structure model index analysis of the system. the most important aspects are as follows.

- **Firstly, dimensions of performance indicators:** The main body of the analysis object. As to a performance indicator which is defined by the user, the indicators dimensional is organized by level. The Upper indicator index value is calculated by underlying index in a certain way; relationship between the upper and lower indicators performance indicators calculated; indicator located in the bottom is obtained through the system of indicators, the fetch process performance as an indicator of the disjunctive equation; indicators calculated and disjunctive equations are based on user's own definition for
- **Secondly, time dimension:** Time data analysis are identified. The time dimension is divided into four levels, respectively, the year, half a year, quarter and month. Various indicators occurs according to the level of a certain time, for example, a simple monthly, the quarter units occurs according to the month, quarter and thus generate relevant indicators data. In addition, various indicators can also be based on a combination of multiple layers of time as a data cycle, also called the combination of financial indicators

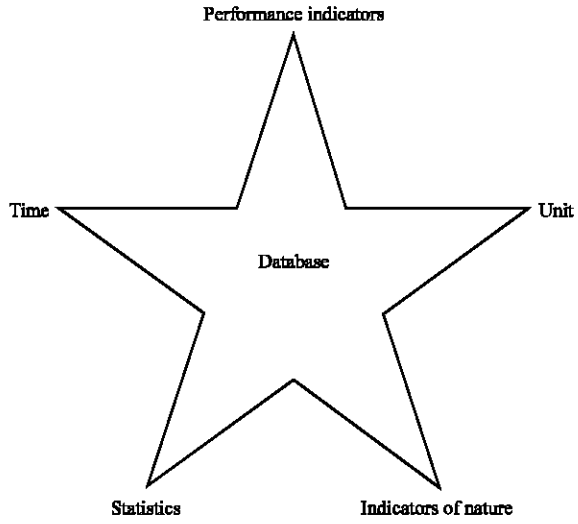

Fig. 4: Star data structure model of index analysis

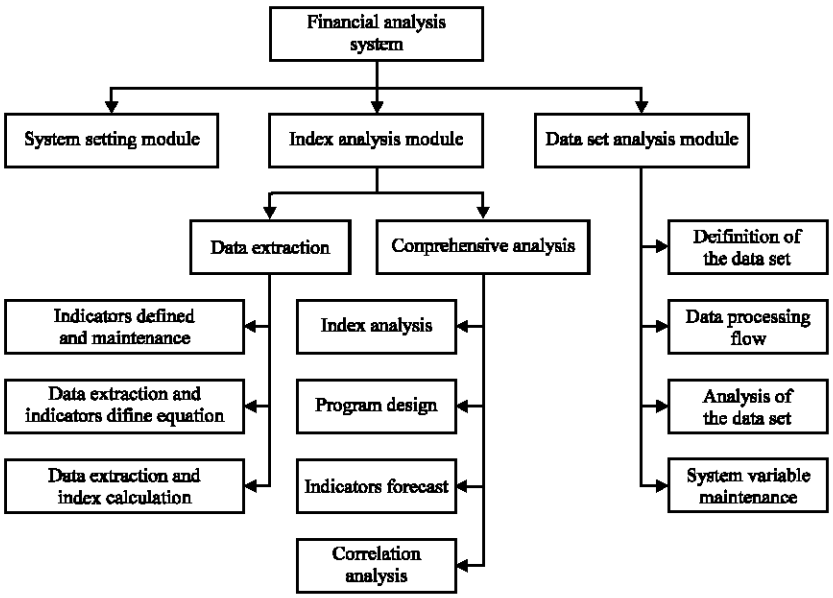

Fig. 5: System function block diagram

Table 4: System settings module object and the corresponding function

Object	Main function
Eissrsc.Pbl	Common input and output modules, universal data input/output, transfer in/out and print functions
Eisxtgl.Pbl	System management module, such as user management, user change, modify the password system blockade
Eisinst.Pbl	System installation settings module, such as financial analysis system installation, database creation
Eispubl.pbl	Public modules, such as login window, database counection function

- **Thirdly, unit dimensions:** To provide the the indicator data belongs department information. By the same token, the unit dimension is also generated by user-defined the unit data with a certain level of relationship and the units are often on different levels has a corresponding relationship with the upper and lower levels in part of the enterprise organizational system. Each unit defined has its own unit class attributes and data extraction index equation defined according to the class of subject (Cross *et al*., 2012)
- **Fourthly, indicators nature dimensions:** That pointed out that the indicators data belongs budget value or actual value. For the budget with the actual values of the indicators are obtained by the budget equation and actual equation
- **Fifthly, statistics dimension:** The description of the statistical properties of the indicators data. Statistic references the indicators analyzed the data, the statistics contained in the "budget" and "actual" while both refer to the budget with the actual values of the indicators data generation

As shown in Fig. 5, it is a functional modules schematic diagram of OLAP and data warehouse technology-based financial analysis system, can be seen from the figure which mainly consists of three modules: System settings module, the indicators analysis module data set analysis module. Specifically, the three aspects are as follows.

System settings module: System settings module set the maintenance of information work in order to complete the system, for example, parameter setting and maintenance of the data, be connected to the database user management and system security, data maintenance and processing, as well as the maintenance of the operating authority of the user. Here, as shown in Table 4, to conduct a detailed analysis.

Indicators analysis module: The index analysis module refers to the financial work involved to examine the data items is set to the corresponding financial indicators as core to expand indicator data extraction and analysis. Overall, the module consists of two parts, one is the data extract and the other is the comprehensive analysis of the data. In order to further elaborated there may be formed shown in Table 5.

Data set analysis module: Analysis module of the data set has certain adaptability, continuous data processing but also on the collection of data and can be expanded to a

Table 5: Index analysis module object and the corresponding function

Object	Main function
Eissjxq.pbl	Implementation indicators data extraction operation, the external system data extraction to the indicators system
Eiszbjs.Pbl	Build the index calculation tree implementation of relevant indicators calculated to produce a non-detail level indicators data
Eiszbfx.pbl	Work based on the analysis of financial indicators: Drill analysis, composition analysis, comparative analysis
Eisfasj.pbl	Program design features, auxiliary enterprises budget
Eiszbyc.pbl	Trend forecasting indicators, the arithmetic average, weighted average, exponential smoothing and other calculation methods
Eisxgfx.pbl	Indicators correlation analysis, linear regression, multiple linear regression and one Yuan polynomial regression analysis method

Table 6: Data analysis module object and the corresponding function

Object	Main function
Eisdsdef.pbl	Data sets defined function: Register of the data set, the data structure semantic maintenance
Eispflw.pbl	Define, implement and other operations of the data processing flow
Eiscross.pbl	Crosstab analysis capabilities datasets
Eisgraph.pbl	Analysis of data related to maintenance, variable management functions with data sets

wide range of data and the operating environment is also relatively safe. We can further analysis of such a module as shown in Table 6.

CONCLUSION

Today, the domestic and international competition is gradually increasing, companies wishing to gain a foothold in this environment, you must do financial work and the financial analysis was undoubtedly the most important. Financial analysis work should follow the pace of scientific development, use the existing advanced information and tap the potential value of the information, the deepening financial analysis system, thereby gaining access to more wealth. A financial analysis based on OLAP and data warehouse technology involved in this study has gain certain application and achieved good results. I believe that with continue explore and study, its value will be more digging.

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