Design and Development of Enterprise Management Accounting Information System Based on BI Technology

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Abstract: Based on Hadoop architecture, combined with data warehouse technology, data mining technology and OLAP online analysis technology, and based on the idea of software system engineering, this paper constructs an enterprise management accounting information system. The system will aim at various limitations existing in the practical application of enterprise management accounting at present, and will take the convenient network information technology and efficient big data technology as the basis, and take business intelligence as the connection point to realize the highly modeled and virtualized construction of management accounting business. JavaWeb supports users to use accounting analysis, risk management, decision support and other system modules to complete various operational functions of enterprise management accounting. It will also strengthen the circulation and application of enterprise data information, promote the transformation of enterprise conventional data information into business opinions from different angles, plan and control various economic activities of enterprises, and help decision makers make various targeted decisions. Business Intelligence (BI)-based enterprise management accounting information system can fully reflect the advantages of comprehensive application of data and multi-dimensional mining analysis under the premise of integration of industry and finance, which will bring enough help to the business development of enterprises and promote the construction of management accounting informatization.

Keywords: Business intelligence (BI); Hadoop architecture; Management accounting information system; JavaWeb

1 Introduction

In recent years, with the rapid iteration and comprehensive application of Internet, cloud computing and artificial intelligence high-tech, the types and scale of data in the social environment show an exponential growth, which not only shows a positive impact in people's daily life, but also marks the official arrival of the era of big data with the majestic power to reshape the economic structure and promote social development. As the commanding point of global science and technology and industrial competition, big data has become the core power of global economic recovery and development, and has continuously led human society from

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the industrial economy era to the digital economy era [3]. As a brand-new economic form, digital knowledge and information have become a necessary production factor and strategic resource, which not only promotes the transformation and upgrading of enterprise industrial model, but also promotes the upgrading of enterprise management model, and then influences the value orientation and development prospects of enterprises. This will change the decision-making function, management role, management means and management efficiency of the management accounting directly involved in value creation in the digital economy era.

Since management accounting was introduced into China in 1970s, it has gone through many stages of academic research and practical exploration, and its functions and working methods are constantly evolving and changing. From the initial single strong cost control and internal management of enterprises, it has gradually changed to participation in business planning and decision support, and it has become the most effective tool for the integration of strategy, business and finance of enterprises. However, in the face of the rapid development of digital economy, the production, operation and management activities of enterprises have been upgraded digitally, and the traditional management accounting system and mode of thinking have been obviously unsuitable. Many shortcomings such as "neglecting management and emphasizing accounting", "neglecting theory and emphasizing methods", "neglecting the overall situation and emphasizing local affairs" and "neglecting data and emphasizing accounting" urgently need the support of current high-tech network information technology and data processing technology to complete the functional innovation of management accounting. With the National Ministry of Finance successively promulgating "Guiding Opinions of the Ministry of Finance on Comprehensively Promoting the Construction of Management Accounting System" and "Outline of the 14th Five-Year Plan of Accounting Reform and Development", it provides important guiding opinions for deepening the application of enterprise management accounting. Under the general situation of digital economy, enterprise management accounting should take financial data and business data as the foundation, make full use of the advantages of specialized division of labor, Internet, big data and intelligent technology, establish a data sharing service center, and incorporate the informatization demand of management accounting into the informatization planning. So as to realize the overall planning of informatization construction and practical application, and promote the effective application of management accounting by building new or integrating and reforming existing systems [10]. In view of this, this paper believes that taking business intelligence technology as the core, combining Hadoop architecture and JavaWeb application development technology, we can complete the construction of enterprise management accounting information system. As the most advanced application of management accounting, business intelligence can extract, clean, store, analyze, mine and visualize the data of various operating systems of enterprises, and develop the existing problems and optimizable links of enterprises with real data results. It also helps enterprises to establish and improve modern enterprise systems and enhance their core competitiveness and value creativity from accounting analysis, risk management and decision support. At the same time, it has promoted the informatization construction of management accounting, and fully confirmed the significance of comprehensively promoting the construction of management accounting system.

2 Introduction of key technologies

2.1 Business Intelligence (BI) technology

Business Intelligence (BI) technology refers to a comprehensive solution that uses modern data warehouse technology, online analysis and processing technology, data mining and data presentation technology to complete data analysis to realize commercial value. Business intelligence technology has the characteristics of systematization and systematization. After the whole workflow is highly virtual and abstract, from the system level, business intelligence technology can be divided into four stages: data preprocessing, data warehouse establishment, data analysis and data presentation. From the architecture point of view, business intelligence includes active data layer, data conversion layer, data warehouse (data mart) layer, OLAP and data mining layer and user presentation layer [9]. As shown in Figure 1, it is the overall architecture design of business intelligence. The figure not only defines the data flow path under business intelligence technology, but also shows the application levels of four key technologies.

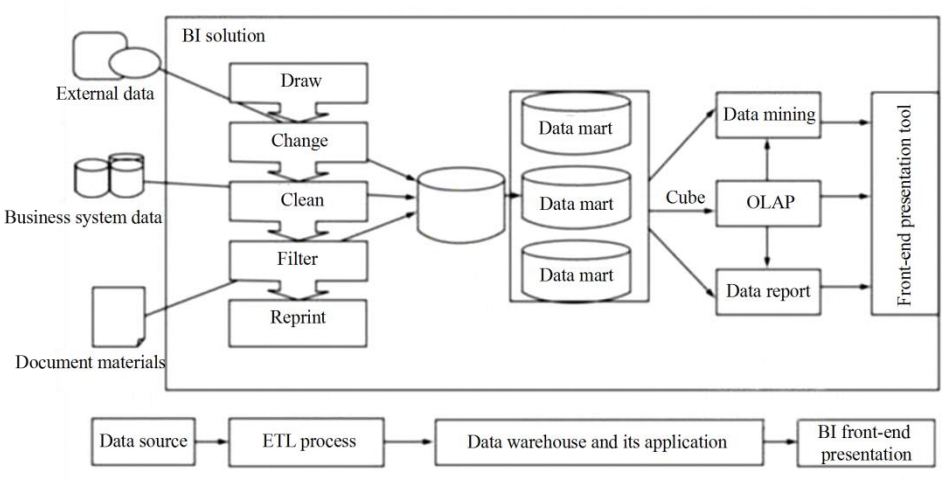

Figure 1: Overall architecture diagram of business intelligence technology

Data warehouse technology: Data warehouse is a subject-oriented, integrated, relatively stable data set that can intuitively reflect historical changes, and is used to support enterprise management and decision-making process. The upstream of the data warehouse is all kinds of data sources, and the downstream of the data warehouse is analytical data that can be used for mining and processing [4]. Compared with the traditional database software, the data warehouse can adapt to the frequent updating of data, and can accept many types of data sources, including semi-structured or unstructured data. It can finish the secondary processing of data, that is, according to certain rules and standards, it can process a large number of historical data.

The construction of data warehouse needs to go through two basic steps: model design and ETL processing, in which model design and establishment include conceptual model, logical model and physical model, while ETL processing includes processes such as extraction, cleaning, conversion and loading. It is not only the crucial link of building data warehouse, but also the core of enterprise data management.

Online analytical processing technology: Online analytical processing (OLAP) is the most widely used data analysis technology at present, and it is also one of many methods to support data analysis decisions. OLAP can break through the limitation of traditional relational database with cube multidimensional data structure, and realize multidimensional and efficient data operation and analysis. In the actual application process, users change the position and definition of data cube according to different analysis requirements to realize data analysis operations such as slicing, cutting, drilling down, drilling up, rolling up and rotating, so as to obtain the relationship results between different data [2].

Data mining technology: Data mining technology belongs to the same kind as cascade analysis and processing technology, which is one of the methods to support data analysis and decision. Data mining refers to the use of various automatic algorithms or semi-automatic tools to browse and traverse data, and discover potential data rules or hidden patterns. Compared with OLAP, data mining can adapt to a larger amount of data samples. The results are also more predictive, which provides necessary data support for enterprise managers or decision makers to make decisions in a changeable environment [1].

Data visualization technology: Data visualization technology can combine the data analysis results of OLAP, data mining and other technologies in business intelligence with various data charts, and can efficiently and conveniently screen and display data through flexible operation. The dynamic effect of data can intuitively express the relationship between data and the development and change trend in a period of time, and speed up the understanding and mastery of data so as to make better decisions for enterprises.

2.2 Hadoop architecture

Hadoop is an open source framework for processing, storing and analyzing massive distributed and unstructured data, and it is an open source big data software platform implemented in Java language. Hadoop architecture is characterized by low cost, high reliability, high scalability, high efficiency and high fault tolerance, which makes Hadoop the most popular big data analysis system [6]. In the process of continuous updating and development of Hadoop, it has gradually developed into a community, and many tools and components have been integrated and coordinated to form a Hadoop ecosystem, so as to solve big data processing problems more comprehensively and efficiently. Figure 2 shows Hadoop ecosystem, which mainly includes core components such as HDFS, MapReduce, HBase, Zookeeper, Pig, Hive, and other plug-ins with data capture or transmission functions such as Sqoop and Flume. For this system, the addition of Hadoop architecture can greatly expand the data source of BI technology, and users can complete more comprehensive data analysis and processing more conveniently, so as to improve the accuracy of value judgment and decision-making.

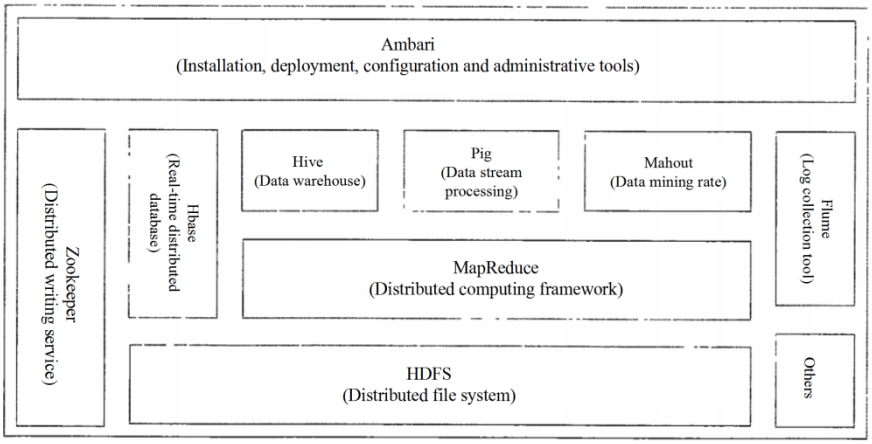

Figure 2: The Ecosystem of the Hadoop

2.3 JavaWeb Technology

Web is an application architecture based on the Internet, and its core is to provide users with various forms of information content and information services. JavaWeb is a technology stack that uses Java technology to solve the development and application of related Web. The application of Java technology focuses on the design and development of the Web server, which usually takes Java language as the development environment, relies on Servlet and JSP technology, and combines the third-party framework to realize the rapid development and application of Web applications and services. For this system, JavaWeb technology is used to build the main function page of enterprise management accounting information system and design and develop all kinds of API interfaces, and it is convenient for users to obtain the functions and services of the system through the form of Web.

2.4 Development environment

According to the application requirements of the above related application technologies, we have completed the construction and deployment of the development environment. The design and development of the whole system is divided into two parts. One is the data analysis and processing part based on Hadoop architecture, which corresponds to the first three stages of business intelligence technology. The second part is the display and application of data analysis results based on JavaWeb technology, which corresponds to the fourth stage of business intelligence technology.

For Hadoop architecture, the underlying operating system is Linux, the version is Centos 7.6, and the JDK version is 1.8 and above. Hadoop framework will be arranged as a cluster server with 4 nodes, one of which is the master node, namely Master. Hadoop. The other three nodes are slave nodes, namely Slave Hadoop, and are numbered Slave2, Slave3 and Slave4 respectively. Choose Hadoop-2.7.7, match with Flume-1.9, Kafka-2.11, Zookeeper-3.4, Sqoop-1, Hive-1.2 and other functional components, and deploy them on four nodes simultaneously to complete the construction of Hadoop cluster. Under this cluster, the ETL operation of data in business intelligence technology can be completed by relying on the above functional

components. The key code is shown in Figure 3. Sqoop is used to extract data from the database, and init_etl.sql script command is called to complete data loading, so as to complete the construction of data warehouse Hive.

```
sqoop import
-- connect jdbc mysql: // cdh1: 3306/ source?usesSL-false --username root --password 123456
--table Cus tomer --hive- import --hive-table rds. customer -- hive –overwrite

sqoop import
-- connect jdbc : mysql: // cdh1 :3306/ source?usessL=false --username root -- password 123456
--table product --hive- import --hive-table rds . product --hive-overwrite
beeline -u jdbc:hive2://cdh2:10000/dw -e" TRUNCATE TABLE rds. sales order

sqoop job – exec myjob incremental import

beeline -u jdbc:hive2: //cdh2: 10000/dw -f init etl. sql
```

Figure 3: Key code of data warehouse construction

Online analytical processing and data mining under business intelligence technology will be completed under MapReduce component. Among them, the OLAP implementation depends on Kylin, which is built on Hive and HBase. Kylin reads the source data from Hive, uses MapReduce to build the Cube, and saves the pre-stored calculation results in Hive [7]. Data mining is realized by calling all kinds of algorithms in MapReduce, for example, Apriori association rule algorithm is used to obtain the relationship between the slight changes of customer behavior and the fluctuation of the overall market trend, so as to assist the decision making and implementation.

For JavaWeb technology, we will focus on the development of user interface and the visual display of data analysis results. Its development environment is Windows 10.0, JDK version of development kit 1.8.0_74, Apache Tomcat 9.0 for Web server, IntelliJ IDEA 2019 for Java integrated development tool, Maven 3.5.0 for project management tool and MySql 8.0 for database. In IntelliJ IDEA 2019, the overall server-side framework of JavaWeb has been built by creating a new webapp project and completing the deployment of Spring framework. Through the introduction of the above key technical theories, we have determined the overall environment of system development, the configuration of related software and tools, and the technical feasibility of the overall project of enterprise management accounting information system.

3 Requirement analysis

3.1 System requirement analysis

The enterprise management accounting information system based on business Intelligence (BI) technology will aim at all kinds of dilemmas faced by enterprise management accounting at present, take the informatization construction of management accounting as the goal, take business intelligence as the connection point, and provide comprehensive solutions for

strengthening the overall and strategic situation of enterprise management accounting by virtue of the application advantages of network information technology and big data technology.

The enterprise management accounting information system based on business intelligence (BI) technology can support each information subject in the enterprise to complete the use of the system with simple registration and login operations, and become a participant of management accounting information. Compared with the traditional mode, the unified data management can not only expand data sources, promote the organic interaction between business data and financial data, but also solve the problem of data islands between business departments and financial departments. It can also integrate various data analysis and processing methods to improve the efficiency of management accounting. Thus, it is helpful for enterprise managers or decision makers to improve the enterprise management mode, control the business activities of enterprises, and improve the effectiveness and feasibility of decision-making.

3.2 Global design

The enterprise management accounting information system based on business intelligence (BI) technology will adopt B/S architecture. On the one hand, it is convenient for users of different levels, departments and roles to log in and use the system through various equipment terminals. On the other hand, D3.js class library can be used to realize the visual display of data analysis results. According to each link of data flow and analysis process, the enterprise management accounting information system is divided into data application layer, data analysis layer, data storage layer and data source layer. Figure 4 shows the overall architecture of the system. The system includes various data interfaces and system service support functions that support data sources, as well as routine accounting analysis, risk management and decision support functions. The overall design of the system is in line with economy, robustness and practical principles. There are necessary data relationships among all levels, and the arrow also indicates the direction of data circulation and application. The functional modules are independent and connected with each other, which jointly provide favorable support for the management of enterprises.

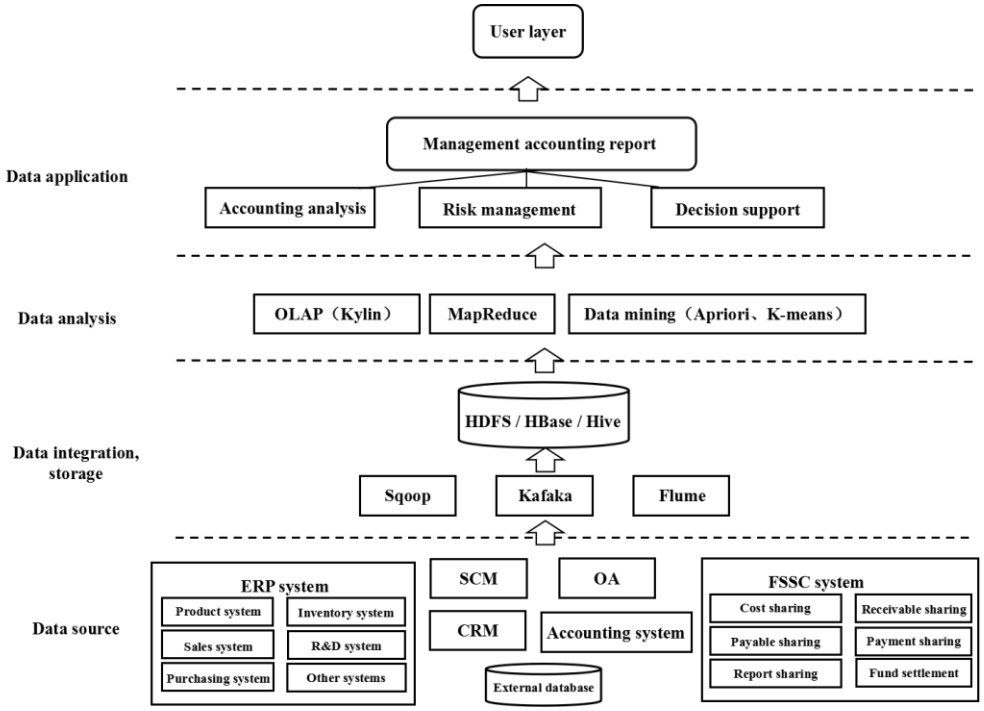

Figure 4: Overall architecture diagram of enterprise management accounting information system

4 Detailed function realization

4.1 Accounting analysis

Under this function module, users can view the comprehensive data of each business department and financial part of the enterprise through the account book function. Complete the proportional conversion with unified monetary measurement method and standard accounting standards, and form a systematic report to reflect it. The accounting function mainly depends on Hadoop architecture to collect, clarify, store and call all kinds of data. For example, Sqoop component is used to directly transmit the data of each business system and the structured data in the financial data system to HDFS of management accounting to complete distributed storage, so that the integration of business data and financial data can be completed efficiently and conveniently. In addition, more semi-structured and unstructured data can be obtained by Flume, Scrapy and other components, and stored in the data warehouse in the form of themes, which not only improves the comprehensiveness and diversification of data sources, but also strengthens the information interaction among various data [8]. Under the accounting analysis function, it can also support the data visualization technology to transform all kinds of data information into various types of three-dimensional views and dynamic views, so as to help users better analyze data in a more intuitive way.

4.2 Risk management

Under this function module, users can analyze and identify the internal and external data of the enterprise, and carry out risk management from each link or process around the enterprise's business objectives, so as to reduce the probability of risk occurrence, achieve the purpose of effectively avoiding risks, and then promote the normal realization of the enterprise's decision-making objectives. In the running process of the risk management module, the system makes statistical analysis of the past risk events of the enterprise, builds a risk scoring matrix by relying on OLAP, and calculates and scores the corresponding risk events. Table 1 is the information table of enterprise risk events, Table 2 is the result table of risk matrix model analysis, and Figure 5 is the risk matrix. The system combines the results of data analysis with the identification results of risk events to form an enterprise risk database, and then formulates corresponding control measures to improve the enterprise risk management system [5].

Table 1: Risk information sheet

Risk probability	Risk influence	Score	Description	Probability of occurrence	Important signs
P3	F3	3	Likely	50~100	It happened in the last three years.
P2	F2	2	Probably	20~50	It happened once.
P1	F1	1	Unlikely	0~20	It hasn't happened. It's unlikely to happen.

Table 2: Risk matrix model analysis results table

Risk matrix area	Comprehensive score	Risk project	Influence degree	Important signs
9 area	9	Employee growth risk	High	Likely
5 area	4	Daily management risk	Medium	Probably
7 area	3	Industry policy risk	High	Unlikely

4.3 Decision support

As the key application node of business intelligence technology, decision support will cover four levels: data processing, data storage, data analysis and data visualization. Among them, the data processing layer, as the basic link of decision support, can rely on Hadoop architecture to complete all kinds of data processing. The data source contains not only the original data inside and outside the enterprise, but also the data results obtained from the analysis and processing of the accounting analysis function module and the risk management function module. Compared with the way of making decisions by relying solely on financial data in the past, business intelligence can greatly improve the comprehensiveness and timeliness of data, and can also handle more complex data information and data types. The storage layer undertakes the data processing layer and fully relies on HDFS, HBase and Hive storage platforms. Compared with the traditional relational database, it can not only greatly improve the storage capacity of the system, but also complete distributed storage of different data information according to different topics to provide convenience for subsequent calls. Data analysis and display is the final presentation of decision support function. It relies on OLAP and data mining technology under business intelligence technology to complete deeper analysis and visually show it to users. It

completes the encapsulation of multiple functions of the system with friendly man-machine interface, and provides substantial help for users to make decisions with convenient operation.

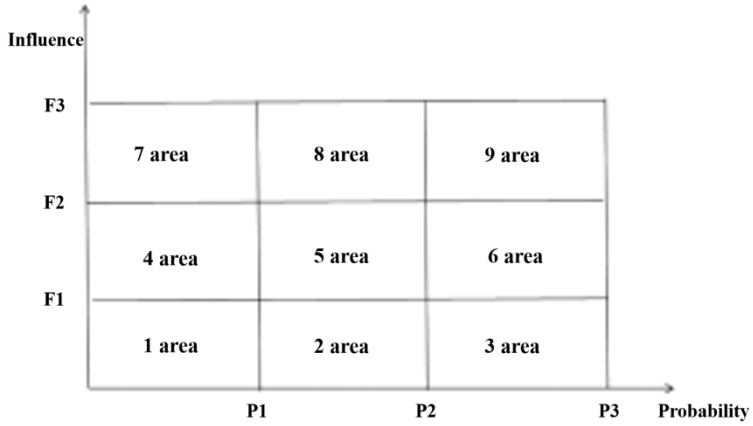

Figure 5: Operation process of risk management module

5 Conclusions

Enterprise management accounting information system takes business intelligence technology as the core, adopts Hadoop architecture and various functional components to complete data preprocessing, data warehouse establishment and data analysis, and uses JavaWeb to complete the development of data presentation and user interface design. It is convenient for users at all levels of enterprises to complete all operational functions of enterprise management accounting through accounting analysis, risk management, decision support and other system functions. It will also strengthen the circulation and application of enterprise data information, promote the transformation of enterprise conventional data information into business opinions from different angles, plan and control various economic activities of enterprises, and help decision makers make various targeted decisions. The construction of the system not only brings enough help to the business development of enterprises, but also makes an important attempt to the digitalization and informatization reform of enterprises.

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