APPLICATION OF JAVA TECHNOLOGY IN THE REGIONAL COMPARATIVE ADVANTAGE ANALYSIS SYSTEM OF MAIN GRAIN IN CHINA

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Abstract: Since no comparative advantage analysis system developed for agricultural products in China counties, this paper discussed how to use comparative advantage theory and Java language to design regional main grain comparative advantage analysis system. The system applies comparative advantage index calculation method to rapidly provide users with relevant data and analysis of grain production comparative advantage in difference region .For future extension, It not only ensures system and data safety but also makes the system run on internet and any computer with Java Virtual Machine.

Keywords: Region, Comparative advantage, Index, Java

1. INTRODUCTION

According to the theory of comparative advantage, any country or region, whether developed, developing or underdeveloped in agriculture,has agricultural products with comparative advantages due to regional features and difference; the only thing is that regional agricultural products judged to have advantages may not have shown real comparative advantage in production. At the same time, comparative advantage is not still but ever changing with the Chinese and international markets. (Ma Huilan, 2004). This reveals the importance to improve international competitiveness of agricultural products by optimizing regional agricultural structure based on

regional agricultural development and regional comparative advantage analysis of agricultural products in China. Similarly, for the Chinese market, it should be a practical choice to analyze the regional comparative advantage of agricultural products and meet the domestic demands by obtaining more cheap products through regional labor division and trade. (Zhao Bolin, 2002). Therefore, using comprehensive comparative indices, one of the methods for quantitative analysis of comparative indices, and Java, the object-based programming language, this paper designs a regional comparative advantage analysis system of main grain based on rural economic data of counties, offering users a tool for quick access to comprehensive comparative indices of main grain in counties as well as relevant information analysis.

The reason why Java is selected as the language for developing the regional comparative advantage analysis system is, with features of cross-platform, security, object-based, multi-threading, universal design and virtual machine, and based on full consideration of system design and functional requirements, Java meets the following system requirements:

The system shall have scalable functions for further development. The system shall be able to operate online. The system security shall be emphasized as data of counties are not made public.

2. MAIN FUNCTIONS OF THE SYSTEM

The system comprises information maintenance subsystem, information query subsystem, calculation and display subsystem, comparison and analysis subsystem, and help subsystem.

The information maintenance subsystem provides input and maintenance of basic system data. Use “Add” to input a single data record, “Maintain” to modify or delete existing data in the system, and “Import from Excel” to add data from existing county-level main grain statistical database and national main grain statistical database to the system.

The information query subsystem supports query by year or by variety. When “Query by Year” is used, and year, province and county are confirmed, the system will display the area and per unit yield of all varieties of a certain year in some counties; when “Query by Variety” is used, and variety, year, province and county are confirmed, the system will display the area and per unit yield of a certain variety (rice, wheat, maize and soybean are available) in some years and some counties.

The index calculation subsystem calculates the scale advantage index, efficiency advantage index and comprehensive comparative advantage index of each variety every year according to the input data in the system. The calculation results are saved in the system in the form of SQL Server datasheet.

The comparison and analysis subsystem, playing a key role in analyzing comparative advantage of main grain in a region, has four functions: "Index ordering" sorts indices of a certain year at national, provincial or county level; "Inter-region comparison" selects counties of different provinces to compare the indices of the same variety in the same year, displaying results in table or column; "Intra-region comparison" selects counties of the same province to compare indices of one or more varieties in the same year, displaying results in table or column; "Chronological comparison" selects a county to compare indices of different varieties in successive years, displaying results in table or curve.

In addition, the system provides Help function for the users' convenience.

3. SYSTEM ARCHITECTURE

The system is developed by Struts and Hibernate. Struts is used to create presentation and control layers in Model-View-Controller (MVC), while Hibernate is used for model layer and data persistence. See Figure 1 for the system architecture.

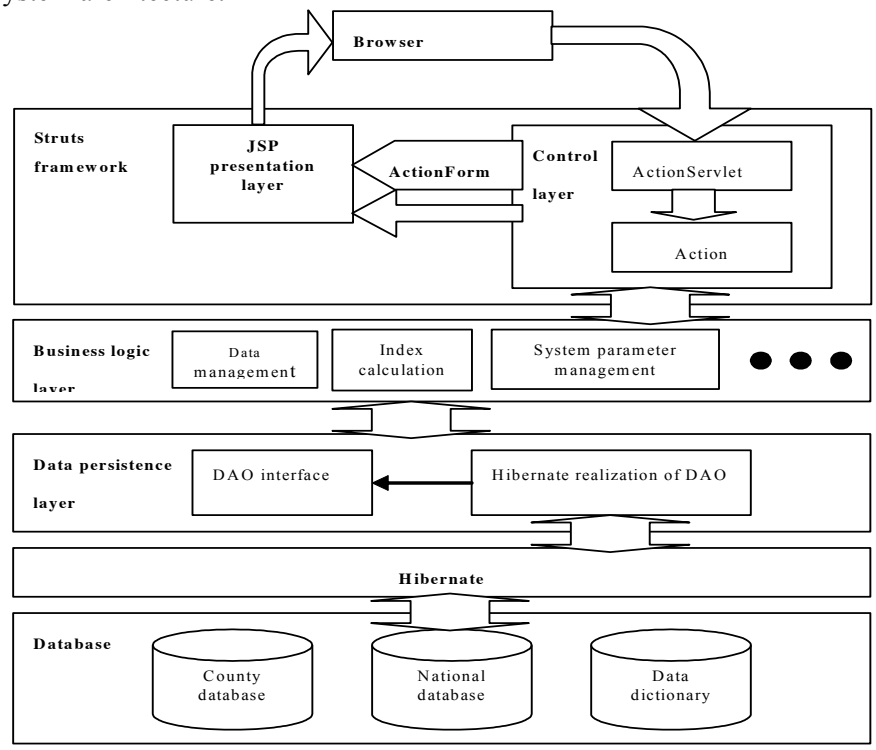

Fig.1: System Architecture.

In Model-View-Controller, Model represents business logic (realized by JavaBean and EJB components) of the application and data persistence; View is the presentation layer (generated by JSP page) of the application; Controller controls the processing of the application (usually one Servlet. The MVC design pattern separates the application logic, processing and display logic into distinct components.

Struts, like other projects of Apache, is an open source project. As an excellent MVC framework, it provides invisible underpinnings for MVC system development, and mainly uses Servlet, JSP and custom tag library.

The MVC structure is attached with great importance for separating modules of the business logic layer from the presentation layer. The DAO mode and Hibernate framework are adopted at data persistence layer, isolating data persistence from actual applications, so that only modification of DAO and Hibernate configuration will be required to change data storage solution in the future.

4. TECHNOLOGY REALIZATION

4.1 Database access technology

Hibernate is adopted as the solution for data persistence.

As an open source object-to-relational mapping (O/R mapping) framework, Hibernate uses a lightweight object encapsulation for JDBC and achieves O/R mapping, allowing Java developers to manipulate traditional relational database by object-oriented programming. Hibernate can be applied on any occasions with JDBC, for example, on Java client program or Web application of Servlet/JSP; moreover, Hibernate can replace CMP in J2EE architecture to perform the responsibility of data persistence.

Hibernate can isolate data access code from the database used so that the specific database is unknown. Another database can be used by simply modifying the property in Hibernate's configuration file.

Hibernate simplifies the operation at data persistence layer of the application system, allowing the developer to focus on business realization.

4.2 Data import

The massive historical data in the system are stored by year in Visual FoxPro format in different files. A quick and efficient way is needed to import legacy data to the new system, which adopts MS SQL Server2000 database for storage.

To fit Java language, a VFP data file should be converted into an Excel file and processed by POI tool in Apache Jakata project.

The file system API of POI, an open source tool, uses pure Java language to realize OLE2 compound document format, while HSSF API allows read/write of Excel file by Java POI.

Specifically, class ExcelFileParser in net.edu.caas.argsys. poi package is responsible for realizing the function. The class has four methods including two parserArgDataCountyFile() and parserArgDataCountyFile(), and the external data file has two formats – provincial data and national data. The two parserArgDataCountyFile() methods in ExcelFileParser are for analyzing provincial data files, while the two parserArgDataNationalFile() methods are for national data files.

4.3 Data table display and export

As a lot of data tables are generated in the system, display-tag open source tool is adopted to solve problems in display, including paging, ordering, data export, etc. Paging and ordering of tables are realized using tags of the tool in JSP page. See Figure 2 for codes.

```
<display:table name="sessionScope.nodeList" class="its" pagesize="15" sort="list" export="true">
    <display:column property="areaId" title="地区代码" sortable="true" headerClass="sortable" />
    <display:column property="areaName" title="地区名称" sortable="true" headerClass="sortable" />
    <display:setProperty name="basic.empty.showtable" value="true" />

</display:table>
```

Fig.2: Program Codes for Table Paging and Ordering.

In addition, display-tag provides another package – org.displaytag.export to solve the problem with data export. The package can help exporting data in the table to an Excel file according to the table format.

4.4 Figure display

After index calculation, the system can compare and analyze the indices in three ways, “Inter-region comparison”, “Intra-region comparison” and “Chronological comparison”. The results need to be presented in figures so as to show the comparison and change of indices in a more intuitive way.

Cewolf tag library is adopted to display figures in the system. Cewolf, a JSP tag library developed with JfreeChart tool, can be used inside a Servlet/JSP based web application to embed complex graphical charts of all

kinds (e.g. line, pie, bar chart, etc.) into a web page. It provides a full featured tag library to define all properties of the chart (colors, strokes, legend, etc.). Thus the JSP which embeds the chart is not polluted with any java code.

Figure 3 shows the codes of cewolf tags in the page of inter-region comparison results

```
<cewolf:chart id="line" title="地区间比较结果" type="verticalbar" xaxislabel="地区" yaxislabel="指数">
    <cewolf:data>
        <cewolf:producer id="cpBtwAreasDataSet" usecache="false"/>
    </cewolf:data>
</cewolf:chart>
<p>
    <cewolf:img chartid="line" renderer="cewolf" width="500" height="400" />
<P>
```

Fig.3: Codes of cewolf tag.

5. DISPLAY OF SYSTEM FUNCTIONS

5.1 Information Maintenance Subsystem

It features Add information, Maintain information, and Import from Excel. See Figure 4.

The interface displays in four pages the area and per unit yield of rice, wheat, maize, soybean and all grains of Chaoyang district, Beijing in 1995-2004. On the interface the user can query, modify or delete data. Figure 4 shows the first page.

Fig.4: Information Maintenance Subsystem

5.2 Information Query Subsystem

It displays the area and per unit yield of rice, wheat, maize and soybean of counties by year and by variety. See figure 5.

Fig.5: Information Query Subsystem.

5.3 Comparison and Analysis Subsystem

The subsystem features index ordering, inter-region comparison, intra-region comparison, chronological comparison and other functions. It can display the analysis result in form or in graph. See Figure 6.

Fig.6: Comparison and Analysis Subsystem

6. SUMMARY

6.1 Conclusion

The "Regional Comparative Advantage Analysis System of Main Grain" is a software tool designed for managers and researchers. It builds main grain statistic databases at national, provincial and county level respectively. With functions of information maintenance and query, the system realizes the comparative advantage analysis of main grain production in counties using comprehensive comparative indices. Main achievements of the research include:

Comparative advantage theory, information technology and model technology are used to scientifically evaluate and analyze the advantages and disadvantages of counties in main grain production, providing supporting information for the structural adjustment and arrangement of agricultural production of counties in China.

Since there's few comparative advantage analysis and research on agricultural products of counties in China using information technology, the design and development of the system have made up the gap.

The system realizes the comparative advantage analysis of main grain in counties throughout China. The regional information analysis given by the system can basically reveal the production features and status of the regional grain.

By adopting Java language, one of the best enterprise and mobile application development platforms in the world, the system not only realizes online operation, but also can run on any computing equipment installed with Java virtual machine disregarding the OS, thus is easier to be promoted.

6.2 Further R&D

With the boom of computer technology and the expansion of its application, GIS (geographic information system) technology develops rapidly and geographic information has become one of the major information resources and tools today. Meanwhile, due to unique spatial information management and processing capability, GIS has become strong technical support of agriculture modernization and sustainable development. In addition, as Internet technology strides forward, Internet has become the new system release platform of GIS. It's the tendency of GIS to take advantage of Internet technology and launch spatial data on Web for users to view and use. Therefore, this study should be furthered in spatial information analysis.

6.2.1 To realize GIS-based rural economic information management and analysis of counties

The regional comparative advantage analysis system of main grain mainly realizes the geographic comparison and analysis of grain production in counties, so its information features spatial nature; meanwhile, traditional data management systems and methods can no longer meet the requirement for processing the ever-increasing agricultural economic information, especially mass spatial data. Therefore, as another way of information exchange and sharing, the system meets the tendency of leveraging GIS to analyze and process volume geographic data.

6.2.2 To combine with WEBGIS

WEBGIS is one of the tendencies of GIS. We will mange, analyze and convey agricultural economic information resources through Internet, and improve the system into WEBGIS software that integrates map processing and release.

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REFERENCES

Ma Huilan. Theory of Comparative Advantage of Regional Agricultural Products [Doctoral degree dissertation of Xinjiang Agricultural University], Xinjiang: Xinjiang Agricultural University, 2004.

Zhao Bolin. A Study of the Countermeasures of China's Regional Agriculture after Joining WTO, Journal of Shanxi University of Finance & Economics, 2002, 24 (1): 41～44.