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# The Design of the Assistant Decision Support System of Cross-Regional Rural Labor Flow

ZHANG Liang\*, LI Cun-bin

School of Business and Management, North China Electric Power University, Beijing 102206, China

**Abstract** The framework of the assistant decision support system of cross-regional rural labor flow is established, the system combines the cross-regional rural labor flow with DSS, which provides the leaders with the maximum assistant decision-making function in the regulation and guidance of rural labors as well as in relevant programs. The assistant decision support system functions are discussed, the function modules of this system are introduced from four aspects, including the analysis of labor flow, the prediction of labor flow, the regulation of cross-regional flow and the configuration of decision support system; based on the data base obtained from dynamic tracking of the migrant workers and combining other data sources, the data warehouse model is established, for example, in the analysis of the labor migration times, a star multi-dimensional data model is designed from the time dimension, place dimension, the type of work dimension, companions dimension and so on; the trans-regional flow of rural labor force is analyzed and predicted by using OLAP from the labor's migration times, migration places and other various perspectives. The operation principles of the assistant decision support system of trans-regional labor flow are introduced, it is pointed out that the system serves the policy-makers of the regulation of labor flow and other relevant enterprises, the system will play an important role in the tracking monitoring and cross-regional regulation of the rural labor flow.

**Key words** Rural labor force, Trans-regional flow, Assistant decision support system, Data warehouse, China

Advancing continuously accompanied by the industrialization and urbanization progress, labor mobility can optimize the allocation of labor resources, promote the process of urbanization and improve the income of the residents in outflow places. After a follow-up investigation of a number of typical villages in Inner Mongolia, Shandong, Hunan, Jilin, Jiangxi and other provinces in early 2009, the studying team establishes a dynamic tracking database and network platform of the rural migrant workers and plans to continue the same approach in future investigations so as to obtain more data to analyze the characteristics of migrant workers, find out the trend of labor mobility and lay the foundation of developing the assistant decision support system of the cross-regional rural labor mobility.

## 1 The framework design of the assistant decision support system of the cross-regional rural labor mobility

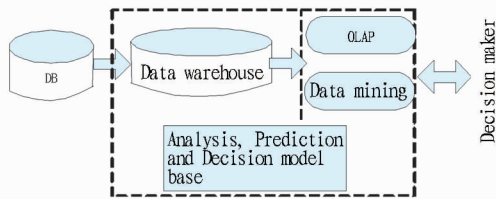
The assistant decision support system of the cross-regional rural labor flow is an interactive computer system helping the staff especially the decision makers who are engaged in the regulation and guidance of rural labor forces to use relevant data and models to conduct assistant decision-making. It combines the cross-regional rural labor flow with DSS so as to provide the leaders with the maximum assistant decision-making function in the regulation and guidance of rural labors as well as

in relevant programs.

The overall framework of the assistant support system of the cross-regional rural labor flow is shown in Fig 1. As shown in Fig 1, "DB" represents one or a group of databases; "data warehouse" is the subject-oriented, integrated, time-related and non-modified data set in the management and decision-making. "OLAP" is an analysis technique, which has the function of summary, consolidation and aggregation as well as the capability to observe the information from different angles; "data mining" is the process of mining useful information from the large amount of data stored in databases, data warehouses or other large information bases<sup>[1]</sup>. The components within the dashed frame is the core in designing the assistant decision support system of the cross-regional rural labor mobility, the bottom part of the database could not meet the system's need for information, constructed based on the data warehouse, the assistant decision support system of the cross-regional rural labor mobility can extract, transform and load the data through ETL tools so as to form the data source of decision support, on the basis of this data source the multi-dimensional statistical analysis (OLAP, online analytical processing) and data mining can be further conducted. At the same time, the decision support system can build an analysis, prediction and decision model base which can be extended and flexibly assembled and exist with the component form, providing the decision makers with powerful assistant decision capabilities.

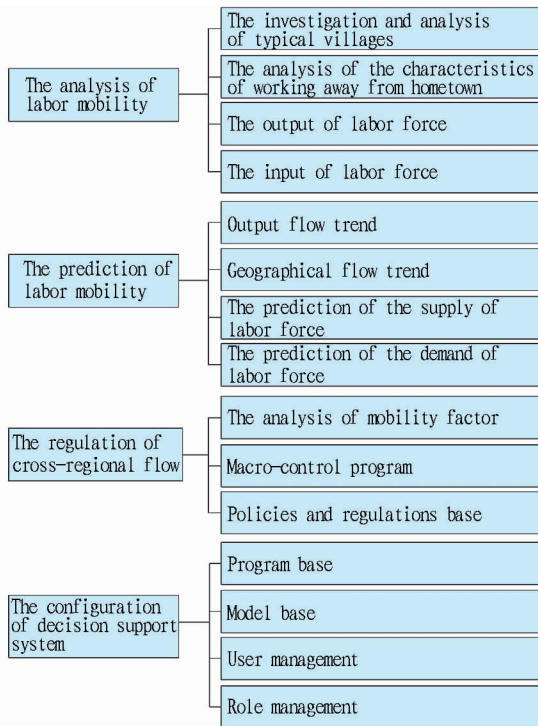
## 2 The function design of the assistant decision support system of the cross-regional mobility of rural labor forces

**2.1 Function module** Through the computer the decision



**Fig. 1** The overall framework of the assistant support system of the cross-regional flow of rural labor force

support system conducts model calculation and knowledge reasoning as well as obtains the information and knowledge from the data so as to achieve assistant decision support<sup>[2]</sup>. As shown in Fig 2, the assistant decision support system of the cross-regional rural labor mobility mainly consists of four function modules, including the analysis of labor mobility, the prediction of labor mobility, the control of cross-regional flow and the configuration of decision support system, each module contains corresponding sub-modules.



**Fig. 2** The function structure of the assistant decision support system of cross-regional labor flow

**2.1.1** The analysis of labor mobility. This module has four sub-modules, including the investigation of typical villages, the characteristic analysis of working away from hometown, the output of labor force and the input of labor force. The analysis of labor mobility mainly focuses on the overall analysis of typical village, covering the total number of households, the total population, the total number of labor force, the number of migrant workers, the number of workers returning home, the number of people joining the social security and so on. The annual analysis of the features of the labor's working out includes the analysis of their education, trained professions, skill level, their type

of works, the insurance they attend, main working regions, the cumulative time their working away from hometown, working intention, their migration times in a year and whether they work at the same place for more than two years or not. Based on the investigation data, the assistant decision support system uses the open-source chart control to draw histograms, pie charts, line charts and other types of charts so as to conduct the chart analysis of the labor movement of the typical village and easily derive the Excel reports. Using the historical statistical data and experience database and combining other relevant data source about labor mobility, the experts and scholars further analyze the input and output of labor force.

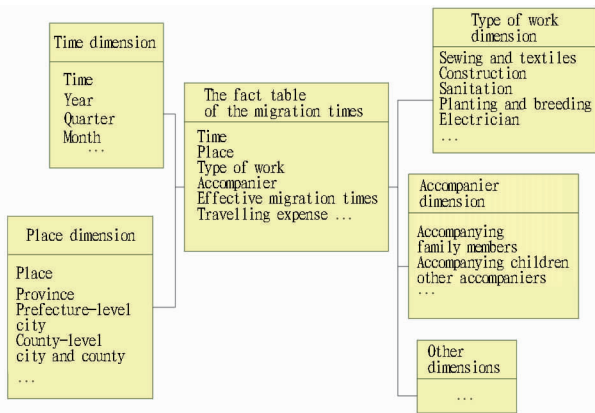
**2.1.2** The prediction of labor mobility. The prediction results of the preparatory work in the control of the cross-regional labor flow lay the foundation of decision-making. In the decision support system, there should be a relatively complete mobility prediction function, both a macro one and micro one are needed, the prediction methods, including Delphi method, moving average method, exponential smoothing method, seasonal index method, linear regression analysis, Markov, grey prediction and so on, can be adopted. For example, the current flow of rural labor force is prominently characterized by disorder, that is, blindness. However, as time progresses, economy develops and society advances, the current disordered mobility will get changed regularly. The flow of rural labor force can be divided into the flow to the first industry, the secondary and tertiary industries according to the industrial flow direction; it can also be divided into the flow to local province and county, to inland provinces, to coastal provinces and other places according to their mobility regions. According to these two different divisions, the author establishes two models to respectively inspect the industrial flow trend and geographical flow trend of rural labor force<sup>[3]</sup>. Similarly, the experts and scholars can forecast the labor's demand and supply from the macro perspective.

**2.1.3** The regulation of cross-regional flow. It means to analyze the supply-demand information and the dynamic affecting factors of rural labor mobility as well as to study the technique to optimize the cross-regional labor flow under typical situation. The cross-regional mobility of rural labor force needs to be coordinated and guided; it also calls for the formulation of the macro-control policy about labor mobility so as to form an ordered flow of labor force, all above decisions need technical support. Based on the monitoring information and demand information of labor mobility and the simulation of the labor mobility state under different situations, the assistant decision support system to guide and control labor mobility is then established. According to the "Analysis – Prediction – Decision" idea in building the system, module belongs to the decision support part. On the basis of the actual research, analysis and prediction, the studying team proposes a factor index base of rural labor mobility and also puts forward a macro-control program. The government and relevant departments can formulate policies and regulations related to labor mobility.

**2.1.4** The configuration of decision support system. This module provides the system with basic configuration function,

which is directly related to assistant decision-making level of application system. The system maintainers can increase the number of methods and modules for the decision makers to analyze, predict and use, while inputting the data into the method base and module base, the expert should input the methods' names, roles, implementation steps, phasic output results, *etc.*, according to the set steps so that the system could intelligently display the needed decision-making information to the decision makers. For example, there is one method in the method base – Least Squares Method, which is adopted to solve the regression coefficient of the linear regression models in the model base. The sub-module of user management lists the system's management users, which could be added, edited and deleted. The system defines three management roles including system administrators, experts and administrative staff when it is initialized. The system administrators can add themselves new roles and give corresponding rights to the new roles and can also edit the existing roles.

**2.2 The establishment of data warehouse and the analysis from multi-dimensional perspective** As the assistant decision support system of cross-regional flow needs and combining other labor-related data sources, the relevant data items are determined and the data warehouse model is established after a comprehensive analysis. For example, in the analysis of the labor migration times, a star multi-dimensional data model is designed. The center of the star model is the fact table of migration times, including time dimension, place dimension, the type of work dimension, the accompanier dimension and so on. Metric data contains the indexes related to the analysis of migration times, including the effective times of getting employed and travelling expense, *etc.* (Fig 3).



**Fig.3 The fact table of the labor migration times**

After the data warehouse was established, it is needed to introduce the data from other relevant data systems, the original data the assistant decision support system of the cross-regional flow needed may be distributed in different physical positions and the system uses different data organization forms and system platforms, which will result in the repetition of and the inconsistency between the data in different systems. During the process of the data transfer in establishing the data warehouse, the ETL tools can concentrate the data which comes from different operation system platforms and different data organiza-

tion forms in one data warehouse according to certain rules so as to ensure the complete consistency of the data in data warehouse and achieve the purpose to fully use various data sources. ETL tool is essentially a data converter, which provides a method to convert the data from source system to target system. ETL provides a universal solution to support multiple data sources, such as RDBMS, Mainframe, XML, text and so on, and it also supports various data source interface. Moreover, it can calculate and convert the data through various calculation methods, which shows its flexibility and scalability. ETL can better combine the data integration and data cleaning together. The system strengthens the Excel introduction function for the convenience of use. After the data warehouse was established, the decision makers can conveniently use OLAP to analyze and predict the labor's migration times and the migrant workers' working areas, *etc.*, from various angles. For example, the all-around and stereoscopic analysis of the labors' working out are conducted by cutting, chopping, drilling, rotating and other OLAP methods from the time, region, type of work, accompanier and other angles.

### 3 The operation principles of the assistant decision support system of the cross-regional labor flow

The system uses the B/S structure design, so the client is free of installation, based on the Microsoft Visual Studio 2008 platform, the system uses the Asp.net technique to develop the assistant decision support system of the trans-regional labor migration. By using the MSChart and Ajax under the Net3.5 framework leased by Microsoft, the system can generate various interactive statistical reports so as to provide the decision makers with decision support information.

The physical storage data base (LaborDSS) integrating the model base and method base is established in Microsoft Sql Service in order to support the operation of decision support system. The man-machine interaction system uses the menu driven and control of Window format with very friendly user interface and gets started in the multi-task way. The system provides various conversational styles and operation functions with very friendly user interface as well as various channels to obtain the data and various forms of output information and so on, it plays the role of controlling the mechanism in the whole decision-making process.

### 4 Conclusions

The decision support system of cross-regional labor flow is a support system with assistant decision function integrating the annual analysis of the labor's characteristics, the input and output of the labor force, the labor's employment, the policy consultation, their mobility trend and so on, it is applied to the policy-makers of the regulation and control of rural labor mobility and the decision-makers of relevant enterprises. The decision support system based on the establishment of data base

test. The causality test raised by Granger can be used to solve this problem. Because the result of test sensitively depends on the choice of lag period, so the choice of the lag period should follow the following principles; at first, choosing the lag period according to the AIC criterion and SC criterion, but under the

uncertain situation, the lag period can be determined by the likelihood ratio (LR) raised by Neyman-Person. The result of Granger-Sims causality test of the relationship between  $\Delta I_g$  and  $\Delta I_g C$  is shown on Table 3.

**Table 3** The results of Granger-Sims causality test of the relationship between  $\Delta I_g$  and  $\Delta I_g C$

Null hypothesis	Lag period	F test value	Probability	Conclusion
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	1	2.900 5	0.104 0	Refuse
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	1	18.557 6	0.312 6	Accept
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	2	1.246 1	0.000 3	Refuse
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	2	7.818 2	0.003 9	Refuse
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	3	1.053 0	0.400 1	Accept
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	3	4.240 9	0.025 0	Refuse
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	4	1.664 2	0.227 7	Accept
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	4	2.888 4	0.073 6	Refuse

It can be seen from Table 3 that when the lag period equals 1, the actual consumption of rural residents in Hebei is not the Granger cause of the actual income, but the actual income is the Granger cause of the actual consumption; when the lag period equals 2, the Granger causality between them is hard to determine; when the lag period equals 3 and 4, the actual income of rural residents in Hebei is not the Granger cause of the actual consumption, but the actual consumption is the Granger cause of the actual income. The implication of this conclusion is that in short term, the actual income of rural residents in Hebei Province has significant impact on the actual consumption, but the impact will diminish gradually until disappear two years later; in contrast, the impact of the actual consumption of rural residents in Hebei on the actual income is not so significant in short term, but as time goes on, the impact will be obvious gradually. Therefore during the process of mutual impact and functions of the actual income and the actual consumption, in short term the impact of the actual income of rural residents on the actual consumption is mainly represented; but in long term, the impact of the actual consumption of rural residents on the actual income is mainly represented.

### 3 Conclusions

In summary, during the process of mutual impact and functions of the actual income and the actual consumption, in short term the impact of the actual income of rural residents on the actual consumption is mainly represented; in the middle term the mutual impact of them are all significant; from the long term, the impact of the actual consumption of rural residents on the actual income is mainly reflected. In view of the above fea-

tures, necessary measures should be taken by Hebei Province. The government can expand consumption through increasing the income of rural residents in short term, while the government can push the economic growth by expanding domestic demand in long term.

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and the analysis from multi-dimensional perspectives will play an important role in the tracking monitoring and cross-regional regulation of the rural labor flow.

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