Canonical Correlation Analysis of Regional Economic Development Based on the MVC Framework in Weka Platform: A Case Study in Beijing

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Abstract: According to McKinsey's forecast, the future networking will bring the market size of 3.9~11.1 trillion US dollars to the global economy, and the smart city construction is one of the largest application scenarios. This paper makes a qualitative analysis of regional logistics and regional economic development. Also, by combining the characteristics of Beijing, people can see the regional logistics capability and regional economic development indicator system were constructed through this paper. The purpose is to enable the complicated cities to manage and serve the regional economy through the construction of the networking and resource sharing. The data for 2001-2013 Beijing was selected. Through the research of typical correlation analysis, the correlation between the two indicator systems is analyzed to judge the relationship between Beijing regional logistics capability and regional economic development.

1. Introduction

Beijing regional economic exchanges and cooperation has become a common economic phenomenon. Regional logistics, business flow, information flow and funds flow make the logistics activities become more frequent. How to construct the regional logistics system is the problem to be solved to make the Beijing region economy develop fast, healthy, stable, and sustainable. In the current research related to the Beijing logistics, experts and scholars mostly put forward some constructive suggestions for the development of logistics industry in Beijing City, but the correlation analysis for the city of Beijing regional logistics and regional economy is in the discussion stage of logistics industry theory, lack of quantitative research.

The construction of index system directly affects the subsequent empirical research. The scientific and reasonable index system determines their ability to explain object feature and ultimately affect accuracy of empirical research analysis. This paper focuses on the three principles: pertinence, scientific and operability. In this part the reasons for selecting the indexes were analysed, and then the relevant indicators were explained. The ability of regional logistics demand is a derived demand. In a certain extent, regional economic development will lead regional logistics demand. Therefore, the regional logistics capability index system will be built from three aspects: regional logistics output capacity, logistics infrastructure and logistics information infrastructure.

The regional logistics output capability can reflect the regional logistics capability. The regional logistics output capability can be indicated by the index of logistics related industry output value, rotation volume of freight transport, freight volumes.

In this paper, transportation, storage and postal industry added value is used to represent the logistics industry output value of related industries. Transportation, storage and postal industry added value refers to the final output of resident units in a country (or area) at market prices engaged in production activities of transportation, storage and postal industry in a certain period of time. Freight volumes refer to the number of actual delivery of the goods in transpose enterprise in a certain period of time. Rotation volume of freight transport refers to the production of the number of the transport of goods (tons) and the transport distance (km). The index can reflect comprehensive transportation production, including the two factors of number of transport objects and the transport distance.

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Logistics infrastructure includes railway operating mileage, highway mileage, and inland navigation mileage. Because of its geographical features, there is no inland waterway in Beijing. Highway, railway transportation account for a large proportion, so highway and railway operating mileage can be used as a representative of the infrastructure. With the rapid development of information technology, logistics, regional logistics information platform construction has been paid more and more attention [1]. With the help of logistics information technology, combined with the advanced supply chain management technology, efficiency, optimization can be achieved in logistics operation and then the development of regional logistics industry can be effectively promoted. Logistics information infrastructure can be reflected by the business volume of post to a certain extent.

2. Basic Framework and Theory on MVC

2.1. Basic Framework

Based on the project requirements, we finished the conceptual design, detail design, and database E-R design. Layered design was completed for presentation layer, control layer, business logical layer and persistent layer. The network deployment is made for actual application environment plays a guiding role in the following up integrate cabling procedure [2]. Iterative development model is used for developing management of the Spring MVC based vocational college internship management system. The UML modeling of main functions, configurations and core codes are listed in this dissertation. Rich client technology has been adopted to configure system menus based on actual requirement of work environment. This increased the usability, maintainability, and extensibility of the system.

2.2. Procedure

Role based visiting control enables mufti-user multi-privilege dynamic setting, which ensured the system's security. Data in the Excel tables can be imported to or exported from the system. Jasper Report is used to analyse mixed types of data and generate corresponding report forms [3]. The first major change in the architecture comes with the introduction of the MVC Model 1. This can be seen in Fig. 1. This architecture was completely based on the page centric approach. In this model a Java Server Pages to program to control the Presentation, Business Logic and flow of the program. In this model the concept of the Business Logic was introduced. The business logic was hard coded in the form of the Java Beans and expressions. All this codes was used to write within the JSP page. Let us assume a case when we want to transfer the flow of the JSP application based on the data we received from the input

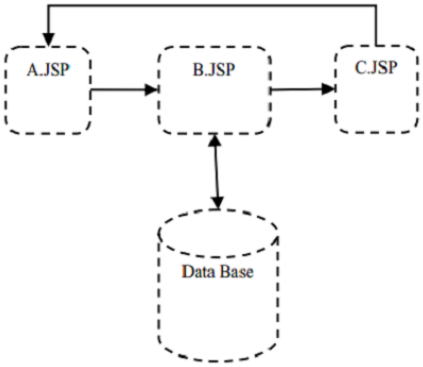

Fig. 1. Navigation in MVC -1 Architecture

The model 1 architecture was able to solve some of the problem of the web and internet programming but still there were a lot of things missing from it (Fig. 2). It was centred on the navigation of the JSP pages so there was the scope of the further development in the architecture point of view. During this process the next development was the Model 2 architecture. This problem was solved using the Servlet and JSP together. The Servest handles the Initial request and

partially process the data [4]. It set up the beans then forward the result to the one of the JSP page. The Servlet decide the one of the page to be displayed from the list of pages.

In this Model 2 architecture the JSP Pages were used to Presentation purpose only. The Business logic has been removed from the page. This makes the pages easier to represent and light weight pages which were easy to display on the internet. In this model all Control and application logic were handled by the Servlet. The Servlet was written in the java programming language. So it was also easier to handle the programming part of the Servlet. In this scenario the Servest becomes the power full for the complete application and it has emerged as the center point for the application.

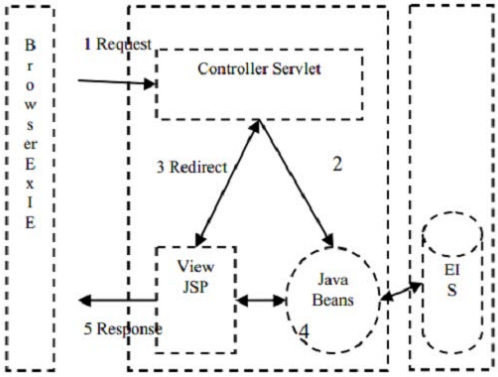

Fig. 2. MVC -2 architecture

In the model 2 architecture the Servlet becomes the gatekeeper for the all common tasks. It provides the common services like authentication, authorization, error control and follow of the application. This architecture has solved the most of the problems. But still there were many new issues emerged while applying this architecture. Web and Internet is ever growing area and the demands for the applications are growing. A single framework is not capable to handle the architecture of the application. To meet the currents requirement of the applications it's necessary to design an architecture to implement the frameworks. Struts framework have been designed and developed for the front end control of the web applications. It provides the various features for the applications that interact to the users. It also follows the MVC 2 design features. Spring Framework is the designed to handle the various tasks [5]. The spring work for the desktop and internet based applications also. It follows the principals of the MVC 2. The simultaneous use of the Struts and spring frameworks in the single application with the applying the MVC Design principals so that we can Improve the performance of the applications. Struts Framework consists of three major blocks, Described in brief as follows. (Fig. 3)

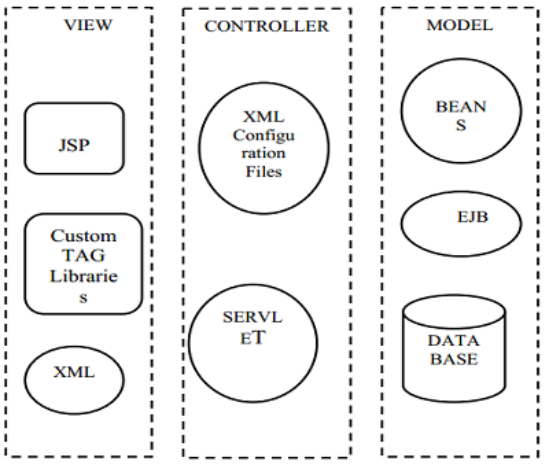

Fig. 3. Struts Model Architecture

2.3. Major Benefits

This approach is based a combination of applying the two framework struts and spring for the application development. The sequence diagram for the combined application is explained as above,

which is the main driving force for the application. This approach assumes that basic knowledge of web applications is essential. We have tested the above concepts and find out it successfully. Major benefits of the above architecture are as follows.

1) It will provide a very clean division between actions, action forms, controllers, handlers, JavaBeans models, and views.

2) Spring's MVC is very flexible. Unlike Struts, this forces your Action and Form objects into concrete inheritance. We are using advantage of both.

3) Spring MVC is entirely based on interfaces. Every part of the Spring MVC framework is configurable.

4) It provides controllers, making it easy to handling of many requests from User Interface.

3. Establishment of Statistical Index System

3.1. Regional Logistics Capability Index System

The construction of index system directly affects the subsequent empirical research. The scientific and reasonable index system determines their ability to explain object feature and ultimately affect accuracy of empirical research analysis [6]. This paper focuses on the three principles: pertinence, scientific and operability. In this part the reasons for selecting the indexes were analysed, and then the relevant indicators were explained. The ability of regional logistics demand is a derived demand. In a certain extent, regional economic development will lead regional logistics demand. Therefore, the regional logistics capability index system will be built from three aspects: regional logistics output capacity, logistics infrastructure and logistics information infrastructure.

The regional logistics output capability can reflect the regional logistics capability [7]. The regional logistics output capability can be indicated by the index of logistics related industry output value, rotation volume of freight transport, freight volumes. In this paper, transportation, storage and postal industry added value is used to represent the logistics industry output value of related industries.

Transportation, storage and postal industry added value refers to the final output of resident units in a country (or area) at market prices engaged in production activities of transportation, storage and postal industry in a certain period of time. Freight volumes refer to the number of actual delivery of the goods in transpose enterprise in a certain period of time [8]. Rotation volume of freight transport refers to the production of the number of the transport of goods (tons) and the transport distance (km). The index can reflect comprehensive transportation production, including the two factors of number of transport objects and the transport distance. Logistics infrastructure includes railway operating mileage, highway mileage, and inland navigation mileage. Because of its geographical features, there is no inland waterway in Beijing. Highway, railway transportation account for a large proportion, so highway and railway operating mileage can be used as a representative of the infrastructure.

3.2. Comprehensive Index System

With the rapid development of information technology, logistics, regional logistics information platform construction has been paid more and more attention. With the help of logistics information technology, combined with the advanced supply chain management technology, efficiency, optimization can be achieved in logistics operation and then the development of regional logistics industry can be effectively promoted. Logistics information infrastructure can be reflected by the business volume of post to a certain extent.

The regional economy is the result of the interaction of external conditions and internal factors of economic development in a certain area [9]. So the single index "GDP" used to analyse is unreasonable, which should be combined with regional characteristics. Considering the various factors affecting the economic development, the more reasonable comprehensive index system is constructed.

Gross domestic product (GDP) refers to the final output of all resident units in a country (or area) at market prices of production activities in a certain period of time [10]. Therefore, GDP should be used as an important regional economic development indicator. In 2013, the added value of first industry in Beijing was 16.183 billion yuan. The added value of second industrial was 435.23 billion yuan, of which the industrial added value was 353.689 billion yuan. The added value of tertiary industrial was 1498.643 billion yuan. Therefore, in the economic development of Beijing, the third industry accounted for the largest proportion, reaching 76.85%, which was different from other areas. Therefore, the value added of tertiary industry was increased to the index system. In addition, we must recognize that, although the add value of the third industry in Beijing was the maximum, but on the whole logistics services for industrial still cannot be ignored, and the industrial add value for regional logistics capability is obviously. So the industrial add value should be added into the index system.

The consumption level of residents and the per capita GDP is able to induce the logistics demand in a certain extent. The consumption level of residents is household consumption expenditure by the resident population of average. GDP per capita refers to the ratio of the absolute value of gross domestic product and the annual average population, which measure the economic contribution from each resident in a country or region. Therefore, the two indicators were selected on behalf of the Beijing regional economic development.

Total retail sale of social consumer goods is an important indicator measuring regional consumption capacity. On the one hand, the lift of regional logistics capability can help to promote the relations between the intra-regional and regional external, which has the ability to enhance the consumption; on the other hand, consumption upgrade will promote the regional logistics capability.

4. Canonical Correlation Analyses in Beijing

According to the index system established in the preceding chapter, the index systems of regional economic development are GDP x1, Industrial GDP x2, Tertiary industrial GDP x3, the total retail sales of consumer goods x4, GDP per capita x5 consumption level of residents x6.

System of regional logistics capability index is freight volume y1, rotation volume of freight transport y2, business total of Posts and telecommunications y3, infrastructure mileage y4, the logistics industry output value y5. Taking Beijing as the research object, data of Beijing city in 2001 -2013 years were collected, from 2001 to 2013 “ China statistical yearbook”, shown in Table 1 and Table 2.

Table 1. Regional economic development index

year	x_1	x_2	x_3	x_4	x_5	x_6
2013	19500.56	3536.89	14986.43	8375.10	93213.00	33337.00
2012	17879.40	3294.32	13669.93	7702.80	87475.00	30350.00
2011	16251.93	3048.78	12363.18	6900.30	81658.00	27760.00
2010	14113.58	2763.99	10600.84	6229.30	73856.00	24982.00
2009	12153.03	2303.08	9179.19	5309.90	66940.00	22023.00
2008	11115.00	2131.75	8375.76	4645.50	64491.00	20113.00
2007	9846.81	2082.76	7326.15	3835.20	60096.00	18553.00
2006	8117.78	1821.86	5837.55	3295.30	51722.00	16487.00
2005	6969.52	1707.04	4854.33	2911.70	45993.00	14662.00
2004	6033.21	1554.73	4092.27	2191.80	40916.00	13425.00
2003	5007.21	1224.48	3435.95	1916.70	34777.00	12014.00
2002	4315.00	1021.16	2982.57	1744.80	30730.00	10882.00
2001	3707.96	938.81	2484.83	1593.50	26980.00	9057.00

Table 2. Distribution of educational level by socioeconomic background in each population group, ages 19-22, 23-26 and 27-31 years (%)

year	y_1	y_2	y_3	y_4	y_5
2013	25748.00	1051.14	757.04	2.30	883.58
2012	26162.00	1001.13	631.23	2.28	816.31
2011	24663.00	999.60	566.45	2.25	808.95
2010	21762.00	876.93	7227.34	2.23	712.01
2009	20470.00	731.59	970.45	2.20	556.64
2008	20525.00	758.89	839.67	2.15	498.92
2007	19877.00	724.80	704.68	2.19	497.55
2006	33008.00	653.20	503.49	2.16	455.21
2005	32113.00	582.10	405.90	1.58	403.32
2004	31321.00	537.70	343.84	1.57	356.78
2003	30729.00	462.50	287.29	1.56	262.20
2002	30799.00	411.60	256.25	1.55	200.97
2001	30608.00	393.60	215.89	1.51	139.75

Because the 11 indicators in Table 1 and Table 2 had different units, in order to eliminate the influence of units and the size of the base, data were standardized. This paper will use SPSS software processing for data standardization.

Table 3. The correlation coefficient between the two sets of indicators

Correlation Between Set-1 and Set-2					
	y_1	y_2	y_3	y_4	y_5
x_1	-0.5748	0.9885	0.6695	0.8697	0.9854
x_2	-0.5455	0.9931	0.6672	0.8632	0.9959
x_3	-0.5798	0.9865	0.6690	0.8704	0.9822
x_4	-0.5730	0.9814	0.6818	0.8628	0.9794
x_5	-0.6138	0.9936	0.7101	0.9030	0.9886
x_6	-0.5558	0.9865	0.6643	0.8639	0.9873

From table 3 the correlation coefficient between the two sets of indicators, in addition to the freight volume, two groups of indicators showed positive correlation, indicating that they are mutual promotion. Table 4 showed the first canonical correlation coefficient was 0.998, the second typical correlation coefficient was 0.996, the third typical correlation coefficient was 0.848, the fourth typical correlation coefficient was 0.515, and the fifth typical correlation coefficient was 0.472.

Table 4. Canonical Correlations

Canonical Correlations	
1	0.998
2	0.996
3	0.848
4	0.515
5	0.472

Table 5. A Significant Test of Canonical Correlation Coefficient

Test of remaining correlations are zero				
	Wilk's	Chi-SQ	DF	Sig.
1	0	72.612	30	0
2	0.001	39.577	20	0.006
3	0.16	10.982	12	0.53
4	0.571	3.363	6	0.762
5	0.777	1.515	2	0.469

Table 5 showed significant canonical correlation coefficient, from left to right respectively lambda chi square statistics Wilk's λ statistics, degree of freedom and probability. At the significance level of 0.01, the first canonical variables and second canonical variables are significant.

Table 6. (A) Typical Redundant Analysis

Proportion of Variance of Set-1 Explained by Its Own Can.Var.	
Prop Var	
CV1-1	0.876
CV1-2	0.108
CV1-3	0.001
CV1-4	0.001
CV1-5	0

(B) Typical Redundant Analysis

Proportion of Variance of Set-1 Explained by Opposite Can.Var.	
Prop Var	
CV2-1	0.872
CV2-2	0.108
CV2-3	0.001
CV2-4	0
CV2-5	0

(C) Typical Redundant Analysis

Proportion of Variance of Set-2 Explained by Its Own Can.Var.	
Prop Var	
CV2-1	0.602
CV2-2	0.161
CV2-3	0.181
CV2-4	0.006
CV2-5	0.051

(D) Typical Redundant Analysis

Proportion of Variance of Set-2 Explained by Opposite Can.Var.	
Prop Var	
CV1-1	0.599
CV1-2	0.159
CV1-3	0.13
CV1-4	0.002
CV1-5	0.011

From Table 6 typical redundant analysis, typical variables U1, U2 ,U3 ,U4 ,U5 were able to explain 87.6%, 10.8%, 0.1%,0.1% and 0% fluctuations of regional economic indicators and respectively explain 87.2%, 10.8%, 0.1% ,0%, 0% fluctuations of regional logistics capability index; typical variables V1, V2 ,V3 ,V4 ,V5 can respectively explain 60.2%, 16.1%, 18.1% 0.6% and 5.1% fluctuations of the regional logistics capability index, and explain 59.9%, 15.9%, 13%, 0.2% and 1.1% fluctuations of the regional economic indicators. Therefore, U3 and V3, U4 and V4, U5 and V5 had the bad ability to explain the regional economic development and regional logistics capability, and not very good to determine the relationship between the two relationship. Therefore, this paper will focus on the analysis of the first two canonical variables.

The variable x1and x3 of U1 had relatively large loads, which mean U1 was the combination of GDP and tertiary industrial added value. y5 of V1 had larger load, which mean V1 mainly expresses the logistics industry output value, namely the logistics capability. The symbol of x1 and y5 were the same, which mean logistics industry output value and GDP were in the same direction of development. The industry promotion of logistics output capacity will promote regional economic growth.

The variable x1and x3 of U2 had a relatively large load. y2 and y5 of V1 had larger load, which showed that compared with V1, V2 reflected the regional logistics capability combining with the freight turnover. The y2 and x3 had the same direction of change, which mean there was positive correlation between the freight turnover and tertiary industrial added value. That is to say, the tertiary industrial led economic development will lead to the development of logistics. On the other hand the enhancement of the logistics.

5. Conclusions Conflict of Interest Acknowledgment

Influence of regional logistics capacity in Beijing on regional economic development will be more and more, and the development of the ability will promote the development of the tertiary industrial, so as to promote the development of economy. In the two of the typical variables, the sign of x1, x6, and x5 were the same, which indicate their direction of development were the same. Regional economic development and people's consumption capacity will cause the demand for logistics services. The sign of x1 and y4 were opposite, which mean that infrastructure construction level block economic development. Regional economy will continue to increase logistics demand, so as to improve the regional logistics capability. To a certain extent, it can promote the development of regional economy and regional logistics development. With the combination of qualitative and quantitative analysis of the results the following suggestions were put forward: Firstly, GDP in Beijing especially the tertiary industry had caused a strong role for regional logistics capability. This is decided by the industrial structure in Beijing. Although in the traditional sense, no matter what aspects of industrial products supply chain, logistics demand has always the largest, but based other industrial structure of Beijing and some of the policy itself, the current Beijing area industrial proportion and growth rate was lower than the tertiary industry, and this situation will continue, and will not be reversed. So, the Beijing economic development plan in the future still should pay attention to the development of the tertiary industry. Secondly, rotation volume of freight transport, the logistics industry output value and infrastructure construction can promote regional logistics capability. Beijing should increase logistics investment, expand the scale of logistics, to ensure the normal operation of logistics. Combined with the policy and current situation, the construction of infrastructure in conditions should be strengthened; rotation volume ok freight transport should be increased to ensure the support of regional logistics capability and the development of regional economy. At the same time outstanding logistics enterprises should also be introduced, advanced logistics technology and advanced management technology should be introduced to improve the logistics output capacity, so as to enhance the ability of regional logistics in Beijing.

Conflict of Interest

The authors confirm that this article content has no conflicts of interest.

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