

Simulation Analysis Of The Efficiency Of The “New Silk Road” Economic Zone Logistics

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Abstract

The “New Silk Road” economic zone is regarded as the research object in this paper. First of all, according to a large number of documents and facts, we summarize the “New Silk Road” economic factors with efficient logistics infrastructure; Secondly, it builds a system dynamics model of the relationship between logistics infrastructure and the development of economy, and on the basis of systematic analysis, it draws causal charts and system flow charts of logistics as well as economy, so as to draw a conclusion that the contact between the logistics infrastructure and the growth of economy within the economic zone is a long-stable term. What's more, view from the amount of current existing logistics infrastructure, the amount of the existing infrastructure has played an important role. And meanwhile it is pointed out that at the same time with logistics infrastructure investment in fixed assets. It is needed to pay close attention and enhance the use of existing logistics infrastructure of the economic benefits as well.

Keywords

New Silk Road; System Dynamics; Logistics infrastructure; Logistics efficiency.

1. Factors of Logistics Infrastructure Efficiency Analysis

1.1 Social factor

(1)Logistics management department

The logistics management department hasn't formed a whole system, so it's difficult to realize unification of logistics and transportation. At present this type of management system where the management pattern is from top to bottom belonging to superior department, seriously restricts reasonable allocation of logistics transportation in today's society and does serious impact on the speed of the development of logistics transportation, so that the transport efficiency of the whole logistics system can't be shown as much as possible.

(2)Construction talent of logistics infrastructure

With the rapid development of logistics industry, its demand for talent also increases, but behind it the reasons such as poor professional education and different cognitive gradations lead to a shortage of logistics talent, mainly lacking of high-level logistics management talent [5].

1.2 Economic factor

(1)Logistics infrastructure investment in fixed assets

In decades, national investment in fixed assets of transportation industry has increased, at the end of 2013 the investment reached 3.67901 trillion Yuan. This article is based on the statistics of northwestern five provinces (Shanxi,Gansu,Ningxia,Qinghai,Xinjiang) [9], each year's investment as shown in Fig.1.

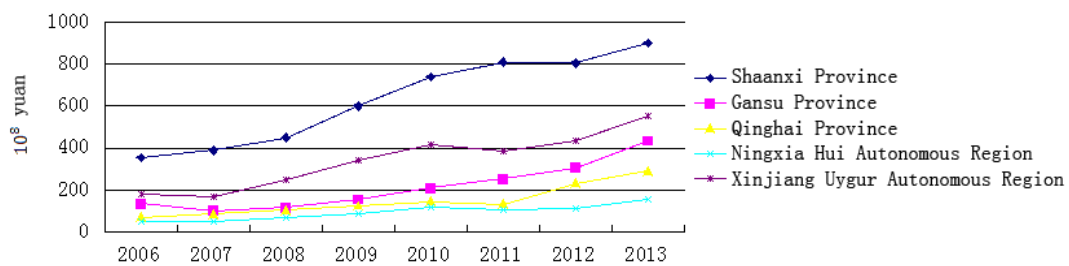


Fig.1 2006-2013 Investment in fixed assets of transportation industry in five provinces

As shown in Fig.1, during the eight years each province’s investment in transportation industry increased year by year, meanwhile investment data rose rapidly. As the starting point of the New Silk Road, Shanxi attached great importance to the development of transportation industry and the growth rate was obvious [4].

(2)Logistics infrastructure construction

a. Highway construction

At the end of 2013, 567700 kilometers of highway in the five provinces took up 13% in the construction of national highway mileage. Seen from Fig.2, highway construction of the five provinces within economic zone presented a steady rising trend [3].

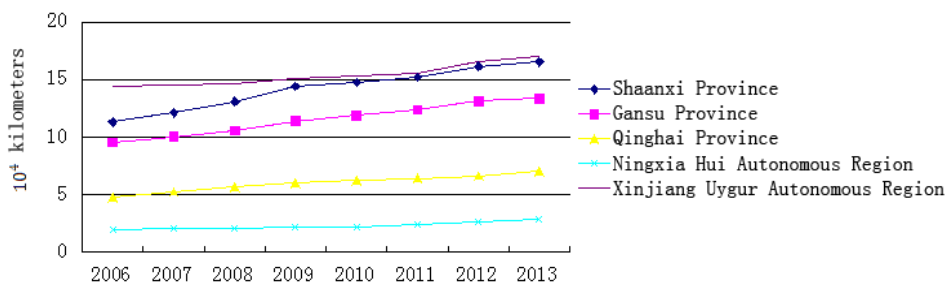


Fig.2 2006-2013 Highway mileage (10⁴kilometers) in five provinces

b. Railway construction

According to statistics, operating mileage of railway construction in the five provinces accounted for 14% of the national operating mileage [2].

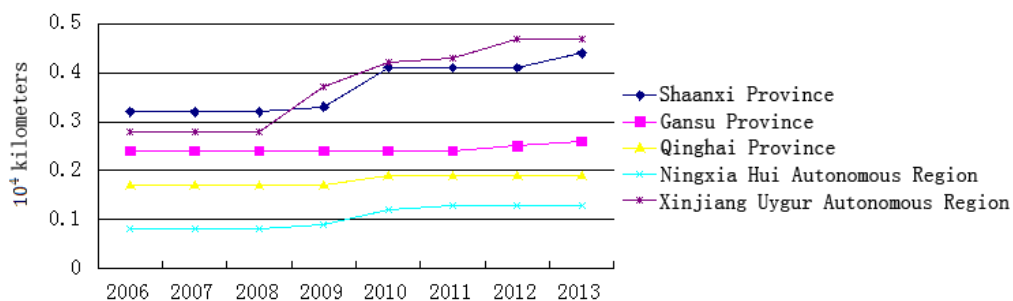


Fig.3 2006-2013 Railway operating mileage (10⁴kilometers) in five provinces



Fig.4 2006-2013 Inland waterway mileage (10⁴ kilometers) in five provinces

c. Waterway construction

As shown in Fig.4, inland waterway mileage in Qinghai province presented gradual trend of rise, the other four provinces had few changes in waterway mileage because of the geographical environment.

d. Aviation construction

Airports of the five provinces expected to complete 330000 vehicles of airplane rising and landing, 36.66 million of passenger throughput, 260000 tons of cargo throughput and year-on-year growth was 15%, 14% and 7% in 2014.

(3) Volume of infrastructure freight traffic and freight turnover

a. Volume of highway, railway and waterway freight traffic

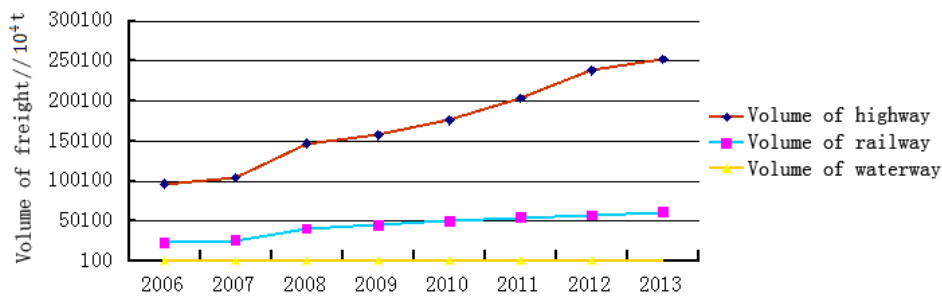


Fig.3-5 2006-2013 Volume of freight traffic in five provinces

Seeing from volume of freight traffic in the five provinces, the volume of highway freight traffic always presented a sustained growth trend; the volume of waterway freight traffic increased slowly; because the highest volume of waterway freight traffic was less than 3 million tons, so in this picture the growth trend of the volume of waterway freight traffic was not obvious, and it might be related to few inland waterway in the five provinces [3].

b. Highway, railway and waterway freight turnover

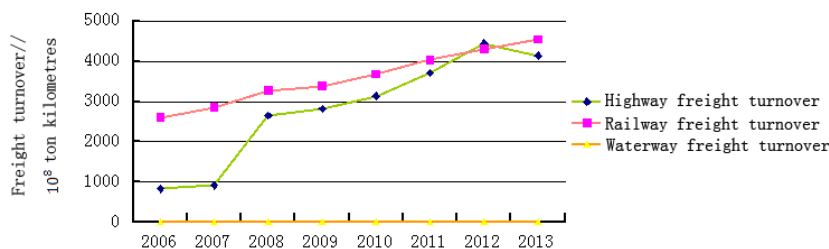


Fig.6 2006-2013 Freight turnover in five provinces

Conclude from Fig.6, there was an obvious trend in highway and railway freight turnover in the five provinces, because the waterway freight turnover in the five provinces was less than 100 million ton-km, so the change curve in Fig.6 was similar to x axis.

2. Model Building

System Dynamics, SD combines system science theory and computer simulation and studies its feedback construction and behavior [1]. Using the structural model of cause and effect among systems to test and calculate for simulating a series of dynamic behavior of the system in future and the combination of qualitative and quantitative. Making simulated experiment by SD model under different circumstances and policies. According to this method, the corresponding optimization measures are put forward.

2.1 Cause and effect chart

Through the analysis of many elements the “New Silk Road” economic zone related to modern logistics, the system dynamics model for coordination logistics and economic construction is set up. This article builds a casual and effect chart between modern logistics and economy, on the basis of existing research and many factors of economic development and logistics system, as shown in Fig.7.

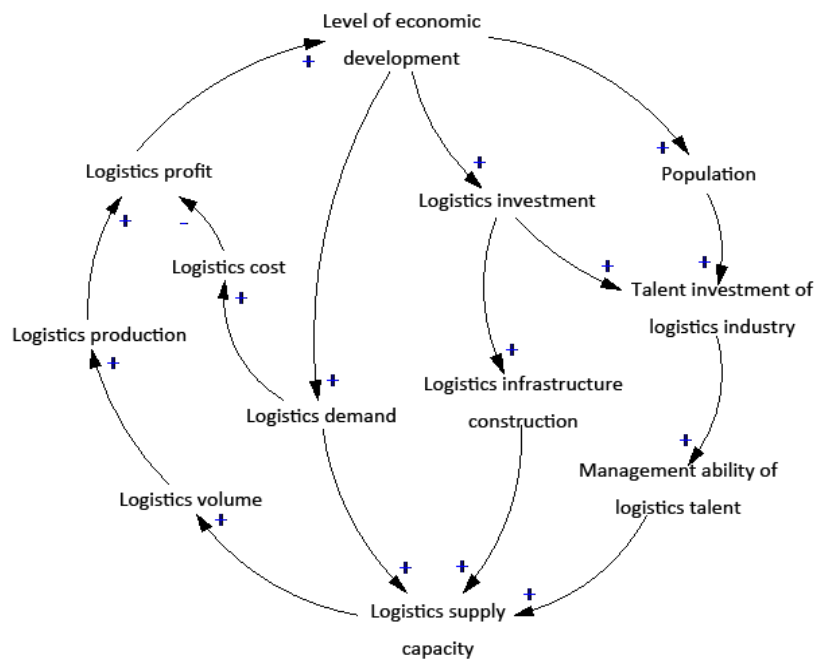


Fig.7 Cause and effect chart

As shown in Fig.7, acceleration of logistics towards economic growth increases obviously. Meanwhile, the development of economy also leads to favorable environment of logistics. Through the analysis of feedback chain between logistics and economy, a conclusion can be drawn that the construction of logistics infrastructure plays an important role in economic growth.

2.2 System flow chart

Taking VENSIM software as platform, the system dynamics analysis is based on the coordination development of logistics and the “New Silk Road”, the system flow chart is constructed in Fig.8.

According to the practical need of study in this article and easy acquisition of data, this article determines the boundary of this system:

(1) Subsystem of the economic development of the “New Silk Road” economic zone: the development of economy involves GDP growth and industrial structure adjustment, because in this article the focus of the study is the relationship between logistics infrastructure and economy, so the increasing rate of economy is mainly caused by the increase of logistics supply.

(2) Subsystem of logistics infrastructure: there are many economic factors of the development of logistics. The discussion topic of this article concentrates on the problem that the development of economy in economic zone leads to the development of logistics, analyzed in two directions—logistics demand and supply.

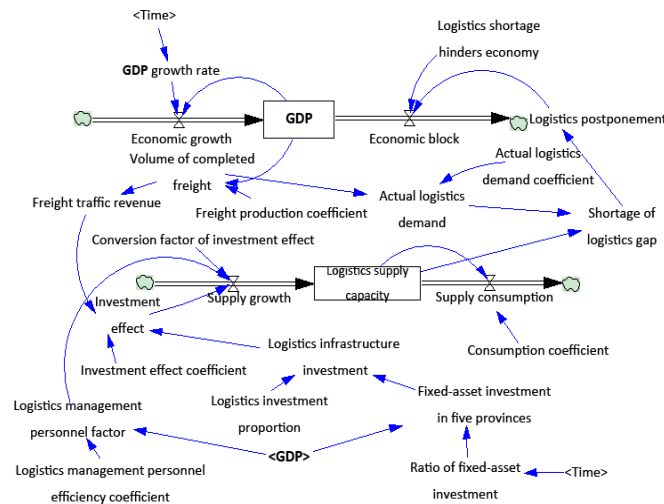


Fig.7 Cause and effect chart

2.3 Model fitting test

(1) Historical data test

By operating model (Fig.4-3), simulated values of each variable can be gotten. Using GDP as the test variable and doing the fitting test on the basis of the five provinces’ data during 2006—2013. The result is shown in Table.1.

Table 1 Model fitting test (GDP as test value) *10⁸yuan

Year	2006	2007	2008	2009	2010	2011	2012	2013
Actual data	11441	13701	16887	18269	22722	27915	31844	35680
Simulated data	11441	13614	16336	19092	21699	26905	33093	36725
Error//%	0	0.63	3.26	-4.5	4.50	3.62	-3.92	-2.93

During 2006—2013 the absolute value of error is less than or equal 5.0% comparing simulated value and truth value of GDP, which proves the model fitting is good and the result of the test is reasonable and applicable [8].

(2) Parameter sensitivity test

This article tests the sensitivity of model by changing the investment proportion of fixed assets. On the basis of expected research result, use model to investigate influence on gross national product made by increasing the investment proportion of fixed assets in logistics infrastructure. Now increasing the investment proportion of logistics fixed assets from 9% (current) to 14% (current 1), and operating the model, as shown in Fig.8.

Fig.8 Increase the investment proportion of fixed assets in logistics infrastructure corresponding GDP As shown in Fig.8, changes of investment proportion of fixed assets make difference in the amplitude of the curve, but the overall trend of the model has changed a lot. So this parameter sensitivity is not good therefore the model’s requirement of data is not high and it plays an important role in the practical application of the model [8].

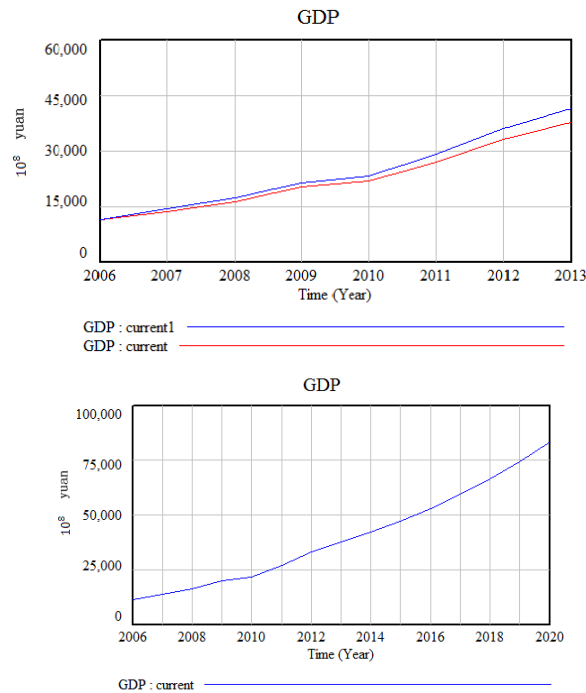


Fig.9 GDP tendency in five provinces

3. Model Simulation and Result

3.1 Model operation tendency analysis

(1) GDP tendency

By operating model, as shown in Fig.9, GDP of the five provinces is increasing and the annual increase is also climbing.

(2) Logistics demand tendency

The logistics demand of the five provinces is increasing, mainly because of the rapid development of economy and the implementation of a series of policies such as Western Development and Revisiting the New Silk Road. In the meantime, raising the level of logistics supply will also promote the development of logistics industry, as shown in Fig.10.

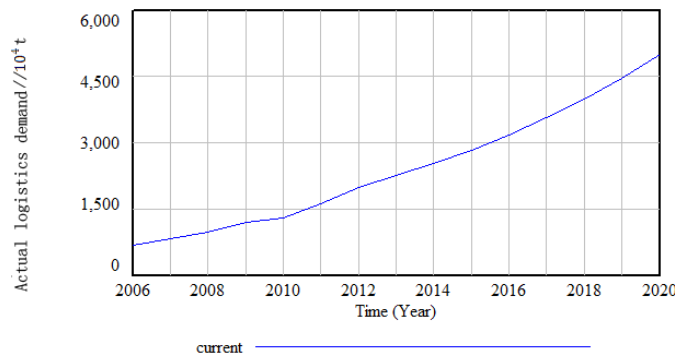


Fig.10 Logistics demand tendency in five provinces

(3) Logistics supply tendency

The supply capacity of logistics in the five provinces is increasing. With the implement of a series of Silk Road Economic Zone policies as well as growing social demand for logistics, the supply capacity of logistics in the five provinces is increasing which promotes the development of economy, as shown in Fig.11.

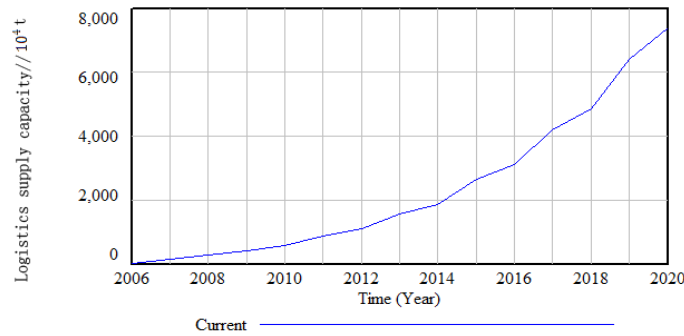


Fig.11 Logistics supply capacity tendency in five provinces

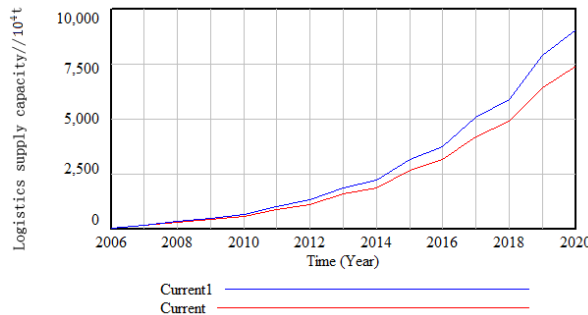


Fig.12 Logistics supply capacity tendency relative to adjustment of investment effect coefficient

3.2 Result discussion

(1) The influence of supply capacity increase for economic development

a. Investment effect coefficient

Increasing investment effect coefficient from the initial value 0.7 (current) to 0.8 (current 1), the investment increased by 10%, and changes of supply capacity of logistics are shown in Fig.12.

b. Supply consumption coefficient

Increasing consumption coefficient from the initial value 0.03 (current) to 0.13 (current 1), the consumption increased by 10%, and changes of supply capacity of logistics are shown in Fig.13.

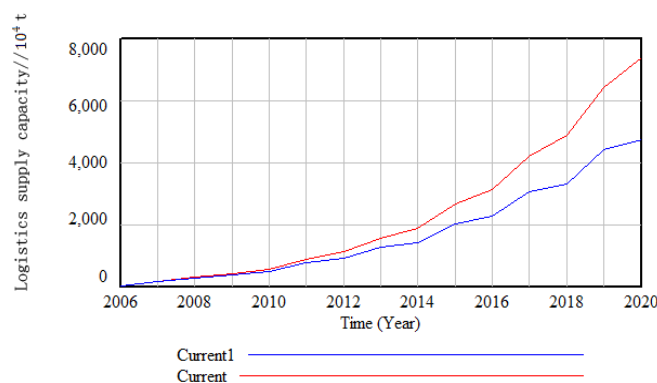


Fig.13 Logistics supply capacity tendency relative to adjustment of supply consumption coefficient

The supply of logistics is influenced by the dual function of investment coefficient and fixed asset consumption, and the data increase in two directions above has different direction force on the five provinces within economic zone. The growth trend in fixed asset investment will improve the speed of economic development. When the fixed asset consumption accelerates, it will cause hindering effect on the development of economy.

(2) The influence of logistics demand increase for economic development

Realize increase or decrease of logistics demand by adjusting effect variable of logistics demand. Adjusting logistics demand coefficient from the initial value 0.5 (current) to 0.6 (current 1), demand increased by 10%, and actual changes of logistics demand are shown in Fig.14.

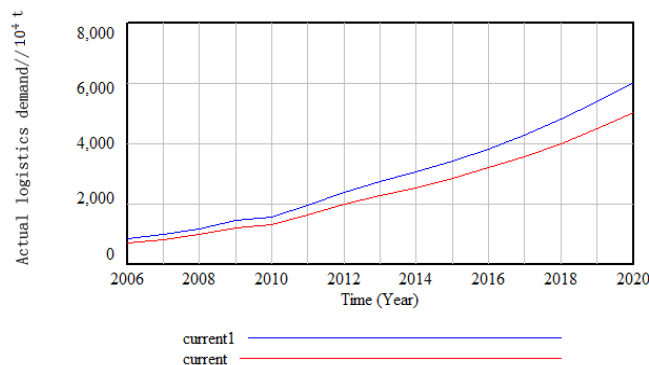


Fig.14 Change of actual logistics demand relative to adjustment of logistics demand coefficient

According to the simulation results obtained above, there is a positive correlation trend between logistics demand coefficient and logistics demand. The growth of logistics demand has a strong role in promoting supply capacity of logistics, driving and promoting the sound and rapid development of local economy.

(3) The influence of economic development for logistics industry

Increasing 0.05 of economic growth rate on the basis of the initial value, and related changes of logistics demand and volume of completed freight are shown in Fig.15.

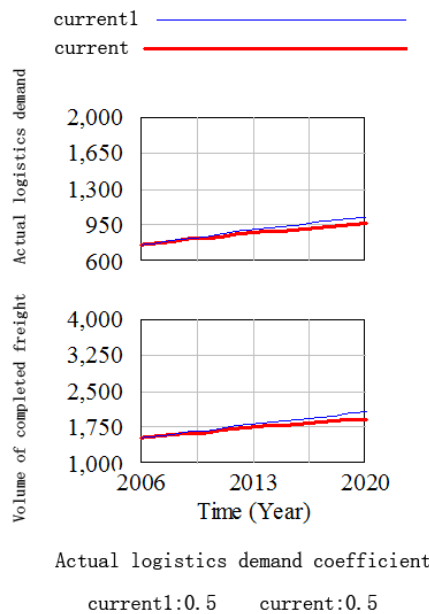


Fig.15 Logistics demand and volume of completed freight tendency relative to adjustment of GDP growth rate

The increase of logistics demand will happen along with the development of economy, the government and society can meet the demand of logistics in current situation by continuing to increase the investment in fixed assets of logistics infrastructure, and improve the supply capacity of logistics. Therefore, rapid development of economy has a great promotion to the supply capacity and actual demand of logistics. Meanwhile adding value of the balance between supply and demand can be beneficial to promote the further development of logistics industry [6].

3.3 Suggestions

(1) Change old concepts of logistics and strengthen understanding of modern logistics

At first we should concentrate on optimization of the logistics infrastructure and growth of the infrastructure efficiency to change old concepts of logistics transportation. Secondly having big vision, to be innovative and realize economy of social resources, meanwhile to realize growth in overall efficiency of logistics industry.

(2) Establishment of logistics coordination mechanism and effective integration of resources

Establish coordination mechanism of modern logistics to realize overall efficiency of logistics transportation. Coordinate problems brought by each province and department involved in economic zone which participates in goods delivery of logistics industry together, and use good solutions in view of main aspects [7].

(3) Continue to intensify the building of logistics infrastructure

The development of logistics industry depends heavily on the logistics infrastructure construction, and we must intensify the infrastructure construction of cities of different levels and trading ports with purpose.

(4) Strengthen cultivation of logistics professional talent

Now in China, talent problem puts serious restrict on development of logistics industry, especially in northwestern regions. But the main five provinces of the “New Silk Road” economic zone are all in northwestern inland which are short of talent. Suggestion is to set up logistics and similar subject as well as cultivate talent on the base of it.

(5) Continue to increase investment of logistics infrastructure in the “New Silk Road” economic zone

Because the scale of logistics infrastructure in western regions is still small, the government should continue to increase investment on the development of logistics infrastructure in western regions and to speed up the highway investment.

4. Conclusions

This article built a system model of the relationship between logistics infrastructure and the development of economy, on the basis of data from 2006 to 2013, a conclusion was obtained that investment of logistics infrastructure must be increased in order to improve economic growth. In the meantime, stimulating future data by using model as well as building economic growth changes of “New Silk Road” economic zone by 2020, so as to draw a conclusion that the amount of existing infrastructure must play a role in future development. Therefore it is also needed to strengthen logistics infrastructure in order to improve the economic growth of economic zone in the future.

5. Acknowledgement

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