

# Research on interactive development model of logistics and commerce in comprehensive logistics park development based on system dynamics

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**Abstract.** Logistics Park is the inevitable product of the development of modern logistics industry, the reasonable construction of Logistics Park is conducive to promoting the stable development of urban economy. The paper uses the method of system dynamics and case analysis, considering the regional economy, facilities and equipment, industrial demand and other aspects, quantifying various influencing factors, and through the model to build the relationship between the various factors. It aims to provide a new theory and method for the research of interactive development model between logistics and commerce. Logistics service area and commercial service area are important parts of Logistics Park, These two parts of the promotion will promote the logistics park business income increase, increase profits, So as to promote the improvement of the overall facilities and environment, and provide support for the development of Logistics Park in a certain area.

## 1. Introduction

One of the important signs to measure the comprehensive competitiveness of cities and people's living standards is the development level of logistics industry. Logistics park is the inevitable product of the development of modern logistics industry, the reasonable construction of logistics park is conducive to promoting the stable development of urban economy [1]. At present, the relationship between the two analysis mainly includes qualitative and quantitative research, qualitative research is mainly reflected in the impact of logistics park on the urban regional economy, Logistics park construction based on regional economy, etc. The quantitative research is mainly based on system dynamics, econometrics, and grey relational analysis and so on. At present, the research at home and abroad is more about logistics park construction planning, site selection, scale, operation and management, the impact of logistics park construction on urban economy is less studied [2-5]. Because the system dynamics theory can effectively analyze complex dynamic feedback problems, This chapter analyzes the relationship between the project construction and economic development of an international comprehensive logistics park by establishing a system dynamics model, so as to study the effect of logistics park construction on



the economic development of a city, and put forward an effective commercial operation mode according to the actual situation, In order to promote the development of a city 's economy and logistics.

Reasonable research on Logistics Park is helpful to strengthen regional logistics development, So as to promote the development of regional economy and improve the overall strength of urban agglomeration. A comprehensive and correct analysis of these issues, cannot use the traditional way, because of the many and complex factors involved, but the system dynamics approach can solve this problem, It systematically studies logistics parks and regional economies, Then build a model, comprehensive and systematic analysis of regional logistics relevance. The traditional theory provides the basis for establishing the dynamic model of regional logistics system, its theories include management, organization and various systems, Content includes information, experience and judgment, and they can be combined with feedback theory to complete the extraction of system dynamics model [6-10].

## **2. the establishment of a regional international integrated logistics park system dynamics model**

This chapter is mainly based on the qualitative analysis of experts in relevant fields to determine the variables and causal relationships within the system boundaries, then based on the actual data and the planning data, the system dynamics model is established.

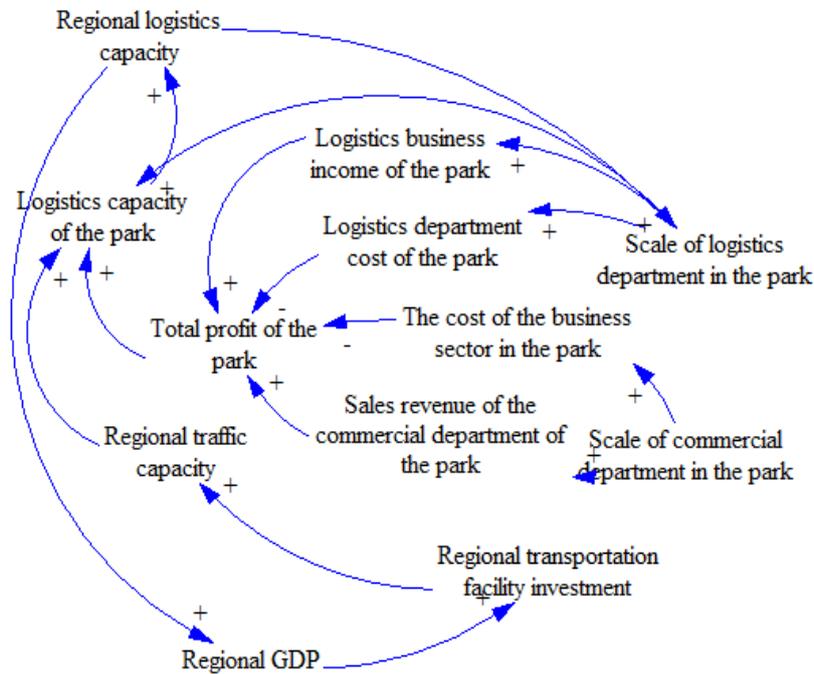
### *2.1. Causality diagram*

In a co-integration analysis of the impact of logistics on economic growth, some scholars have pointed out that there are three factors exist long-term stable relationship, namely, the level of logistics development, logistics fixed assets investment and regional gross domestic product ( GDP ).In this chapter, fixed assets investment in logistics, logistics development level and regional gross domestic product ( GDP ) as the model parameter variables, considering that the research object is the impact of logistics park construction on urban economic development, therefore, the construction and operation index of logistics park is selected as one of the system boundaries. So here mainly considering the logistics park logistics scale, regional logistics capacity, regional economic development. As can be seen from the causality diagram in figure 1, the main influencing circuits are:

Development of logistics department in logistics park ---->+ Logistics capacity of the park ---->+ Regional (city) logistics capacity ---->+ Regional economic development (GDP of a city) ---->+ Regional transportation facility investment ---->+ Regional (city) logistics capacity ---->+ Development of logistics department in logistics park.

Development of logistics department in logistics park ---->+ total profit of logistics park ---->+ Logistics capacity of the park ---->+ Regional (city) logistics capacity ---->+ Regional economic development (GDP of a city) ---->+ Regional transportation facility investment ---->+ Regional (city) logistics capacity ---->+ Development of logistics department in logistics park.

Development of commercial department in logistics park ---->+ Total profit of logistics park Logistics capacity of the park ---->+ Regional (city) logistics capacity ---->+ Regional economic development (GDP of a city) ---->+ Regional transportation facility investment ---->+ Regional (city) logistics capacity ---->+ Development of logistics department in logistics park [11-16].



**Figure 1.** Causal diagram

## 2.2. Model assumptions

Because of the complexity of the actual operation, so we need to make some assumptions about the relevant operating conditions of the study, avoiding the side effects of variables or factors on the results of the study. But at the same time, Because of the complexity of the real environment, therefore, the less conditions for the relevant assumptions, the more realistic. In order to find a balance between the two, this chapter presents the following basic assumptions:

(1) Because regional logistics capacity often involves many aspects, there are many related indicators, here in order to do a certain simplification, so choose freight turnover to measure regional logistics capacity.

(2) Assuming that there is no significant economic fluctuation in the future development of a city's GDP, at the same time, the growth trend of fiscal revenue and transportation facilities investment in fiscal revenue is basically consistent with the historical trend, and there is no significant change in growth.

(3) Transportation investment can improve the city's logistics supply capacity, this chapter assumes that this part comes from government investment, regardless of the social investment part.

(4) the scale of the park construction and the first phase of the project schedule is consistent, by 2015, the construction will be basically completed, and temporarily regardless of the construction of the late project, so the scale of the park remained unchanged after 2015[17-20].

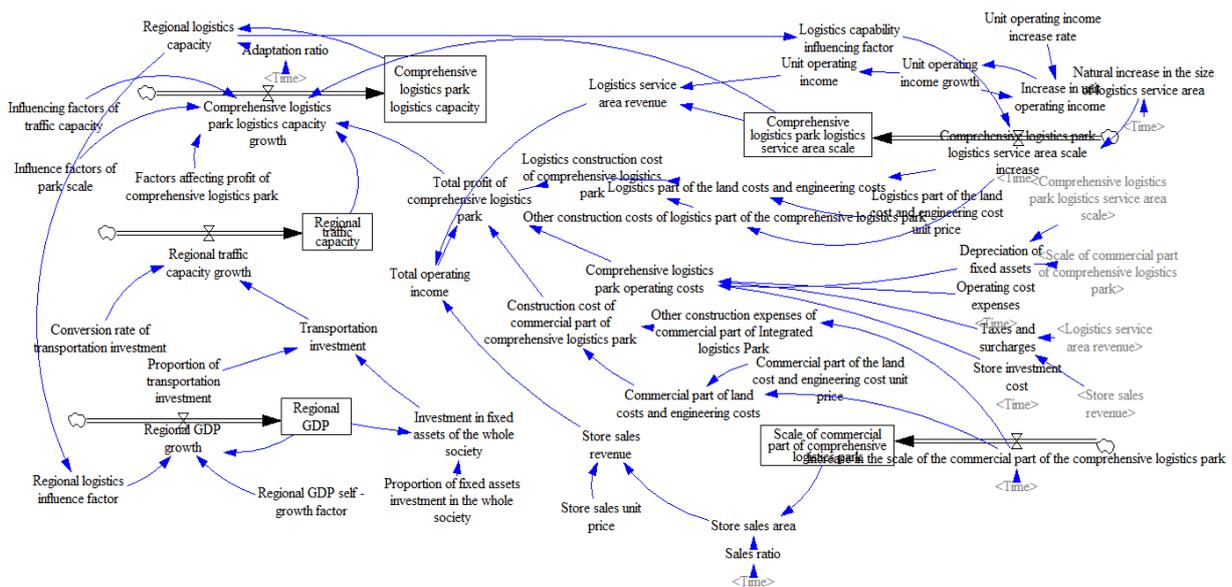
Investment and financing plan as shown in table 1:

**Table 1.** Investment and financing plan (ten thousand yuan)

	Financial time	Financing amount ( ten thousand yuan )	Capital matters	Time of use	Investment amount	Source of funding
Phase I project	2013/1 1/1	10000	For company registration and payment of land transfer payments	2013/1 1/1	10000.00	Investment start-up funds
	2013/1 1/1	3885	Payment of pre-construction costs, construction and installation costs, infrastructure	2013/1 1/12	3000	Financial return of funds
	2014/3/1	5000	Pay 90 % of the upfront project costs, construction and installation costs and municipal facilities costs 70 %, sales costs 40 %, financial costs 30 %	2014/1 0/1	11918.05	Delivery loan
	1905/7 /7		Payment of two lots of land	2014/1 0/1	8219.84	Sales rebate
			Payment for the remaining 30 % of the works	2015/1 0/1	8220.17	Sales rebate
			Payment of operating part of the	2006/1 /12	5471.13	Sales rebate

2.3. Flow chart and implementation process

Model - based causality diagram analysis, the internal structure of the model can be obtained, That is, it is necessary to build a system model including logistics development level, logistics fixed assets investment, GDP and logistics park regional construction. After making some basic assumptions about the model, the system dynamics model of the relationship between the construction of an international logistics park and the economic development of a city is established by the system dynamics simulation software vensim. Among them, 2013 - 2033 is the model running time, 1 year is the simulation step size, By referring to the statistical yearbook of a city as well as the relevant specific data of the project investment and financing and planning of a certain city road and harbor international comprehensive logistics park, establish a system dynamics model, as shown in figure 2:

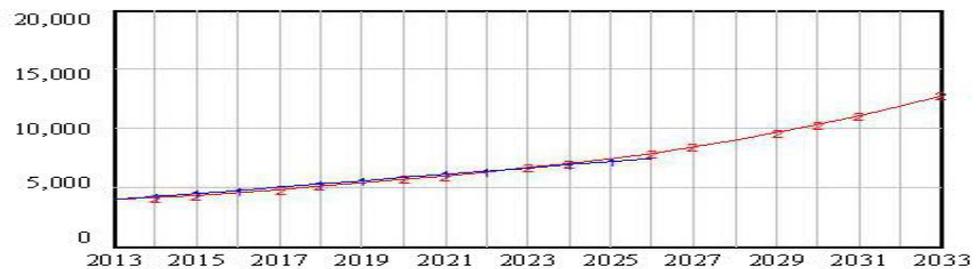


**Figure 2.** International Integrated Logistics Park System Dynamics Model Flow Graph in a city

### 3. Simulation of system dynamics model of a city road and harbor international integrated logistics park

After the model is built, the simulation results of the model need to be compared with the actual results, to test whether the historical value and development trend of the model fitting are consistent with the actual situation, on this basis, we can ensure that scenario analysis can simulate the future development trend. Therefore, this chapter compares the simulation parameters, actual values and project planning values of the system dynamics model of a city road and harbor international comprehensive logistics park to measure the effectiveness of the model as a whole.

(1) Check the fit of regional logistics capacity as shown in figure 3 and table 2.



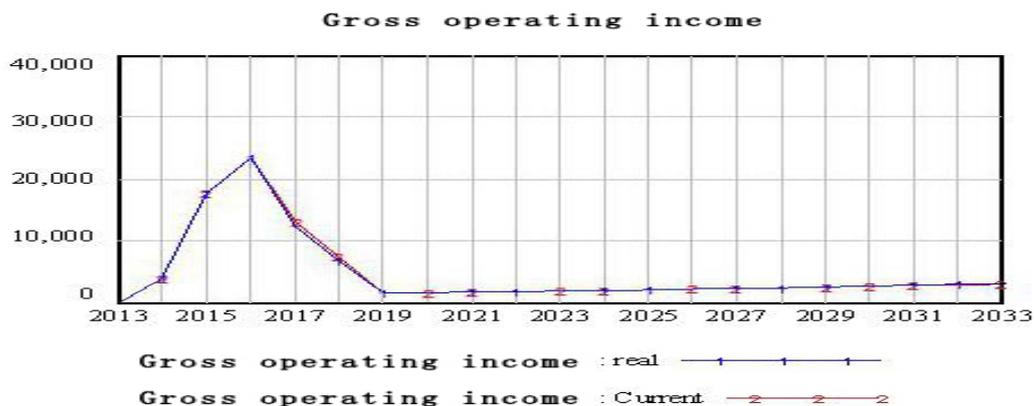
Regional logistics capability : real 1  
Regional logistics capability : Current 2

Figure 3. Regional logistics capacity of the fitting test chart

Table 2. Checklist of fitting of regional logistics capability

Regional logistics capacity	2013	2014	2016	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Actual value	3,960	4,229	4,498	4,767	5,036	5,305	5,574	5,843	6,112	6,381	6,650	6,919	7,188	7,457
Analog value	3,960	4,167	4,368	4,666	4,834	5,110	5,394	5,691	6,003	6,331	6,676	7,041	7,428	7,839
Error rate	0.00%	-1.70%	-3.11%	-4.22%	-4.01%	-3.68%	-3.23%	-2.60%	-1.78%	-0.78%	0.39%	1.76%	3.34%	6.12%

(2) The fitting of total operating income is examined as shown in figure 4 and table 3.



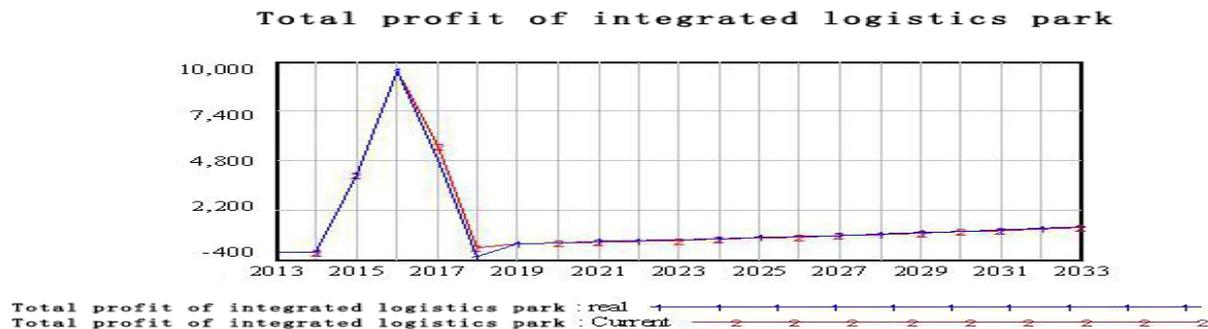
Gross operating income : real 1  
Gross operating income : Current 2

Figure 4. Check the total operating income

**Table 3.** Checklist of the total operating income

Year	2014	2016	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Actual value	3,885	17,580	23,440	12,336	6,784	1,540	1,617	1,698	1,783	1,872	1,955	2,054	2,167
Analog value	3,885	17,696	23,460	13,124	7,328	1,536	1,613	1,694	1,779	1,868	1,951	2,059	2,162
Error rate	0.00%	0.09%	0.09%	6.39%	8.02%	-0.26%	-0.26%	-0.24%	-0.22%	-0.21%	-0.20%	-0.24%	-0.23%

(3) The comprehensive logistics park profit total fitting test as shown in figure 5 and table 4.

**Figure 5.** Consolidated survey of the total profit of the integrated logistics park**Table 4.** Checklist of the total profit of the integrated logistics park

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
real	4,047	9,500	4,843	-268	449	494	542	591	644	699	756	817
Current	4,036	9,493	5,562	220	421	466	513	562	615	669	727	787
Error rate	-0.27%	-0.07%	14.85%	-182.18%	-6.35%	-5.81%	-5.33%	-4.91%	-4.54%	-4.21%	-3.92%	-3.66%

By comparing the regional logistics capacity, total operating income and total profit of the comprehensive logistics park, it is found that the historical fitting of the results and the historical error rate of the actual value are not more than 5%. It can be said that the model results can better describe the operation status of the dynamic model of the international comprehensive logistics park of a city road and harbor, indicating that the structural design and parameter selection of the model are reasonable [21 - 22].

#### 4. Conclusion

Based on the above analysis results, it can be concluded that:

Because the construction of Logistics Park can improve the ability of logistics supply, so as to promote economic development and the increase of logistics capacity of a city, so we should increase the construction and planning of Logistics Park, so as to better serve the development of the city.

Because the better the logistics ability to promote the role of logistics demand and supply capacity, therefore, we should vigorously develop the economy, increase investment in transportation infrastructure, promote the growth of logistics demand and logistics capacity, to improve the logistics ability of the international comprehensive logistics park to create a good environment.

Logistics service area and commercial service area are important parts of international integrated logistics park, Both parts of the promotion will promote the international integrated logistics park business income increase, profit increase, So as to promote the improvement of the overall facility environment, Therefore, further planning and construction of these two parts is needed to lay a good commercial foundation for the development of logistics industry.

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