

# Dynamic Change of Industry Ecosystem Network in China

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**Abstract:** The article puts forward the concept of "industrial ecosystem" to reflect the flow of Chinese industry internal resources are in more complex situations. Used SNA method, and based on the input-output data in 1997-2007, then analyze the evolution process of industrial structure in our country from the perspective of social network characteristics. Analyze ecological roles by the use of production capacity analysis and middleman role analysis, then induces industry evolution trend diagram, and determine the evolution model. The research results show that our country industry ecosystem participants' role and status has changed, and there is the arrival of the new players, system core role is changing its situation.

## 1. Introduction

Kuznets thought the significant correlation on the industrial structure and economic growth which optimized the industry structure can effectively promote economic growth. Industry ecosystem aims to analyze the resource flows during a period of time and dynamically describe the complicated correlation among various industries, then confirm the middleman role in the ecosystem. In previous studies, Du Huadong analyzed the flow of resources in the process of industrial structure evolution which mainly based on input-output table data to represent. Han Jianfei, Chen Ming based on the input-output table data in 2010 and built the complex industry network model, set the industry as examples, they found the complex industry network of small world.

## 2. Data sources and processing

### 2.1 Data source

The article original data are industry input and output basic flow from China's national bureau of statistics in 1997, 2007. Internal data is concerning about China's three major industries, a total of 42 niche business.

### 2.2 Data processing

This paper based on the input and output of basic traffic data of two annual years and used the Ucinet software 6.0 of SNA analysis, to calculate the network, and calculate the role in the middle of measurement of each industry.

## 3. Node selection of industrial ecological system

In this paper, as for the industry ecosystem construction in China, according to the national bureau of statistics released by the input and output basic flow, treat each sector as each node in the network ecosystem, a total of 42 industries, namely 42 node. Specific industry showed as in table 1:

Table 1 industry category

Detailed industry		Detailed industry		Detailed industry	
A1	Animal husbandry and fishery	I13	Metal smelting and rolling	S1	Transportation and Warehousing
I1	Coal Mining and Dressing	I14	processing industry	S2	Mail Business
I2	Petroleum and Natural Gas Extraction	I15	Metal Products	S3	Information transmission, computer services and software
I3	Metals Mining and Dressing	I16	General and special equipment manufacturing	S4	Wholesale and Retail Trade
I4	Nonmetals Mining and Dressing	I17	Transportation Equipment	S5	Hotels and Catering
I5	Food production and tobacco processing	I18	Electronic equipment manufacturing	S6	Financial Industry
I6	Textile Industry	I19	Instruments and cultural office machinery manufacturing	S7	Real Estate Business
I7	Tertiary industry	I20	Craft and other manufacturing	S8	Leasing and Business Service
I8	Timber processing	I21	Scrap Waste	S9	Research and Experimental Development Industry
I9	Printing processing	I22	Electricity, heat production and supply industry	S10	Poly technical Services
I10	Oil processing and coking and nuclear fuel	I23	Production and Supply of Gas	S11	Water resources, Environment and Public Facilities
I11	Chemical Industry	I24	Production and Supply of Water	S12	Residing Services and Other
I12	Nonmetal Mineral	I25	Construction Industry	S13	Education

#### 4. China's industrial ecosystem structure and dynamic evolution

##### 4.1 The industrial structure and chart of topology

This paper mainly uses the network topology diagram to reflect the inside structure of the industry ecosystem in China. China's industry ecosystem is closely intertwined, it is unfavorable to observation and analysis. This paper will set the network density, center, readings potential indicators as the standard, sort the departments in 42 sectors with the relevant system of importance, and the obvious connections between industry characteristics, and the characteristics of change which is not obvious during ten years. According to the Ucinet software 6.0, we calculated the  $D_n$  and  $C_n$  of 42 industries in 1997 and 2007, the concrete numerical value are as shown in table2:

Table 2 the table of  $D_n$  and  $C_n$ 

	1997	2007
Network density $D_n$	0.9082	0.9569
Degree center $C_n$	3.69	7.63

##### 4.2 Capacity role analysis

This article on the basis of the input-output basic flow table for China in 1997 and 2007, including the three major industries and 42 sectors, and utilizes the industry resource flows for capacity role analysis. We distinguish "donors" and "absorber" according to the industry capacity coefficient  $k$ . If the  $k$  is greater than 1, then the industry was identified as "donors", because it provides more output to other industries than receives input from other industries. This type of industry will make to the industry ecosystem more healthy. On the contrary, if the  $k$  is less than 1, then the industry was identified as "absorber", because it provides less output to other industries than receives input from other industries. This type of industry will damage to the industry ecosystem.

##### 4.3 Broker role analysis

For further analysis of the relationship between industry departments, this chapter brings in five types of broker role from SNA. Particularly, every section may play not only one role in the industry network. So we choose the highest frequency of role-playing, as the industry's broker role.

The frequency of each department will be calculated by the Ucinet software 6.0.

#### 4.4 The dynamic evolution of Chinese industrial ecological system

The 3.2 chapter mainly analyses the resource flow condition in the overall ecosystem for capacity analysis, the 3.3 chapter mainly does broker analysis to consider role-playing of industry network. For better reflecting the dynamic evolution of industry roles in the ecosystem, we will be comprehensive consideration capacity role and broker role. From 1997 to 2007, the dynamic evolution of Chinese industry ecosystem is shown in Fig1.

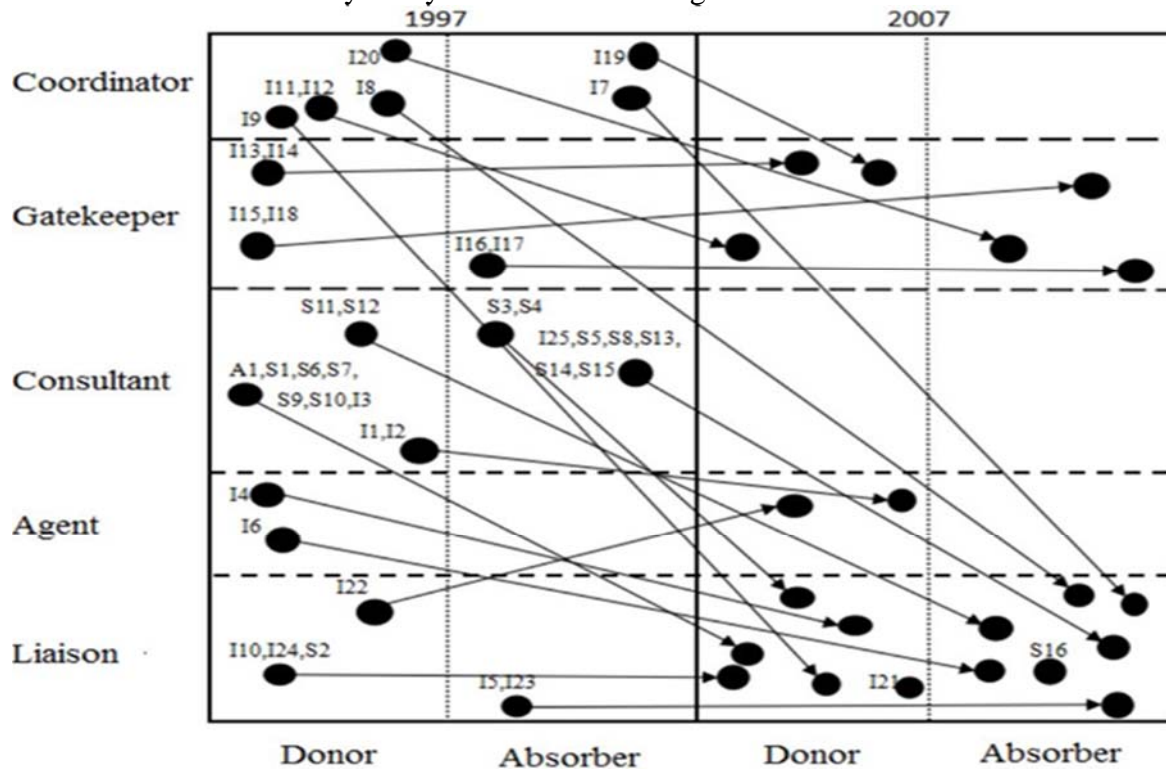


Fig1 The dynamic evolution of Chinese industrial ecological system

We can see from figure 1 that Chinese industrial structure from 1997 to 2007, the broker role changes from initial clutter distribution into liaison (mainly A and S industry) and gatekeeper (mainly I industry) types of roles. Whatever the absorber role of ecosystem has increasing. In particular, I21 and S16 industry independent outside the ecosystem science 2007, and until 2007 they went into the ecosystem. For clear understanding of tendency, we put forward four patterns to reflect the industry ecosystem's evolution.

For the adaptation pattern, the migrator pattern, the dominator pattern and the settler pattern. The adaptation pattern is the pattern that both the capacity role and the broker role are changed, this pattern tend to completely change the resources flow situation to adapt to the economic surroundings, eventually making the ecosystem structure more obvious. The dominator pattern is the pattern that the capacity role changed but the broker role unchanged, this pattern focuses on the dominant position in the industry ecosystem. The migrator pattern is the pattern that the broker role changed but the capacity role unchanged, this pattern focuses on the industry's influence on the whole ecosystem. The settler pattern is the pattern that both the capacity role and the broker role are unchanged, this pattern need to overcome inertia changes of industry ecosystem to some extent, to maintain its static status.

With the reform and development, the service industry, as the representative industry in the area where has new business and the new technology input, the contact with other industries is gradually increases. Whatever, the state of broker role's dynamic change from consultant to liaison is obviously. However, until 2007, service industry's broker role didn't change, remains to be absorber. The scale of output is still relatively lags behind. Therefore, the migration pattern of service industry was determined. While, for most of the manufacturing industry, these industries have a

large amount of fixed investment, and their output model is relatively single, as time goes by, their capacity role tend to be a stable state. At the same time, the manufacturing industry as the pillar industry of national economy, the broker role in the ecological system is hard to change. Therefore, the manufacturing industry's settler pattern was determined.

## 5. Summary

With the continuous reform and optimize of China's industrial structure, the importance of the symbiosis and cooperation among industries is increasingly highlighted. The three industries and their each internal niche business are constantly interact with each other during the optimization of the development process. At the same time, due to China's large and complexity character of industrial structure, they produce a series of value-added synergies. In brief, the article analyze the capacity role's and the broker role's situation of changes, for providing a better understanding of our country's industrial structure, and suggest a serious of policies.

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