A STUDY OF SHANGHAI'S INDUSTRIAL STRUCTURE

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ABSTRACT

The main purpose of this paper is to study the dynamic behavior change of Shanghai's industrial structure. Shanghai's industry is facing a severe situation now. In one hand, the industry is required to make adjustments in its structure and distribution according to Shanghai economic development strategy; in the other hand, its ageing technology and structure of products, together with the shortage of energy and raw material, result in decline of profits in industrial enterprises and "landslip" of government revenue. Therefore, how to adjust the structure of Shanghai's industry reasonably is becoming an urgent task. With the aid of industrial development history of western developed countries, this paper analyzes the reasonable development of industry from four aspects, creats a system dynamics model to simulate the dynamic change of city's industrial structure and tests its validate. At last, the paper uses this model to analyze the trend of Shanghai industrial production and studies several problems in industrial economy, such as: selecting the leading industrial department of the city; allocating funds reasonably; using energy and raw material efficiently and affecting of technology, pollution and transportation on industry. In policy test, the paper proposes a series policies to authorities responsible for industry development for reference.

INTRODUCTION

Shanghai, the largest city of China, is at a critical time. It is facing a lot of problems relating with the rethinking about the present general development strategy of the city and the role of the city in national economy. This paper only discusses the industrial development which is one of main problems in city's general development. Shortage of funds, energy and raw material, serious pollution and backlog in transportation have relation with the industry directly or indirectly. So, Shanghai is required to make adjustments in its structure and distribution of industry to meet the needs of national economic development and development of science & technology, economy and culture of the city itself.

Due to historical reasons, there are some serious problems in its industrial structure. The increase of output value mainly relies on the input of a large amount of material, rather than on the progress of technology. Because of the backward of industrial technology, products made in Shanghai not only have no competitiveness in international markets, but also have been losing their technology advantages in internal markets. Furthermore,the increasing prices of raw material now results in rise of products costs, decline of enterprise profits and "landslip" of government revenue.

Therefore, the structure of Shanghai's industry has to be adjusted. The main problem studied in SDMSIS (System Dynamic Model of Shanghai Industrial Structure) is how to change the present structure into a more reasonable one gradually, basing on its existing economic capacity and science & technology and refering to the industrial development experiences of foreign countries. This paper analyzes the dynamic changes of structure of Shanghai's industry in following ways:

(1). Selecting leading industrial department;
(2). Affecting of technology on industry;
(3). Utilizing energy efficiently;
(4). Utilizing resources reasonably and its influence on industry;
(5). Restrictive factors in transportation and pollution.

BRIEF INTRODUCTION OF SDMSIS STRUCTURE

The model, having 15 level variables and 390 equations, has worked in VAX-11 computer successfully. The sensitive analysis, historical data examination and extreme condition test have shown the model is effective and can be used as a tool to analyze and simulate the dynamic changes of structure of Shanghai's industry.

The industry of the city is divided into ten departments in this model: metallurgy, electricity, petroleum, petrochemistry,mechanical engineering,building material,foodstuff, textile, clothing and others.

Figure 1 is the main feedback loops of the model:

loop 1: GNP-->+INI-->+INDE-->+PROC-->+VAO-->+GNP is the positive feedback loop of industry growth.
loop 2 : GNP-->+INI-->+INDE-->PROC-->+ESDR-->-PCUR-->+VAO-->+GNP is the negative feedback loop restricting the industry growth by resources.

loop 3 : INRDE-->+INDE-->EL-->-CERM-->- (+PROF-->+ / -POLL-->-) INRDE is the positive feedback loop resulting from the investment proportion of each industrial department.

Loop 1 is the stimulation of industry growth. Loop 2 is the restrictive factors in industry growing. Loop 3 is the Key of the model reflecting the conflicts between the industrial growing and resource shortage.

The measures of adjusting the allocation of investment aims at controlling the development of each industrial department. In this model the investment proportion of each industrial department is produced by feedback of following variables: profit, material and energy consumption,productivity and pollution.

THE SIMULATING RESULTS AND ANALYSIS OF SDMSIS

1. The growing trend of industrial production.
Figure 2 is the change trend of growth rate of city's industrial production and financial income.
Figure 2 shows that growth rate of industrial production is in "landslip", and even negative growth arised recently in financial

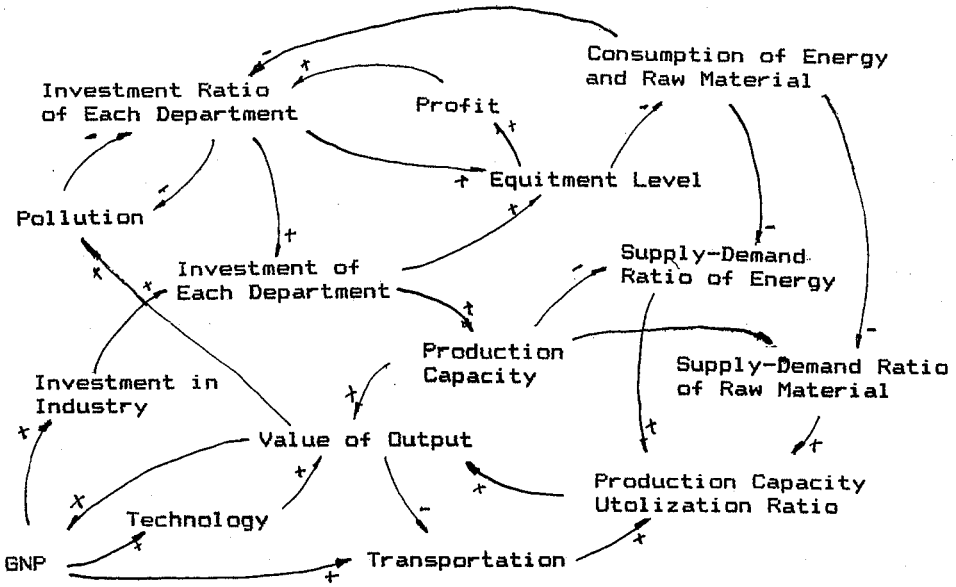

Figure 1. Main loops in the model

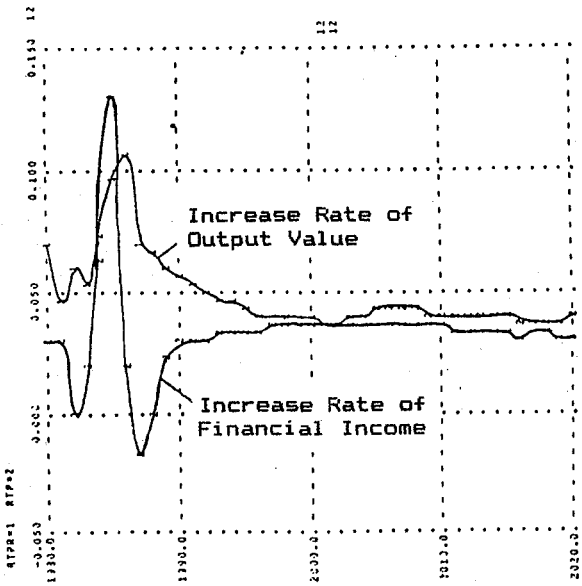

Figure 2. Increase rate of output value and financial income.

income. This situation couldn't become normal until the middle of 90s.

2. Restrictive factors.

Figure 3 is the utilization rate of production capacity which determines the growth rate of industry and is determined by supply-demand ratio of energy, supply-demand ratio of raw material and backlog ratio in transportation.

Backlog ratio in transportation (including harbours, railways and highways) will reach peak in 1990, coming up to 32% . After that, the rate will remain 1.2--1.3 if extra investment is not provided.That supply-demand ratio of both energy and raw material will decline shows that the resources, the base of high growth rate of city's industrial development, will be in serious short supply in next 30 years. We should pay more attention to this situation.

POLICY TESTS

1. Investment Proportion of each industrial department.

The investment proportion in basic run of the model is determined by historical data. If this proportion is produced by feedback functions of the model in line with the targets stated above, how is the industry going to develop? Figure 4 and 5 are comparisons between new and basic runs of the model about the value of output and government revenue.

Clearly, the new policy has remarkable advantages of increasing value of output, arising no negative growth in government revenue and controlling "landslip" in industrial production.

2. Selection of leading industrial department.

Correct selection of leading industrial department is very important. From the industrial development history of western countries, leading industrial department must have three basic conditions; the production demand elasticity is greater than 1; productivity is growing upward; the scale of production makes up a quite portion in whole industrial production.

The simulation of the model shows that such departments as metallurgy, petrochemistry, petroleum, mechanical engineering and clothing possess condition 1 and 2, and value of output in mechanical engineering possesses a dominant part in whole value of industrial output. Therefore, it's suitable to select mechanical engineering as the leading department in next 30 years and to expand metallurgy, petro-chemistry, petroleum and clothing departments at the same time in order to develop city's industry.

3. Increase of supply-demand ratio of raw material and energy.

There are two ways for selection to increase the supply-demand ratio. One is to adjust the structure of industrial department. This policy has remarkable advantages, but the shortage of energy and material still exists. The other is not only to increase investment in tech-nical improvement but also to inprove the equipments in industrial sectors.

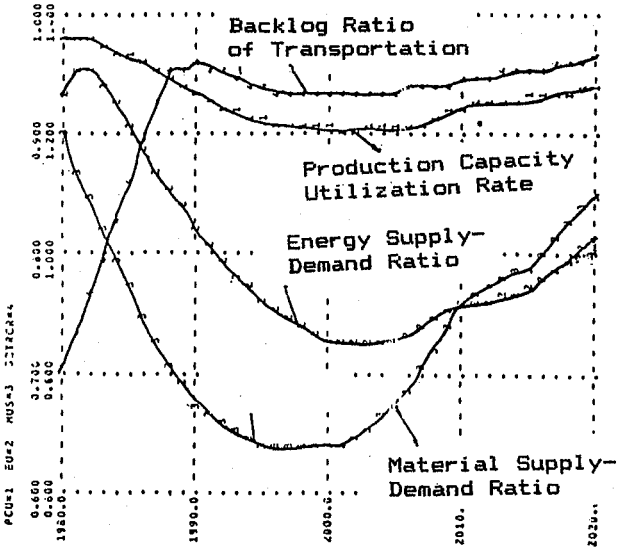

Figure 3. Restrictive factors

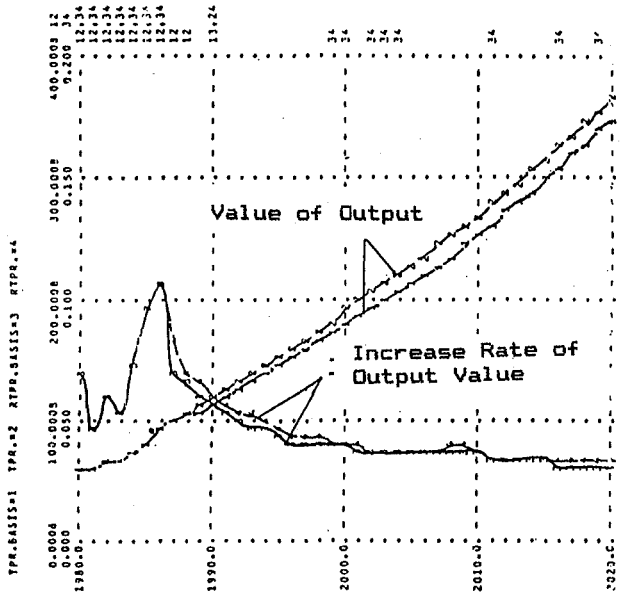

Figure 4.. Policy test of output value and its increase rate

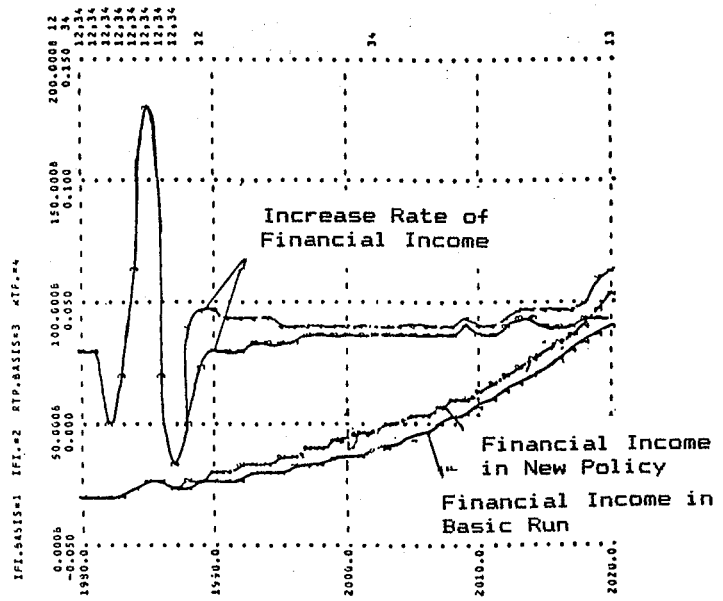

Figure 5. Policy test of financial income and its increase rate

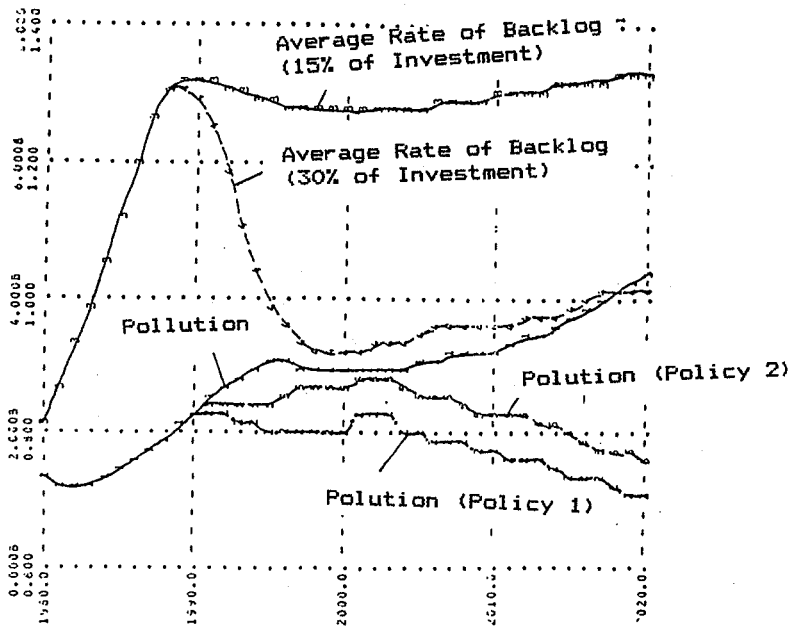

Figure 6. Transportation And Pollution

The following table shows some resources supply and demand relations if the investment in technical improvement is raised from the current 15% of total industrial investment to 30% . (Note: the numbers with negative sign mean that supply is greater than demand).

From the table, it's clear that increasing technology investment has positive effect, particularly on reducing consumption of electricity and steel.

		Coal (10000 ton /year)		Electricity (100000000 Kwt /year)		Steel (10000 ton /year)		Lumber (10000 m3 /year)	
	Time	Demand	Short-age	Demand	Short-age	Demand	Short-age	Demand	Short-age
30%	1985	1543.8	78.5	141.52	3.22	279.1	36.07	63.37	4.29
	2000	2983.2	968.8	313.4	33.52	623.5	123.0	107.4	27.4
	2020	5337.7	1577.3	584.15	-103.77	1189.6	-48.9	176.2	1.13
15%	1985	1615.8	150.8	152.13	13.82	301.6	55.6	64.9	5.9
	2000	3142.1	1127.2	323.06	55.76	678.5	105.1	110.2	30.2
	2020	5590.2	1829.7	575.2	-41.47	1277.8	51.3	181.1	6.0

4. Transportation and pollution.

The difficulties in transportation will be solved mainly by adding investment. Figure 6 shows that if the investment in transportation is doubled, the average ratio of backlog can be controlled in the coming years.

There are two policies to deal with pollution. One is to increase investment and adopt measures to speed up technical improvement; the other is to increase investment only. Through comparison with methods of technical economy, policy one appears having better effects and making more full use of investment. It is worth to be recommended.

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