THE APPLICATION OF S.D.- I/O/O MODEL TO THE IMPROVEMENT OF REGIONAL INDUSTRIAL STRUCTURE AND THE ECONOMIC DEVELOPMENT

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This paper introduces an effective Model, which is the combination of the methods of S.D.-I/O/O (input-occupancy-output) in studying the improvement of regional industrtial structure and the problems in economic development.

1. The Main Goal of Studying the Improvement of Regional Industrial Structure and the Problems in Economic Development and the Selection of Studying Methods:

The Main Goal of studying the improvement of regional industrial structure and the problems in economic development:(1) To study the evolution trend of the industrial structure; (2) To seek for the improvement projent for the rational readjustment of industrial structure by taking the realization of the aim of economic development to raise the people's living standard as the purpose due to the sustained, stable and coordinating development of economy and by taking the basic balance of total supply and total demand and the rational allocation of resources as the criteria; (3) to study the rational proportionate relationships among the indusrtial departments and to study their investment proportions and their corresponding speeds of development;

and (4) To study and to formulate the necessary industrial policies.

As the problems to be studied are a large complicated non-linear system of time lag, it is necessary not only to study the current trends and aims of the economic development but also to study those of future. The methods which are static and difficult to deal with the dynamic feedback problems of time lag and which cannot be used to make medium- and long-term forecasts are not to be chosen. The methods chosen must be able not only to reflect the interrelationship between the industries but to deal with the large and complicated non-linear system of dynamic feedback of time lag as well. Through demonstration of various aspects, we have studied and developed the S.D.-Input-occupance-output Model.

2. The Principle and the Structure of the Model:

2.1 The Principle of the Model:

The method of Input-Output is an effective method to study the relationship of quantitative inter-dependence between input and output in the economic activities. It can reflect clearly the economic activities and various quantitative relationships between the industrial constructures on the cross section. This is an important means to be used for synthetic balance. The method of input-occupancy-output is to add the occupancy to the traditional method of input-output so that the real situation of production can be reflected more objectively. This is because that Wassily Leontief, an American economist, has put forward that the actual meaning of input in the input-output analysis is the consumption of various factors in the course of economic activities. This

can be shown by the vertical direction of the input-output tables, which are compiled by various countries today. The contents in the input direction are shown as follows:

$$\Sigma Xij+Dj+Vj+Mj=Xj$$

In this formula, Xij denotes the intermediate input in the course of production, i.e, raw material,energy,etc.

Dj denotes the depreciation of fixed assets, i.e, the transfer value of the consumed fixed assets .

Vj denotes the payment for labor in the course of production.

Mj denotes the net income, i.e, the taxes and profit paid.

As the occupancy of labor and fixed assents is not shown in the present input-output table, a false impression will be formed that the total output vector,X,will be obtained if only the total ultimate demand vector, Y, is determinde;i.e. $X=(I-A)^{-1}Y$. In fact, even after the value of Y is determinde, the value of X will not be obtained if the quantity of present occupancies of fixed assets, natural resources and labor cannot be guaranteed, because, in the actual course of production, a lot of resources,such as:fixed assets, land,labor, etc., have to be consumed besides the consumption of the means of production. That is to say, in order to obtain the output, not only must the consumption be required, but original input-output table is expanded to input-occupancy-output table, the real situation of prodution will be reflected more precisely, and the quantitative relationship of inter-dependence of consumption and occupancy analyzed and studied by using the input-occupancy-output table is more comprehensive and more reliable. However, the quantitative relationship of interdependece reflected by the

The Input-Occupancy-Output Table (I)

			Intermediate Goods		Final Products						Total
			1 ,2,...n	Sub-total	Consumption	Increase of Fixed Assets	Increase of Current assets	Import (-)	Export	Sub-total	Output
Input	Intermediate Input	1 2 ⋮ n									
		Sub-total									
	Primary Input	Depreciation of Fixed Asset									
		Labor Reward									
		Net Income									
		Sub-total									
	Total Input										
Occupancy	Fixed Assets	1 2 ⋮ n									
		Sub-toal									
	Current Assets	1 2 ⋮ n									
		Sub-total									
	Natural Resources	Land									
		Mineral Deposits									
		⋮									
	Labor	Highly Skilled Worker									
		Medium									
		Non-skilled									

input-occupancy-output table is just a cross section of the economic course.

The input-output table is generally applied to setting up the input-output model by means of the linear algebra. In this model, the production function is considered to be linear; the pre-requisites are that the input is directly proportional to the output and both the consumption coefficient and the occupancy coefficient are constant. The problen of technical changes and a series of dynamic problems, such as: time lag, etc. in input-output have not been really soved.

The S.D. method is developed on the basis of the theories of system, control and information. Its foundation

is the theory of feedback control. Its means is the technique problems of high range,non-linearity, structural function in the complicated time lag system of the multipulated feedback, and the dynamic behavior. It will give play to its unique strong points, especially when it is applied to studying and planning the future behavior and the corresponding long-term strategic decision of the complicated social system. however, when it is applied to studying the problems of industrial structure and when the industrial departments are divided more elaborately, it is difficult to grasp accurately the interrelationship between the industrial departments, thus leading to the more serious error to the results of modelling; while it is the strong points of input-occupancy-output table that the interrelationship between the industries and their relationship of occupancy can be reflected accurately. Therefore,when the methods of S.D.and input-occupancy-output are organically combined,each of the two methods will play its own role and they will complement each other. It will not only reflect the interrelationship between the industries and their occupancy accurately, but will deal with the problems of high range, non-linearity, time lag of multipulated feedack reasonably as well. It will also make the experiment on the policy project and realize the dynamic modelling easily. This combined model has its unique strong points in studying the problem of rationalization of industrial structure and of economic development.

2.2. The Basic Structure of the Model:

The model is to divide the national economy in Xinjiang province, which accounts for one-sixth of the whole area of

china, into 59 departments; the secondary industry into 39 departments; the third industry into 15 departments. The balance formula of input-output objects in certain industrial departments can be shown as:

$$Xi=Wi+Di+Ei+Mi$$

In the formula, Xi denotes the total output of the industrial department 'i';

Wi denotes the intermediate demand of the output of the department 'i';

Di denotes the ultimate demand for the output of the department 'i';

Ei denotes the output for the export demand of the department 'i';

Mi denotes the inport demand of the same sort of output in the department 'i'.

In the model, each industrial department is divided into intermediate demand, accumulation, consumption, allotment of output outside the locality (including export), allotment of output inside the locality (including Import).all the departments are in the state of dynamic change.

(1) intermediate demand: it is decided by the output of various industrial departments through the index of direct consumption. When there are several industrial departments, the intermediate demand of a certain industrial department from other industrial departments may be shown as:

$$Wi=\sum_{j=1}^{n} aijXj \qquad j=1,2,\cdots,n.$$

aij is the direct consumption index of 'j' industrial departments in industry 'i'.

(2) Accumulation: It can be divided into fixed asset accumulation and circulating fund accumulation.

The fixed asset accumulation of a certain industrial department can be expressed as:

$$\Delta Xi(t+\Delta t)=Xi(t+\Delta t)-Xi(t)$$

In the formula, $\Delta Xi(t+\Delta t)$ is the net amount of production increased during the time t to Δt;

$Xi(t+\Delta t)$ is the amount of production during the time $(t+\Delta t)$;

$Xi(t)$ is the amount of production in time t;

i is the industry 'i'.

For the sake of realizing $Xi(t+\Delta t)$, the need of increasing the amount of fixed assets occupied is:

$$\Delta Ki(t+\Delta t) = \Delta Xi(t+\Delta t)/\lambda i$$

In the formula, λi is the index of the fixed assets occupied for the unit production in tiom $(t+\Delta t)$.

For the sake of realizing $Xi(t+\Delta t)$, the depreciation charge of the fixed assets in the 'i' industry will be expressed as:

$$\Delta Pi(t+\Delta t)=Xi(t)/\lambda i \times Si$$

IN the formula, Si is the depreciation charge of the fixed assets in the time $(t+\Delta t)$,

which can be expressed as:

$$\Delta Zi(t+\Delta t)=\Delta Ki(t+\Delta t)+\Delta Pi(t+\Delta t)$$

when the rate of utilizing the fixed assets is R, then the amount of investment on fixed assets performed will be expressed as:

$$Ti=\Delta Zi(t+\Delta t)/R$$

The accumulation of circulating fund: It mainly denotes the increase of inventory.

(3) Consumption: It includes the social as well as the residential consumptions.The residential consumption will also be classified as the farmer's consumption and the others cinsumption. The amount of consumption is worked out according to the present real level and the consumption level that needs to be reached in future.

(4) Allotment of outpnt outside the locality (Including export) and allotment of output inside the locality (Including import):

The amount of allotments of output both outside and inside the locality will greatly influence the development of the industry. The great production and the great allotment of output outside the locality will always embody the strategy of certain economic development. In the model, fully satisfying the demand of the local market is the basic point and then, the outward looking economy will gradually be developed, i.e., to increase the amount of allotment of some outputs outside the locality (including export). For the future development, the model must be designed in different programs.

The feedback relationship between various main elements in the model is showm in Fig.1,2. There are about 2,000 formulae in the model. Due to the limited space, no more examples will be stated.

3. Analysis on the result of the Model:

As the model is designed in the way of taking the model structure and total amount as a direction, the basic structure and total amount as a direction, the basic balance between the rational allocation of resources as a criterion and the interrelationship between industries as an overall

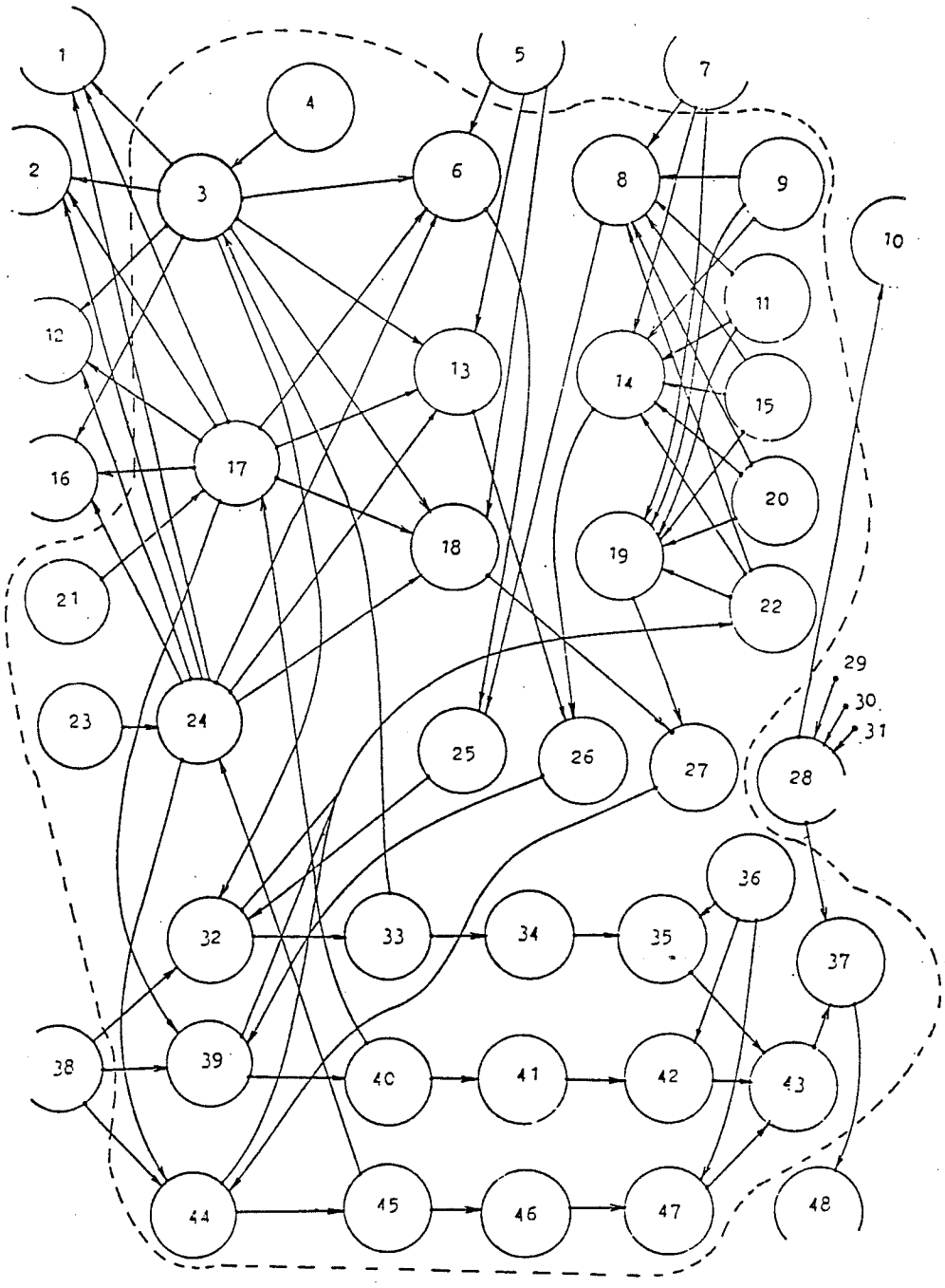
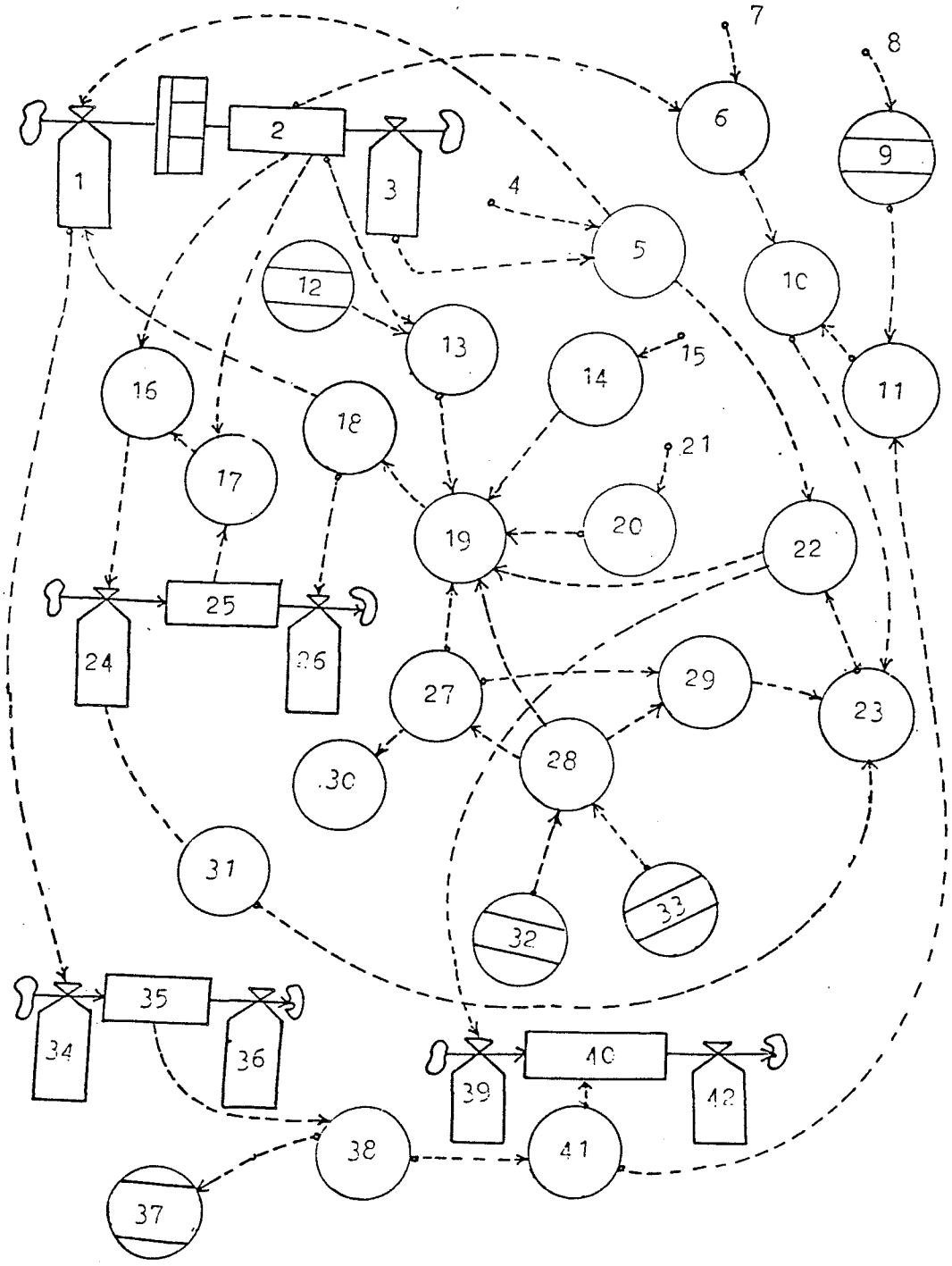


Fig. 1. The Sketch on the Feed-back Relationships Between Variouе Main Elements in the S.D. -- Input-Occupancy-Output Model

Note: As there are 59 industries in this model, the interrelationships between each industry and the other 58 industries as well as the readjusted input-occupancy-output coefficient of the industry itself cannot be fully shown in the normal S.D. cause-and effect chart or the S.D. flow-chart. The Sketch shown here is that of three industries only.

1. Intermediate Demand on Other Industries
2. National Income
3. Output of Industry No. 1
4. Minimum Rate of Increment
5. Other Industrial Departments
6. Intermediate Demand on Industry No. 1
7. Consumption
8. Ultimate Demand on Industry No. 1
9. Capital Construction
10. Fixed Assets Investment from the Whole Society
11. Renewal and Reconstruction
12. Gross Social Product
13. Intermediate Demand on Industry No. 2
14. Ultimate Demand on Industry No. 1
15. Expected Amount of Allotment from various Industries
16. Gross National Product
17. Output of Industry No. 2
18. Intermediate Demand on Industry No. 2
19. Ultimate Demand on Industry No. 3
20. Capital Repair
21. Minimum Rate of Industry No. 2
22. Inventory of Various Industries
23. Minimum Rate of Investment of Industry No. 3
24. Output of Industry No. 2
25. Total Demand on Industry No. 1
26. Total Demand on Industry No. 2
27. Total Demand on Industry No. 3
28. Investment Available from the Whole Society
29. Accumulation
30. Depreciation
31. Others
32. Difference Between Supply and Demand of Industry No. 1
33. Increment of Output of Industry No. 1
34. Occupancy of Fixed Assets Newly Increased of Industry No. 1
35. Demand on Investment of Industry No. 1
36. Rate of Fixed Assets Available
37. Difference Between Supply and Demand of Investment
38. Expected Allotment of Output Inside the Locality of Various Industries
39. Difference Between Supply and Demand of Industry No. 2
40. Increment of Output of Industry No. 2
41. Occupancy of Fixed assets Newly Increased of Industry No. 2
42. Demand on Investment of Industry No. 2
43. Total Demand on Investment
44. Difference Between Supply and Demand of Industry No. 3
45. Increment of output of Industry No. 3
46. Occupancy of Fixed Assets Newly Increased of Industry No. 3
47. Demand on Investment of Industry No. 3
48. Net In-flow of National Income



Fif. 2. The Sketch of the Flow-Chart of the Model

1. Amount of Increment
2. Output
3. Amount of Decrease
4. Cocersion Coefficients
5. Depreciation of Fixed Assets
6. Product of National Income
7. Rate of Net Output
8. Time
9. Prime Value of Net Input
10. Amount of National Income Employed
11. Net Inflow of National Income
12. Consumption Coefficient
13. Intermediate Consumption
14. Amount of Allotment of Output Outside the Locality and Export
15. Rate of Increment
16. Inventory Newly Increased
17. Reconciliation Multiplier of Inventory
18. Difference Between Production and Demand
19. Total Demand
20. Amount of Allotment of Output Inside the Locality and Import
21. Rate of Increment
22. Fixed Assets Investment
23. Fixed Assets Accumulation
24. Amount of Increment
25. Inventory
26. Amount of Decrease
27. Social Consumption
28. Residents' Consumption
29. Total Consumption
30. Function Table
31. Accumulation of Current Assets
32. Population
33. Per Capita Consumption Level
34. amount of Increment
35. Accumulation of Fixed Assets Newly Increased
36. Amount of Decrease
37. Rate of Fixed Assets Available
38. Accumulation of Fixed Assets Investment
39. Amount of Increment
40. Accumulation of Fixed Assets Investment
41. Difference
42. Amount of Decrease

restriction, the best industrial structure of coordinately developed economy with less input, large output is found from the modelled programs; the basic pattern for readjusting the industrial structure in the year of 2000 in Xinjiang is put forward; the basic track for the development if national economy in Xinjiang is moddelled. Through the test on the practicality and the effectiveness of the model, the error between the main values of parameter for the modelled results and the practical values are less than 3%. The results of the study is highly appraised and paid great attention by the related authorities of both the nation and Xinjiang Province. It is of great practical value, and it provides the basic for making out the log-term development project and the related policies.

4. Conclusion:

It is a rather successful try by using the method of S.D. integrating with the input-occupancy-output method to study the problems of improving the regional industrial structure and the problems of economic development, which raises the application of S.D. method to studying the social economic problems more scientifically and effectively, and puts forward an effective model in studying the problems of improving the industrial structure and the economic development by using the model of S.D. integrating with the input-occupancy-output method.

Reference Literature

(1) Chen Xi-Kang: The Contemporary Input-output Theory and Practice in China , The Chinese International Broadcasting Publishing House, 1988.