STUDY ON THE MODEL FOR REGIONAL PROGRAMMING

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I. Posing of the Problem:

Region is a regional scope with specially designated sensations of politics, nature and economy. It is a compound system formed by the systems of economy, society, science and technology, and ecological environment. The research on the regional programming concerns various activities. such as: human production, society, ecological environment and people's everyday life, and the aims and the systems of the regional programming are in multiple levels and ways. The main goal is, under the prerequisition of the harmonized developments of economy, society, science and technology, and ecological environment in the region, to find out the best utilization of the resources, the rationalization of the industrial structures, the way and scheme of promoting the benefit gained from the input and output in the regional system so as to satisfy the continuously raising of the living standard of the people of different nationalities. The study on the development of the region is an enormous systematical project. Therefore, the quantitative method must be used in integrating with the qualitative method to study it. As the conditions and the scopes adaptable to various quantitative methods of study are not the same, the level of solving problems is limited and it would be difficult to reach the goal of studying the regional programming if only one certain method is used. So, we have studied the model for the regional programming.

II. The Structural Theory of the Model System:

The model for the regional programming that we have studied and set up is the model system in which the S.D. method is the main body integrating with the other economical and mathematical methods. The model is able to get advantages from various methods and to complement each other. The function of such model for regional programming is the best one, with which the function of any model fromed by any single method cannot be contrasted. The structural theory is formulated as follows:

1.Integrating the S . D. Model with the method of input-occupancy-output:

As the key problem of studying the regional programming is the rationalization of the industrial structure, the degree of connection between the different industrial departments has to be studied so as to determine the industrial department , which has the priority of development and which brings along the other industrial departments to a certain level, and to determine the relationship of the rationally developing speeds and proportions between the different industrial departments. When the industrial departments are classified more clearly, it will be difficult to grasp accurately the connection and the relationship between the different industrial departments by using the S . D. method. The method of input-occupancy-output (Li, 1990) will be able to reflect accurately the degree of connection between the different industrial departments, to reflect not only the consumption between industries but also the occupancy of natural resources, fixed assets, current capital and labor of the industry. However, it is static and reflects only a section of the course of the development of economy. When it is integrated with the S . D. model, the two methods will complement each other through taking respectively their advantages. The ways of integration are:

The identical equation for each production department:

$$X_i = D_i + (E_i - M_i) + W_i$$

When, X_i denotes the total output of Dept. i

D_i denotes the final domestic demand on Dept. i

$(E_i - M_i)$ denotes the net amount of trade made by Dept. i (Amount of export - Amount of import)

W_i denotes the intermediate use of commodity i.

$$W_i = \sum_{j-1}^{n} a_{ij} X_{ij}$$

When, X_{ij} denotes the intermediate use of commodity i in Department j

a_{ij} denotes the appropriate coefficient of the direct consumption.

In the model, according to the structure of input-occupancy-output, each industry will be classified into five parts, i.e. the intermediate use, accumulation, consumption, allocation from the department (including export), and allocation to the department (including import). The dynamic simulation will be proceeded by using the S. D. method to forecast the developing tendency of the prior developed industry and the tendencies of changes in the coefficient of the direct consumption, various kinds of occupancy and the amounts of future allocation to or from the department.

2. Integrating the S. D. with the method of econometrics:

The econometrics takes the inherent law of economics as the basis and the statistical mathematics as the foundation, to set up the regressive equations of chronogical order, causation, etc. so as to construct the system of regressive equation which can be used in the analysis of the economical structure and economical forecast.

In studying the regional programming, it is necessary to make an accurate appraisal on the related important economical variables. As some of the required variables are not listed in the table of input-occupancy-output, it is necessary to mix the equation of econometrics into the S. D. model.

For example, the output values of both the light and

heavy industries are not reflected in the input-occupancy-output table, we may adopt the method of econometrics to set up the equation of econometrics which can be changed to form an equation of systematical dynamics.

For example, the equation $Y_1 = A + BX_1 + CX_2$ can be written into a DYNAMO equation: A Y_1.K = BX_1.K + CX_2.K.

3. Integrating S. D. model with the linear programming:

In studying the regional programming, for the sake of finding out the way and scheme for promoting the benefit gained from the input and output, it is relatively better to use the multiple schemes of S. D. model, but it needs to spend more time and the result achieved is frequently not ideal, while the linear programming is good at finding out the best solution to the future state. So, the integration of the S. D. model with the linear programming may effectively promote the excellent function of the regional developing model.

The general form of the linear programming is, under the condition of fulfilling the requirement of a group of linear restriction,

$$\begin{cases} \Sigma a_{ij} X_j \geqslant (\text{or} \leq, \text{or} =) D_i \\ X_j \geqslant 0 \end{cases}$$

For the objective function $Z = \Sigma C_j X_j$, find the maximum or the minimum value. Among these, X_j is the jth economic variable, that needs to be found, a_{ij} is the consumption coefficient (or the output coefficient), D_j is the amount of the jth kind of resources (or the requirement of conditions) and C_j is the income coefficient (or expense coefficient) of the jth economic variable that needs to be found. The integrating method is:

(1) Study and work out the feasible solution to the scope by applying the method of S. D. In the actual social life, there is a certain changing scope for each of the economic variables. The best mathematical solution may not be the best solution to the actual life, and it may not be even feasible at all. Therefore, it is necessary to work out a feasible solution to the scope by applying the S. D. method

on the basis of the qualitative analysis of high quality and to forecast the values of a_{ij} , C_j, D_j and other related variables on the point of the given critical moment in a certain developing period in the future.

(2) Substitute the value of a_{ij} , C_j , and D_j in the linear programming model, the solution denotes the best disposition of resources under a certain target or that the target at which the reasonable industrial structure may reach under the best disposition of resources. At the same time, the best solution at the given critical moment may be led into the dynamic process of the S. D. model and then, some other variables, that need to be calculated according to these best solutions.

4. Integrating the model of S . D.- I/O/O with the Turnpike Theorem:

As early as the end of the 1950's, the American economists, P. A. Semullson and R. Solow, applied the method of linear programming to the study on the problem of economic growth by considering the maximum amount of assets at the end of the programming period as the goal. They found out, when the period of programming is rather long, the locus of the best solution to this problem converged to the Neumann's locus of the balanced growth. The properties of the turnpike theorem may be stated briefly as: when the way of balanced growth of the output (this way is named as the turnpike or the Neumann's radiation) is described as the only determination of the input-output relation of the reproduction system in the confined society, besides the primitive stage of the programming period and the limited stage of the terminal stage, the best way of growth is continuously within the given territory of the turnpike.

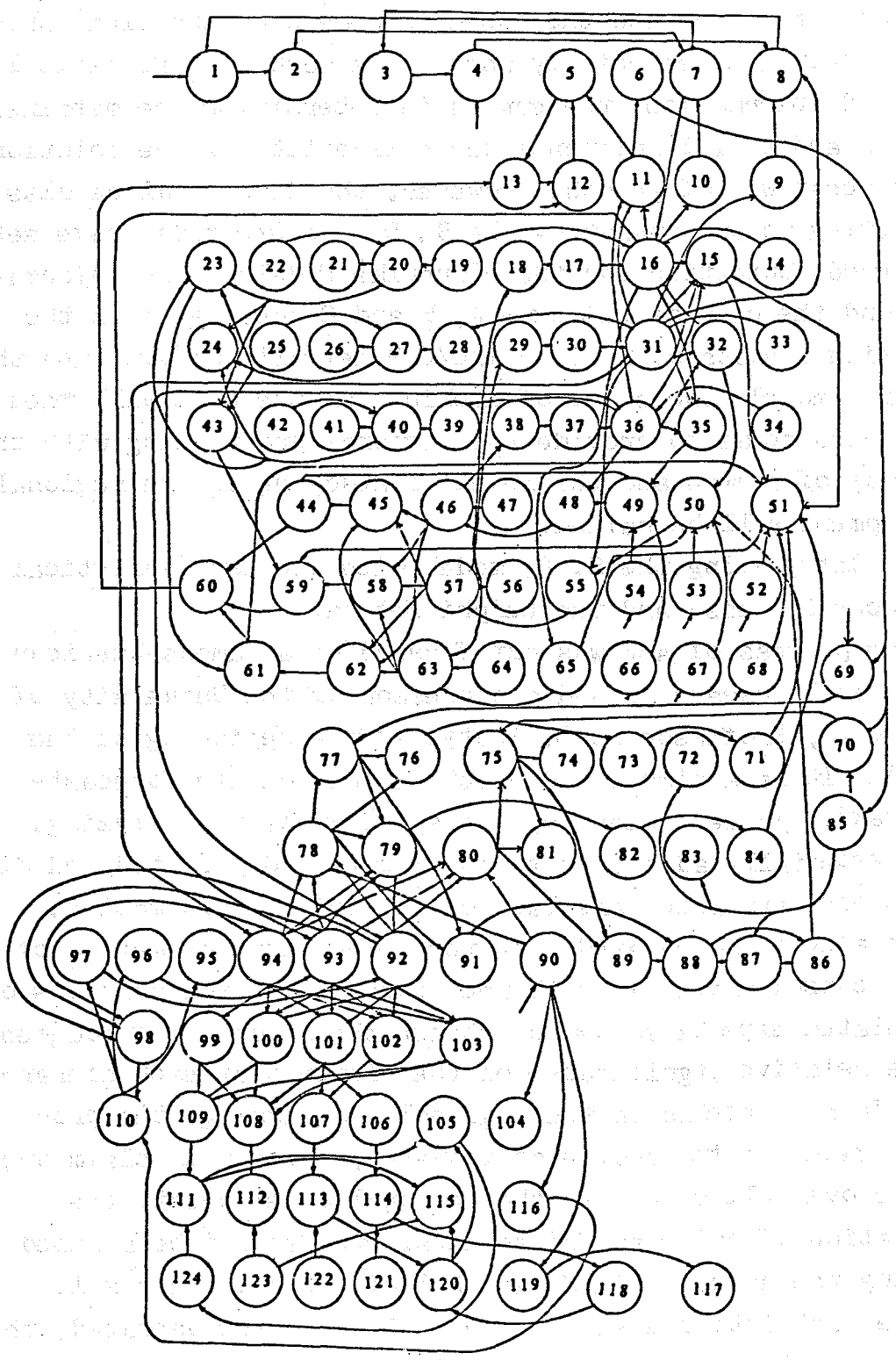
The application of the turnpike theorem to the building of turnpike model is an effective measure in studying the regional programming. At present, the most successful method of economic model is the integration of the turnpike theorem with the method of input-output. The difficulty in the practical

application is to pre-determinate the matrix of direct consumption coefficient, matrix A, the matrix of the investment coefficient, matrix B, and the consumer demand on the final products, matrix C, especially when it is lack of systematical data and information, the errors in determining the matrixes of A, B and C will influence the reliability of the solution to the best way of growth. However, the successful results of setting up and operating the S. D. - I/O/O model have set up a good foundation for the "Turnpike Model". The information and the data of matrixes A, B and C obtained from the operating results of S. D. - I/O/O Model will be put into the turnpike model, the scope of seeking for the best will then be reduced so as to provide the regional programming with the best way of growth and the level of studying on the regional development will be raised.

5. Integrating the S. D. model with the AHP (Analytical Hierarchy Process) and the Delphi Method:

The process of AHP was put forward by a famous American operational researcher and a professor of the University of Pittsburgh, Professor A. L. Soaty, at the beginning of the 1970's. It is a simple and practical method for forecasting, making polies, planning and systematically analyzing. It is especially adaptable to solving the complicated and difficult problems which are lack of sufficient information. It can also be integrated with the Delphi method (method of expert consultant). It will then concentrate the opinions of the related experts so as to enhance the accuracy of judgment on the relative significance of the elements at each hierarchy. In researching on the regional programming, the problems, such as: the choice of industry, which will claim precedence over all others in the regional development, the formulation of policies and schemes, etc. should be studied by using the methods of AHP and Delphi. Then, the result will be sent into the S. D. Model. After being operated, the schemes obtained can be arranged in order and chosen by the method of AHP. The causality of the models is shown in the

diagram attached.



The Causality Diagram

1. Proved deposits of resource A
2. Annually maximum consumable amount of resource A
3. Proved deposits of resource B
4 Annually maximum consumable amount of resource B
5. Total investment (supply)
6. Total consumption
7. Bearing capacity of resource A
8. Bearing capacity of resource B
9. Annual consumption of resource B
10. Annual consumption of resource A
11. Total national production
12. External net in-flow
13. Difference between demand & supply on investment
14. Progress on science and technology No. 1
15. Intermediate demand
16. Output No, 1
17. Fixed asset No. 1
18. Newly increased fixed asset No. 1
19. Newly increased output No. 1
20. Newly increased current asset No. 1
21. Occupancy of current asset No. 1
22. Output-current asset ratio
23. Product No. 1 in the newly increased inventory
24. Product No.2 in the newly increased inventory
25. Output-aurrent asset ratio No. 2
26. Occupancy of current No. 2
27. Newly increased current asset No. 2
28. Newly increased output No. 2
29. Newly increased fixed asset No. 2
30. Fixed asset No.2
31. Output No. 2
32. Intermediate demand No. 2
33. Progress on Science and technology No. 2
34. Progress on science and technology No. 3
35. Intermediate demand No. 3
36. Output No. 3
37. Fixed asset No. 3
38. Newly increased fixed
39. Newly increased output No. 3
40. Newly increased current asset No. 3
41. Occupancy of current asset No. 3
42. Output-current asset ratio No. 3
43. Product No. 3 in the Newly increased inventory
44. Investment goods No. 3
45. Investments classifiable as fixed assets No. 3
46. Fixed asset investment No. 3
47. Output coefficient of fixed assets No. 3
48. Difference between demand & supply of product No. 3
49. Total demand No. 3
50. Total demand No. 2
51. Total demand No. 1
52. Amount alloted to No. 1
53. Amount alloted to No. 2
54. Amount alloted to No. 3
55. Difference between demand & supply of product No. 2
56. Output coefficient of fixed assets No. 2
57. Fixed asset investment No. 2
58. Investment classifiable as fixed assets No. 2
59. Investment goods No. 2
60. Total investment (demand)
61. Investment goods No. 1
62. Investments classiable as fixed assets No. 1
63. Fixed asset investment No. 1
64. Output coefficient of fixed asset No. 1
65. Difference between demand & supply of product No. 1
66. Amount alloted from No. 3
67. Amount alloted from No. 2
68. Amount alloted from No. 1
69. Total consumption of rural inhabitants

70. Total consumption of inhabitants in cities & towns
71. Total consumption No. 3
72. Social consumption No. 3
73. Inhabitant's consumption No. 3
74. Consumption of cities & towns
75. Consumption level of inhabitant in cities & towns
76. Rural consumption
77. Consumption level of rural inhabitants
78. Total rural population
79. Rural consumption No.2
80. Population in cities & towns
81. Consumption in cities & towns
82. Consumption of inhabitant No. 2
83. Social consumption No. 2
84. Total consumption No. 2
85. Social consumption
86. Total consumption No. 1
87. Social consumption No. 1
88. Inhabitant's consumption No. 1
89. Consumption of cities & towns No. 1
90. Total population
91. Rural consumption No, 1
92. Labor No. 3
93. Labor No. 2
94. Labor No. 1
95. Productivity of labor No.1
96. Productivity of labor No.2
97. Productivity of labor No.3
98. Demand for labor
99. Senior technical personnel
100. General technical personnel
101. Technical workers (farmers)
102. General workers (farmers)
103. Administrative personnel
104. Population of retirement age
105. Undergraduates studying at the university
106. Demand for other students
107. Demand for graduates from general high-school
108. Demand for graduates from polytechnic (or vocational) school
109. Demand for graduates from universities
110. Pressure of employment
111. Difference between demand and supply of graduates from universities
112. Difference between demand and supply of graduates from polytechnic (or vocational) school
113. Difference between demand and supply of graduates from general high-school
114. Difference between demand and supply of other students
115. Total students studying at the polytechnic (or vocational) school
116. Population at age of labor
117. Pupils studying at the primary school
118. Students studying at other schools
119. Total school-age children
120. Students studying at general high school
121. Other students who need to be employed
122. Graduates from general high-school who need to be employed
123. Graduates from polytechnic (or vocational) school who need to be employed
124 University graduates who need to be employed

III. Conclusion:

By integrating the S. D. and I/O/O model with the econometrics, linear programming, turnpike model, AHP method, etc. the model system for the regional programming is built up, the functions of models have been strengthened and the reliability and scientific level of the research on the regional programming have been enhanced, thus providing the study on the regional programming with a new model. This widens the way for studying the problems by integrating the S. D. model with other economical and mathematical methods, and at the same time, enhances the reliability of studying and solving the complicated problems by using the S. D. model.

References

Li, Zhou Wei: "The Application of S. D.-I/O/O Model to the Improvement of Regional Industrial Structure and the Economic Development". 1990
≪ System Dynamic '90 ≫ Volume 2, pp.674-676.