

STUDY ON S . D . MODEL ON THE CAPACITY OF CITY POPULATION

Xie Hong Bin

Postgraduate, the Geography Dept. of Xinjiang University

Li Zhou Wei

Associate professor, The Research Center of Economics, the
Xinjiang People's Government

Abstract

The rising population and the expanding pace of the cities lead to the environmental deterioration. The serious environmental problem has increasingly brought attention to people. This paper provides an effective model for studying and solving this problem.

I. Posing of the Problem:

The environmental problem is one of the serious crises that the world is being faced with today. The protection and improvement of the environment have been an urgent objective pursued by human being. The city is the place where the population and the economics are most concentrated, and the environmental problem is most protruding. The "Urbanization" leads to "Urban Disease", such as: the difficulty of employment, housing, water and land resources, heavy traffic, environmental pollution, etc. and this will inevitably bring about the decline in the quality of living. It is, therefore, of significance to study the capacity of city population.

With the development of society and the deepening of cognition on the environmental problem, the conception of the population capacity is being widely developed. Here, we set the limit of the population capacity as the amount of population that the city can support all the time at the premise of keeping the environment from being damaged and the non-renewable resources from exhausting and at the increasingly rising of the standard of living quality.

II. Purpose of Study and the Choice of Method in Constructing the Model:

1. Purpose of study:

The capacity of the urban population of Urumqi is simulated in dynamic and quantity and the appropriate proposals of policy are put forward on the bases of studying thoroughly the history and the present conditions of resources, environment, economics, society and the development of science and technology, analyzing the restrictive factors of the urban development, studying the evolutionary trend of the industrial structure and the scale of the economic development as well as the standard of food production and guarantee, forecasting the developing trends of population, the consuming structure and standard, and the ecological environment, studying the multi-feedback relations between the science and technology, economics, society and ecological environment, which promote and restrict each other.

2. Method of selecting the construction of model:

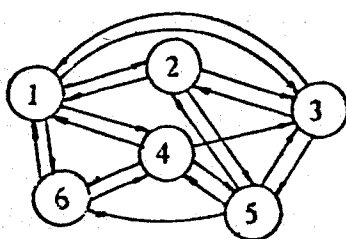
Considering that the developments of economics and society are a non-linear and dynamic process, any method that considers the complicated process as black box to be dealt with or any linear algebraical method is not adaptable. After being studied and proved, the method of S. D. (System Dynamic), the "Society Laboratory", which is good at dealing with high-order, non-linear and multi-feedback system, is chosen.

3. Structure of Model:

The model is composed of the sub-systems of population, economics, yield of food production, exploration and utilization of water resource, environmental protection and the progress of science and technology. The relationship between these sub-systems is that the progress of science and technology accelerates the improvements of the production technique, the management and the level of service as well as the exploration and utilization of water resource. It also accelerates the developments of non-staple food production and the economy

in the suburb, and the increasingly rising of the consuming standard. The development of society and economy will improve the developments of culture, education and health, and the people's living standard will then be raised. However, the growth of population and the development of economy will lead to serious pollution and the increase on the environmental load. Meanwhile, the growth of population will not only raise the demands on food and water resource, but will also increase the pressure on housing, employment and education as well as the difficulties of heavy traffic and communications, so the space for human activities reduces relatively and the quality of living declines. On the basis of simulating the dynamic process of population capacity in many schemes, seeking for the way of rationally exploring and utilizing the natural resources, adjusting the industrial and economic structures, increasing the benefits, improving the ecological environment, effectively controlling the quantity of population, enhancing the people's quality, integrating the benefits of economy and society with that of ecology in a high degree, making the population, economy, society and ecological environment develop harmoniously and stably, the dynamic and developing process of population at the predetermined standard of living quality can be achieved, thus providing the reliable basis for the departments concerned to formulate the policies on economy, society, science and technology, protection of ecological environment and the development of population.

The relationship between the various main factors is shown in Diagram 1.



1. Population
2. Exploration of resources
3. Environmental pollution
4. Economic system
5. Progress of science & technology
6. Production and guarantee of food

Diagram 1

III. Analysis on Sub-systems:

1. Sub-system of population:

The contents of population structure, the urban and suburban population, nationality, sex and age, are studied and the stress is put on the developing trend of population and the counter-measure for controlling the population.

The main feed-back relation is shown in Diagram 2.

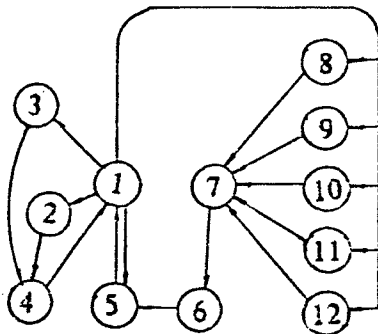


Diagram 2

- 1. Total population
- 2. No. of women at birth age
- 3. Policy of birth control
- 4. Birth rate
- 5. Death rate
- 6. Average life expectancy
- 7. Quality of living
- 8. Degree of pollution
- 9. Food per capita
- 10. Health service allocated per capita
- 11. Cultural & entertainment investment per capita
- 12. Housing area per capita

2. Sub-system of Economy:

This is composed of the material production from the departments, including the agriculture, industry, architecture, communication and transportation, commerce, etc. and the non-material production departments, including the science, education, culture and health. The stress is put on studying not only the reasonable industrial and economical structures, but also the output and construction, as well as the proportion between accumulation and consumption.

The main feedback relation is shown in Diagram 3.

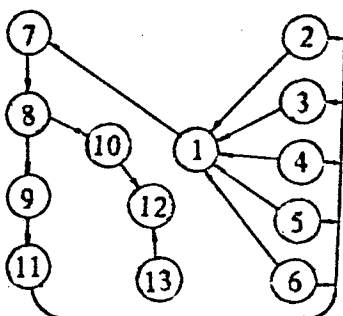


Diagram 3

- 1. Total social output
- 2. Total industrial output
- 3. Total agricultural output
- 4. Total architectural output
- 5. Total postage & communication output
- 6. Total commercial output
- 7. National income
- 8. Amount of national income used
- 9. Amount of accumulation
- 10. Amount of consumption
- 11. Amount of investment
- 12. Amount of consumption per capita
- 13. Population

3. Sub-system of food production and guarantee:

The stress is put on studying the potentialities in exploring and utilizing the water and land resources and the dynamic process of food production and guarantee.

The main feedback relation is shown in Diagram 4.

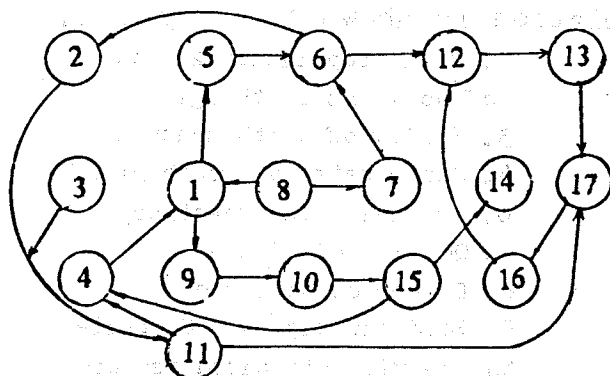


Diagram 4

- 1. Total amount of usable water resource
- 2. Output of agriculture 3. Output of animal husbandry
- 4. Investment on construction 5. Farm land 6. Total food output
- 7. Output per area 8. Science and technology 9. Pasture
- 10. Fodder 11, National income 12. Food per capita
- 13. Quantity of heat and protein per capita
- 14. Meat, milk and protein per capita 15. Total animals and poultry
- 16. Total population 17. Living quality

4. Sub-system of ecological environment:

The dynamic process of producing and treating the pollution produced by the industry, agriculture and everyday living is mainly studied.

The main feedback relation is shown in Diagram 5.

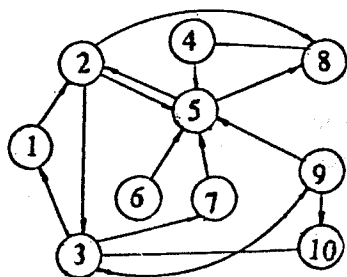


Diagram 5

- 1. Production Investment
- 2. Economy 3. National income
- 4. population
- 5. Degree of pollution
- 6. Policy and measures taken
- 7. Levels of science & technology 8. Living quality 9. Investment on environmental protection
- 10. Economical benefit from environment

5. Sub-system of progress on science and technology:

The progress on science and technology is the fundamental factor for the development of modern society. The factors influencing the speed of progress on science and technology include the level of national education, fund, equipment, quantity of laborers, ability of scientific research and the degree of technological improvement.

The main feedback relation is shown in Diagram 6.

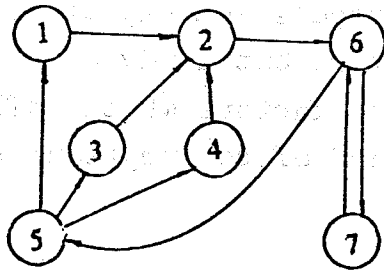


Diagram 6

1. Level of national education
2. Progressing speed of technology
3. Improvement of technology
4. Scientific research
5. Accumulation
6. Development of economy
7. Level of consumption

IV. The Analysis on the Simulating Result and the Main Conclusion:

1. Analysis on the simulating result:

By means of simulating in many schemes and seeking for the best, we can see that the increasing investment, improving technology, adjusting industrial structure and exploring the water resource reasonably can greatly increase not only the production of GNP, the yield of food, meat, fish and dairy products, but also the effect supply. The limited amount of water resource restrains the further expansion of the city scale. Therefore, if the population can be controlled effectively, the standard of people's consumption and the quality of living will be raised greatly. If the growth of population cannot be controlled effectively, the quality of living will be difficult to be improved and the gap of living standard between the other cities and ours will be further expanded. It is the basic policy for Urumqi to formulate the policies of controlling the population as soon as possible, to limit the development of the industry of high-consumption of water and to build a

water-saving city.

2. The Main Conclusion:

Applying the S. D. model to the study of the city population capacity, we can easily put many factors influencing the city population capacity into the model and deeply studying the multi-feedback relations between these factors, especially, the S. D. model can play the special role in the studying on the non-linear and time-lag factors.

Especially, while studying the population capacity, we should not judge it by a single factor, but study comprehensively by means of considering many other factors which influence the quality of living and the standard of consumption; thus, we can draw a reliable conclusion.