PROBLEMS OF POPULATION CONTROL IN CHINA

Jia-di Yu
Xiu-jin Feng

Institute of Systems Engineering
Hefie University of Technology
Hefei,Anhui,PRC

ABSTRACT

Population is an element in the social system. There are a number of elements in the social system which will influence the population growth rate. On the other hand,population growth will,in turn,exert influence on other social elements. We can,therefore,apply the system dynamics(SD) model to dealing with the problems of population control. This paper,based on the investigations carried out in Anhui Province of China,conducts a study of the policies concerning population control in China by use of the system dynamics model.

INTRODUCTION

A rapid population growth will entail a heavy burden on society. In a country,overpopulation and poverty often go together,since they are twin brothers. Viewed worldwide,the rapid growth of population will inevitably result in over-quick consumption of world resources,and human existence will be threatened. Therefore, population control has already received widespread concern.

Population is an element in the social system. Its growth is influenced by some other elements in the system,such as socio-economic level,educational level,scientific and technological level,and ideological state. A vast population will bring a heavy burden on society and leave a country poor,that is,it will limit the development rate of these elements in the social system, such as socio-economic development,universal cultural education,improvement in science and technology,and change in ideology. These elements and population are in mutal causality;in other words,there exists a feedback relationship between them(Fig. 1). In the figure,the element "policy" itself falls into the ideological sphere,but it has a great influence on population growth. Hence,it is shown separately in the figure.
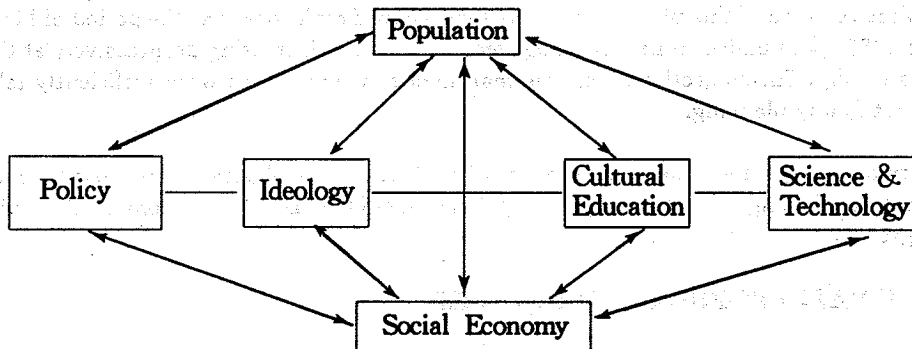

Fig. 1

To bring population growth under control, we must take the whole society as a system to be studied . We should find out the social elements in the system which have a close bearing on population growth and which are the causes that stimulate rapid population growth . We should analyze the relationship between these elements and population growth. Then we can make use of the system dynamics model and other models to seek an optimum policy for the control of population growth. Since society is a complicated system, the policy for population control should be a set of concrete measures. These measures have a different validity in population control, i. e. , their weights are different. It is necessary that the measures with a bigger weight be strengthened. The weights of these measures also vary with space and time. First, since the state of the system (the social conditions)is different in a certain region, and the weight of a particular measure may be different, the policy to be adopted may be different. Second, with the passage of time, the state of the system will change, and the weight of the measure also will vary. As a result, the policy for population control must be continually adjusted.

GROWTH OF CHINA'S POPULATION

China is the most populous country in the world. The result of the nationalwide census in June 1990 indicated that China's total population had reached 1. 13 billion, with an increase by an average of 1. 48‰ from 1982 to 1990. China is a developing country. The rapid growth and the vast sum total of its population have already cast a very heavy burden on the state, thus influencing the development of its national economy. Therefore, the Chinese Government has taken birth control as one of the basic policies of the state and formulated relevant regulations for family planning.

While the Chinese Government advocates a couple bearing only one child, the policy for family planning is not very well implemented in practice, especially in rural areas. This phenomenon is comparatively serious in some provinces, such as in Anhui Province. As a result, the rapid growth of population is still causing much concern.

The birthrate in Anhui Province kept declining from 1979 to 1985, but it went up year by year from 1985 to 1990. In the year from the second half of 1989 to the first half of 1990, the birthrate in Anhui was 25. 04‰, the natural population growth rate being 19. 25‰. the Anhui Government took some measures in 1991, the birthrate began to go down again. The 1990 birthrate in Anhui was found rarely even in China.

The objective cause of this phenomenon was that Anhui Province was at the period of birth boom. Since 1986, the number of first-marriage women has been increasing progressively at the rate of 5‰ annually. The subjective cause was that no effective measures were sufficiently taken to carry out family planning.

It is very obvious that adequate measures can be taken to control population growth. People are, therefore, finding out what steps and policies should be adopted to control the swift population growth.

CAUSES OF RAPID POPULATION GROWTH

1. Macro-causes

In the social system, some elements have a direct bearing upon the population (as in Fig.

---

1). They form a subsystem of population, or called a population system. Now let us analyze the relationship between the three main macro-elements in the figure and the birth rate.

Suppose the birth rate is y, and the macro contributing element is x, then relationship between the two is

$$y = Ae^{Bx}$$

Where A and B are regression coefficients.

Anhui is one of the big provinces in China. It covers an area of 139,000 square kilometers. It has 9 municipalities and 72 counties. Its population in 1990 was 56 million. Anhui Province can be taken as a sample in our study of the problems of China's population. We make use of the statistical data of Anhui to study the three macro-causes of the rapid increase in population.

(1) Economic Level

We take x_1 —the average per capita national income in 1991 of each municipality and county—as an index by which to measure its economic level. By using the exponential regression computation, we can derive

$$y = 27.88e^{-0.00015x_1}$$

Under the conditions in which the confidence limit $x = 5\%$, the result of the test indicates that the correlationship is explicit.

(2) Level of Education

We adopt x_2 —the ratio of the population with junior middle school education or higher in 1991 to the total local population of each municipality and county—as an index to measure the level of education. Also by use of the exponential regression computation, we can derive

$$y = 36.32e^{-0.0198x_2}$$

The test indicates an explicit correlationship.

(3) Factors of Policy

Since the government encourages a couple to bear only one child , x_3 —the one-child rate of each municipality and county in 1991—is used as an index to measure the factors of policy. The one-child rate refers to the percentage of the first babies in the total population born in a year. By use of exponential regression computation, we can obtain

$$y = 45.24e^{-0.0127x_3}$$

The result of the test also indicates an explicit correlationship.

A regression analysis will demonstrate that there exists a negative correlationship between these three elements and population growth which exerts a relatively big effect. In fact, the other elements in the figure also bear some relation to birth rate and are all the macro-causes of

population growth.

2. Micro-causes

In order to explore measures by which to control population growth, we should study the more concrete contributing elements in the population system. Through investigations, we can take the concrete causes and universal phenomena in the population system as elements. There are altogether 31 factors which have been picked out. Then we can give the adjacency matrix in accordance with the relation of causality so as to infer the reachability matrix and identify the levels. Finally, we can make up the system structure model (Fig. 2). In this system structure model, the element at the lower level is the cause of the related element at the higher level. Not only can we find out from this model the concrete micro-causes, but we can also get to know the root macro-causes. These are the economic and cultural elements.

The 31 elements in the system structure model are as follows:

(1)Population

(2)Birth boom

(3)Abandoned girl babies

(4)Multi-birth child-bearing

(5)Early marriage child-bearing

(6)Illegitimacy

(7)Desire to have boy bibies

(8)Many children and grandchildren

(9)Effects of family planning

(10)Sense of the legal system

(11)Moral concepts of the masses

(12)Conditions of the last birth boom

(13)Supporting old people

(14)Income of women

(15)Having a son to carry on his family name

(16)Ancestral influence

(17)Amounts of funds for family planning

(18)Publicity effect of family planning

(19)Number of persons engaged in family planning

(20)Conditions of medical apparatus and instruments

(21)Quality of medical personnel

(22)Political level of cadres

(23)Age structure of population

(24)Family income

(25)Feudal ideas

(26)Government expenditure

(27)Scientific and technological level

(28)Universal cultural education

(29)Wealth of the society

(30)Education of cadres

(31)Socio-economic level

Ultimate
Result

Social
Phenomena

Overall
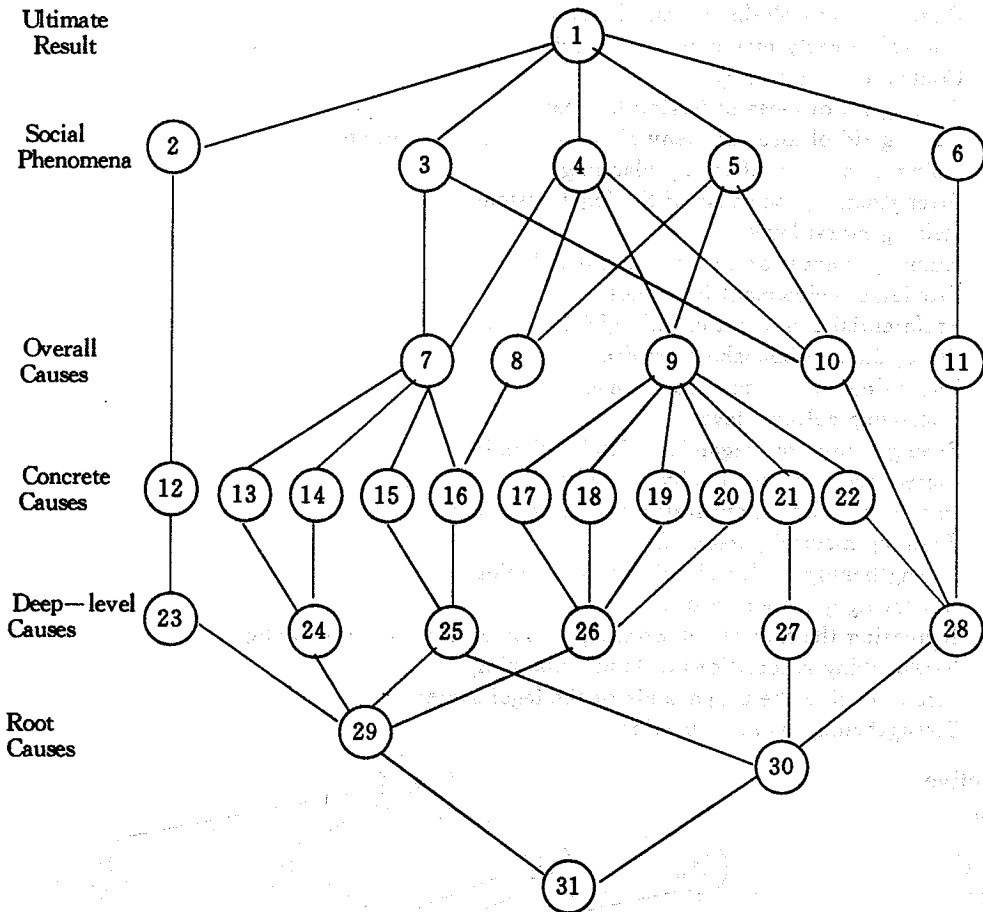Causes

Concrete
Causes

Deep—level
Causes

Root
Causes

Fig. 2

MEASURE TO CONTROL POPULATION GROWTH

In order to study how to control population growth, in addition to using the system structure model to analyze the cause of rapid population growth, we must carry out research on the measures to reduce population growth and make a further analysis of the effect of these measures from which we will find some more effective measures.

For this purpose, we have conducted investigations, collected the measures which have been taken to cut down birth rate, and put forward a number of constructive measures in accor-

dance with the concrete causes in the structrual analysis mentioned above. We have employed the analytic hierarchy process(AHP)to make the target of family planning and concrete measures into a hierarchy model(AHP model),as shown in Fig. 3. The meanings of the various elements in the figure are as follows:

A   Reducing birth rate
B1   Prohibition of abandoned girl babies
B2   Reducing multiple-birth child-bearing
B3   Control of early-marriage child-bearing
B4   Control of illegitimacy
C1   Getting rid of ideas of having boy babies
C2   Getting rid of ideas of many children and grandchildren
C3   Doing a good job of family planning
C4   Strengthening the sense of the legal system
C5   Raising moral level
D1   Running homes for destitute old people
D2   Providing endowment insurance
D3   Preferential treatment of only-girl families
D4   Strengthening household service
D5   Increasing employment for women
D6   Improving cultural level
D7   Strengthening propaganda of family planning
D8   Increasing funds for family planning
D9   Improving medical apparatus and instruments
D10 Training medical personnel
D11 Strengthening leadership of family planning
D12 Improving quality of cadres
D13 Increasing the number of working personnel for family planning
D14 Establishing associations of family planning
D15 Strengthening the propaganda of the legal system
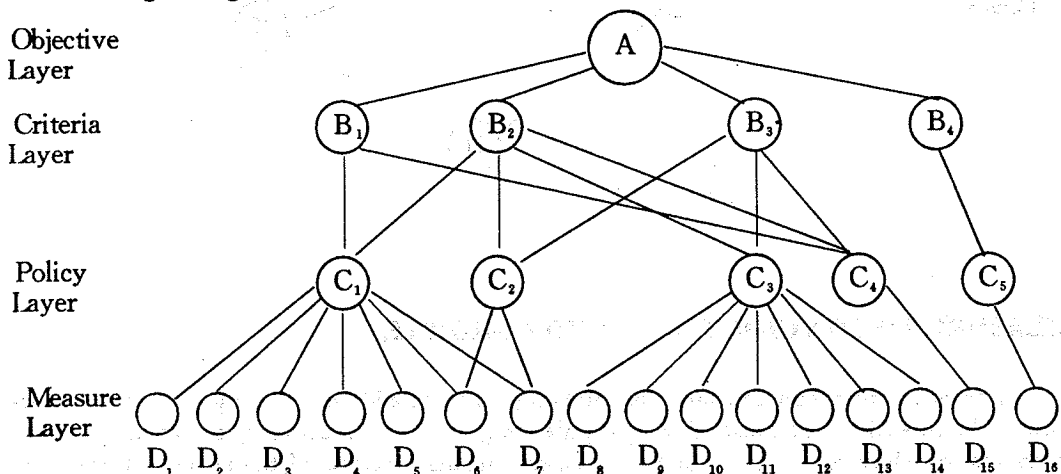D16 Strengthening moral education

Fig. 3

The AHP model falls into four layers. The first layer A is the target of the system. The second B is the criteria which embody the target. If the criteria can be achieved, the target can be attained. The third C is the policies which are adopted to fulfil the different criteria. The fourth D is the concrete measures to implement various policies.

We use AHP to study the validity of different measuures, that is ,their weights. Since we cannot test the validity of each measure separately,we make use of the Delphi method when determining the weights of various measures,that is ,experts fill in the judgement matrices which involve the importance of the various elements within the individual layers in the model. Then, through computations, the weights of the various measures in the layer D can be obtained.

Judging from the analytical computations ,the most effective measures are in order of:D8 increasing funds for family planning;D6 raising cultural level;D11 strengthening leadership of family planning; D13 increasing the number of working personnel for family planning; D10 training medical personnel. The importance of other different measures varies in various places. For example,economic measures have proved to be more effective in poor areas while propaganda and education are comparatively effective in prosperous areas.

THE SYSTEM DYNAMICS MODEL

On the basis of the preceding analytical result,we use the system dynamics method to further study the behavior of the population system and the policies regarding population control. On the lines of the preceding analysis, the main relations of causality in the population system can be summarised in five aspects. The five main relations of causality are described separately in the following causal loops:
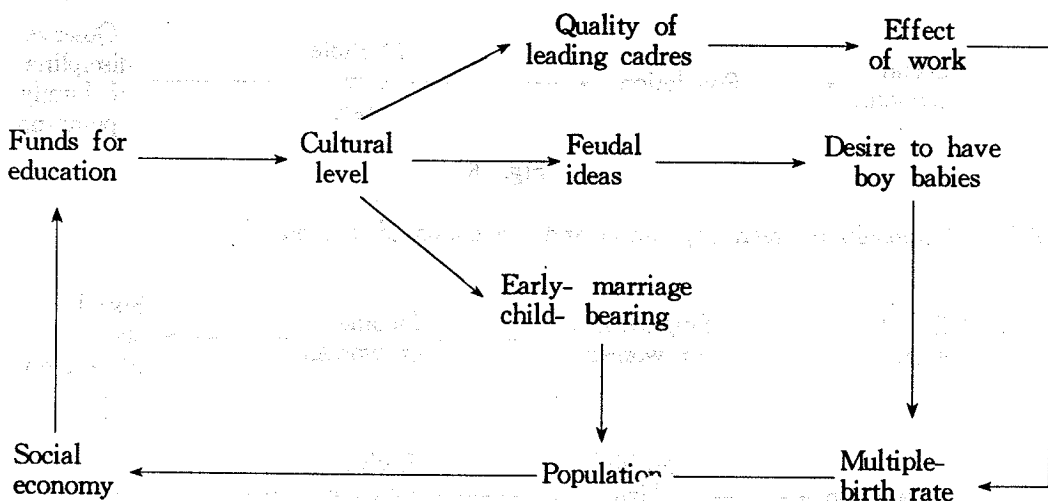
(1)The relationship between population and education

Fig. 4

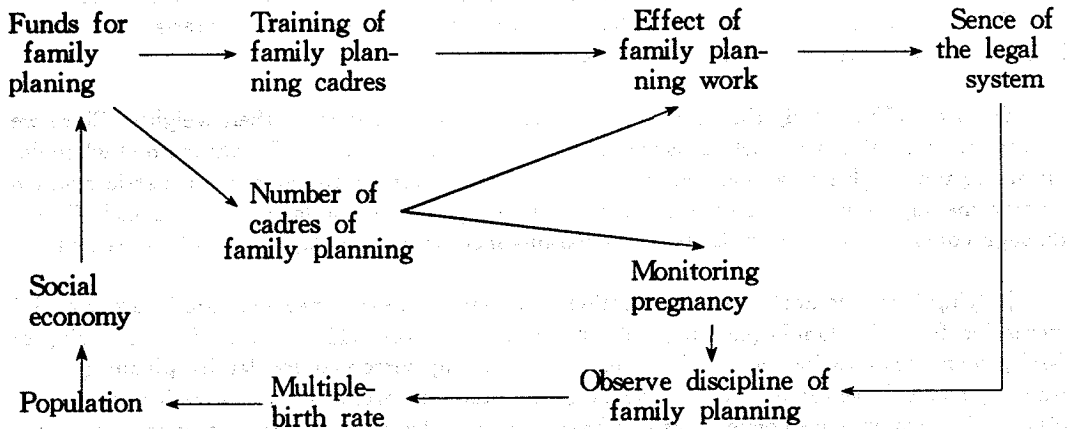(2) The relationship between population and family planning policy

Funds for family planing → Training of family planning cadres → Effect of family planning work → Sence of the legal system

Number of cadres of family planning

Social economy

Population ← Multiple-birth rate ← Observe discipline of family planning

Monitoring pregnancy

Fig. 5

(3) The relationship between population and medical and health work

Funds for family planning → Funds for medical work → Training of medical personnel → Fear of sequelae of operation

Conditions of medical apparatus

Social economy ← Population ← Multiple birth rate ← Observe discipline of family planning
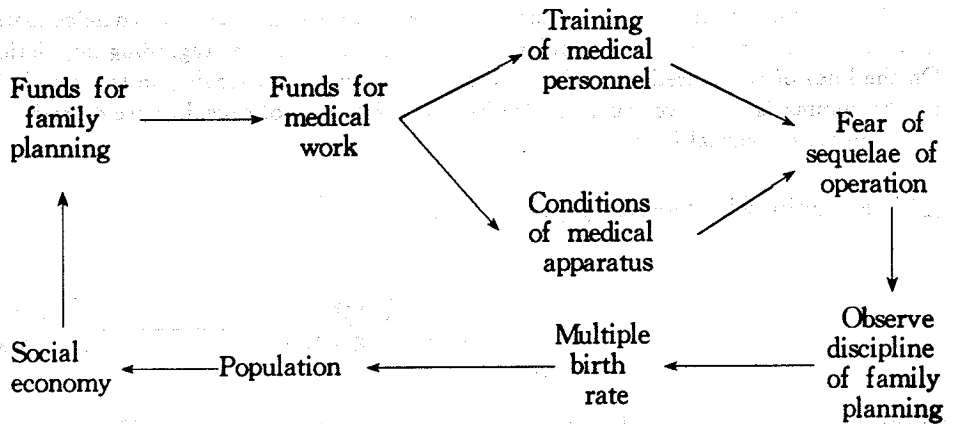
Fig. 6

(4) The relationship between population and the status of women

Social economy → Employment for women → Income of women → Social status of women

Population ← Multiple birth rate ← Desire to have boy babies

Fig. 7

Household service

Homes for oldmen

Endowment insurance

Social status of women

Feudal ideas

Quality of leaders

Effect of work

Desire to have boy babies

Income of women

Cultural level

Employment for women

Early- marriage child- bearing

Social service

Funds for education

Funds for family Planning

Social economy

Population

Multiple birth rate

Funds for medical work

Training for family planning cadres

Number of cadres of family planning

Training of medical personnel

Conditions of medical apparatus

Effect of family planning work

Monitoring pregnancy

Observe discipline of family planning
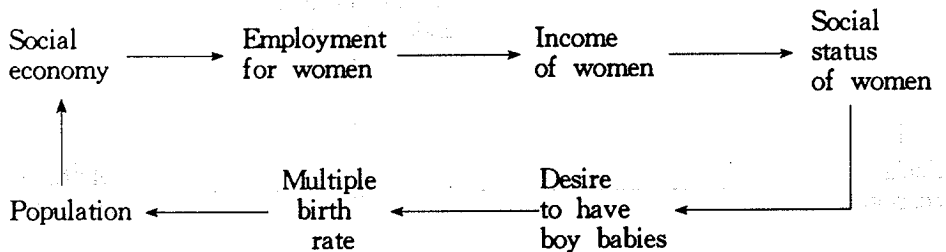
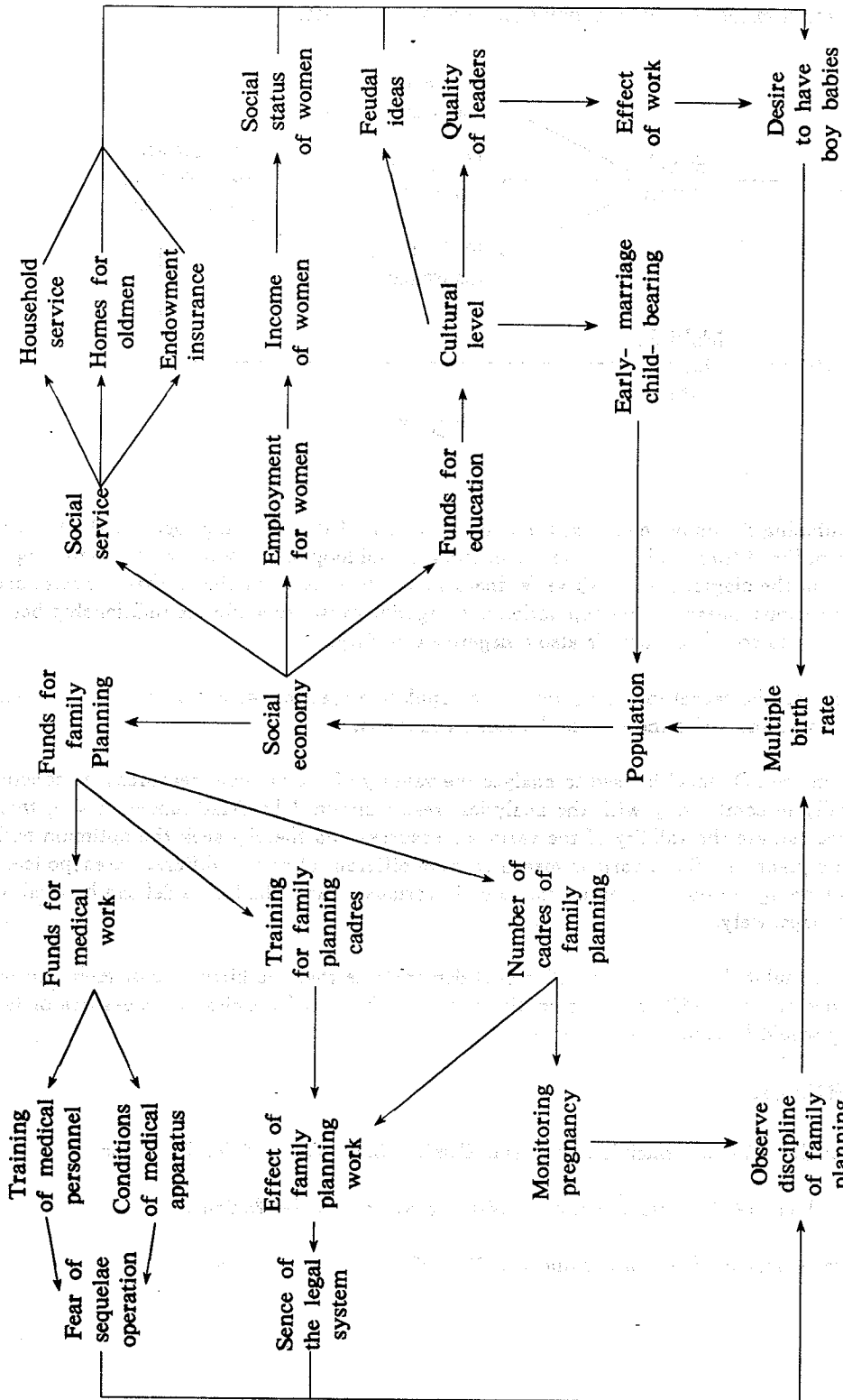Fear of sequelae operation

Sence of the legal system

Fig. 9

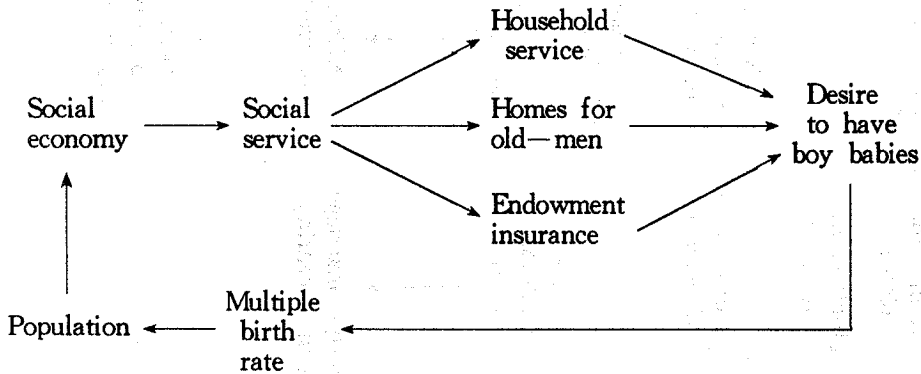(5) The relationship between population and social service

Fig. 8

Combining the above-mentioned five relationships, that is, putting together the five causal loops from Fig. 4 through Fig. 8, we can obtain a causal loop of the population system (Fig. 9). The loop in the diagram is a positive feedback loop. The reason for this is that the relationship between various measures and population is a negative causality while the relationship between population and social economy is also a negative causality.

Based on the causal loop diagram of the population system, we can draw a system dynamics flow chart and write the system dynamics equations.

When the SD model is used to analyze the validity of the various measures, its conclusion is basically in comformity with the analytical result obtained by AHP model. Using this SD model, we can see the validity of the various measures, and thereby seek the optimum policies for family planning. Since various measures have different effects in different area, policies for family planning are not necessarily the same in various areas. The SD model can be used to infer them separately.

The simulated results of the SD model demonstrate that the birth rate of Anhui province will be decreased to 16‰ within next five years, if the actuel policies and measures of family planning would be continually adopted.

REFERENCE

Forrester, J. W. 1968. Principle of System. Camb., Ma. Wright-Allen Press Inc.

Warfield, J. N. 1976. Societal Systems. New York. John Wiley & Sons.

Statistical Almanac of Anhui Province. 1990, 1991.