

STRATEGY STUDY ON ENTIRE COORDINATED DEVELOPMENT OF CHINA

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ABSTRACT

By means of system dynamics, main development modes and strategies on entire coordinated development of science, technology, economy and society of China have been studied. The paper studies the existed development mode and the long term possible trend of Chinese socio-economic development. The possible obstacles, unfavorable factors and some constraints to the development in its different stages are analyzed quantitatively in the paper. Some long term and short term strategies and policies for continuous and entire coordinated development are presented, based on the system simulation and quasi-optimization.

INTRODUCTION

In this paper we apply the theory and methodology of system dynamics, an approach combining quantitative and qualitative analyses, to the study of the strategies of the future development of China's socio-economy. It shows the tendency, characteristics as well as the outlook of the development of China's socio-economy in the coming hundred years. It also gives an entire quantitative analysis of the factors as contradictions, stimulation and obstacles existing in different periods. It studies China in the year 2000 as a part of the history in the long term development and puts forward a plan for the decision of strategies. The research in this paper is based on the model set, including 10 models, which takes the main model SDMNC (about 1000 equations) of China's socio-economy as the core. This model set can be used to analyze and study the following main problems:

1. Mutual influence and interaction in total between society, economy, ecological environment and resources.
2. The relationship between population, science and technology, education, energy, pollution and transportation as well as their effects and influence on national economic development.
3. The relationship between agriculture, industry and social service.
4. The relationship between accumulation and consumption as well as its influence on the national economic development.
5. The issue of growth rate of GNP and the national income.

* Based on projects funded by the State Natural Science Foundation of China

6. Effects of population problems, such as the age structures and the urbanization of rural population on the socio-economy.
7. The substitution of the new energy for the old.

DESCRIPTION OF SDNMC MODEL

The whole model set contains models of SDNMC, population, urbanization, industry structure, energy demand, finance etc. In this paper, only the SDNMC structure is briefly described. SDNMC all together consists of 14 sectors: population, non-agricultural production capacity, capital accumulation, national income and its allocation, consumption production, capital product production, means of production capacity, energy, transportation, science and technology, education, pollution and so on. Each sector relates another through the combination of variables and loops. Such interaction forms the feedback structure of the model. In Figure 1, the main feedback loops in the model is described. For the sake of easy reading, Figure 1 is simplified with some relation chains omitted.

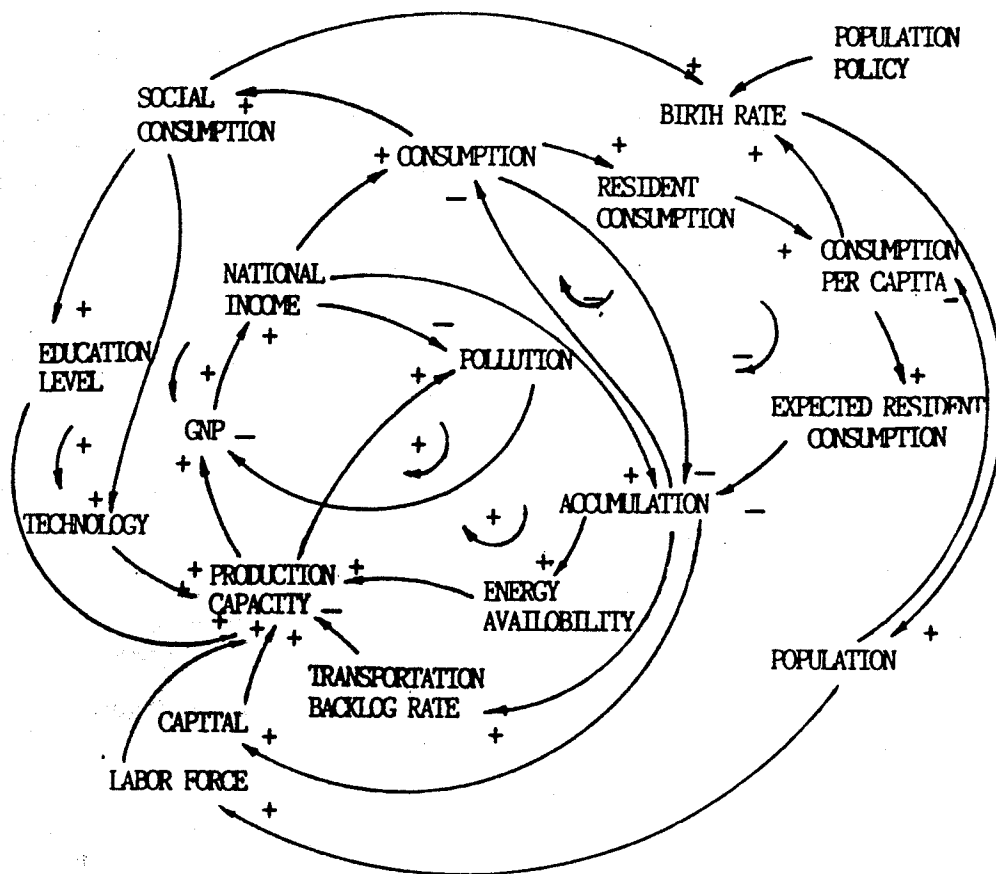


Figure 1. Main Feedback Loops of SDNMC

Some main feedback loops of SDNMC are roughly shown as follows:

(1) Positive feedback loops

National Income --> + Accumulation --> + Capital --> + Production

Capacity --> + GNP --> + National Income

National Income --> + Accumulation --> + Energy Availability
 - Transportation Backlog Rate
 - Pollution

+ + + +
 --> - GNP --> National Income --> Consumption --> Social Consumption
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--> + Level of Education --> + Production Capacity
 + Level of Science and Technology

--> + GNP --> + National Income

(2) Negative feedback loops

Production capacity can formulate three negative feedback loops through National Income, Consumption and Accumulation, further through Pollution, Energy Availability and Transportation Backlog rate.

Population may formulate two negative feedback loops through variables of Consumption Per Capita, Social Consumption and Birth rate.

Next comes the brief introduction of mechanism of some sectors. Ages of population are divided into 5 groups: 0-6, 7-15, 16-45, 46-60 and who are over 60 years old (not including 60). The life expectancy is affected by such four factors as food, social welfare, pollution and the degree of population crowding. "The control of fertility" reflects the effects of the government's population policy, and also gets feedback from fertility.

MAIN DEVELOPMENT MODES OF CHINA

1. Existing Development Mode

The mode is high growth rate (more 10%), high accumulation rate, and low productivity with a serious fluctuation of 7-10 years cycle.

2. Possible Future Development Mode

The mode is continuous and entire coordinated development of science, technology, economy and society with a lower economic growth rate (about 4%) and lower accumulation rate (about 25%).

THE RESULTS AND PROBLEMS CAUSED BY EXISTING DEVELOPMENT MODE

In the past 4 decades, although the GNP had a great growth in

China, there have been various kinds of problems and obstacles in the route of its economic development. The main problems and obstacles are the followings: the undesired big fluctuation of 7-10 years cycle in economic development, the low productivity, the unbalance between three major industries and between different branches within each industry, the overpopulation, the shortage of energy supplies, the insufficiency of communication and the transportation, the inadequateness of fund, the seriousness of pollution, the serious inflation started from mid last decade and so forth.

The simulation results reveal the obstacles both in the short-term and long-term further.

1. The Short-term (from the present time to 2000 AD or so) Obstacles

The simulation results show that we should not take an over-optimistic attitude towards the future. If we let the present structure continue, energy supply, transportation and pollution will become serious problems in the period of 1980-2000. The energy availability will reduce 26%, the pollution degree will increase 55%, and the transportation backlog rate will reduce 11%.

At the same time, although the actual production capacity will increase about 32%, yet the loss will be near 25% owing to the problems such as the energy supply insufficiency, transportation in short supply, the worse pollution and so on. The further research shows that in the year 2000, the transportation problem will become more serious than the energy problem.

If we say the problems of population, energy and transportation have already been understood universally, then up to now, the danger of pollution remains far from thinking highly of. It is shown in the study that if we do not control pollution, the seriousness of pollution in the year 2000 will be 11 times as much as in the year 1965.

Furthermore, the simulation results show that the fund shortage will be more serious in the last 10 years of this century. The fund shortage rate (defined as the ratio of the fund shortage amount to the fund amount) will reach about 11% in average. Until after the year of 2000, the fund shortage case will be subsiding.

2. The Long-term Obstacles

In the long view, the overpopulation and energy supply problems will become the main obstacles for our national economy's steady increase and its development.

The pressure of overpopulation will continue to be heavier. Even if the reasonable population control policy would be thoroughly carried out and a good prospect of population increasing would appear, the population will be more than 1250 millions in 2000 AD, and about 1350 millions in 2010 AD, the largest population will be more than 1400 millions in the 30-40's of next century. In the long one hundred years after the 90's of this century, our population will be continuously above 1200 millions.

The problem of energy. Suppose the conventional energy reserves would not increase in the base year, the varying tendency of the conventional energy reserves remaining ratio will sharply reduce from 2035 AD's 75% to 2050's 50% and 2060's 25%. It is estimated that the substitution of the new energy for the old will appear in the later 50 years of the next century.

STRATEGIES ON CHINA'S FUTURE DEVELOPMENT

In order to achieve a long, steady and coordinated development in different branches such as society, economy, science and technology, ecology and so on, we hold that the following aspects should be paid fully attention.

1. Striving for Economic Structure Adjustment

China's economy will undergo a relatively difficult development period in coming years. In this period, we should devote major efforts to developing science and technology, actively adjust economic structure, and adjust the proportion between three major industries and between different branches within each industry, so as to reach the goal of long-term and coordinated development of our society, economy, science and technology, and ecology.

2. The Speed of National Economic Development

In the light of consideration of the objective laws of national economic development, the specific national conditions and the long-term interests, we suggest that after having been a high speed of more than 10% in the past years, the economic growth rate should be lowered gradually to 5% or so, and then to 3% by the latter half of next century. After the accumulative capital reaches a comparatively large scale, it is unnecessary and impossible to retain the continued high speed. In fact, it is unrealistic and extremely harmful to pursue blindly the continued high speed, or even super-high speed.

3. The Relationship between Accumulation Rate and the Long-term Economic Development.

Just as mentioned above, by simulating comparative study, we think that, in order to promote long-term economic development and continuous rise of the people's consuming standard, a reasonable varying tendency of the accumulation rate should be made to reduce the high accumulative rate (32% or so) in the past and at present to 25% by the year of 2065. Also, in different periods, the average accumulation rate should be from about 30% between 1985 and 2000 and to about 27% optimum after 2000.

4. Problems in Development of Science and Technology, Shortage of Fund and Introduction of Foreign Fund.

In order to make technology play a greater part than fund and

gradually take the leading position after 2005, sufficient investment for science and technology should be guaranteed, and full attention should be paid to the introduction of technology. This means the total fund needed for the economic development should be increased. As mentioned previously, in the latter 10 years of the century our fund will be in a serious shortage. As a result, neither accumulative nor consumption fund can meet the increasing demands, thus, during this period, the introducing of foreign fund will appear to be even more important. An analysis of policy of capital problems reveals if the fixed capital can be increased by introducing foreign capital, and shortage of fund be lowered to 6.6%, the GNP will be increased 5.7% more than without the introduction of foreign fund, and at the same time national income will be increased 4.6%.

5. Finance and Banking.

It is well known that this is the key sector of national economy, and people are paying close attention to how it will be brought into play. Study in this paper shows functions of economic levers such as wage and salary, price, tax rate, interest rate and interest rate of loans.

A. The average growth rate of wage and salary should be held between 4% and 6% per year, otherwise, if it is continued higher than 8%, price index of consumer goods will be increases from 100 in 1975 to 400 in 2000 and 1000 in 2025. It is harmful to the vitality of enterprises whether the average growth rate of wage is too high or too low. The result of simulation reveals that it will be harmful to enterprises and the whole national economic development when the average growth rate of wage is higher than 6% per year.

B. The leverage of price

It will both be harmful to the whole economic development if price index of industrial products is lower than 3.5% and higher than 10%. Generally speaking, decision of proper growth rate of price index of farm produce, consumer goods, industrial products and commodities should accord with the following principle:

farm products > consumer goods > industrial products > commodities

The leverage of price and the limit of salary growth rate can be used to control growth rate of price index of consumer goods which should be limited at 4% or so per year.

C. Tax rate.

The reasonable range of our tax rate should be 10%-25%, higher or lower than this, it will both result in great decrease of national financial income.

D. Interest rate and interest rate of loans.

The high or low interest rate of loans depends mainly on changes of interest rate, i.e., the former will increase or decrease following changes of the latter. Simulation research shows that a

comparatively reasonable range of change for interest rate and interest rate of loans is 6-14% and 8-18%.

6. Policy of Population Controlling.

Population problem will cast long-term and important influence on the prospect of socio-economic development. To accomplish smoothly the transition from the present population situation to a new and reasonable state, to guarantee that in the next century the proportion of the elderly people and the main labor force is not higher than 20% and less than 40% respectively, and, to achieve the goal of "better prospect of population development" described above the average fertility and rate must be effectively controlled. That is, the fertility should be lower than 1.5 or so, but years later, it should be gradually extended and kept at 1.8 or so. Simulation tells us that it is impossible to decrease our population to 7-8 billion in one hundred years.

7. Urbanization of Agricultural Population.

This issue is closely related to so called "reform of industry", which we mean how to improve dislocational proportion shaped between the three major industries in the past several decades. But in this paper we only discuss the reallocation of the existing unreasonable proportionate labor force among the three major industries. In the coming 30-40 years one of the important items of our industrial transformation is how agricultural population, which is already in over proportion, can be turned into non-agricultural population. The main obstacle to this is that the speed of agricultural growth is too slow. In order to transform labor force allocation of the three industries from 69%, 19% and 12% in 1984 to 25.5%, 37.5% and 37% in 2024 AD respectively, we suggest the following policies be adopted which are favorable to the transformation of structure of labor force to the decrease of agricultural labor force.

A. Agricultural investment of should be greatly increased, so as to accelerate agricultural modernization.

B. Investment of consumer goods production should be increased to favor the extra agricultural labor force and population to gradually migrate to near boom towns.

C. Energetic support and encouragement should be devoted to developing the third industry.

B. Problems in Energy Supply.

From now on until the year of 2000, problems of energy shortage will continuously be very serious. How can we solve these problems? Study reveals that:

A. Under the condition that the speed of industrial enterprise's technology progress is not very fast, potentials in the reform of industrial capital to save energy is still quite limited;

B. In terms of the near future, reform of the current unreasonable energy price is more important than that of energy investment and technological innovation;

C. The plan is not recommendable which mainly relies on importing energy to improve the situation of energy shortage in the near future, and at the same time to decrease domestic energy investment, because that will make the situation of energy supply even worse after 2000 AD.

In order to solve the problems in replacement old and new energies in the latter half of next century, our exploitation and development of new energy should be started definitely before 2020 AD.

9. In terms of the near future, problems of transportation may be even more urgent than those of energy, therefore sufficient investment should be given to transportation losing no time, in the expectation of relaxing the tension by the year of 2000 AD or so.

10. While the world economy enters marine times, China has to increase the investment portion in marine industry and adjust the investment proportion between its different branches the early the possible. In the same time, our country has to make preparation for setting up new future marine industries before 2010 AD.

11. For the purpose of holding back the existing harm and the future potential harm of pollution the investment portion should be at least two percent of the GNP.

CONCLUSIONS

The research reveals that technology progress would be a dominant source of future economic growth of our country. It is estimated that the level of sciences and technology of China would approach advanced world's level in the middle of the next century. 70% of the economic growth could be attributed to technology progress then.

Although the actual production capacity can be increased by three times at the end of the century if the current economic structure in unchanged, the shortages both in energy supply and transportation and heavy pollution would generate a 25% loss in total output. The transportation would be a more serious problem than the energy supply, according to the research.

Leverage function of finance and banking are explored.

Over population would still be serious problem. Chinese population will maintain at a level above one billion in the next century. Apt policy of birth control plays a key role in solving population problem of our country. The study about accumulation rate indicates that the accumulation rate of our country should

decrease from current level of 30% to 25%, in order to favor the long term development.

In terms of solving energy problem, adjusting unreasonable energy price would be more effective than energy investment and industrial capital retrofit in short term.

The study about energy transition and the substitution of new energys for old ones shows that adequate considerations should be devoted to develop new energies and this development should begin no later than the 20s of the next century.

The investment portion in marine industry should be increased and the invesment allocation between its different branches should be adjusted the early the possible.

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