

# **A SOCIO-ECONOMY DEVELOPMENT STRATEGY STUDY OF A TYPICAL UNDERDEVELOPED COASTAL OPEN CITY**

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## **INTRODUCTION**

This study is related to the socio-economic development strategy of a typical underdeveloped coastal open city (named L) which was mainly done by means of system dynamics approach.

L city is located in the north to the Taiwan Straits. It is one of the most famous lands of overseas Chinese ancestors in China. And it famous with a long history and splendid ancient culture. It is the starting point of the "Silk Way On Sea" with excellent ports and rich natural resources. L city had its economic prosperity in the ancient times. Coming to the modern times, however, its economy was very backward because of having been closed the region to international intercourse for a very long time. Since the implementation of the economic reform and open policy, the city has achieved a great progress in the economy while the pace of the regional industrialization has been more rapid than the past decades. It is a typical example in the coastal open area of China. Therefore, it is necessary to study the problems of regions to guarantee the continuous, steady and coordinated development of the regional economy in the future.

## **THE MAIN STRUCTURE OF THE MODEL**

The model was created based on the analysis of the city's socio-economy. As a regional socio-econo-environment system dynamics model (named RSEESDM), it is expected to be a "policy laboratory" for the development strategy study of the city.

The frame and feedback structure of RSEESDM is shown in Figure 1. RSEESDM contains ten sectors as follow: population, industry, service, agriculture, construction, transportation and post, electrical power, commerce, national income and allocation, and environmental pollution. The whole model describes the interactions and feedback relationships among society, economy, and environment. There are four main feedback loops, 2 positive and 2 negative. The main feedback loops determine the whole dynamic process of the system evolution and coordination. The positive loops determine the growth process of the socio-economic system. Conversely, the negative feedback loops describe the restrictive effects of the constraints of the system on the economic growth. In the consideration of distinctive features of the city's

population, the population sector is built on the basis of the exogenously treated fertility rate which can be changed in the policy test. The population is distinguished into three groups according to the age structure. The exterior asset flow-in is also treated exogenously for the policy simulation because it is difficult to forecast how much asset will flow in the city with highly varying situation in the present time.

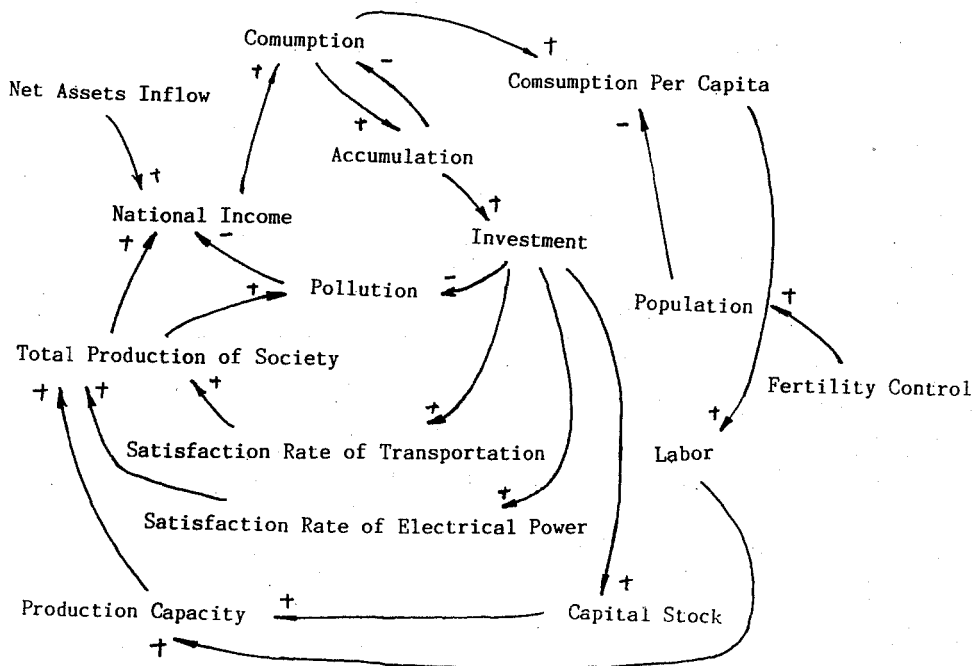


Figure 1. The Main Feedback Loops

## POLICY ANALYSIS

By means of RSEESDM, a variety of policies are simulated on the basis of L city as the background. In the below, several main policy simulation results are provided by brief analyses.

### Simulation Results of Individual Policies

#### (1). The effect of exterior assets on the economic growth

A policy is designed for testing the effect which assumes that after 1988 the net exterior asset inflow is annually increased by  $0.1 \cdot (t - 1988) / 100$  millions,  $t$  is the time ordinate, and  $1988 \leq t \leq 2000$  with respect to the condition of Base-Run. Under the assumption, the policy is simulated, and the result is given in Table 1. In the table it can be found that the marginal GNP output rate of the exterior asset tends to rise with the time going. The main reason of the manifestation is that there exists the delay from investment to capital formation.

After certain year delay, however, the investment will lead to the effect which will be greater with the time going. Here only 22% of the asset inflow is used in the accumulation. Therefore, it is profitable if the city absorbs and utilizes the exterior asset such as foreign capital, overseas Chinese asset, etc., since the ratio of GNP output to investment is greater than 2--3.

Table 1. The effect of exterior assets on economic development

Year	Marginal GNP Output Ratio
1985	0.000
1990	2.986
2000	3.086

(2). The effect of controlling fertility rate on the economic growth

This policy test assumes that the fertility rate (in this model it represents the number of children born by 1,000 women of 15--19 years old.) is controlled, and it drops gradually from 1988 with remaining at the level of 6% after 1995. This goal can be attained by making and implementing stringent fertility plans. The comparison analysis result of the test with the Base-Run is listed in Table 2. The table shows that if the city's government takes active actions and measurements in the family planning, then the population in 2000 can be reduced by 450,000 in comparison with the Base-Run which is about equal to the population of a mid-sized county; the natural growth rate of population can be controlled under the level of 1.0% in 2000. It means that in this case with no additional conditions needed, in 2000 GNP per capita of L city can be increased by 7.1% compared with the Base-Run. This is not a little achievement.

Now the population of L city is over 5.18 millions who are living on the limited land that is diminishing with a rapid pace. With the rapid growth of the population, recently, the arable per capita drops very quickly, from 0.5 mu to 0.4 mu (1 mu=0.1647 acre). The land is overburdened by the great population. Because of the rapid growth of population in this area in the past decade a big part of the economic growth was eaten by the rapid increase of the population. Therefore, strictly implementing the family planning still is a very urgent task.

Table 2. The effect of controlling fertility on economic development

Year	Natural Growth Rate (%)		GNP Per Capita (R.M.B. Yuan)		Increment of GNP Per Capita
	Base-Run	Test	Base-Run	Test	
1990	1.843	1.613	712.6	714.6	19.0
1995	1.806	1.090	1,257.9	1,291.7	33.8
2000	1.816	0.944	2,113.5	2,263.7	150.2

(3). The effect of raising accumulation rate on the economic growth

As L city is concerned, the accumulation rate of 22% is relatively low. At the beginning of the economic development, from the experiences of some developed countries, appropriately raising the rate is in accordance with the long-term benefit of the region. Of course, the proportion can not be so high that makes the consumption level of the residents drop and dampens the working enthusiasm of the masses. For L city, however, the pressure of the private assets on the market is too heavy. Therefore, conducting private savings to the making of businesses should be a long-run strategy. A set of the accumulation rates are tested. The result shows that the accumulation

rate of about 25% is proper. The simulation result is shown in Table 3. We find that there exists a delay time in the effect of the accumulation on the economy. Strategically speaking, appropriately raising accumulation rate is undoubtedly advantageous to the long-term economic growth, which can be seen in Table 3.

Table 3. The effect of raising the accumulation rate on the economic growth

Year	Increment of GNP Compared With Base-Run	Increment of TCPC Compared With Base-Run
1990	0.00	-3.10
1995	1.54	-20.80
2000	7.71	14.30

Note: TCPC is the total consumption per capita.

### Simulation Results of Synthetic Policies

In fact, a socio-economic system is affected comprehensively by the very big number of factors. Thus it can be of more practical value that the effect of synthetic policies on the dynamic behavior of the whole system is compositely examined than that of an individual policy on the economy is separately studied. Three typical synthetic policies are provided here based on the individual policy analysis above.

#### A. Test 1 (optimistic option)

The assumption of this test is as follows: (1) net exterior assets flow in more rapidly after 1990; (2) the fertility rate drops gradually after 1988 due to the strict implementation of the family planning; (3) the proportion of investment in the electrical power is properly raised and the effect of energy conservation is spectacular; (4) composite technology rises more rapidly owing to the more rapid introduction of the foreign capital, equipment, and technology; (5) the proportion of investment in industry will slightly decrease from 1990, and that of investment in agriculture and environmental protection will be gradually raised, moreover, harnessing and controlling pollution as well as developing agriculture will be stressed; (6) the creditability of products rises gradually and the market demand increases; (7) the tensive relationship of supply to demand of the crude materials is gradually alleviated; (8) the proportion of accumulation rises from 1990.

#### B. Test 2 (neutral option)

This test assumes: (1) the fertility rate is slowly controlled; (2) the effect of energy conservation is not significant; (3) the proportion of investment in industry descends slowly from 1990, but the drop is small compared with Test 1; (4) harnessing and controlling pollution is slowly emphasized with time going; (5) the proportion of accumulation rises gradually from 1990.

#### C. Test 3 (moderately lower-effectiveness option)

The conditions of this test are the following: (1) the management for businesses is improved in a slow pace from 1990; (2) the effect of energy conservation is not significant. (3) the proportion of investment in industry rises from 1990; (4) the proportion of

investment in the service sector descends slowly from 1990; (5) environment pollution is not regarded as a constraint for the future economic development; (6) the family planning is not well put into effect.

The simulation results of the above-mentioned comprehensive policies are analysed in Figure 2, compared with those of the Base-Run. Viewed from the figures, the comprehensive tests behave in totally different styles. Test 1 gives an optimistic behavior. Test 3 shows a lower-effectiveness of the economy, which is not desired. The result shows that a complex socio-economy system is counter-intuitive. Test 2 is a pattern of neutral development. In the test simulations, we find that there exists the paradox of investment policies. Too much investment in industry may never produce more in the long-term even though people who make decisions desire to achieve more rapid economic development without paying adequate attention to controlling pollution and fertility and investing in the services. In fact, more investment in industry without considering the urgent demand of investment in the other sector will cause an inefficient outcome. It is contrary to that might have been imagined. Conversely, however, the service sectors consume less electrical power than does industry, which is favorable to the enhancement of economic effectiveness since the shortage of electrical power is very severe at present. Viewed from the present situation, the electrical power industry must precede the other sectors. Furthermore, faster technological progress and better utilization of resources can generate a faster growth of output even if the capital stock does not grow any faster. A socio-economic as a whole tends to pursue the coordinated development.

#### POLICY RECOMMENDATION

The policy simulations provide us with a lot of information about how to improve and forward the development of the socio-economy. They are very helpful for us to study the process and trend of the system affected by a set of internal and external factors in order to perceive the long-run development of the system in the present. They are able to indicate for decision-makers which measurements should be taken and which problems should be solved ahead of some time to achieve the continued, steady, and coordinated development of an economy. We suggest that in planning a socio-economy people who make decisions take on the following policies:

1. At the beginning of the regional industrialization, it is necessary to hold a certain proportion of investment in industry, but the development of industry should coordinate with the development of other industries. Further, the care should be taken about the environmental pollution. Otherwise, the production capacity of industry can not be adequately utilized, and the environmental pollution will have negative effect on the long-run economic development because the industrialization will bring a bad influence on the environment. From the figures which show the results of synthetic policy tests, the proportion of 2% of investment in the environment protection to the total investment can significantly alleviate pollution and improve the environment, which is shown helpful to the rise of the economic effectiveness. In the short term this goal can be achieved by placing emphasis on the strict implementation of the "Environment Protection Law". However, the proportion must be raised to a higher level in order to get rid of the pollution.

2. As an underdeveloped region, L city should stringently control the

fertility rate for the realization of the strategical goals. For L city, the goal of controlling the fertility rate between 60--70(per 1,000 women of 15-59 years old) can be attained by carrying out the family planning well. The policy simulations have shown that the fertility control is decisive to the long-run socio-economic development of the city.

3. In the starting stage of economic development, it is in accordance with the long-term benefit of the people to properly raise the proportion of accumulation. The policy simulations have shown that it is relatively suitable to hold the proportion at the level of about 25%. To increase the accumulation, however, concerned policies and laws should be stipulated, some of which can proceed the nationwide implementation, in order to encourage the private investment in the making of businesses. Since the private assets of the city is quite available there is a great potential development in the private investment.

4. As concerns an underdeveloped coastal open region, both technology and management will be raised by introducing and utilizing foreign capital, equipment, and technology. The simulation result shows it gives a positive effect on the regional economic development with the ratio of GNP output to investment of exterior assets greater than 2--3 after some year delay. Thus we suggest that the local government pay attention to the improvement of the investment conditions (soft&hard surroundings) in order to attract the foreign capital.

5. From the strategic point of view, the economic take-off, in the future, will depends mainly on the enhancement of labour productivity although the economic development depends mainly on the input of a big quantity of assets and a great number of labour in the present. Therefore, it is urgent to develop education, especially middle level education, more rapidly to cultivate workers with the knowledge of modern science and technology. For L city, with the economic development being stressed, the development of education, science and technology should be emphasized simultaneously in order to raise the quality of the population and labour. The history of experiences shows that highly-educated population and labour are the propeller of the continuous economic development. The policy should be made which encourages the cooperation of the local researchers with the external professionals as well as the absorption and introduction of application experts with privilege. It is a short path to quickly raise the level of science and technology of the region.

6. In the process of the regional industrialization, the land protection should be stressed by the increase of agricultural investment; with the development of natural resources the surroundings should be protected.

7. Under the condition in which electrical power supply is severely short, the electrical power industry must be put on the top priority in the list of development programmes. The simulation results tell us that the shortage of electrical power supply has caused a big loss of the industrial production. We find it wise to develop the power industry ahead of other industries.

8. The discard and depreciation rate should be raised appropriately for industrial equipments in order to speed up the updating of the equipments, conserve energy, raise the quality and creditability of products, and increase the market demand.

9. Some privilege policies should be made for some poor counties in order for them to get rid of the poverty, which make the economic

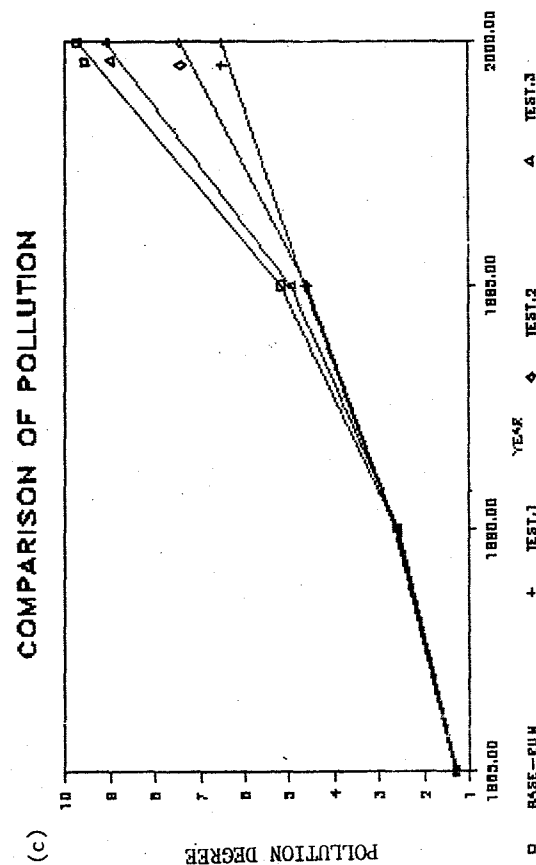
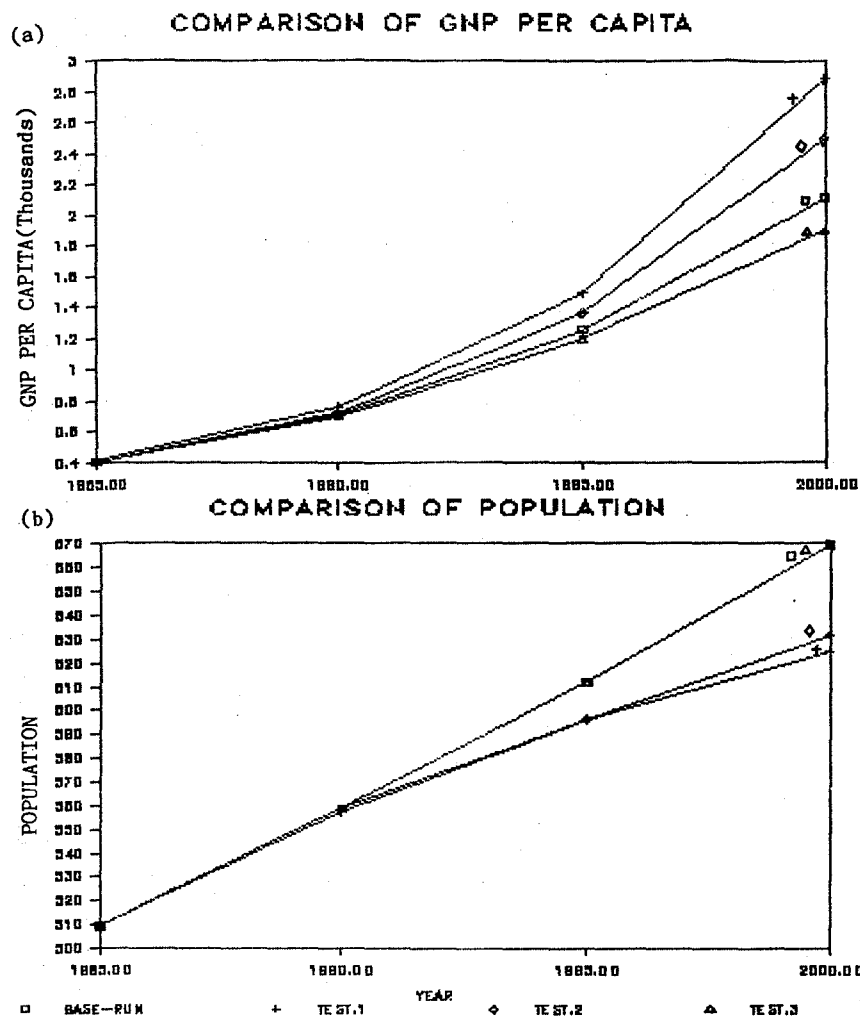


Figure 2. Simulation results of the comprehensive policies

development of the whole region coordinated.

In one word, from the beginning of the economic development, the coordinating development of society, economy, and environment protection must be adequately stressed in order to achieve the continuous, steady and coordinated growth of the regional socio-economy.

## CONCLUSIONS

Because of the counter intuitive behavior of a socio-economic system, people can never perceive all relationships inherent in the system. People can only approximately recognize the relationships among different parts of an extreme complexity, non-linearity, and high-order system. In fact, the model does not reflect all aspects of a system. However, it does reflect basic parts which are necessary for the discussion of the strategic problems. And our model is based on the perspective of basic structures of the system.

The policies above-recommended only point out the directions of toiling to achieve economic goals and social realizations. More travails remain for people who administrate the socio-economy and make decisions. But to a great extent their achievements depend upon the economic reform being under the way in our country since any change in the macro economic policy made by the central government will substantially influence the implementation and success of the policy we recommended above.

The discussion is helpful for persons who are involved in the development study as reference although it has been done for a special region. It is especially useful for those who study the long-run development strategy of a regional socio-economy.

## REFERENCES

- Forrester, J.W. Urban Dynamics. 1969. The M.I.T. Press, Cambridge, Mass.
- Forrester, J.W. Principles of Systems. 1968. The M.I.T Press, Cambridge, Mass.
- Wang Qifan and Shan M. Some Limits to A Big City In China. 1987. Proceedings of The 15th International Conference Of The System Dynamics Society, Shanghai, China.
- Wang Qifan. System Dynamics. 1988. The Tsing Hua University Press, Peking, China (in Chinese).
- Yang S.J. Theory and Policy for Economic Development, Jiangsu People's Publishing House, Dec. 1983, First Edition. (in Chinese)
- Meadows, D.T. et al. The Limits To Growth, Cambridge, Mass.:The M.I.T. Press, 1972.
- Wang J. Selecting Correct Long-run Development Strategy, Xinhua's Digests, No.3, 1988, pp36 (in Chinese).