

# Strategic Study and Dynamics Decision for Development Program of City Housing

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**Abstract:** The cause and effect analysis of the main factors which affect city housing is made, by means of the system dynamics theory. On the basis of analysis the feedback cycle and flow diagram result. According to the actual situation, the simulated model of system dynamics for developing city housing program is established in order to make possible prediction and decision for city housing.

**Key Words:** system dynamics, city housing, program, decision

Allotting houses with welfare coming to a halt, it symbolizes that city housing has come into operation with personal financial conditions. Housing construction has become a new growth area in the economy and will be brought into a city's macro-program. The city housing requirement should be a kind of decision of multiple factors, i.e. it should hold a dynamic balance of housing supply and demand according to a city's economic development, population growth and land occupancy. But the decision effectiveness achieved in accord with traditional decision processes relies more and more on decision makers' individual experience and ability, so different decision makers may come to different or even completely opposite conclusions when facing the same macro-condition. Due to the lack of scientific, overall and systemic prediction program, it will cause contradiction between housing supply and demand in quantity and structure, as well as decrease the effect of housing investment.

In order to enable housing development companies to come up with development plans according to city administration's long-term program and actual housing supply and demand, this paper will establish a scientific dynamic simulation laboratory for housing development companies, in accord with, systemic dynamics theory, a city's economic development, population growth and land occupancy, present housing conditions and consuming customs, etc, so as to achieve scientific predictions for city dwellers' housing requirements, provide simulation results and help with decision-making.

## 1. Basic structural description of city housing system

City housing system program is a complex system with many influencing factors. According to the established research scope, it can be divided into three sub-systems.

a. City economic system. It includes the total number of industries, enterprise construction & depreciation, average rate of employment, jobs, ratio of labor to employment, enterprise labor factors, work attracting factors, etc..

b. Population system. It includes population size, rate of birth, rate of death, rate of migration, average size of family, etc..

c. Housing System. It includes housing quantity, housing construction, housing depreciation, housing construction factors, housing obtaining factors, etc..

The relation between these three sub-systems is as follow:

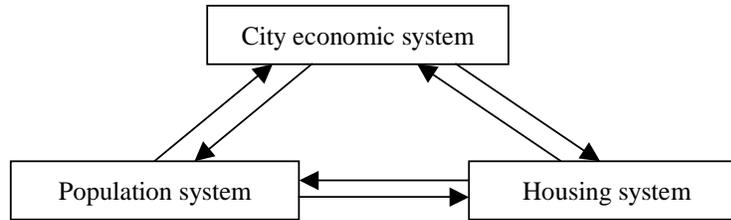


Fig. 1 Relation between each system

## 2. Cause and effect analysis of city housing system

These three sub-systems are connected through three auxiliary variables, they are rate of land occupancy, ratio of employment labor, ratio of housing supply to demand. The cause and effect relation is as follow:

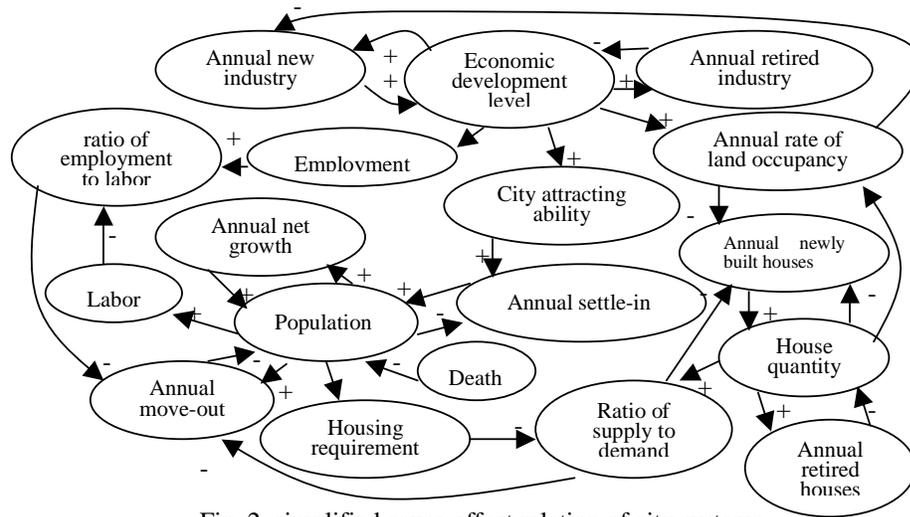


Fig. 2, simplified cause-effect relation of city systems

## 3. System flow chart of city housing

On the basis of the analysis of cause-effect, the systemic flow of the model is established. Through the data analysis, system feedback mechanism establishment, using theory and method of systemic dynamics, confirming equation of each factor's rate and estate, a SD decision model of city housing development program is established by dint of "vensim" language, the systemic dynamics simulation language. Value and data of every factor acquired by means of statistics and analysis using probability theory, mathematical statistics and fuzzy mathematics are on the basis of a mass of social investigation and study of one city's situation.

### 3.1 city population system

a. estate variable: population size

b. rate variable: rate of birth, rate of death, rate of migration

c. auxiliary variable: rating rate of birth, rating rate of death, rating rate of migration, initial quantity of population

### 3.2 Housing construction system

a. estate variable: housing quantity

b. rate variable: housing construction, housing depreciation

c. auxiliary variable: expected rate of housing construction, initial quantity of housing, factors of housing activity, initial value of rating housing construction rate, average housing acreage stated by the government, expected housing quantity, gap of government's aim, maximum value of difference, actual construction fund, balance of construction fund, actual government construction investment, total loan of construction, expected

construction fund, total self-collecting fund, increasing factors of rate of government investment and construction fund, rate of construction loan and construction fund, construction expenses, land collection expenses, construction expenses of per square meter, increasing factor of construction expenses of per square meter, increasing factor of per acre.

3.3 explanation of important predicted variables in the system

- a. population size: It means present city population
- b. inhabitant’s latent purchasing quantity: It means inhabitant’s requirement of housing quantity according to a city’s economic development level.
- c. inhabitant’s effective purchasing quantity: It means inhabitant’s requirement quantity of purchasing ability.
- d. gap of government aim: It means the difference value between the expected government quantity and present actual housing quantity.
- e. difference of inhabitant’s demand: It means the difference between inhabitant’s actual demanding quantity and present actual housing quantity on the market in the simulation system.
- f. expected housing quantity: It means the total inhabitant’s required quantity calculated according to average housing acreage per person stated by government.
- g. actual housing quantity: It means the present housing quantity.
- h. actual average housing acreage per person: It means the rate between actual housing quantity and total population.

3.4 explanation of important decision variables in the system

- a. rate of expected construction: It means the construction speed decided by the gap between of government aim and inhabitant’s demand.
- b. housing construction: It means the newly built housing acreage per year.
- c. initial value of rating rate of housing construction: It means the average value of construction ability of housing development companies in a certain time.

**4. decision simulation analysis of city housing system**

The model of housing development program can be run many times through different setup of parameters. Here is one example of model running.

4.1 basic parameters

- a. initial time: in 1998.
- b. final time: in 2010.
- c. initial population quantity: 188,675 persons.
- d. initial housing quantity: 1,937,690m<sup>2</sup>.
- e. expected average acreage per person: 12m<sup>2</sup> in 2000, 13m<sup>2</sup> in 2005 and 14m<sup>2</sup> in 2010.

4.2 basic running and result analysis of the model

According to the above parameters, the result of some important variables are given in the following figure.

- a. graph of population quantity

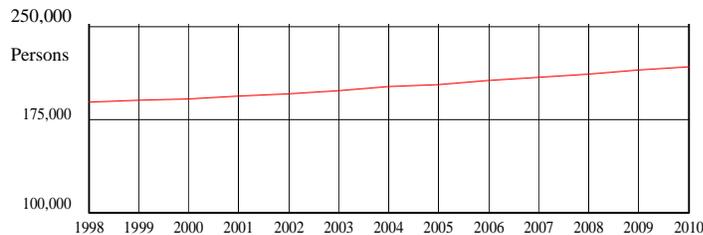


Fig. 3. graph of population size

b. graph of inhabitant's latent purchasing quantity

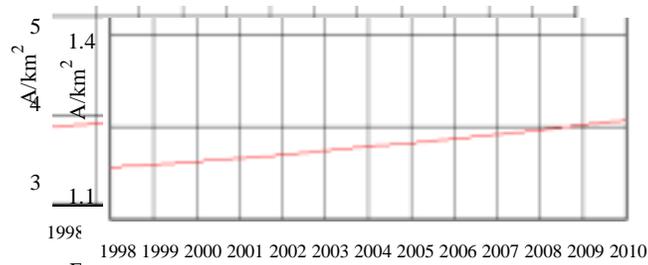


Fig.5. graph of inhabitant's effective purchasing quantity

c. graph of inhabitant's effective purchasing quantity

d. graph of expected housing quantity

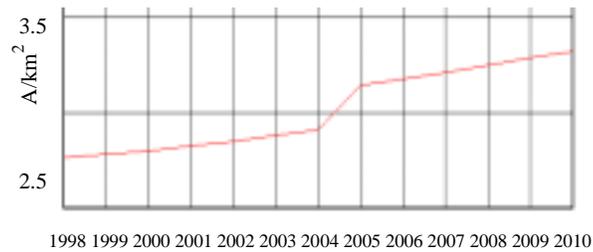


Fig. 6. graph of expected housing quantity



Fig. 7. graph of rate of expected construction

e. graph of rate of expected construction

#### 4.3 result analysis

The data from model running indicate that:

- the population of one city will increase from 188,675 to 216,877 (Fig. 3).
- the inhabitant's latent purchasing quantity will increase from 3.885 km<sup>2</sup> to 4.486 km<sup>2</sup> (Fig. 4).
- the inhabitant's effective purchasing quantity will increase from 97.1350 km<sup>2</sup> to 1.121km<sup>2</sup>(Fig. 5). Among them, the requirement quantity for 70 m<sup>2</sup> and below apartments will increase from 33.7981 km<sup>2</sup> to 38.3113km<sup>2</sup>, 70-90 m<sup>2</sup> apartments will increase from 35.0539 km<sup>2</sup> to 40.2460 km<sup>2</sup>, 90-120m<sup>2</sup> apartments will increase from 18.8197 km<sup>2</sup> to 22.4385km<sup>2</sup>, 120 m<sup>2</sup> and over apartments will increase from 9.4632km<sup>2</sup> to 11.1269 km<sup>2</sup>.
- the expected housing quantity will increase from 2.64 km<sup>2</sup> to 3.036 km<sup>2</sup>(Fig.6). The above data indicate that inhabitant's housing requirements enhance along with population growth. This requires housing development companies to provide housing according inhabitant's demand.
- housing construction: Total quantity indicates the situation of increase first and decrease later (Fig.7).

### 5. Conclusion

a. This subject analyzes and studies ,by mean of systemic dynamics theory ,the relations among factors which influence city housing requirement ,predicts the housing requirement of inhabitant, provide decision result

analysis, and is of definite significance in guiding city housing program and development.

b. Housing development program model is a simulated laboratory, decision makers can simulate many times and analyze the result.

c. Make sure the guideline of housing construction speed, etc. is based on the expected average acreage per person.

d. This subject has done an inaugurating work for the establishment of city housing system model under the new housing policy.

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