DESIGN AND ANALYSIS OF THE DEVELOPME T MODEL IN CHIBA PREFECTURE

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ABSTRACT

In this study, we have selected chiba prefecture as an subject. Chiba Prefecture is located in the Metropolitan Region which is made up of Tokyo Metropolis and three prefectures. Though its local power is not so high compared with others, Chiba Prefecture has been remarkably vitalized in recent years. In order to study how the life environment of our local society will change in the near future, we have designed a local development model based on the System-Dynamics and analyzed it until 2000. The whole model is made up of 6 sectors; population, industry, land and dwelling, finance, education and medical facility. In the population sector, we have studied the change in the age structure. In the industry sector, we have analyzed the change in the structure by studying agriculture as the representative of the primary industry, manufacturing as the representative of the secondary industry and tourist industry and retail as the representative of the tertiary industry. Based on such kind of analysis, we have studied the effect of the change in sector on our life environment. From our study we have concluded the followings in 2000.the population of Chiba Prefecture will reach the level of 6.27 millions. The secondary industry will grow move rapidly than the tertiary industry, it's will become post Industry Society. The local society might become advanced-age society, we way say that our Chiba Prefecture will be relatively comfortable to live, compared with the other areas of the Metropolitan Region.

INTRODUCTION

IN Japan today, the tendency is for the gravitatiton of population to and the accumulation of informaton in the Tokyo Metropolitan Region to be accelerated. On the other hand, a thinning population is exerting an evil influence upon the provinces and local public bodies are groping for regional activation and urbanization. The reason for the outgrowth of such a tendency is attributed to attractions to cities and the urban economic, vital and social fascinations in turn stimulate the gravitation and the accumulation. The gravitation of population and the accumulation of information as aforementioned may be considered the sources of confusion and the grdual worsening of living environment.

It thus acquires interest from how the population, economy and enironment in which we live change 10 and 20 years later. Moreover, the estimation of the growth or degeneration of cities will be very helpful for the prefectural or municipal authorities in planning or correcting their policies,maintaining and increasing services intended for the inhabitants. However, complications exist in the relationship among the changing local environment,

population, finance, public sector, etc. accompanied by the vicissitudes of economy. The purpose of this study is to examine how our living environment and national resources change by relating factors in regional development with changes in population components and industrial structure, land and housing improvements, and the health of public finance to thereby build up a regional development model and make clear the influence of changes in population and the trend of economy. The area taken up as a subject for discussing a regional development model is Chiba Prefecture, one of those constituting the Tokyo Metropolitan Region.

PREPARATION OF REGIONAL DEVELOPMENT MODEL

There have been made public a number of urban models such as Hyogo (Matsuzaki 1976), Saitama (Kaneko 1976), Hiroshima (Kitajima 1976), Metropolitan (Simada 1981), and Chiba Prefectural (Japan Long-Term Credt Bank 1978) models. Among those models, the Chiba Prefectural model was prepared by the Chiba Prefectural Government on the ground of the determination of its administrative policy. The model we are trying to build up is designed to examine how the living of inhabitants in the prefecture changes with the development of the region.

As the basic factors in an urban model, there are cited workers, houses, industries and land (muroi 1976) and we assumed that the relationship among the various factors in regional development was formed with a feedbach loop shown in Figure 1. From this standpoint, we deemed in our model (hereinafter called the 'Chiba model') that population, industry, land and dwelling and finance were principal modules. we further added education and medical facility to the principal modules to obtain indexes to weighing not only factors affecting the principal modules but aiso the quality of living of prefectural citizens and formed a regional development model. Figure 2 shows the relationship among them.

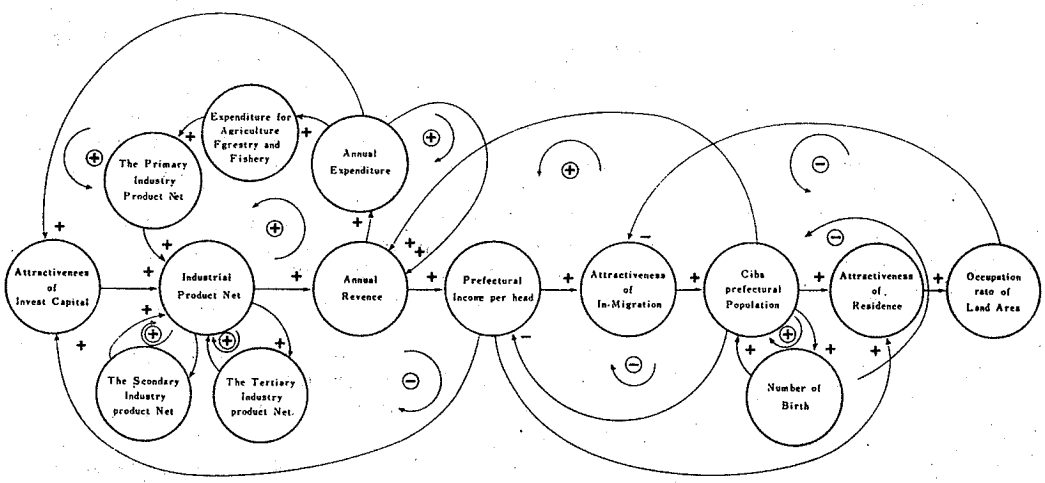

Figure 1 Feedback structure of the development model

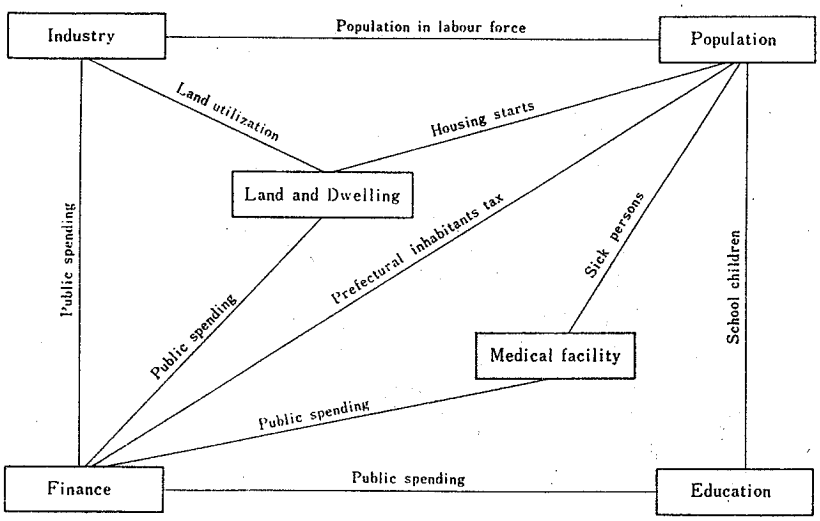

Figure 2 Relation among sectors

For developing the Chibamodel, we have taken the following into cosideration:
(1) Since Chiba undergoes the profound influence of Tokyo from the geographical point of view, the influence of the activities in the latter is introduced in the model;
(2) With the existing social structure and system in mind, the model is formed so that no internal change in the model is caused to change the construction of the model;
(3) We judged that, since the end of high economic growth in 1965, the macro-socioeconomic structure had remained basically unchanged and, with this period as aperiod of model observation, collected data; and
(4) Let us make clear the system configuration of each of the modules: population, industry, land and dwelling, finance, education and medical facility sector.

OUTLINE OF CHIBA PREFECTURE

Chiba Pref. taken up for discussion is located at the east end of central Japan and it faces the Pacific on the east and south, forming part of the Tokyo Bay on the west, abutting on Tokyo Metropolis and Saitama Pref. on the northwest and communicating with Ibaragi Pref. on the north. (see Figure 3) In the central mountainous region, the land is highly placed and a stretch of 200 - 300 m high lie on the south of the Peninsula. The remaining region is substantially flat with the rich soil. The coast is ruggedly indented and abundant in picturesque scenery with a number of harbors and fishing banks. The climate is mild.

Due to the topographic features and climate, Chiba Pref. has flourishing agriculture, forestry and fishing industries and occupies a very high place on the domestic market as regards the

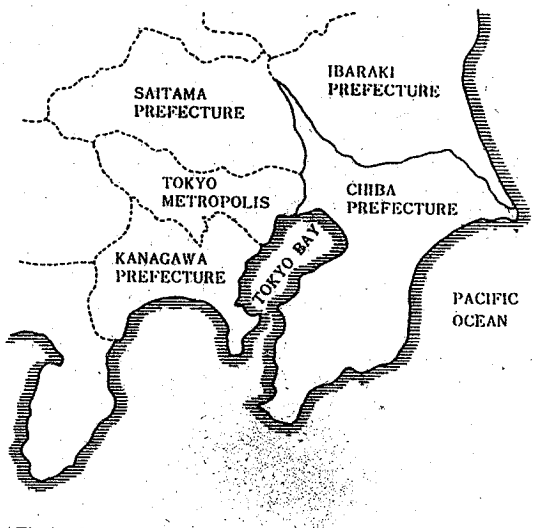

Figure 3 Chiba Prefecture and surrounding Prefectures
The Tokyo Metropolitan Region including the metropolis of Tokyo and three adjoining prefectures, Chiba, Saitama and Kanagawa.

production derived from the industries. Chiba Pref. which has been industrialized rapidly since 1961 affords to create the manufacturing district stretching between Tokyo and Chiba, where over 60,000 industrial works are being operated. Not only inland industries since 1968 but also high technologies recently have been introduced into this prefecture. The quik industrialization like this has caused Chiba Pref. to gain population further and accordingly create Narita, Kaihin and Chiba new towns as satellite ones of the Tokyo Metropolitan Region.

Chiba Pref. thus increasingly becomes important in the Tokyo Metropolitan Region as the result of improvement in its economic and traffic infrastructure. However, changes resulting from the rapid industrialization have made the living environment of the inhabitants sharply change and posed serious problems awaiting solution as those inherent in Chiba Pref., including regional differences attributable to depopulation and overpopulation because of urbanization and the poor accumulation of high-added-value type industries. This is one of the reasons why we have taken up Chiba Pref. as a model for regional development. Table 1 illustrates the position of Chiba Pref. in the whole country.

The present situation of Chiba Pref. by reference to each module adopted in the Chiba model will be summed up as follows:

Population

The population continuously increased from 4,150,000 in 1975 to 4,740,000 in 1980 and then 5,148,000 in 1985, the population increasing rate (1985/1980) as high as 8.5% ranking first throughout the country. however, the growth rate was well lower than 14.2% during a period from 1975 through 1980. The reason for this is attributed to showdown in the growth of social movement under the influence of business conditions. (See Figure 4) Notwithstanding, a social increase in population was

Table 1 The Position of Chiba Prefecture

Item	Year	Unit	Chiba Prefecture	Japan	Precedence
Area	1984	km^2	5,146	377,780	27
Population	1985,10	10^3person	5,148	121,047	8
Population density	1985	person/km^2	990	318	6
Number of householdo	1985,10	10^3householdo	1,572	38,113	8
Prefectural income	1982	billon-yen	8,759	222,096	8
Prefectural income per head	1982	10^3yen	1,781	1,871	10
Number of industry employees	1982,10	10^3person	2,319	57,888	9
Agricultual population	1985,2	10^2person	613	19,839	8
Agricultual product net	1984	billon-yen	483	11,654	3
Number of enterprises	1981	10^3enterpris	185	6,488	10
Housing starts	1984	10^3house	54	1,187	8
Commercial selling sum (retail trade)	1981-82	billon-yen	3,424	94,175	9
Number of manufacturing enterprises	1984	enterpris	9,395	429,042	14
Shipment sum of product goods	1984	billon-yen	10,654	253,017	8
Number of hospitals	1984	hospital	302	9,580	9
Doctors/10^4person	1982	person	9.4	14.3	45
Number of registered car	1985	10^3car	1,700	46,363	10

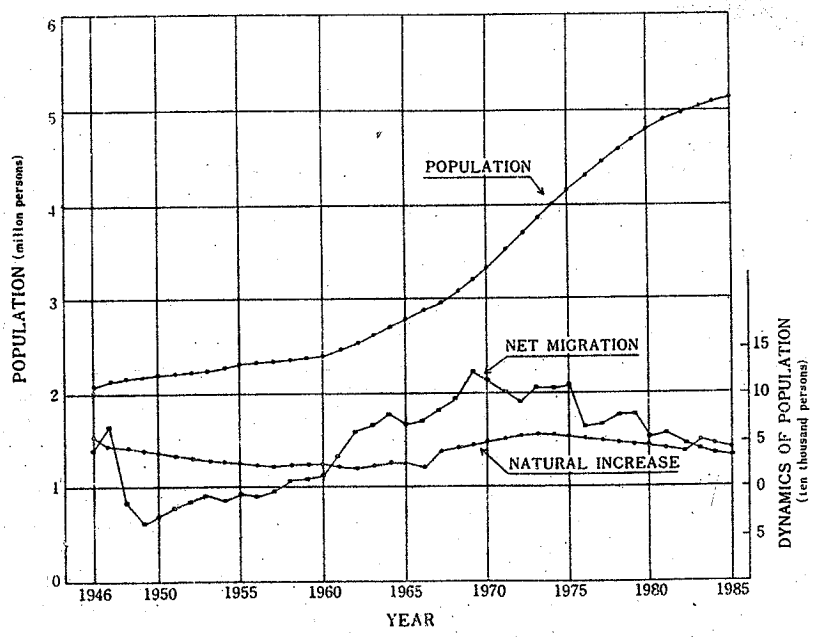

Figure 4 Transition of Chiba Prefecture population

beginning to appear in the western part of the prefecture as the environs of Tokyo, with the gravitation of population to Tokyo. Moreover, the birth and mortality rates tended to decrease and, as far as the age structure was concerned,a population of those 65 years or older was seen to increase noticeably.

Industry

Historically, the industrial structre has changed as follows: the weight of the primary industry lowered first because of the rapid development of the domestic industry, particularly the heavy chemical industry, and that of the secondary industry increased instead. However, the importance of the secondary industry relatively decreased with the oil crisis as a turning point, while that of the tertiary industry increased. The component ratio of the gross production in Chiba Pref. by industries has also changed as follow: the weight of the primary industry decreased from 6.2% in 1977 to 3.8% in 1983 and that of the secondary industry form 42.6% to 38.6%, while that of the tertiary industry increased form 51.4% to 56.7%. The 20.5% growth of the services sector within the tertiary industry was particularly noticeable. The industrial works classified into 0.3% primary, 18.4% secondary and 81.3% tertiary industries,with the workers into 0.4%, 31.9% and 67.7%, respectively.

a) Primary industry
The number of farmers and cultivated acreage were decreasing while urbanization and industrialization were under way. Notwithstanding, the gross agricultural production ranked 3rd across the nation and Chiba Pref. was performing a role of agricultural prefecture. In the field of fishing industry, the number of fishing operators, which was on the decrease with the reclamation of the water front of the Tokyo Bay and the change of the industrial structure, is stable for these 4 - 5 years.

b) Secondary industry
The industrial structure in Chiba Pref. has entirely been changed by the construction of the coastal industrial zone between Tokyo and Chiba through the reclamation of the foreshore since 1955. The industrial structure in Chiba Pref. is characterized in that the raw material industry dealing in oil and steel is still a mainstay. As a supplier of basic materials and energies, Chiba Pref. was supplying 16% oil, 10.4% steel and 8.7% electric power of the country.

c) Tertiary industry
The growth of the service sector in the tertiary industry is conspicuous and, above all, the information-related service sector showed a higher growth than that in 1975, with 256 and 2,819 in the number of businesses and workers or 80.3% and 90.7% up, respectively.
With respect to sightseeing and leisure, the number of sightseers including those living in Chiba Pref. and visitors increased from 63,000,000 in1979 to 90,491,000 in 1984, up 43.6%. However, most of them are sea bathers, golfers, amusement park visitors and those visiting shrines on New Year's Day and, because it is possible to make a day's trip from Tokyo, the number of day trippers is up over 85% for these several years. In consequence, the amount of consumption per head was as small as¥2,858(1984).

Land,dwelling

Land utilization is classified into the following categories: agriculture 30%; forestry 34%; and urbanization 36%. The farmland decreased from 1972 to 1979 by 11.8%, which was far greater than 5.8% in the whole natoin. That decrease in farmland and forestry conservancy started in1965 but the decreasing ratio has been kept stable since 1975. Particularly during a period of 10 years from 1970 to 1980,26,000 ha of the farmland and about 6,500 ha of forests were utilized for other purposes. Land covering an area of about 6,400 ha ws newly created by reclamation during the period.
The price of land for housing lots had sharply risen sine 1970 owing to demand for housing lots, the activation of economic activities and credit relaxation but dropped by even 10.8% since 1974 under the influence of the oil crisis in 1973. Then the price of land kept leveling-off and again rose up to 7.4% in 1979 and is still rising thenceafter. The reason for the price rise is considered attributable to the fact that Chiba Pref. has become a satellite area of Tokyo and that the transportation and infrastructure and living environment have improved.

Finance

Economy which had undergone growth due to rapid industrialization since the latter half of the 1970s began to edge off and it was strongly desired to take stimulative measures to counter the dullness of activity in private investment in facilities by means of treasury investment and loan. The PREFECTURE's financial situation was not exception and its budget scale corresponding to a rise in consumer price expanded. The budget scale in 1982 was up 13.5 times that in 1965. Even the annual revenue and expenditure were up 8.8% and 8.5% over the year, respectively.

Education

With an increase in population, the number of pupils in primary schools, that of students in middle schools and high schools increased by a large margin to 72.8%,64.6% and 71.3% in 1985 from the percentage in 1976. However, the increasing rate over the year for the primary schools was -3.5% and those for the middle and high schools were 4.0% and 9.7% because of recent reduction in the birth rate. The number of pupils is seen to decease. The educational expenses relying on the defraymeny out of the Treasury was up 21.2% in 1984 as compared with that in 1979. The increasing rate is low for these several years.

On the other hand, 94.7% of those graduated form middle schools entered schools of higher grade in 1984. As for those graduated from high schools entered schools of higher grade 28.5% and found employment 33.2% and entered educational training institutes 33.3%. The ratio of students who are going on to schools of higher grade ws lower than the national average.

Medical facility

The number of medical facilities in 1984 was 4,461, 54.8% of them

being general clinics. The number of beds was 49,127, 59.1% of them being intended as those for general use. Moreover, the number of general clinics, general beds and doctors (4,959 in number) increased by 9.9%,5.7% and 24.3% as compared with the percentage in 1979, respectively. The munber of doctors every 10,000 inhabitants is 9.78, which was lower than the national average of 15.06.

Transpotation

The accumulated actual length of road in Chiba Pref. is 37,712 km with the pavement ratio being 58.9%. With respect to the national railroads, the number of passengers was 557,343,000 in 1984 and those who utilized the national railroads accounted for 92.8% of the total. The increasing rate was 6.6% up the result in 1980 for those utilized the national railroads and remained at an increase of 2.4% over the year. The numberof tons of railway goods sent tends decrease recently; namely, the actual result,with 2,246,000 tons in1984,largely reduced by 85.7% compared with that in1980. The decreased portion was replaced with what was by automobiles. Moreove,the amount of goods transported by automobiles was 81 times greater than that of railway goods.
A New Tokyo International Airport was opened in Narita, 1978 and the number of passengers amounted to 11 millon, while the goods handled to 710,000 tons (1984), these actual results being comparable in scale with those worldwide. The amount of goods handled in principal harbors of Chiba Pref. reached 146,000 tons (1985).

CONSTRUCTION OF THE MODEL

As shown in Figure 2, six sectors of population,industry, land and dwelling, finance, eduaction and medical facility consitute a regional development model.
As a descriptive language, DYNAMO was used. The DYNAMO has a slightly different specification depending on the computer manufacturer offering the language. In this model,DYNAMO F-6 NEC was used for description. This processor is convenient for when repetitive description exists because not only an arrangement but also a DO loop are usable. Inaddition, FORTRAN may be used to prepare user macro-functions to analyze particular factors.

Population sector

The population was formed as follows: Recently an older population is on the increase while a youngerpopulation decreases and the whole population was divided into the following eight part so that the population comonent ratio can be made clear.

(1) 0-14 years population	(5) 45-54 years population
(2) 15-24	(6) 55-64
(3) 25-34	(7) 65-74
(4) 25-34	(8) 75 and over

The population in each part is obtained as follows:

$$P(i).K=P.J+(DT)(TR(i-1).JK-TR(i).JK-DR(i).JK+IMR(i).JK-OMR(i).JK) \quad (1)$$

P(i) : population (in number) in Pi part
D(i) : population in mortality in Pi part Pi (in number)
TR(i-1): number of persons moved from i-1 part to i part (in number)
TR(i) : number of persons moved form i part to i+1 part (in number)
IMR(i) : number of persons in-migration
OMR(i) : number of persons out-migration

However, P(1) population represents the number of newly borned (BR) in the case of TR(i-1). BR was obtained by multiplying the 15-44 years old population (sum of P2,P3 and 80% of P4) and the birth rate (TBRR).

The total population (TP) is obtainable as the sum of part population. The number of households (TH) was obtained from the household ratio (THM). The P1 part population and P2 - P6 part population were obtained as those intended for the educational paet and working population, respectively. TP and TH are connected to industry and medical facility. Moreover, the population density was obtained from the percentage of those 65 years or older as indexes to the old-age society and indicative of the percentage of an older population (AS) and increase or decrease of population. Figure 5 shows a population sector flow diagram.

Industry sector

The model of the industry sector was set on the basis of primary, secondary and tertiary industries. Since the industrial structure was seen to be changeable, we built up the model centering around the agricultural and fishing industries for the primary industry, the manufacturing industry for the secondary industry and the

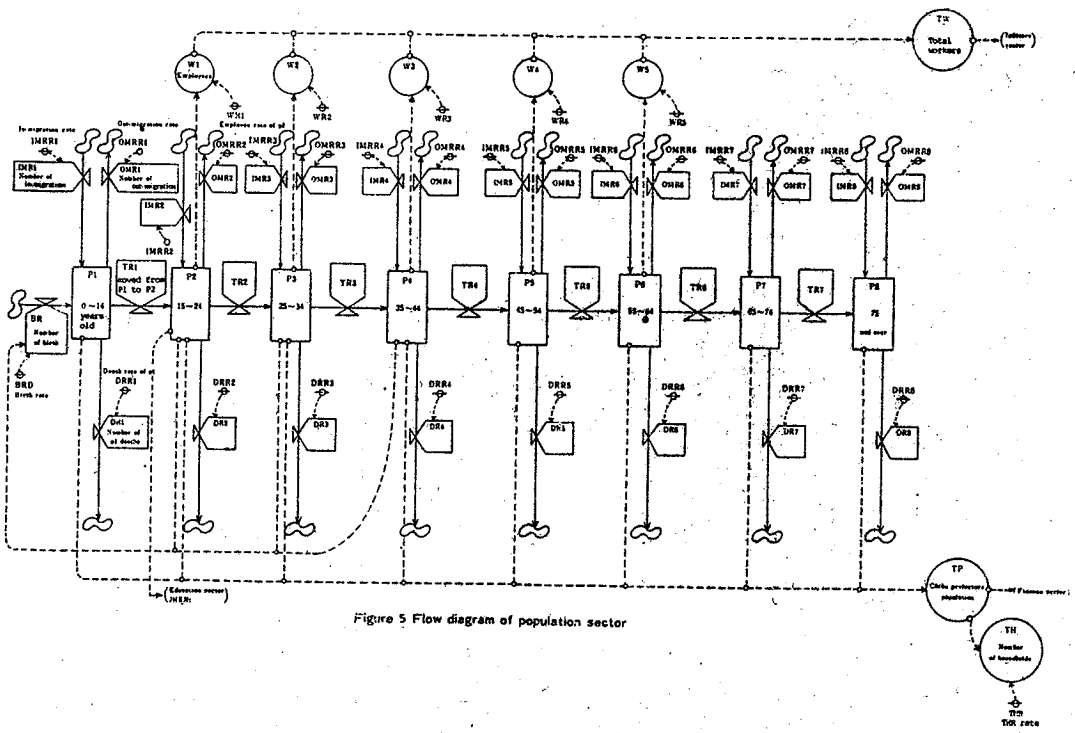

Figure 5 Flow diagram of population sector

retail, sightseeing and transportation industries for the tertiary industry.

(a) Primary industry
in agriculture, the number of farmes and agricultural businesses was obtained to examine the gross agricultural production with agricultural stok as a level equation. The same procedure was applied to the fishing industry. Moreover, since the primary industry. Moreover, since the primary industry relies on the public finance to a large extent, attractions to the business in the primary industry was examined in connection with the fascination for the agriculture, forestry and fishing defrayment out of the Treasury. Based on the above understanding, net production and the number of employees and businesses in the primary industry was obtained. (See Figure 6a)

(b) Secondary industry
In preparing the model, the manufacturing industry was divided in six categories: foodstuffs, chemistry.oil.coal.rubber; steel. metal.nonmetal; general transportation.precision instruments; electric equipment; and others, so that changes relative to each industry might be made clear. It was so arranged that the number of enterprises might be obtained from the percentage of the enterprises by industries with the number of manufacturing enterprises as a level equation. In so doing, the number of employees and the production of goods shipped on an industry basis were obtained. (See Figure 6b)
For instance, the number of enterprises MANU(i) on an industry basis is as follows;

$$MANU(i).K=MANU(i).J*MANUR(i).K \qquad (2)$$

MANU(i) : i number of enterprises by industries
TMANU : number of manufacturing enterprises
MANUR(i) : number of enterprises by industries

The net production in the secondary industry was thus obtained to provide production indexes. The results obtained from the manufacturing industry was expanded and applied to the secondary industry.

(c) Tertiary industry
In the field of the retail industry, the selling floor area, the number of employees and the sales of goods were obtained. In this case, it was so arranged that rice prices reflected on the results. The estimation of the rice price index was made using the user macro-function. As for the sightseeing industry, the model was formed in considerration of facilities capable of offering services, consumption for sightseeing and the number of employees. The amount of cargoes handled is indicative of the situation of transportation; cargoes are mostly transported by trucks and number of them is problematical. Accordingly, the number of trucks in possession was expressed as an index to the examination of the above situation. The number of enterprises, taxes and passenger cars was considered stimuli to the increase of the number of tourists. The results obtaines were expanded over the tertiary industry to obtain the net production.(See Figure 6c and 6d)
The industrial trend was examined by obtaining the net production, the number of employees and enterprises in each industry.

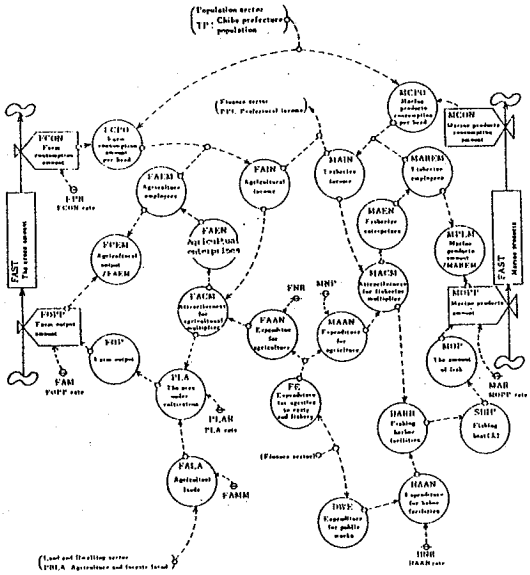

Figure 6a Flow diagram of primary industry subsector in the Industry sector

MA1: Food manufacturing
MA2: Manufacture of chemical, petroleum coal and rubber products
MA3: Iron and steel, manufacture of non-ferrous metals and fabricated metal products
MA4: Manufacture of general machinery, transportaion equipment, precision instruments and machinery
MA5: Manufacture of electrical machinery, equipment and supplies
MA6: Other manufacturing industris

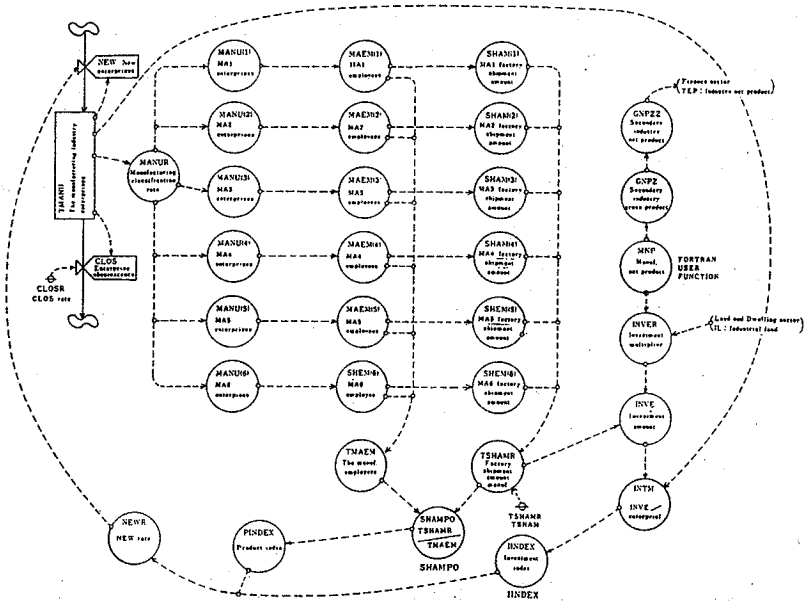

Figure 6b Flow diagram of tertiary (sightseeing industry, transpotation) subsector in the

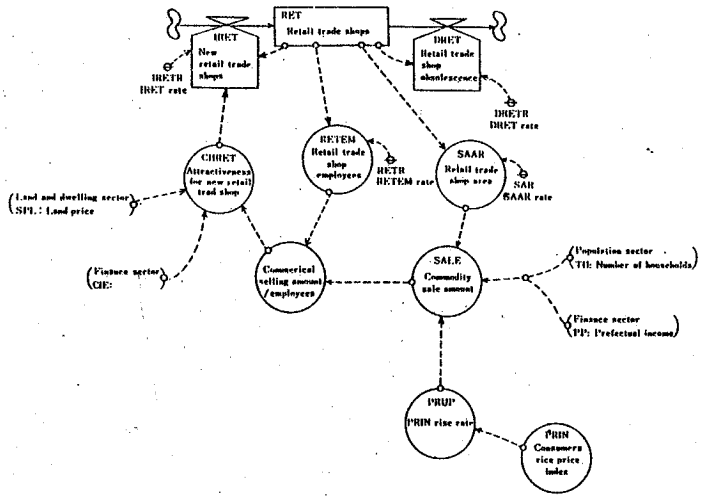

Figure 6c Flow diagram of tertiary industry (retail trade) subsector in the Industry sector

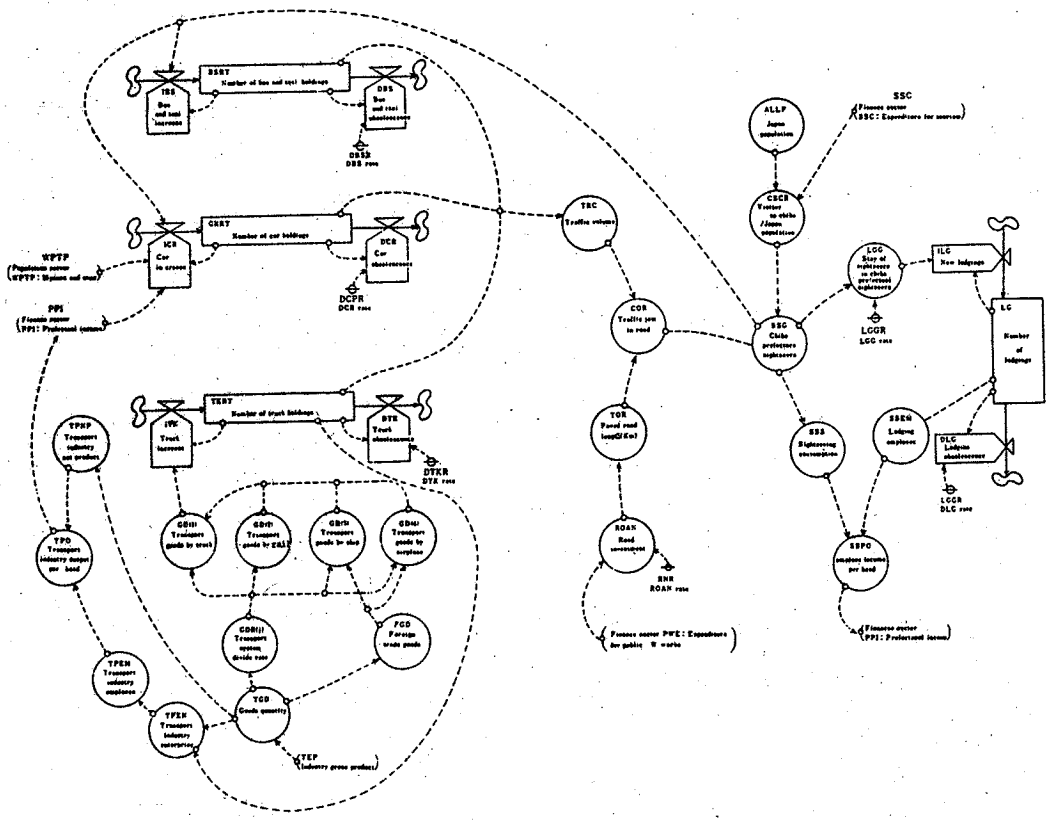

Figure 6d Flow diagram of tertiary industry (sightseeing industry and transpotation) subsector in the Industry sector

Land and Dwelling sector

The land and dwelling sector comprises the land and dwelling sectors.
In the land sector, land for agriculture (PBLA),industry (IL) and dwelling (RL) were employed at three levels to express the conditions under which it was utilized in order to structurally familize ourselves with demand for and supply of land. Figure 7 shoes a flow diagram. As PBLA tends to dwindle, it may be given as follows:

$$PBLA.K=PBLA.J+(DT)(-DL.JK) \quad (3)$$

PBLA : land for agriculture (m^2)
DL : converted area (m^2)
In this case, DL can be obtained by multiplying PBLA and conversion rate (AR). AR is given as a table function.
IL can be obtained as follows:

$$IL.K=IL.J+(DT)(EBLA.JK-EWRL.JK) \quad (4)$$

IL : land for industry (m^2)
EBLA : area for construction of enterprises (m^2)
EWRL : area dispensed with for enterprises (m^2)
EBLA is obtainable from the total number of enterprises (EBR) and premises area (ELP) per enterprises. EBR is the sum of the number of enterprises in the primary and tertiary industries. EWRL can also be obtained from EWR and ELP.
AS an index to the land utilization, an exclusive land possesion rato (LPC) is obtained to calulate the ratio of the sum of IL and RL to the total area (TCL) in Chiba Pref.

Regarding the dwelling sector, the number of general living houses was used to make a model. The number of residences is as follows:

$$RL.K=RL.J+(DT)(RB.JK-RD.JK) \quad (5)$$

R : number of residences
RB : number of residences being constructed
RD : number of residences being scrapped
RB means the number (ER) of residences to be supplied and that (RO) of new ones deemd desirable. RS is also obtained by dividing a residences area (RL) by the floor area (RLPP) per residence and multiplying it by the new residence supplying rate (NRCC). NRCC is expressed by the table function by means of attractions to residences (PA). PA is determined by exclusive land possession (LPZ), land price (PAR) huosing expense loading (PSBR) multipliers. On the other hand, RO is obtained by dividing the total populatipon (TP) by the average number (RP) of people per household and multiplying it by a desirable new house building rate (NRC).
Attractions to housees represent the degree to which houses in Chiba are more attractive than those in Tokyo. Provided the houses in Chiba are more attractive than those in Tokyo (e.q., less expensive,wide,etc.), Chiba Pref. will gain population.

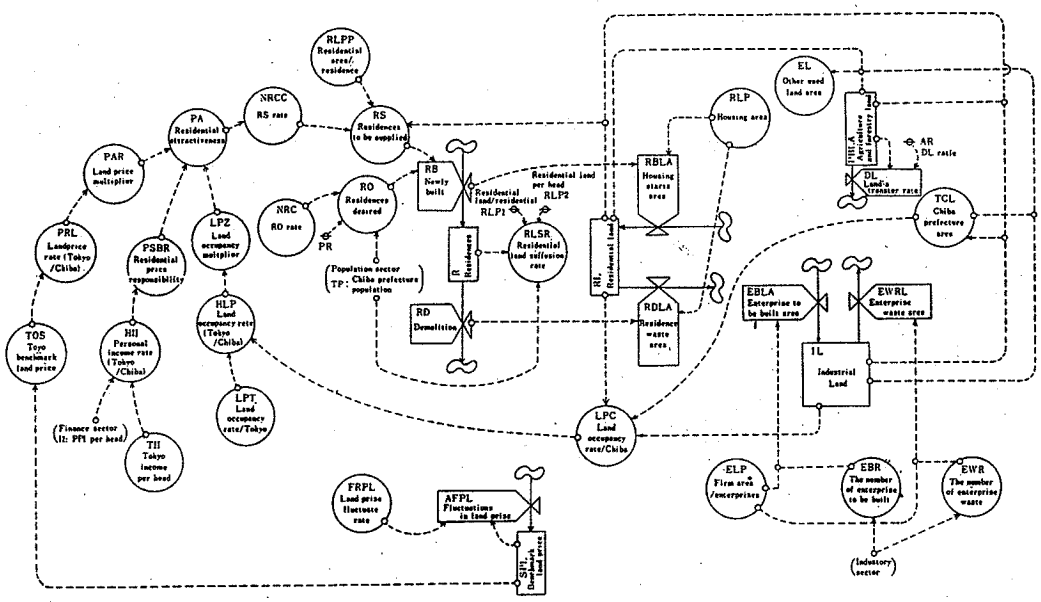

Figure 7 Flow diagram of Land and Dwelling setor

Finance sector

Ordinary, general and special accountings are employed in the prefectural finance and this finance sector is built up with the general accounting shown in a flow diagram of Figure 8.
The revenue was considerd obtainable from the prefectural bonds, prefectural tax, local allocation tax grant, defrayment out of the Treaury,balance at the beginning of a period and other revenues, while the expenditure was involed in the livelihood, commercial and industrial, agricultural, foresty and fishing, educational, civel engineering and other expenses (e.q., congress, general affair and disaster relief expenses). The prefectural tax flowing in Chiba Pref. is as follows:

$$PT.KL=PPT.K+ENT.K+OPT.K \qquad (6)$$

RT : prefectural tax (yen in thousand)
PPT : prefectural inhabitant tax (yen in thousand)
ENT : business tax (yen in thousand)
OPT : other prefectural taxes (yen in thousand)

PPT is obtained by multiplying the prefectural tax (CAPPT) per head and the total population (TP); ENT by multiplying the total industrial net production (TEP) and amultiplier; and OPT by multiplying the prefectural income (PPI) and a multiplier.
The expenditure expenses by items were obtained by multiplying the total revenue and expenditure expenses each obtained from the actual results.
The indexes taken up in this paper were used to define the growth of the prefectural inhabitant tax, the percentage of the self-resticted source of revenue and the prefectural tax per head of the total income perhead in Chiba Pref. to prove the trend of the prefectural tax.

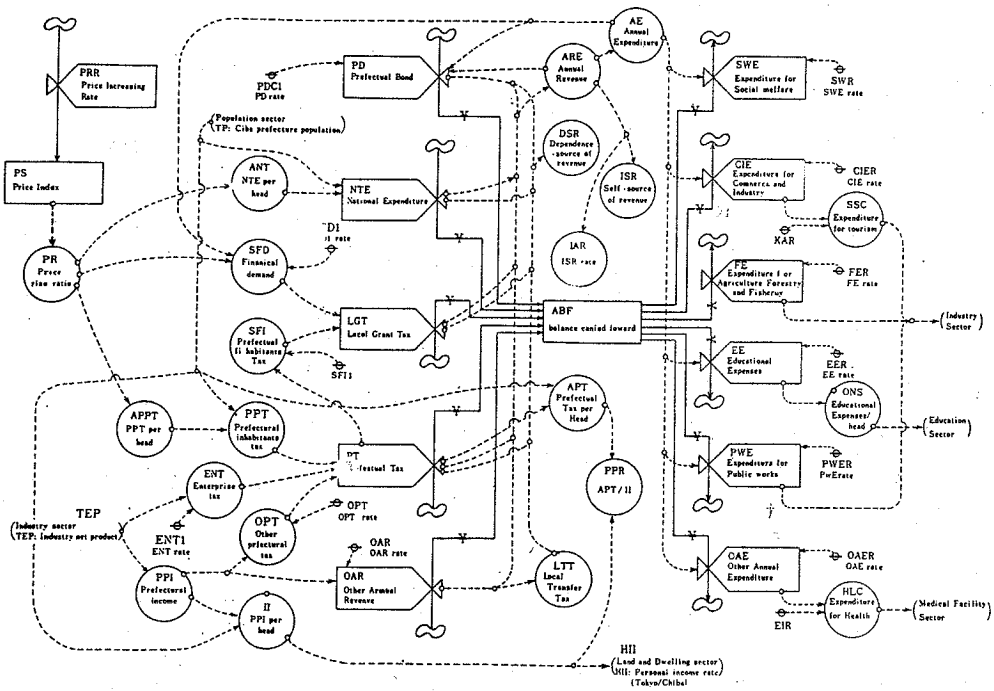

Figure 8 Flow diagram of Finance sector

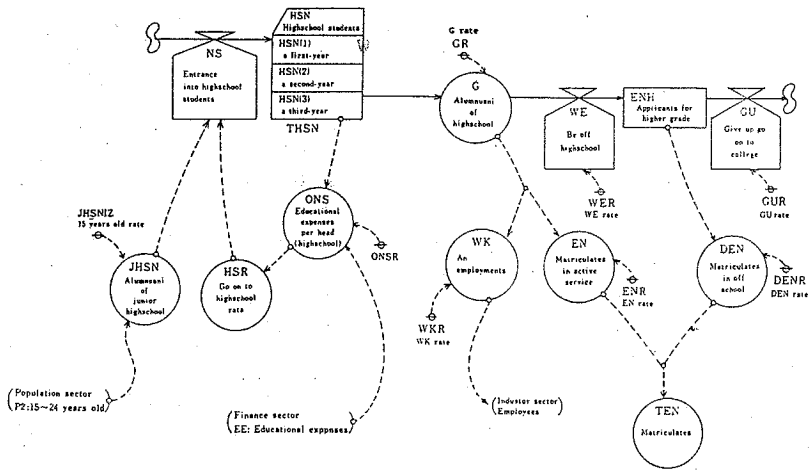

Figure 9 Flow diagram of Education sector

Education sector

In Japan, all children are supposed to receive compulsory education up to the level of primary and middle school education. In the education sector, the ratio of students who go on to schools of higher grade from high schools was mainly examined with the fact in mind that the aforementioned ratio from high schools to colleges and universities had been lower than the national average.
Those (JHSN) graduated from middle schools enter high schools and graduate therefrom three years later, a certain number of them wishing to enter colleges and universities. However, some of them (WE) would fail to enter a college and wait for another chance to be enrolled and actually enrolled more than one year later. The ratio of students who go on to schools of higher grade was obtained by the sum of those who passed college entrance examinations directely upon graduation and waited for another chance (EN(and (DEN). The number of high school students (THSN) was computed using the linear box-train-car. In addition, educational expenses per head was examined.

$$HSN(1).K=HSN(1).J+(DT)(NS.JK) \quad (7)$$

$$ENH.K=ENH.J+(DT)(WE.JK*DEN.J-GU.JK) \quad (8)$$

HSN(1) : number of high school students (thousand) at first grade
NS : those newly entered (in thousand)
WE : those actually enrolled but changed into ones awaiting for another chance
DEN : number of those wishing to go to schools of higher grade among those awaiting for another chance
GU : number of those given going to schools of higher grade
Figure 9 shoes an education sector flow diagram.

Medical facility

In consideration of public sector, the regional environmental condition, the number of public facilities and the social welfare system should be considered. in the case of Chiba Pref. the model was built up with an emphasis placed upon the medical care, especially on the number of doctors. Although the medical model should have been viewed as the health dynamics, it has been simplified in the following manner. The number of doctors, which was closely related to that of those medical school graduates, was judged whether or not it was suitable depending on the number of impatents and the increase in the number of beds. As an index, the number of doctors per population of ten-thousand was taken up. Figure 10 shows a medical care flow diagram.

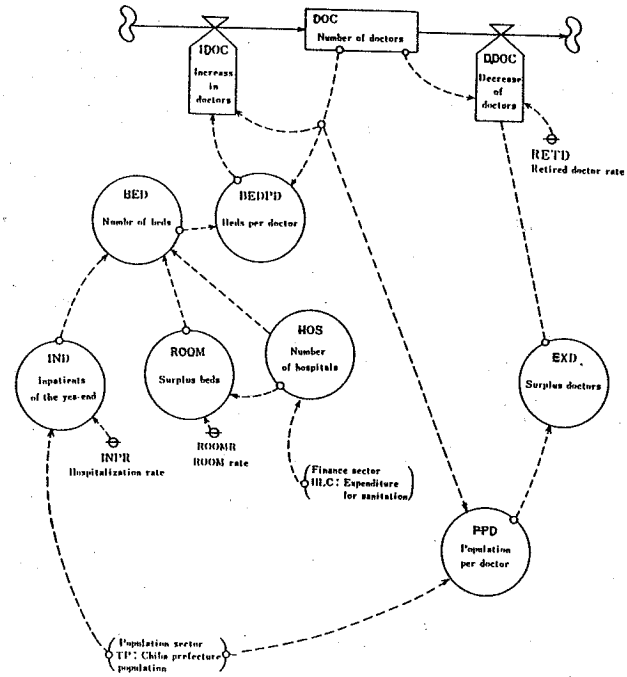

Figure 10 Flow diagram of Medcal facility sector

SIMULATION CONDITION AND ADPTABILITY OF MODEL

The simulation was conducted under the following conditions:
(1) Condisideration was give to a period of 35 years from 1965 to 2000.
(2) Calculation period was set annually.
(3) Printing and plotting were also set annualy.
(4) The initial value of the model was set to the actual value in 1965.

The adequacy of the model was hard to judge. Table 2 shows the relation of the actual value from 1965 up to the present to the calculated value and they seem to be in accordance with each other. So that the model thus built by us is considered satisfactory explanatory of the present situation in Chiba Pref.

SIMULATION EFFECT

The calculated results up to 2000 were shown in Tables 3,4,5,6. and Figure 11.

The population of Chiba Pref. is expected to increase up to 7,270,000 in 2000, with an increase in a population of those 65 years old. In the industry sector, because of a sharp increase in the tertiary industry, the living of the inhabitants will become more convenient. Land for industrialization and housing was seen to increase, with improvement in this quarlity but the quantitative deficiency in the number of living houses should be taken

into consideration. In addittion,the financial source tendes to rely on the national treasury. With the increase of the income, the percentage of tax born is expected to increase,whereby the living circumstantces of the inhabitant may be improved further but their tax local will increasingly be raised.

Table 2 Actual value and computational value

	Chiba prefecture population (10^3 person)		Industry net product (billon-yen)		Number of residences (10^3residences)		Annual renue (billon-yen)	
year	actual	computational	actual	computational	actual	computational	actual	computational
1965	2,702	2,702	562	415	618	618	57	55
1970	3,367	3,334	1,589	1,589	810	813	148	162
1975	4,149	4,086	3,853	3,852		1,182	345	400
1980	4,735	4,701	6,021	6,023		1,513	683	656
1985	5,148	5,184		7,943	(83 1,588	1,677)		960

Table 3 The computative numbers of the population sector

year	total population	0 - 14 years old	15 - 64 years old	65 and over	number of household	population density	number of in-migration	number of out-migration
1980	4,700	1,079	3,255	366	1,410	915	234	168
1985	5,184	1,101	3,621	462	1,581	1,007	204	159
1990	5,567	1,104	3,892	571	1,698	1,081	212	165
1995	5,932	1,115	4,126	691	1,809	1,152	219	170
2000	6,274	1,131	4,324	819	1,914	1,218	225	175

UNIT ; population 10^3persons : household 10^3households
population density persons/km^2

Table 4 The computative munbers of the Industry

year	Amount of product net (billon-yen) primary	secondary	tertiary	Number of enterprises (10^2 enterprises) primary	secondary	tertiary
1980	256	2,456	3,311	6.4	325	1,442
1985	270	2,809	4,864	5.6	338	1,530
1990	310	2,924	5,629	6.1	355	1,624
1995	348	3,042	6,070	6.6	374	1,170
2000	387	3,166	6,594	7.5	392	1,822

year	Number of employees (10^3 persons) primary	secondary	tertiary	Amount of transport goods (millon-tons)
1980	6.2	469	958	342
1985	5.4	488	1,106	370
1990	5.9	513	1,167	479
1995	6.5	539	1,228	586
2000	7.3	567	1,307	696

Table 5 The computative numbers of the finance sector

year	Annual revenue (billion-yen) current prices	Annual revenue (billion-yen) constant prices	annual expediture (billion-yen) current prices	annual expediture (billion-yen) constant prices	Self-source revenue (%)	Prefectuarl(Tax /Income) (%)	Educational expenses per head (highschool)
1980	651	216	646	213	45.6	3.4	335(10^3)
1985	960	265	944	261	48.0	3.7	364
1990	1,337	327	1,315	322	47.5	4.1	456
1995	1,819	405	1,740	399	46.2	4.5	618
2000	2,450	505	2,411	497	43.7	4.9	827

Table 6 The computative numbers of the Land and Dwelling

year	Industrial land (km^2)	Residential land (km^2)	Residences (10^3houses)	Land occupancy rate(%)
1980	65.5	294.5	1,513	7.0
1985	66.9	331.5	1,782	7.7
1990	68.0	378.8	2,047	8.7
1995	69.3	429.6	2,327	9.7
2000	70.8	483.3	2,624	10.8

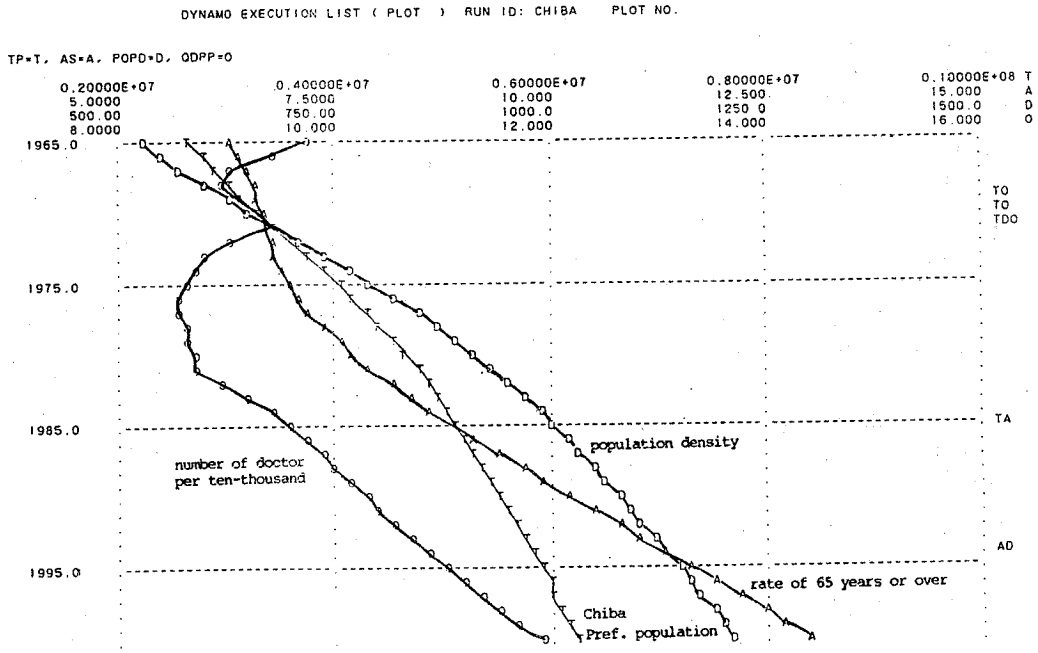

Figure 11 Population

LASTLY

Based on the simulation, the following can be estimated. Chiba Pref. expects growth at a stable rate in the economic field. By this is meant that Chiba Pref. undergoes a qualitative but not quantitative growth with the stability of commodity price. With the expansion of Tkoyo Metropolitan Region, the economic growth will continue at an annual rate of 6%.The age component will show an increasing percentage of the old like in Europe but the livilihood in Chiba Pref. will totally improved in quality. In the preparation of the system, those required as additional factors and for complicated analysis have been so arranged that it can be related to data and analysis in the place desired at any time with the functions.

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