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DESIGN AND APPLICATION OF EMULATION MODEL IN BIG CITY'S ECONOMIC STRUCTURE

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Abstract

Based on the participation in the research and design of the economic structure--emulation model of Urumqi City, this paper was written. Regarding the general problems we met in the research and design and also focuing on the three phrases; Economic theory, System dynamic Method and Application results in practice. this paper discussed the idea and principle. Method and system about the design process of the model was also presented in this paper.

The author thinks that the design of economic structure emulation model should follow six main thoughts and principles.Its model system should includ six main parameter model designs. And the close combination of economic theory and system dynamic method with the application result in practice should be taken as first consideration.The ability of using Dynamic method to solve the economic structure problems can therefore be enhanced.

I

A big city, the centre of various economic activities is a development from commodity economy. Adjustment to a big city's production structure play an important role in the aim of regulating economic structure and geting an economic efficiency.

By regulating economic structure we mean the adjustment of relationships among factors which composed the national economy.As we know,in a synthetical study of national economic structure, we can use different indicators and methods to do calassification research. This article focuses on how design system dynamic model in researching big city's economic structure.

II

The key point in applying system dynamic model to economic structure is its model design and model built. Our procedure will be as follows. Section One discusses the design ideas of Modelling.

1. Design Ideas Of Emulate Model In Big City's Economic Structure

As we know,the economic effects of social production and reproduction are responses to the whole national economy's synthetic operation. From the view of systematic theory, economic effects are not only affected by national economic structure but also operating mechinics. The laters are inderect. For

a emulate model design of big city's economy our emphasis is on its structure affectors. We developed emulated model of big city's economic structure from following six main design ideas.

A. Planning and Proportional to Operate Social Production.

Marx's reproduction formula is not only reflects the capitalism's production character but also contains some basic reproduction theories which,suitable for any societies,especially for the socialist society.Although today's world ecnomic enviroment has a lot of difference from that of Marx's times, proportional production which is the condition of reproduction still work for any society in our times.

Practice in many countries and region has proved and will continue to prove that if we take the marx's reproduction low as basement and keep the ecnomic development in proportional we can get ecnomic stable increase in economy. Otherwise there will be economic larging and degerating. this is an objective law that no human's will can chang it.

B. Two Design Ideas Combination of EMIBCES and Economic Development Strategy

Economic strategy is a researching of a whole situation operated in national economy. The characters of general system are mainly determined by the system structure. So economic structure is the focus of development strategy researching which is also the guidline and bccsis of economic structure. Different economic developmental strategy needs keeping with different economic structure. Adjustment to whole strategy will certainly require adjustment of the economic structure. Once the strategy is fixed, the economic structure must be adjusted to fit the demanding of strategy.

C. Big City's Economic Structure Emulation Model Design Goal -- To maximize Social Economic Efficience

To some extent, economic constructure is to set up an advanced and reasonable national economic structure which will make the social reproduction economic effecet continue growing. If economic effect is not good enought to meet national ecnomic aggragation and social common demand, the society's exponded reproduction will not be possible.And there would be national defecit and defficient of national productive capacity.It must be pointed out the BCESEMD'S focus is on maximasum econnimc effect which is also the key problem of Chinese economy.

D. The Design of EMIBCES Should Reflects Chinese Big City's Distinguishable Feature Strip-chunk Economic Pattern

By strip--chunk econonic pattern of big city in China we mean that there are three kinds of enterprise in one city.They are central planning enterprise, local planning enterprise and city's enterprise.In our analysis,we have to take all these enterprises as a whole to conside inside relations of their economic activities, but we can't unite them in planning because they have different minister sector and different exponded reproduction planning. But we have to conside all of them in order to make our model fit the actual system. So we emphasize chinese big city's strip-chunk economic pattern feature, to assure our design modle qualified.

E. The Design of EMIBCES Should Had the Model Has as Much Ability as Possible to Solve real Problems.

What abilities does model should have in operating and dealing with variety problems? According to above design idears and principle,first, we should have it has a function of doing economic structure research. That is the model should reflects economic effect relationships among three big trades, insider respective industry, between industry and agriculture, and among agriculture,

light industry and heavy industry at any point time. Secend, the model should reflects the main social economic indicators of effects such as GNP, output value per capita, investment effect, labour productive effeciency,funds using effects, and energy using effect etc. Third, according to our development strategy, change some parameter on proposed to emulate the whole system operating and developing state, try to find the unity between target and possibility. Fourth,to supply understandable variety figurative information for researchers.

F. To Set Up a Parameter Model System Is an Important Component of EMIBCES

Practice has proved that parameter has the same important role as the model. Many parameters need to set a series of corresponding parameter models which are used partly for caculating and partly for compnter super sum. All of them are important component of EMIBCES.

2. Method For Seting Up The Centre City's Economic Emulate Modle

The modle-setting method we mean here isn't the general model setting mothod in dynamic system, it is the selection and the determination of very specific variables in the modle. For the length limit cause we explain this in three aspects.

A. The Determination of Flow Position Variable (FPV) and Flow Rate Variable (FRV)

As we know there are eight kinds of variable eqution in dynamice theroy. The flow position variable eqution and flow rate variable eqution are fundamental equations. The first problem we face in the modle design is how to determine the flow position variable and FRV which are very important for illustrating the whole system. In our opinion, to solve the problem about the dtermintion of FPV and FRV we must start from Marx's productive factor theory to select FPV and FRV. Marx belives that productive factor itself is a multilayer complicated struture.

This structure center is the labour and productive means which are alsocalled the subjective factor and objective factor of production. Marx said, no matter what the social production system is, the labour and productive means are always the productive factors. They are essential material and prerequisite condition for producing material things. They include productive means and productive objects such as land, mineral resources, raw material productive equipment, production construction material and transport equipment etc. The productive tools play a main role in the productive means. Therefore, to take fixed assets as FPV in the procedure of seting up EMIBCES is not only necessary but also acceptable. There are four reasons. first, according chinese existing accounting system that anything listed as fixed assets should have two conditions, One is over one years lifetime, the other is over quota for each of price.(800 Yun for large enterprise, 500 Yun for medium enterprise, 200 Yun for small enterprise.) Second, As long as the fixed productive facter forms, lts effects on the production development remain steady.Third,in accounting system we special set up fixed asset account to reflect fixed asset, an important productivity factor, and increas or decrease situation. The date is also easy to get . Fourth, fixed asset is a very tipical accumulating variable. As social simple reproduction and expended reproduction continus going on from one hand, the fixed assets increased yearly, on the other hand, fixed assets decreased by translate its value into products yearly. So, fixed asset is an important FPV. But we can't make only fixed asset to be the FPV in researching emulatioin model of big city's structure. Because both productive materials and labors are heart of productive factors structure.

Naturally, the labor number should be choosen as a FPV. In fact, the number of labor is also a very typical accumulating variant. From one hand, as the simple reproduction and expended reproduction proceeded the number of labor increased yearly. On the other hand, the number of labors will decreased as time goes on and other influnce factors such as older people retired, transfor other places, ect. Taking both fixed asset and labors numbers to be FPV of economic structure emulate model is not only the need of production principle but also the design idea of above model. The determination of fixed assets and labor numbers as two FPV provid prerequisite and principle for the determination of FRv. Here we not explain more about design of FRV.

B. Design of the Main Auxiliary Variable Equation.

Generally, once FPV and FRV are determined, the design range of the main auxiliary variable equation has been basically defined. The determination of FPV and FRV, makes the skeleton of the main auxiliary variable equation obvious. We know that, the variation of fixed assets (one of FPV) is affected by two variables. The one is new increasment of fixed assets in one year, the other is the depreciation quantity of fixed capital a year. We can figure out the later through the depreciation rate. The former we can use delayed function to process, but the delayed fuction is determined by two variables. That is the determination of investment variable, and is the determination of the time that forms fixed assetsc, the later is a constant number generally. Actually,in the age of Chinese alternation between new system and old system, this constant number usually change greatly. So careful research need taking.We will state this point later. To the former the processing should be in this way. The investment is determined by two factors, the investment demand and the degree to satisfy the needs. The former we used max-fuction to process, that is to subtract the present fixed assets by the present fixed assets demanding.

This subtracted equation only has three cases. The first case is that its differences biger than zero, that is investment demand is bigger than the existing fixed assets. The second case is that its differences is smaller than zero,that is investment demend is smaller than exising fixed asset. The third case is that its differences is equals zero, that is the investment demanding equals the existing fixed asset. The later two cases have no meaning of investment demanding.

In design of maximum function, we compared integer 1 with difference. There are only three cases after drawing in inteder 1's compare bject. The first case is that the difference is bigger than 1. That means investment demanding is bigger than existing fixed asset. In maximum function take the difference as a invest demanding value. The second case is that the difference bigger than zero but smaller then 1, that means invest demanding is a little bigger than existing fixed asset,we take 1 to be invest demanding value in maximum function. The third case is that the difference is smaller than zero,that means invest demanding is smaller than existing fixed asset. In this case, invest demanding has no mean, maximum function take 1 as invest demanding value. The latter we use mini-function to process.If the ratio of investment to investment needs is more than 1.Those means the fund is enough. The supply is more than demand. so take 1 as minifunction. If the ratio of investment to investment needs is less than 1, this means the fund is not enough. Supply is less than demand. It is approrite to take the ratio. This ratio represents the degree of fund meet the demand. If the ratio is 1, that means the fund Just meet investment demand. Investment demand is an strong synthetic variable. Its determination is influnced by two aspect's facts. The one is overall situation, long term and special needy

proceed, the country plan regulation and management. The other is that enterprises proceed from maket demand, take maket as production guidance try their best to meet people' social demand. For the planning management or maket demand here, we mean social consumption demanding of a kind product or an enterprise. In transforming social consumption demanding to fixed asset investmant demanding we need an transform link which is reprisented by ratio between output value demand and fixed assets output value ratio. The problem is that we should how describe output value demand as an variable .In our opinion for this variable,we should proceeding our researching on output demand variable respectively according to Marx's two sectors production, productive means andconsume material classify mathod of social reproduction. For livelihood means which are consumed by general people always have an limit for any kinds product or enterprise to people average consume level. It is reasonable and requisite to forecast and consider the demand of any kind product or enterprise according to this limit. Only for a big city, taking people consume maxmaum to be a base, we not only conside pland demand but also maket demand and not only in big city's inside maket but also outside maket of inport and export. But, for production demand of productive means it is difficalt to masure or foracast by using an maxmumvalue. So to this problem, we conside it from two aspects. One aspect is starting from big city's concrete practice to see how well coordinated between enterprise of productive means and livelihood means, and also among inside enterprise of productive means. Namely we often called what is the chang trend of long line product and short line product. The other aspect is to see how well the outside maket's enterprise of pròduce productive means influnce to the big city's every unite of total production value demand social for productive means in its own territory. Then, according to the social GNP's predictive value at different point-in-time which is iterratived through model system to fore cast the develop demand of production means industry. By design these auxiliary variable equation, the dynamic description of fixed asset's FPV and FRV are much more perfect.

For simplification, the design of labor number as an FPV and auxiliary variable equation design are ommited here.

C. Design of Main Paramater Model

The design of parameter model are becoming more important. We suggest that EMIBCES should set up corresponding model systems in six aspects respectively. They are trade staff member increase model; trade fixed asset forming years model; output level of trade net production value model; total population increase rate model; trade fixed asset depreciating value super sum model; trade production value rate of fixed asset regression model.

Here we only show a trade of the city's fixed asset depreciating super sum model.

Industry of whole city's fixed asset depreciation value super sum model is follow where Q' is whole city's fixed assets annual depreciation value.

$$Q=\sum_{i=1}^{n}\sum_{j=1}^{n}\left(\sum_{k=1}^{n}Yk+\sum_{l=1}^{n}Gl+\sum_{m=1}^{n}Fm+\sum_{f=1}^{n}Zf\right)$$

$\sum_{k=1}^{n} Yk$ is sum of industry's marchine equipmant annual depreciation value. (k=1,2...n)

$\sum_{l=1}^{n} Gl$ is sum of industry's production tools annual depreciation value. (l=1,2....n)

$\sum_{m=1}^{n} Fm$ is sum of industry's construction materials annual depreciation value. (m=1,2....n)

$\sum_{f=1}^{n} Zf$ is the sum of laboury means the depreciation volume in one enterprise a year.therefore the annual average fixed asset depreciation rate of a certain industry in the whole city is follow.

III

Bassed on the design thought and modling method of emulation model in big citys economic structure mentioned above, we designed and applyed the industrial structure simulation model of urumqi city, and preliminarily get the expected effect. This modle, starting out from the actualy situation of uiumqi city and combining with our country's statistic indicator system, divided and defined 31 industries, collected more than 2200 data, aranged more than 200 parameters, established more than 650 equation and organized 36 modules. Operated on the IBM-PC/XT computer, this modle was completed carried out. This modle's cause and effect illstration and flow diagram.

Using urumqi city's economic structure simulation model we proceeded three simulating programs for the eighth "five-year-plan" period and develop period after the ninth "five-yeay-plan". The analog result showed that if we plan and arange it to be realized according to the present ideas (this we take as our first program) investment level will not meet the investment need of more than thirty one trades in urumqi, especially to the every industry where fixed assets increasing slow. If our plan arangement is according to the investment need of every trad, the social gross output will emerged increasing with a high degree in index form. But here main probloms are where the fund come from and how much porsibility of meeting the need canbe realized. And also it need to further research how much possibility to carry out this program.The third program is directed by the guide idea of development strategy and is combined with whole society's development need and possibility. Its focal point is put on rising up economic effect. This program start from the principle of keeping the whole national economic system continuous, stable, coordinate development to put out an apporpriate develop scale under the pre requisite of improved economic syructure and raising up economic effect. And then according to each trade's develop need to arange each one's fixed asset investment. So as to imitate whole national economic operating trend. The result is ideal.

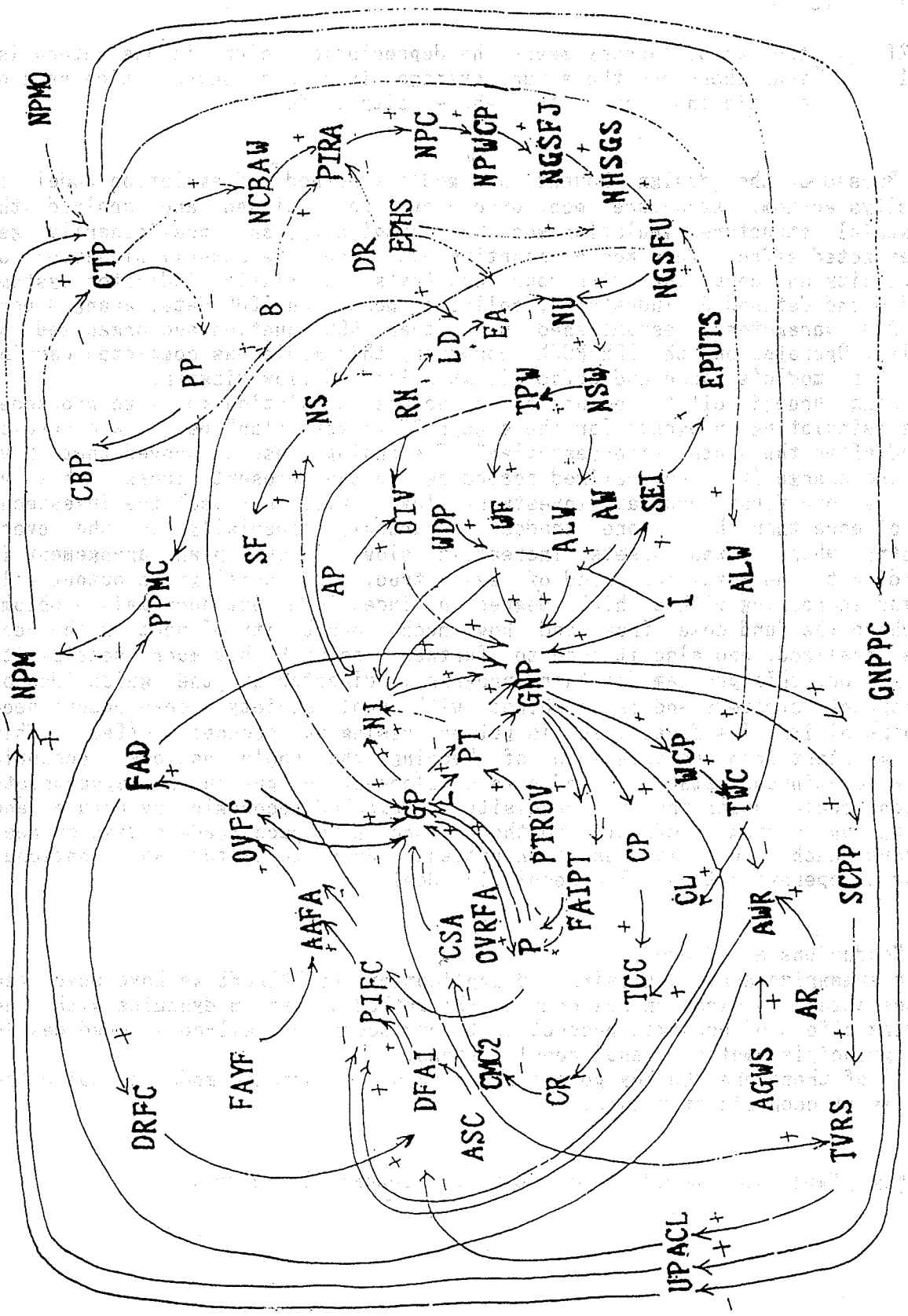
IV

Condusions and Summery

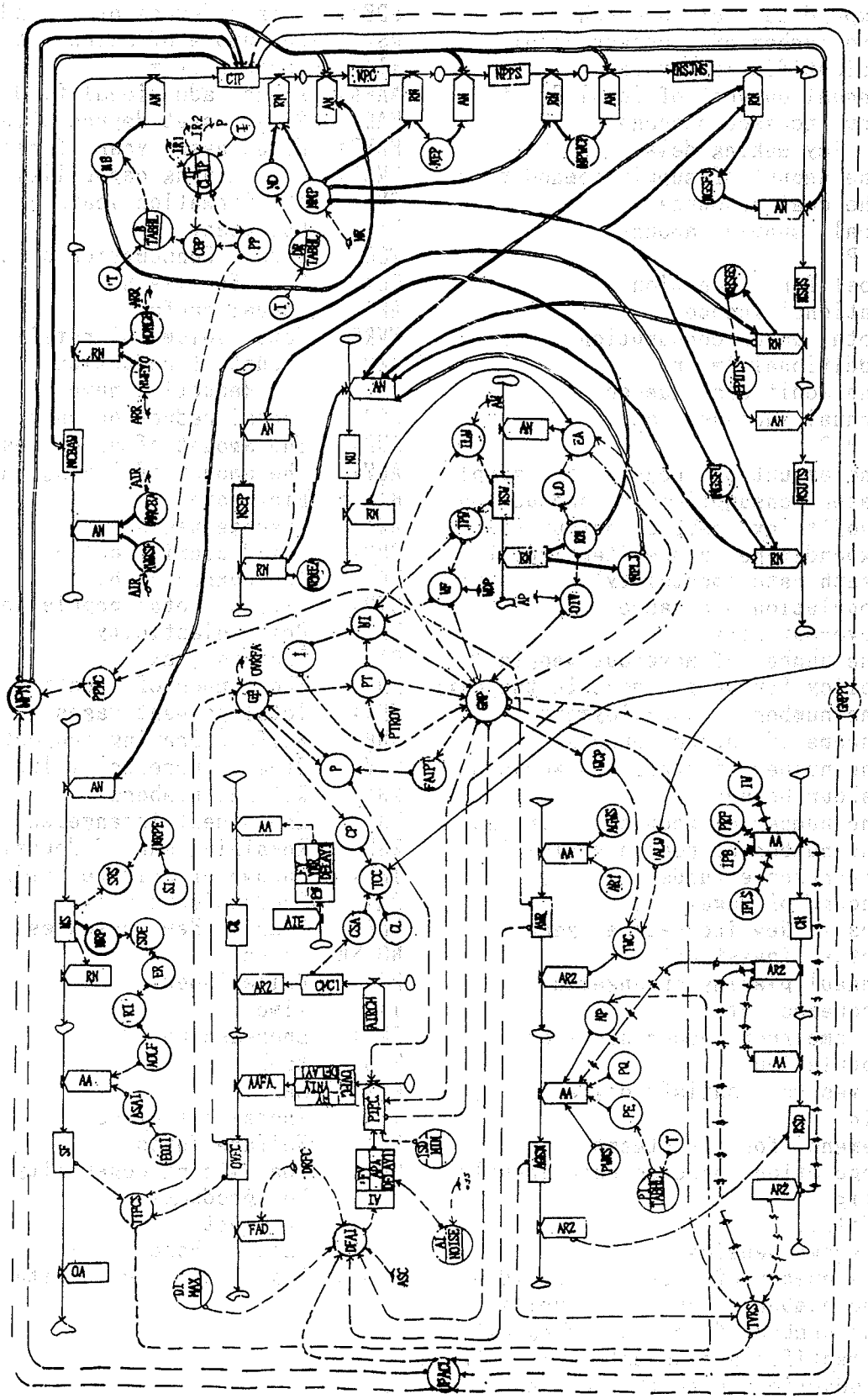
To summarize above analysing and application,the EMIBCES we have developed focuses attention first on how combine the method of system dynamics with the applying effect of economic production theory;second on well-considered design idea, principles methods and model systems.

All of these are the key points of using system dynamic model to solve the problems of economic structure.

EMIBCES :Emulation Model In Big City'S Economic Structure.



THE MAIN CAUSE-EFFECT CHART OF URUMQI ECONOMIC STRUCTURE SYSTEM



THE FLOW CHART OF URUMQI ECONOMIC STRUCTURE SYSTEM

SF: Scientific Fruit
ER: Expenditure on research
NRP: The number of research people
SI: Scientific investment
AOLF: Annual outport of local Fruit
NIS: New increace storage
PMD: Policy-making delay
ASC: The amount of supply commodities
CR: The coal resource
CSA: Coal supply amount
GP: G P
CP: Coal for prodnction
NI: National income
TWC: Total water consumption
AA: Additional Amount
AN: The additional number
AIR: Annual increase rate
GNP: G N P
AGWS: The amount of ground water supply
WCP: Water consumption for produetion
PTROV: Profit tax rate of output value
EOII: Expenditure on one item import
DR: Death rate (mortality)
PP: Population programme
MR: Move-out rate
NMP: The number of move-out people
PPMC: Policy for people move in the city
NU: The number of unemployment
ALW: Ancome of labour workers
NSW: The number of staff and workers
LD: Labour Demand
NPLJ: The number of people leaving jop
NPM: The number of people moving in
PRF: Pre-reserve funds
IW: Income of wage
YNIY: Yearly New increase a year
AI: Actual imvestment
APA: Annaul planing arrangement
IR1: Increace rate1
IFLS: Income from labour services
P: Population
ISD: Investment satisfy degree
MIN: min
DI: Demend for investment
PIRA: Population increase rate annualy
CLIP: clip
DELAY1: delay1
AP: Average pension
NPC: The number of preschool children
NEP: The number of entrance pupils
NPMO: The unmber of people moving out
SEI: Scientific and education investment
PWNS: Productions with the need satisfaction
OA: Obsolete achievement
SDE: Satisfy degree of expenditure
NS: The numbre of scientists
RI: Research item
AAFA: Annual additional fixd asset
FAD: Fixed asset depreciation
FAYF: Fixed asset years formation
CMC1: Coal mining capability
FY: The formation years
P: Pollutant
TCC: Total Consumption of coal
CL: Coal for living
AR1: Annual ramfall
TVRS: Total volume of retail sales
AR2: amount of reduction
RN: The Reduction number
ARR: Annual reduction rate
AWR: The amount of water resoures
ALW: The amount of living water
B: Birthrate
AW: Average wages
CBP: Child-bearing policy
NB: The number of birth
CTP: City's Total population
PE: Price elasticity
PT: Profits tax
ND: The number of death
TPW: Total payment wages
WDP: Welfare Drawing proportion
OIV: Other increace value
RN: Retired numbers
EA: Employment Arrangement
RSD: Remaining sum of deposit
IPB: Income of private business
PQ: Production quality
YNR: Yearly New resoures
NOISE: noise
PI: Price index
T: Time
IR2: Lncrease rate2
TABHL: tabh1
MAX: max
IF: Increase facfors
WF: Welfare funds
CMC2: Coal mining copability
NP: New products
I: Interest
CH: Cash in hand
GNPPC: G N P of per capita

EPHS: Entrance proportion for high scgool
SCPP: Social commdise purchasing power
SNS: The shortage number of scientists
TTFCS: Ten-thousand fixed capital scientific density
ASAI: Annual scientifical achievement import
ASFP: Annual scientifcal fruit production
NRPE: The number of research people in expectation
OVFC: Original value of fixed capital
DRFC: Depreciation rate of Fixed capital
DFAI: The Demand for fixed asset investment
PIFC: Practical investment of fixed capital
AIE: Actally investment for the exploration
AIRMC: Annual increasing rate of coal mining capability
OVRFA: Output value rate of fixed asset
UPACL: Urban people's average consume level
FAIPT: fixed-asset investment for pollution treatment
NCBAW: The number of child-bearing age women
NWBSF: The number of women bewent sixteen and Fourty nine years old
MNCBA: The move-in number of Child-bearing age women
NWFYO: The number of women in Fifity years old
MONCB: The move-out number of Child-beaing age women
NSEP: The number of secondry employment people
NPNEA: The number of people non employment age
NGSFU: The number of graduation students from university and Technical school
EPUTS: Entrance proportion for university and Technical school
NSITS: The number of students in Universitys and Technical schools
NHSGS: The number of high school graduated students
NSHS: The number of student in the high school
NGSFJ: The number of graduate stadents from junior middle school
NSJMS: The number of students in junior middle school
NPWCP: The number of pupils who completed primary school
NPPS: The number of pupils in primary school
AGSN: The amount of goods satisfying the need

REFERENCES

Jay W. Forrester .1968. Principles of system.

Qi Fan Wang .1984. fundamentals of system dynamics. China: Shang hai Mechnic College Press

Zi Li Ling.1980. Study on Max's reproduction theory China: Social Science Press

Mao Kang Su .1988. The tenets and application of system dynamics.
China: Shang hai Communication University press

Yi He Lin .1987. System dynamics. China: Middle South mdustry University Press

Qin Yang .1990. The tenets of social Economic System emulation and a corpus of Application Procedur.
China: Guang Xi Science and Technology Press

Shu Guang Zhang .1982. Economic Structure and Economic effects.
China: Social Science Press