Hierarchic Analysis of Controlling the Ratio of Enrollment Between University Undergraduates and Junior College Students in Engineering Colleges

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ABSTRACT

It is a common feature that junior college classes are being run in regular engineering colleges in Shandong Province . Therefore, how to control a national enrollment ratio between undergraduates and junior college students becomes a practical problem in the management of higher education. This paper. in terms of the fundamental principle of AHP, and through social investigation and systematical analysis of the development law of society, economy and education. proposes a control method of determining the enrollment ratio between undergraduates and junior college students in engineering colleges. At the same time, take the development of the Shandong Building Industry and the Reality of the Shandong Architectural and Civil-Engineering Institute for example, the application of this model and the principle of the dynamic arranging order of AHP has resulted in obtaining the proper ratio between undergraduates and junior college students needed in the development of the Shandong Building Industry, the control ratio of enrollment of the 2 categories of students in this Institute, and its possible changing tendency.

I. The present.problem and Goal of research

Because of long-term lack of research of the hierarchy of higher education in the development of higher engineering education of our country, there have existed for longtime off-balance of the hierarchy of students of engineering college, great insufficiency of junior college students, indistinction of hierarchy, and uncertainty of the importance of junior college students. In order to correct the situation that is unfit for the practical needs of socialist construction, the Education Ministry in the period from 1983 to 1985 sponsored the research about "the Reform of the Hierarchy of Higher Engineering Education". Through systematic research of the hierarchy of higher engineering education, many education scientists form various parts of our country formulated the training goals and criteria for undergraduates and junior college students of engineering colleges. And based on the research, they furthermore reached the conclusion that junior college education Should be greatly developed so as to correct the off-balance. Since then, to the nation-wide higher engineering education, junior college level has generally been raised, and enrollment of junior college students has been enlarged. In view of the fact that there is only one engineering institute of junior college level in

Shandong Province, the method has been adopted that junior college classes are run in regular engineering colleges. And that has become one feature of Shandong higher education.

Practical enrollment of engineering students of Shandong Province since 1985 (table 1)

year (1)	undergraduates (2)	junior students (3)	(2)/(3)	totli undergraduates (4)	total junior students (5)	(4)/(5)
1985	5647	1801	1/0.32	18449	3166	1/0.17
1986	5022	2000	1/0.4	19936	4659	1/0.23
1987	5749	2505	1/0.44	27331	21648	1/0.79

While junior college level is enlarged in regular colleges, adult education is also greatly developed, of which the majority is of junior college level. It is obvious that this adjustment and development have speeded up the fraining of personnel, gradually broke the conflict of personnel shortage and ratio off-balance, and played a positive part in the speed-up of economy construction of our province. But with the rapid development of higher engineering education and the change of enrollment scale many education experts began to worry: Would the rise of junior college level lead to surplus of junior college students? Would excessive enrollment of junior college students in regular colleges lower the position of them? Therefore, how to control the enrollment ratio between undergraduates and junior college students becomes a practical problem of common interest for college leaders and education administrators.

The 13th congress of the Party stressed that the development of science and technology, as well as education should be put in the first place, so as to shift economy construction onto the track of reliance on the progress of science and the improvement of labour's quality. And this point is considered as the first problem in realizing the economy development strategy. Therefore, the development of education directly affects the realization of the economy development strategy of our country. To set up a practical and realistic hierarchy ratio for the higher education is one of the elements that ensure healthy development of higher education. As we know, the need ratio of undergraduates to junior college students varies with the development of science and technology and economy, and this variation is constant. If the ratio is improperly set up, the enrollment scale will rise and fall by turns, leading to unstable conditions of personnel training. Same as this, if any college fails to control scientifically the enrollment ratio, it may result in worsening the position of the college. So we must research the abovementioned problem in terms of a systematic and dynamic viewpoint.

The subject of this paper is, in view of the above problem, on the principle of system engineering, and through comprehensive analysis of the law of society, economy and education, to research the control problem of enrollment ratio between undergraduates and junior college students. This ratio of course can't be very exact. It will only give a developing tendency for the purpose of providing policy-making basis for college leaders and education administration.

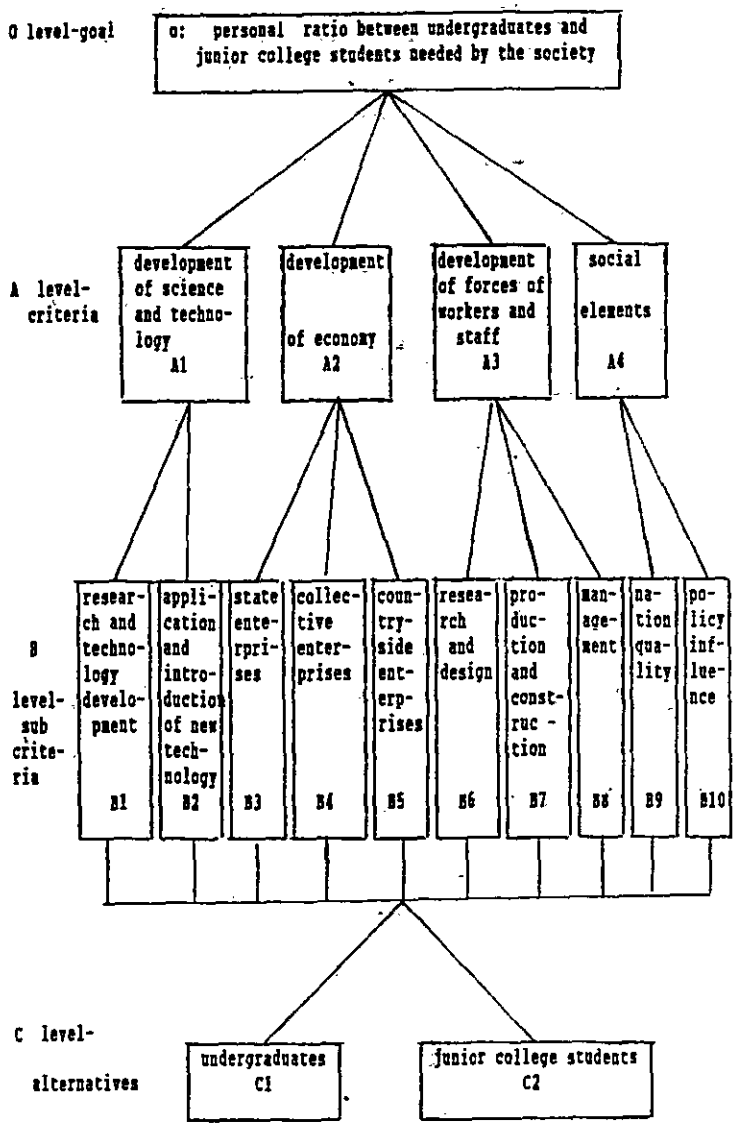
II. Substance of Research and the Hierarchy Model

The set-up enrollment ratio must abide by the development law of society, economy and education, and be based on the comprehensive analysis of all the various elements. Otherwise, no complete, optimum policy-making result will come. In setting up the enrollment ratio of a college, people should first make sure the personnel ratio between undergraduates and junior college students needed by the society. The rational and practical way to set up the enrollment ratio is in accordance with the social need and the reality of the college. Therefore, we must make this research in 2 steps. The first step is to research the personnel ratio between undergraduates and junior college students needed by the society. And the second step is to research the rational enrollment ratio between undergraduates and junior college students in a college. In the above mentioned research, we adopted AHP and the principle of dynamic arranging order, namely, defining the goal first and then finding out all the restricting elements. Through grouping analysis of the restricting elements, a hierarchy structure model was formed. Under this hieraechy structure we analysed the different effects of each restricting element on its goal, namely, the difference of weights. After the arranging order weight of each element was worked out, then in reference of each element the ratio between undergraduate and junior college students was found out, and at last the result of the problem came through weighted grouping. Obviously, as long as the weights of all restricting elements and the ratio of each individual element are proper. The ultimate outcome is sure to be the optimum goal function.

1) The personal ratio between undergraduates and junior college students needed by the society.
Through social investigation and expert advice we formed a hierarchy struture model of this problem (fig.1)

Here the goal function is definite, and the reason for the set-up of the restricting elements is as follows:
A1: Development of science and technology. This is a major affecting element, because higher engineering education is meant to train up special technic personnel, and the development level of science and technology depends upon the training up of personnel. Further more, the personnel ratio between undergraduates and junior college students needed by the society is closely licked with the orientation and the speed of the development of science and technology.

(fig.1)



A2: Development of economy. This is essential basis of the development of higher education. The main goal of engineering colleges is to train up engineering technicians for economy cosonstruction. The speed of development of economy exerts strong effect on the need ratio of different hierarchy

A3: Development forces of workers and staff. This element is a decisive factor in finding out the orientation of service of the future personnel. The need ratio in different hierarchy of personnel depends upon the quality of the laboring forces of all fields. And the development scal and speed of the laboring forces of all fields are of different need urgency

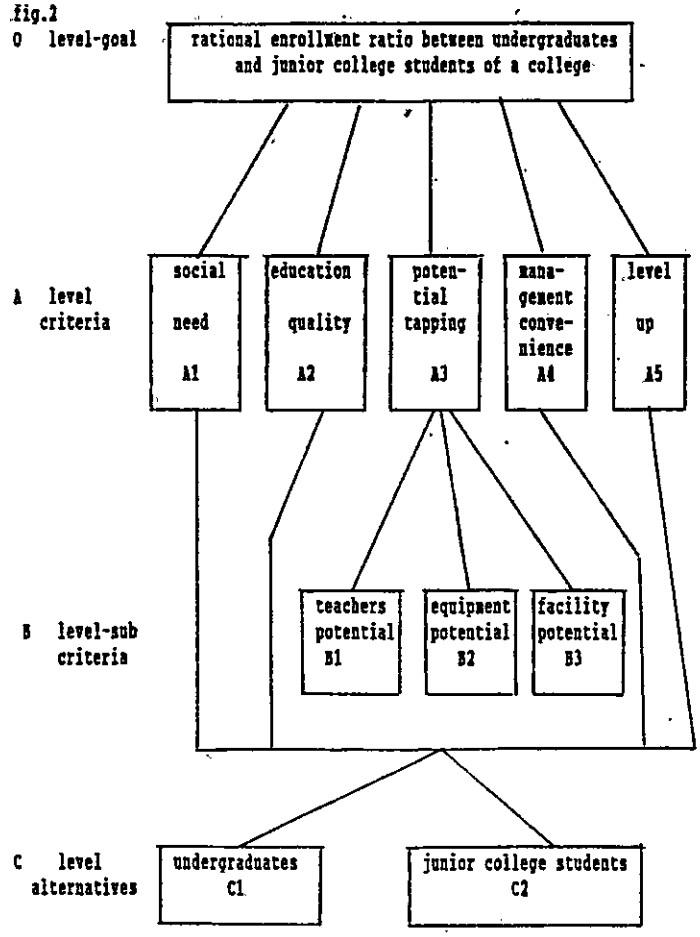
A4: Social elements. This factor is an objective existence of ideology in respect of the need ratio of personnel hierarchy, so it should not be neglected. The elements of B level are decompositions of A level. Out of them, the economy development criteria of the 3 different kinds of enterprises of B3, B4 and B5 are shown in yearly production values. B6, B7 and B8 are used to research the effect of developing scale of the 3 forces on the personnel need ratio of different hierarchy. B10 is meant the effect of policing of cadre appointing. rank promotion and profession selection etc. In the need of hierarchy of educational background. After the hierarchy model was decided, we worked out the weight values of importance of each element in each level. Because the effects of many elements in this model, such as development of economy, development of forces of workers and staff, etc, vary with time, the decision of the weight values of importance must also involve the application of the dynamic arranging order of AHP. And it should also be noted that the weight value of arranging order of each restricting element varies with different natures of different fields. Therefore, the weight value of each element must be decided in accordance with the data and conditions of the specific field.

2) Control of Enrollment Ration between Undergraduates and Junior College Students in a College

It is of no doubt that the set-up of the hierarchy ratio of a college must be based on the soial need ratio. However, if only the social need is noticed and the reality and law of the college are neglected, no optimum result can be obtained. In the light of the viewpoint of systemization, the optimum control of enrollment should be in terms of the social need ratio, the insurance ratio of education quality, the ratio of bringing the potential of a college into full play, the convenience ratio of college management and the ratio of continuous increase of the running level of a college. The running level of a college here means the teaching level, scientific study level and administration level. Under these principles should the enrollment ratio of undergraduates and junior college students be respectively dtermined. The result after grouping is the rational ratio of a college.Our hierarchy model is shown in figure 2.

In this figure the social need ratio between undergraduates and junior college students has been worked out in section (1). The only thing left to determine is the ratio A2, B1, B2, B3, A4 and A5 to the goal. The determination of the weight value of each element is the same as in section (1). Since the social need ratio of undergraduates to junior college students is dynamic,the ultimate result here is also dynamic.

fig.2


0 level-goal
rational enrollment ratio between undergraduates and junior college students of a college
A level criteria
social need A1
education quality A2
potential tapping A3
management convenience A4
level up A5
B level-sub criteria
teachers potential B1
equipment potential B2
facility potential B3
C level alternatives
undergraduates C1
junior college students C2

III. Example

Take the ratio of undergraduates to junior college students needed by the building industry of our province and the reality of Shandong Architectural and Civil-Engineering Institute for example, in the light of model (1) and model (2), the calculated result is to be worked out.

(1) Personnel ratio of undergraduates to junior college students needed by the development of the building industry of our province.

According to hierarchy structure model (1), the weight values of all levels We worked out are:

(table 2)

element	A1	A2	A3	A4
Weight	0.161	0.576	0.199	0.064

(table 3)

element	B1	B2	B3	B4
weight	0.032+0.003t	0.129+0.003t+0.0009t-t	0.075exp(0.096t)	0.098exp(0.096t)

element	B5	B6	B7	B8	B9	B10
weight	0.403exp(0.116t)	0.081+0.002t	0.048+0.016t	0.07	0.032	0.032

In respect to the elements of B level, the ratio of undergraduates to junior college students we worked out is

(table 4)

element	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Undergraduate/ junior college students	5/1	1/2	1/3	1/5	1/9	5/2	1/5	1/1	1/9	1/3

After they are transformed into weight values and grouped by level, the ultimate ratio to be worked out is :

undergradvates C1(t) = 0.182+0.008t-t+0.0003t+0.035exp(0.096t)+0.04exp(0.116t)

junior college students C2(t) = 0.242+0.016t+0.0006t-t+0.139exp(0.096t)+0.363exp(0.116t)

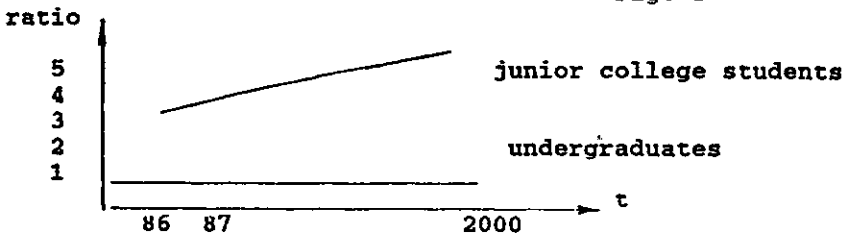
Let t=1,2.....14 go into the above formula, the need ratio of undergraduates to junior college students for the period form 1986 to 2000 is worked out:

(table 5)

year	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
undergraduates/junior college student	1: 2.99	1: 3.08	1: 3.18	1: 3.28	1: 3.38	1: 3.48	1: 3.57	1: 3.67	1: 3.77	1: 3.87	1: 3.97	1: 4.07	1: 4.18	1: 4.28	1: 4.38

This tendency is shown in fig. 3

Fig. 3



As shown in fig.3, the social need of junior college students rises yearly and steadily. Attention should be paid to this by the policy-makers. After this result was worked out, we consulted experts for advice and then fed it back to the building industry. It proves reliable.

(2) Control of enrollment ratio of undergraduates to junior college students in Shandong Architectural and Civil-Engineering Institute. This institute is one of civil engineering, the majority students of which are undergraduates. it's main goal is to train up engineering personnel for the Shandong building industry, so, the set-up enrollment ratio should be in accordance with the ned ratio of Shandong province. Under hierarchy model (2), we obtained the following result:

(table 6)

element	A1 social need	A2 education quality	A3 potential tapping	A4 management convenience	A5 level-up
weight	0.338	0.265	0.102	0.053	0.242

(table 7)

element	B1 teachers potential	B2 equipment potential	B3 facility potential
weight	0.429	0.142	0.429

For A1.A2.B1.B2.B3,A4, and A5, the ratio we set up respectively is

(table 8)

element	A1	A2	B1	B2	B3	A4	A5
undergraduates/ junior college students	C1(t)/ C2(t)	2/1	2/1	1/1	1/2	3/1	3/1

Transform the above ratio into weight value and then group, the result is as follows:

$$\frac{\text{undergraduates}}{\text{junior college students}} = 1:\frac{0.213+0.338\ C2(t)}{0.449+0.338\ C1(t)} \qquad (2)$$

Here C2(t), c1(t) were given in section 1.

The above formula is the control function of enrollment ratio of undergraduates to junior college students in this institute. Same as this, we can use this function as basis to work out the enrollment control ratio for the period of 1986 to 2000 in this institute.

(table 9)

year	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
undergraduates / junior college students	1/ 0.87	1/ 0.88	1/ 0.89	1/ 0.89	1/ 0.90	1/ 0.91	1/ 0.91	1/ 0.92	1/ 0.92	1/ 0.93	1/ 0.98	1/ 0.94	1/ 0.94	1/ 0.95	1/ 0.95

The above result indicates that the enrollment ratio of undergradutes to junior college student may be controlled at 1:0.88 at present. But the proportion of junior college students should get larger successively, and it may be controlled at 1:1 after 1991. At the same time it is also shown in the table that the enrollment ratio of undergraduates to junior college students changes once every 2 years, the enrollment of junior college students being increased. Evidently, it conforms to the reality of education management.

IV. Strategy Policies

Judging from the above results, the need ratio of junior college hierarchy will get larger and larger with the development of the building industry of Shandong Province. The need ratio after 1997 will be 1:4. But as the sole civil engineering institute Shandong Architectural and Civil Engineering Institute should control an optimum enrollment ratio of undergraduates to junior college

students at about 1:1. This confilcts with social need. How this conflict can be resolved? We think the following policies should be adopted:

(1) Strengthen the development of adult higher education and post education.

In recent years adult higher education has got stronger and stronger in our country, and larger numbers of personnel for economy construction were trained up. Development of adult higher education should be continously strengthened in the future, junior college level being properly enlarged,and undergraduates level being strictly controlled. In the development of adult higher education, more attention should be paid to the quality, instead of seeking academic background simply.

Post education is a good way of training up personnel. Especially in the construction sites, personnel with experience and post education background (junior college level) are more welcome. The scale of post education should be greatly enlarged in the future.

(2) put stress on personnel training for countryside enterprises.

From the calculated results in model, (1) we can see that the weight value of countryside enterprises is getting larger and their personnel shortage problem is getting more striking. And because of the effects of old concepts of the pople, few college graduates feel to like jobs in countryside enterprises. Therefore the only way of personnel training for countryside enterprises is to enroll students of countryside residence registration excluded from the state plan. The students will serve in countryside enterprises after graduation. The education department of Shandong Province has specifically made policies for this case. This policies should be adhered to, so as to make education yield higher social efficiency.

(3) Speed up the development of specialized middle school education.

In case that junior college education can't fully meet the social need, to speed up the development of specialized middle school education is also a solution. The graduates of specialized middle schools are welcome as technicians at the first line of production sites. To enlarge enrollment in specialized middle schools also proves a good solution of employment problem.

(4) Strengthen strategic research of higher education

In recent years, with deepening of reform, the State Government and business have put forward request for democratization and scientification in policy-making. This has played a large part in lessening mistakes and increasing efficiency. Same as this, in planning and policy-making of education development, democratization and scientification should also be stressed, and

strategic research of higher education should be strengthened. Urge those comrades who are engaged in natural sciences and social sciences to take active part in the research of education development strategy. Only in this way can higher engineering education progress along the road of scientification and modernization.

V. Calculation of priority

In calculation of priority in Example 1 and 2, we used respectively the methods of pairwise comparison matrix, statistics of weight value and direct allocation. For those elements that can't be quantitatively described, we used the method of pairwise comparison and structure judgement of matrix to work out the weight value. For those elements that have physical measurements, such as the economy elements forces of workers and staff, etc. we used the method of statistics to work out their weight values. We directly allocated weight values through analysis for some other elements.

The calculation process in model (1) is as follows:

O-A level	O	A1	A2	A3	A4	weight values
judgement matrix	A1	1	1/3	1/2	3	0.161
	A2		1	5	7	0.576
	A3			1	3	0.199
	A4				1	0.064

A1-B matrix	A1	B1	B2	weight values
	B1	1	1/4	0.2
	B2		1	0.8

The consistencies of above matrices are all satisfied. Since B1 and B2 are all developing with progress of time, we should find out their changing tendencies respectively.

The determination of developing tendency of B1: from the research and development plan of 1985-2000 of Shandong Construction Committee, we got the following data:

(table 10)

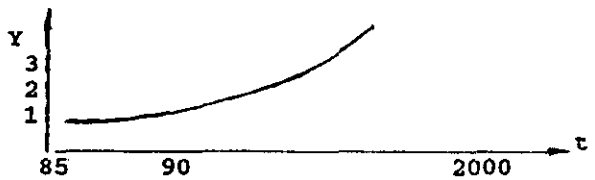
	1985-1990	1991-2000	ratio
science research assignment (number of projects)	32	50	1:1.561
input of funds for science research	10.35 (million yuan)	21.9 (million yuan)	1:2.12

The given development tendency of science and technology is uniform, the calculated changing law is:

in the light of science research assignment: $Y=1+o.o4t$ (3)

in the light of input of funds: $Y=1+0.08t$ (4)

we took formula (4) as the changing tendency of the element. The changing tendency of B2 is not easy to be determined. According to the requirment put forth in the strategy report of development of the Shandong building industry for the period after 1990, that is, putting stress on technical progress, with the technical level of early 80's of the developed countries as the goal, actively adopting applicable new technology new process, new material and new equipment so as to increase the level of the building industry to a large extent, we divided the changing tendency of B2 into 2 phases, namely, a slow development before 1990, calcuated by 20% higher than the present level; a fast development from 1990-2000, calculated by twice higher than the present level, see figure 4.



This law can be accessed with quadratic function, namely:

$$Y= 0.007t\ t +0.022t+1 \qquad (5)$$

here, the weight values of B1 and B2 are:

$$\begin{pmatrix} B1 \\ B2 \end{pmatrix} = \begin{pmatrix} 1+0.08t \\ 0.007t\cdot t+0.022t+1 \end{pmatrix} \begin{pmatrix} 0.2 \\ 0.8 \end{pmatrix} = \begin{pmatrix} 0.2+0.016t \\ 0.005t\cdot t+0.0176t+0.8 \end{pmatrix}$$

A2-B level

Here the values of B3,B4 and B5 can be worked out directly according to the criteria of economy statistis of the Shandong building industry in 1985 and 1986.

Economy criteria of the Shandong building and installation industry of 1985

(table 11)

	state enterprises	collective enterprises	countryside enterprises
production value (10000 yuan)	59151	80269	336621
ratio	1	1.357	5.691
Weight	0.1243	0.1686	0.7071

Economy criteria of the Shandong building and installation insdustry of 1986

(table 12)

	state enterprises	collective enterprises	countryeide enterprises
production value (10000 yuan)	76950	89225	580773
ratio	1	1.16	7.5
weight	0.104	0.12	0.776

Since laboring forces in the countryside enterprises greatly increased from 1985 to 1986, the production value also increased rapidly. Take the weights of 1985 as the initial ones, we hold:

state : 0.13 collective : 0.17 countryside : 0.7

The changing tedency of the economy development of them can be deduced from the forecast of the development of the Shandong building industry. Suppose the economy development incereases in exponents and the economy of state and collective enterprises increase at the same speed. (see literature 2)

(table 13)

	production/ year in 1985	production/ year in 2000	increase rate / year
state,collective	1.3942 (billion yuan)	5.85 (billion yuan)	0.1003
countryside	3.36 (billion yuan)	19.15 (billion yuan)	0.123

given the present value is 1, their increase law will be:

$$\text{state, collective:} \quad Y=(1+0.1003)^t = 1.1003^t = e^{0.096t} \qquad (6)$$

$$\text{countryside:} \quad y=(1+0.1230)^t = 1.123^t = e^{0.116t} \qquad (7)$$

From this the weights of B3,B4 and B5 are:

$$\begin{pmatrix} B3 \\ B4 \\ B5 \end{pmatrix} = \begin{pmatrix} \exp(0.096t) \\ \exp(0.096t) \\ \exp(0.096t) \end{pmatrix} \cdot \begin{pmatrix} 0.13 \\ 0.17 \\ 0.70 \end{pmatrix} = \begin{pmatrix} 0.13\exp(0.096t) \\ 0.17\exp(0.096t) \\ 0.70\exp(0.116t) \end{pmatrix}$$

A3-B level

Here, with the present numbers of technical personnel in the three different labor forces as comparison elements, their weight values are calculated, then their changing laws in the light of

the requirement put forth in reference material 1 and 2. Calculated according to the development report of the building industry and the statistics of different grades of building enterprises, the technical personnel status of the building forces in our province in 1986 is as follows:

(tble 14)

	persons	weight
science research and desigh	14102	0.405
production and construction	8399	0.214
management	12372	0.354

As far as the increase of forces of science research and design is concerned, according to literature (1), four more research institutions will be added to the present forces of our province by the year 2000. The designed rooms on county level will be further strengthened and their development scales will be enlarged. Forecast from personnel department indicates no more increase of design forces on provincial and municipal levels. According to the above tendency and the estimatic that the forces of science research and design of the whole provience will increase by 30% by the year 2000, the law of a steady progress is derived:

$$y=1+0.02t \qquad (8)$$

In the forces of production and construction, the amount of technical personnel at presentis rather small. And still fewer are personnel with the rank of and higher than engineer. They tend to develop more rapidly in the future. According to material (2), the scale of forces of production and construction of our province will grow from 1.3 million persons to 2.8 million by the year 2000. Out of the increase, the majority will be of collective and countryside enterprises. According to the forecast of personnel development of the system of the Ministry of Urban and Rural Construction, the ratio of specialized personnel needed in the development of building industry by the year 2000 will account for 15.95% of the total workers and staff. Among them personnel of civil engineering will account for 36% of the total specialized. According to reckoning of conditions of the technic personnel of the building industry of our province to meet the above requirement will need an increase of six times more than the present amount of specialized personnel. In view of a steady increase tendency, the increase law of technical personnel in the production and construction forces will be: $y= 1+0.33(t)$ (9)
At present, the scale of forces of management is rather large. Of course the quality and standard of management are far from the requirements put forth by the development of circumstances. It certainly needs strengthening and enhancing in the future. But with progressing of reform many people in the higher bodies of administration may be transferred as reinforcement to the field

of management of technology and economy. Therefore, it is estimated that there will be no great increase in the amount of this force later. And thereby we can hold this element invariable. In this way, the obtained weight values of B6, B7 and B8 are as follows:

$$\begin{pmatrix} B6 \\ B7 \\ B8 \end{pmatrix} = \begin{pmatrix} 1+0.02t & & \\ & 1+0.33t & \\ & & 1 \end{pmatrix} \begin{pmatrix} 0.405 \\ 0.241 \\ 0.354 \end{pmatrix} = \begin{pmatrix} 0.405+0.008t \\ 0.241+0.08t \\ 0.354 \end{pmatrix}$$

A4-B level

This level may be considered invariable. Their weight values may directly be given: B9 = 0.5 B10 = o.5 namely, the effects of these two elements be considered equal. Calculation of arranging order results: Through the above calculations, all the weight values of the elements of B level in reference to the elements of A level are worked out to group them and the weight values of the elements of B level in reference to o level will be worked out. Its grouping results are:

'table 15'

goal	A1 0.161	A2 0.579	A3 0.199	A4 0.064	A(Bj)
B1	0.2+0.016t				0.032+0.003t
B2	0.056t+t+0.0176t+0.8				0.129+0.003t+0.0009t
B3		0.13+or(0.096t)			0.075+or(0.096t)
B4		0.17+or(0.096t)			0.098+or(0.096t)
B5		0.7+or(0.116t)			0.403+or(0.116t)
B6			0.405+0.008t		0.081+0.002t
B7			0.241+0.08t		0.048+0.016t
B8			0.354		0.07
B9				0.5	0.32
B10				0.5	0.032

After the process of returning to 1.the obtained weight of Bi (i=1...10) is:

$$Bi = \frac{Bi'}{\sum_{i=j}^{10} Bj} = \frac{Bi'}{\Delta}$$

In it Bi' is the weight shown in the right of the above table

B-C level after process of returning to 1 in the light of the

ratio shown in table 4, the obtained weight in reference to Bi is:

(table 16)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
C1	0.833	0.333	0.25	0.167	0.1	0.714	0.167	0.5	0.1	0.25
C2	0.167	0.667	0.75	0.833	0.9	0.286	0.833	0.5	0.9	0.75

group the weights of B-C level, obtain the weights of undergraduates and junior college students in reference to a goal, namely the ultimate outcome desired.

	B1	B2	B3	B4	B5	B6
	0.032+0.003t	0.129+0.003t+0.0009t²	0.075exp(0.096t)	0.098exp(0.096t)	0.403exp(0.116t)	0.081+0.022t
C1'	0.833	0.333	0.25	0.167	0.1	0.714
C2'	0.167	0.667	0.75	0.833	0.9	0.286

	B7	B8	B9	B10	$\sum_{i=1}^{10} B_i C_j'$
	0.043+0.016t	0.07	0.032	0.032	
C1'	0.167	0.5	0.1	0.25	0.182+0.008t+0.0003t²+0.035exp(0.096t)+0.04exp(0.116t)
C2'	0.833	0.5	0.9	0.75	0.242+0.016t+0.0006t²+0.138exp(0.096t)+0.363exp(0.116t)

After process of returning to 1 of the grouped weights of C1 and C2, we got the need ratio function C1(t)/C2(t), in the same way we got the outcome of model(2).

VI. Conclusion

The two hierarchy models and calculations of weight values concerning the control of enrollment ratio proposed in this paper find a better solution of policy making problem for the education administration. And these models are common importance for application in various industries and institutions. The examples clearly and completely explain the control goal and tendency of enrollment ratio, providing forth education institutions reliable basis in strategy research and plan-making. However, because of historical backgrounds of the development of society and economy, the ratio determination of individual goal in the paper should be considerd together with the dynamic change tendency. Then, the disturbance on the ultimate outcome caused by the unexpected change of each restricting element has not been analysed. These are two defects of this paper, which will be further discussed later.

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