Research on Disciplinary Structure of Postgraduate Education

Based on Grey System Theory

Chen Zusheng*1, Ren Hao2, Zhong Yu-xuan3

*1, 2, 3School of Economics & Management, Tongji University, Shanghai, China, 200092

*1Business school, Guilin University of Electronic Technology, Guilin, China

*1czs999@qq.com; 2renhao_cn@hotmail.com; 3yxzhongzj@163.com

Abstract

By applying grey system theory and MATLAB program, the paper predicts the development trends of graduated postgraduates in different discipline structure and analyses the drawbacks of the postgraduate education's disciplinary structure. According to ever-changing market demands for graduate, our country's further adjustments for industrial structure and new requirements for postgraduate education's disciplinary structure, the the countermeasures and suggestion have been put forward to adjust and optimize education's disciplinary structure.

Keywords

Postgraduate Education, Disciplinary Structure, Grey System Theory

Introduction

Postgraduate education's disciplinary structure is the combination of scientific knowledge in some areas and social needs. And the fundamental task of postgraduate education is to foster the proper talents meeting the development of society and economy. So the disciplinary structure is the guarantee for quality of the postgraduate education. With the further adjustment of industrial structure, ever-changing market demands for the talents and the decline of quality on the postgraduate education, the adjustment and optimization of disciplinary structure for postgraduate education is facing a new challenge.

The paper predicts development trends of the graduated postgraduates of different structure and analyzes the drawbacks of postgraduate education's disciplinary structure by applying grey system theory and MATLAB program. According to ever-changing market demands for talents, our country's further adjustments for industrial structure and the new requirements for postgraduate education's discipline structure, the countermeasures and advice for adjusting and optimizing disciplinary structure.

Grey System Theory and Gm (1, 1) Prediction Model

Grey System Theory and Grey Prediction

Grey system, a poor information system between white and black systems, is only applied to the projects with a small amount of observational data, proposed by well-known Chinese scholar, Professor Deng Julong in 1982, whose study object is the uncertain system with poor information in which some data are known and others are unknown. The theory predicts unknown information of the system through the information known, and its most important feature is that it has no strict requirements for samples and obeys any distribution rules. Grey prediction as main research field of grey system theory is a method to predict the system with uncertain factors.

Through identifying difference degrees of development trend between system factors, namely analyzing the relevancy and operating original data to find out change rules of the system, grey prediction system generates data sequence with strong regulation, corresponding equation model is set and the development trend of things is forecasted as sell in the future. The core content of grey system theory is grey dynamic model, with the thought of to change time series into dynamic equation. According to the theory above and available data with its characteristics in current, the paper selects discrete grey prediction model GM (1, 1) and MATLAB program to analyze the development scale for graduated postgraduates.

GM (1, 1) Model Establishing

Suppose that time series $X(0)$ has n-dimensional observations, namely $X(0) =\{X(0)(1) , X(0)(2),…, X(0)(n)$, and generates a new sequence by accumulating, $X(1)$

=X(1)(1), X(1)(2) ,…, X(1)(n), while the corresponding differential equation of GM (1, 1) is

$$\frac{dX^{(1)}}{dt} + \alpha X(1) = \mu \tag{1}$$

Where α is known as development grey number, and μ is endogenous control grey number.

Then $\hat{\alpha}$ is set to be a parameter vector to be estimated, $\hat{\alpha} = \begin{bmatrix} \alpha \\ \mu \end{bmatrix}$. Though least-squares method, the solution is

$$\hat{\alpha} = (B^T B)^{-1} B^T Y_n \tag{2}$$

Finally the prediction model is

$$X(1)(k+1) = \left[X^{(0)}(1) - \frac{\mu}{\alpha} \right] e^{-\alpha k} + \frac{\mu}{\alpha}, \; k = 0, 1, 2, \ldots, n \tag{3}$$

Generally grey prediction testing includes residual test, correlation test and posterior test. It is argued in this paper that testing accuracy of the model needs to be strengthened, though discrete form of GM (1, 1) model has been set up theoretically. Methods are as follows.

Set mean and variance of the original sequence X(0)

and residual sequence e(0) = {e(0)(t) = X(0)(t) -X(0)(t) ∣ 1, 2, Kn} as follows. Where

$$\overline{X} = \frac{1}{N} \sum_{t=1}^{N} X^{(0)}(t) \tag{4}$$

$$\overline{e} = \frac{1}{N} \sum_{t=1}^{N} e(t) \tag{5}$$

$$S_1^2 = \frac{1}{N} \sum_{t=1}^{N} \left(X^{(0)}(t) - \overline{X} \right)^2 \tag{6}$$

$$S_2^2 = \frac{1}{N} \sum_{t=1}^{N} \left(e(t) - \overline{e} \right)^2 \tag{7}$$

Then small error probability is P = P{ ∣ e(t)- $\overline{e}$ ∣ < 0.6745S1}. Posterior margin ratio is C=S2/S1.

The accuracy of the model is described by P and C, which is divided into four grades in general, such as if it's A level(good), and 0.95 ≤P, C ≤0.35; if it's B level(qualified), then 0.80≤P <0.95, 0.3< C≤0.5; when C level(barely), 0.70≤P < 0.80, 0.5< C ≤0.65; D level(failed), P<0.70, 0.65 <C.

TABLE1 NUMBER OF GRADUATED POSTGRADUATES IN DIFFERENT DISCIPLINARY STRUCTURE FROM 2000 TO 2008 (UNIT IN PERSONS)

Discipline \ Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Philosophy	775	904	1223	1562	1854	2249	3117	3738	4175
Economics	7308	3981	4433	6578	8089	10930	14784	17239	17614
Law	3820	4504	5139	7484	11097	14103	19413	22556	23849
Education	1221	1550	1946	2746	4276	5101	7767	9854	12127
Literature	3714	4193	5157	7426	10483	13314	20107	25064	28038
History	1026	1179	1395	1926	2407	2657	3497	4424	4908
Science	8077	8637	9866	13220	17540	22028	29137	35266	34380
Engineering	14378	24873	30078	41337	56074	72941	94516	114621	117894
Agriculture	2282	2136	2790	3849	5165	6038	8853	11297	12333
Medicine	6166	6992	8677	12207	16128	19405	26415	32453	36696
Military	/	17	33	32	59	114	117	163	195
Management	/	8843	10104	12706	17596	20848	28179	35164	39114

TABLE2 PREDICTED NUMBER OF GRADUATED POSTGRADUATES FROM 2009 TO 2011 (UNIT IN PERSONS)

Philosophy	Economics	Law	Education	Literature	History	Year
4396	18040	23950	13415	30897	5303	2009
4330	18514	23926	14503	33876	5710	2010
3868	19033	23940	15710	30768	6008	2011
Science	**Engineering**	**Agriculture**	**Medicine**	**Military**	**Management**	**Year**
38109	130121	14429	39453	241	44231	2009
39987	140020	17785	45623	278	48970	2010
41120	147891	22101	49876	319	52108	2011

Examples Based On Grey System Theory and Gm (1, 1) Prediction Model

Description and Discussion

On the basis of the number of graduated postgraduates in different discipline structure between the year 2000 and 2008 on website of Chinese Ministry of Education (Table 1), GM (1, 1) model has been established and programs MATLAB was applied to predicts and analyzes the development trend of postgraduates in order to reveal the drawbacks in current disciplinary structure.

The predicted number of postgraduates from 2009 to 2011 after operating is as follows in Table 2. One accuracy testing for them has been carried out, where C = 0.3233, P = 1.1, so it belongs to A level.

And get the following scale change curve of graduated postgraduates of 11 disciplines has been obtained by operating related MATLAB program (Figures 1 and 2). Graduates in Military are omitted because of its too small number. The rest are divided into two figures based on the number of graduates from 2005 to 2011.

The Results

From Figures 1 and 2, the results are

a). The imbalanced development between basic science and applied science. Basic science but not applied science been put emphasis in postgraduate education of China. In recent years, with the development of society and economy and the growing demands for the applied talents, most universities and colleges pay much attention to the development of applied

disciplines, resulting in its popularity. However, from Figures 1 and 2, it still has imbalance development between the basic and applied science in postgraduate education currently. One of the reasons is that parts of students have to choose basic science for the intense competition and high scores for popular subjects. However, furthermore the research and discussion carried out is that subjects on basic science do not meet the needs of social development.

b). More emphasis on science and engineering but less on humanities and social science. From Figures 1 and 2, the scale gap between postgraduate education's discipline structure is still large. Engineering and science occupy half of the scale. Besides, medicine and management are also far ahead of the other disciplines, and the proportion of humanities and social science is low.
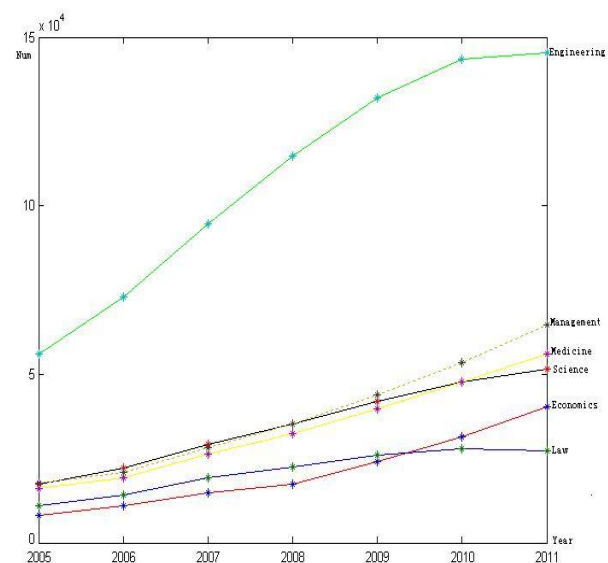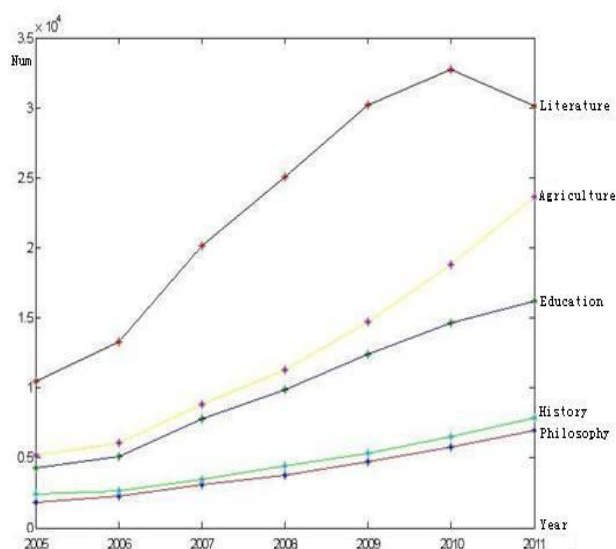

FIG. 1

FIG. 2

c). The balanced development between disciplines. View at the development scale of postgraduate education in the world and it's a process of non-balanced dynamic development, but ours is in balanced condition. Figures 1 and 2 show the growth rate is similar between disciplines. There's no various difference with the expanding in education scale which is extremely balanced .While the gap in base of different disciplines is large. Thus it's no good coordinating proportion of the disciplines and optimizing disciplinary structure of postgraduate education

Conclusions

How talents of postgraduate education meet the needs of society and market is an important criterion to judge whether disciplinary structure is good or not. People's Republic of China's Eleventh Five-Year Plan for the National Economic and Social Development makes industrial structure adjustment and optimization as the main line for economic and social development, stating that accelerating economy restructuring and changing growth pattern are the important strategic points for economic development during the period of the eleventh five-year. Therefore China's postgraduate education's disciplinary structure should be adjusted and optimized, cultivating substantial personnel required to further economic and social development, ensuring the quality of postgraduate education. Specific countermeasures and suggestions are as follows

Proportion Adjustment between Basic and Applied Science

Basic science is the prerequisite for development of the

applied science, necessary for any society and nation. While applied science is well related with public daily lives, without which the development of national economy can't operate well. More emphasis on basic science but less on applied science will definitely lead to the excess personnel for theoretical study, while relative shortage of talents for technology development. With the developing trend market-oriented science & technology and employment will face tremendous pressure and demands for the applied talents more than those of basic science. It's therefore necessary to adjust the proportion of the basic and applied science and optimize the pattern of personnel training.

Develop Burgeoning Discipline and Cross Discipline Energetically

Scientific and technological progress and social development have brought rapid development of academy education. At the same time, a large number of burgeoning and cross disciplines, both theoretical and technical, have emerged, whose power has been improved rapidly and constantly; On the other hand, in the face of a variety of complex economic and social problems in today's world, it's necessary for people to grasp knowledge with a wide range and have certain ability to solve the increasing problem. Therefore it's useful for postgraduate education, as the highest level of higher education, to vigorously develop cross disciplines, cultivate a large number of multiple personnel required by modern science and science & technology development.

Appropriate Imbalanced Development of Disciplinary Structure

Facing education popularity nowadays, the quality of postgraduate education has been increasingly questioned. Major academies have begun to develop disciplines with characteristics, promote disciplines' non-balanced development, enhancing and expanding their brand and reputation. But also China's imbalanced regional development, to some extent, determines the difference of talents in quantity, type and specification. Therefore it's required to rationally adjust and dispose education resources, strengthen discipline construction and promote regional talents' cultivation.

REFERENCES

Deng Julong. The Grey Systems' Basic Method [M], Wuhan: Middle China Science and Engineering University Press, 1987.

Gao Guijuan. The Analysis and Thinking about the Optimization of the Postgraduate Discipline Structure, Degree and Postgraduate Education, 2008.

Guan Xian. Analysis of Motives for Discipline Structure Development in Higher Education, Journal of Technology College Education, 2008.

Wang Genshun, Bao Shuimei. Research on the Optimization of Postgraduate Discipline Structure, Higher Education Exploration, 2007.

Zhao Hengping, Gao Qian. Optimizing Discipline Structure of Colleges and Universities Improving Quality of Personnel Training, Heilongjiang Education, 2007.