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The research on marine pharmaceutical innovation talent in Zhejiang Province

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ABSTRACT

Based on the original analysis framework of the marine science and technology innovation, this article analyses the capacity of marine pharmaceutical innovation in Zhejiang province as an economy demonstration district. And it is found that the development of the marine innovative talents plays an important role in the development of marine innovation. By analyzing the situation of the marine pharmaceutical innovation talents in Zhejiang province, there are some specific suggestions listed to improve the capacity of marine pharmaceutical innovation

Key words: AHP; the marine pharmaceutical science; innovation capacity; innovative talents; Zhejiang

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INTRODUCTION

The marine depending on the abundant resources, wide space and convenient transportation has become the hot competed resource in the 21th century. [1]The competition about the exploitation of marine turns more and more intense among the advanced economies in the whole world. [2]With the rising emphasis on the development of marine, Zhejiang province, as a major province of abundant marine resources, will unswervingly take the road of marine autonomous innovation and technological progress to improve the capacity of marine science and technology innovation. Since 2011, the State Council has approved a series of Zhejiang, Shandong and Guangdong to be the marine economy demonstration areas. [3]

Talent is the key to promote science and technology progress and technological innovation. Exploring the cultivation mode of the marine science and technology innovation talent is an effective way for marine tertiary education to better serve economic development and technological progress of marine services. [4]Thus, this article compares and analyses the marine scientific and technologic innovation talents to get the influence of the innovation talents in the marine science and technology innovation. This article attempts to establish an assessment model of the marine science and technology innovation capability by using AHP and analyzing the evaluation system of the marine science and technology innovation. The aim is to improve the overall marine science and technology innovation capacity by improving the situation of the innovation talents in Zhejiang province.

1. SITUATION OF ASSESSMENT SYSTEMS

In order to assess the capacity of marine science and technology innovation in various regions, the country has done a host of researches on the assessment systems of science and technology innovation, such as the “the Report of National Innovation Index 2010”, “the Evaluation Report of China Innovation Cities” and so on. [5]However, there is a lack of researches relating to the aspects of the competition of the marine science and technology and the capacity of the marine science and technology innovation. Wei Mengxing and Ying Kedong established a rating system of marine scientific and technical strength, which is consisted by the basic level of development of marine science and technology, the level of input in marine science and technology, the level of output from marine science and technology, marine science and technology achievement transformation and the marine influence of economic

and social development. Bai Fuchen established an index system including the capacity of input in the marine science and technology, the capacity of the output from the marine science and technology, the efficiency of the input and output of marine science and technology. He also established the Multilayer Grey Assessment Model using the grey system theory, and get a comprehensive evaluation and comparative analysis of marine science and technology competitiveness of China 11 coastal provinces and municipalities. Wu Yefeng and Shi Ping established the evaluation theory and evaluation system in the competition of marine science and technology of coastal cities in China. [6]

2. MODEL ESTABLISHMENT

2.1 INDEX SELECTION AND DESCRIPTION

The marine science and technology innovation ability evaluation system in global coastal cities is composed of human resources, equipment resources and innovative output, and these elements influence each other to form an organic whole. Currently, since the industrial division of marine science and technology industry and the presence of land economy are significantly different, and the relevant statistical data is imperfect, statistical standards are also inconsistent. Therefore, the construction of the evaluation index system has not been involved in the industrial developmental contribution rates of the capability of marine science and technology innovation to the marine economic. [7]The specific analysis framework of the marine science and technology innovation is in Table 1.

Table 1 Analysis Framework of Marine Science and Technology Innovation

	first-grade index	second-grade index
The input of Marine science and technology	A1 Oceanographic institutes	A11 The number of oceanographic institutes
		A12 The rising speed of oceanographic institutes
	A2 Technical personnel in oceanographic institutes	A21 The number of the technical personnel in oceanographic institutes
		A22 The proportion of PhD of the technical personnel in oceanographic institutes
		A23 The proportion of senior titles of the technical personnel in oceanographic institutes
	A3 Oceanographic equipment	A31 Marine research vessels
		A32 Supercomputers
		A33 Test deepwater pools
	A4 Scientific topics of oceanographic institutes	A41 The number of the scientific topics of oceanographic institutes
		A42 The proportion of the Basic and applied research projects
		A43 The proportion of the application results and IT service projects
The output of Marine science and technology	A5 Scientific papers of oceanographic institutes	A51 The number of the scientific papers of oceanographic institutes
		A52 The proportion of foreign Papers
	A6 Patents of oceanographic institutes	A61 The number of the patents in the oceanographic institutes
		A62 The analysis of patents in marine Science and Technology

2.2 THE ESTABLISHMENT OF THE COMPARATIVE MATRIX PAIRS

After establishing the system, there is a need to structure the judgment matrix to determine the weight of each index. The scores are given by 25 experts on the relative importance of the various indicators in Table 1(The rating standards are shown in Table 2), including professors, associate professors, relevant professors and government officials. After counting and analyzing the scores from professors, the weights of each index are obtained (Referring to the matrix computation). This model obtains the weight levels of various indexes using normalization, and the specific step is to remove the each column and corresponding element in each columns, thus you can get a normalized matrix. Adding the value of t each row in the normalization matrix and being divided by the number of values, finally a sorted percentage and the weights of corresponding index are obtained.

In addition, after pairwise comparisons of the elements at all levels and setting the weights, you must do the consistency test among the various elements in the matrix to determine the relationships. To this end, there is a need to calculate the consistency index, as follows: $CI = \frac{\lambda \max - n}{n - 1}$ In this relation, n is the order of judgment matrix and λ max is the maximum eigenvalue. When random consistency ratio $CR = \frac{CI}{RI} < 0.1$ (Average random

consistency index RI is randomly generated to be the average of the inverted symmetric matrix CI's values), the result is considered to be satisfactorily consistency. Otherwise the value of the elements of the matrix A should be re-adjusted until getting the satisfactorily consistency. [8]Professor T. L. Saaty provides RI values showed in Table 3.

Table 2 Standards and Implications of AHP

Scores Aij	Relations
Aij = 1	equally important
Aij = 3	The former is slightly more important than the latter
Aij = 5	The former is more important than the latter
Aij = 7	The former is much more important than the latter
Aij = 9	The former is extremely more important than the latter
Aij = 2,4,6,8	The intermediate state of the adjacent judgment
Aij = 1/n	Aij > 0, Aij =1, Aij = $\frac{1}{Aij}$

Table 3 Value of Average Random Consistency Index RI

n	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

2.2.1The sequence of the first-grade index
Structure the judgment matrix of the first-grade , and calculate the maximum eigenvalue and the index sort weight.

	A1	A2	A3	A4	A5	A6
A1	1	1/7	1/5	1/5	1/7	1/6
A2	7	1	5	4	3	2
A3	5	1/5	1	2	1/3	1/4
A4	5	1/4	1/2	1	1/6	1/5
A5	7	1/3	3	6	1	1/2
A6	6	1/2	4	5	2	1

By calculating λ max(A) =6.595 CIA =0.119，by looking up tables available RIA =1.240. CRA =0.096<0.1，the matrix is in accordance with consistency（The following matrices have passed the consistency test using the method presented），the weights of A1, A2, A3, A4, A5, A6 separated are 0.094, 0.290, 0.149, 0.047, 0.134, 0.286.

2.2.2The sequence of the second-grade index
Structure the judgment matrix of the second-grade A, and calculate the maximum eigenvalue and the index sort weight.

(1) The judgment matrix of Oceanographic institutes A1:
(2)

	A11	A12
A11	1	1/3
A12	3	1
weights	0.250	0.750

(3) The judgment matrix of technical personnel in oceanographic institutes A2

	A21	A22	A23
A21	1	4	2
A22	1/4	1	2
A23	1/2	1/2	1
weights	0.571	0.143	0.286

(4) The judgment matrix of Oceanographic equipment A3

	A21	A22	A23
A21	1	1	1/3
A22	1	1	1/2
A23	3	2	1
weights	0.200	0.200	0.600

(5) The judgment of scientific topics of oceanographic institutes A4

	A21	A22	A23
A21	1	3	2
A22	1/3	1	2
A23	1/2	1/2	1
weights	0.546	0.182	0.272

(6) The judgment matrix of scientific papers of oceanographic institutes A5

	A11	A12
A11	1	3
A12	1/3	1
weights	0.750	0.250

(7) The judgment matrix of patents of oceanographic institutes A6

	A11	A12
A11	1	2
A12	1/2	1
weight	0.670	0.330

2.2.3 The total sequencing weight of the index hierarchy

Through the above calculation, this model's the total sequencing weight of the index hierarchy is showed in Table 4.

Table 4 Total Sequencing Weight of Evaluation Index System on Capacity of Marine Science and Technology Innovation

First-grade index Ai	The total sequencing weight of the index hierarchy	Second-grade index Aij	The single sequencing weight of the index hierarchy	The total sequencing weight of the index hierarchy
A1 oceanographic institutes	0.094	A11 The number of oceanographic institutes	0.250	0.024
		A12 The rising speed of oceanographic institutes	0.750	0.071
A2 scientific workers of Marine scientific research institutions	0.290	A21 The number of the technical personnel in oceanographic institutes	0.571	0.166
		A22 The proportion of PhD of the technical personnel in oceanographic institutes	0.143	0.041
		A23 The proportion of senior titles of the technical personnel in oceanographic institutes	0.286	0.083
A3 oceanographic equipment	0.149	A31 Marine research vessels	0.200	0.030
		A32 Supercomputers	0.200	0.030
		A33 Test deepwater pools	0.600	0.090
A4 scientific topics of Marine scientific research institutions	0.047	A41 The number of the scientific topics of oceanographic institutes	0.546	0.026
		A42 The proportion of the Basic and applied research projects	0.182	0.009
		A43 The proportion of the application results and IT service projects	0.272	0.013
A5 scientific papers of Marine scientific research institutions	0.134	A51 The number of the scientific papers of oceanographic institutes	0.750	0.101
		A52 The proportion of foreign Papers	0.250	0.034
A6 patents of Marine scientific research institutions	0.286	A61 The number of the patents in the oceanographic institutes	0.670	0.189
		A62 The analysis of patents in marine Science and Technology	0.330	0.093

CONCLUSION

According to the above evaluation index system of marine science and technology innovation, the article obtains the total and single sequencing weight of the index hierarchy of both first-grade and second-grade index. From the calculation of the total sequencing weight of the first-grade index, the conclusion can be obtained that the weight of the innovation talents (0.290) is the largest, which also indicates that the innovation talents play an important role in

the whole evaluation system.

With the rapid development of the marine economy and marine business, some problems on the talents turn out, such as the irrationality of the marine science and technology innovation talents, the lack of high-level innovation talents and applied talents, the weakness of the reserve talents, etc. It has been a trend to accelerate the implementation of innovation-driven development strategy, accelerate the establishment of the development of engage talents and strengthen the development of human resources. Therefore, the role of marine science and technology talents turns increasingly prominent.

3. ANALYSIS OF SITUATION OF MARINE SCIENCE AND TECHNOLOGY INNOVATION TALENTS IN ZHEJIANG PROVINCE

Analysis of existing marine innovation talents in Zhejiang province

Currently, there are 9 marine education universities in the whole province, 26 tertiary key disciplines of ministerial and provincial schools, 11 higher vocational schools, 17 secondary vocational schools. The number of the majors related to the marine engineering is over 20. Besides, the respectively numbers of the postgraduates, undergraduate and vocational technical personnel is approximately 500, 5000, 10000. [9]

The following Table 2 and Table 3 respectively show the total situation of the marine technical capacity in the coastal cities and the comparison on the technological personnel. In terms of the numbers of professional technical personnel, occupational personnel and technical talents, Zhejiang ranks under moderated place. As a cluster of universities, the number of colleges and universities in Zhejiang province and the number of its scientific research is more than other coastal cities. Nevertheless the fewer output of marine science and technology talents indicates that there are still some drawbacks in the aspect of marine science and technology development and talent negotiations in Zhejiang. Most sea-related teaching and research institutions are still relatively not mature, and its accumulation is not thick. Therefore it cannot meet the needs of the rapid rise of marine science and technology research and talent.

Table 2 Overall Scale of Marine Science and Technology Strength in Coastal Cities

	Zhe jiang	Shang hai	Jiang su	Tian jin	Shan dong	Liao ning	Guang dong	Hebei	Hai nan
The number of professional technical personnel	859	2128	1031	1849	2406	539	1732	400	135
The number of practitioners	1042	2591	1280	2630	3094	606	2249	418	153
The number of research institutes	17	13	8	11	20	8	23	4	3

Table 3 Comparison of Technical Personnel in Oceanographic Institutes

Index	Zhe jiang	Shang dong	Guang dong	whole country
The number of marine technical personnel	1171	2882	2162	27888
The proportion of PhD of the technical personnel in oceanographic institutes	7.3	16.3	22	16.5
The proportion of senior titles of the technical personnel in oceanographic institutes	37.5	34.4	6.8	37.3

The source of the data: *China Marine Science and Technology Yearbook in 2010*

Table 4 Achievements of Universities and Research Institutions in Zhejiang, Shandong and Guangdong

	Applicants of high yield（number/proportion）	Inventors of high yield（number）
Zhejiang（39.05%）	Zhejiang University（235/15.8%）	Chen Ying（47）
	Ningbo University（45/3.03%）	Yang Canjun (28)
	Zhejiang Ocean University ((38/2.56%)	Gu Linyi (25)
	Second Institute of Oceanography, State Oceanic Administration (25/1.68%)	Sun Qinghai (24)
	Ocean University of China (24/1.61%)	Fang Hua (32)
	Institute of Oceanology (362/11.48%)	Yuan Wenpeng (29)
	Yellow Sea Fisheries Research Institute , Chinese Academy of Fishery Sciences (91/2.89%)	Liu Changheng (28)
Shandong （8.4%）	Shandong University (45/1.43%)	Tang Jude (27)
	725 Institute, China Shipbuilding Industry Corporation (42/1.33%)	Zhang Tao (27)
	South Sea Institute of Oceanology (112/5.64%)	Xu Anlong (34)
Guangdong （11.83%）	Zhongshan University (104/5.24%)	He Weiping (27)
	South China University of Technology (67/3.37%)	Wang Qiang (27)
	Guangdong Ocean University (64/3.22%)	Cai Junpeng (25)

Situation of training and education on marine scientific and technical talents in Zhejiang province

The education department in Zhejiang province issued a “construction and development plan of the tertiary ocean disciplines in Zhejiang province (2011-2015)”. The overall goal of marine disciplines construction and development in the colleges of Zhejiang province follows: significantly improving of the level of the marine education, forming

more reasonable marine disciplines system in tertiary education, training a group of marine applications talents, basically completing the construction of the docking system of modern marine industry, significantly enhancing the overall strength of international competitiveness and sustainable development of marine education, strong supporting for leading the development of the whole province's marine economy.[10]

The analysis shows that the marine science and technology talents strength in Zhejiang does not take the dominant place compared with the 11 coastal provinces, ranking behind Guangdong, Shandong, Shanghai, Tianjin and Jiangsu, which is not commensurate with the important role of the marine science and technology in the development of Zhejiang. Therefore, it has become a trend to take measures in improving the personnel strength in marine science and technology.

4. Measures to improve the capacity of marine science and technology innovation in Zhejiang province

By analyzing the above data, there are still gaps and shortcomings in marine science and technology personnel training in Zhejiang compared with other coastal provinces. This article will come up with some corresponding measures and suggestions focus on the above problems.

(1) Increasing investment in marine science and technology

Attaching great importance on underdeveloped areas and islands such as remote areas in marine science and technology personnel training, sea-related areas and departments should encourage enterprises to establish special fund on sea-related science and technology talent development to promote the formation of diverse social investment mechanisms.

(2) Improving the university-industry-research cooperation further, introducing advanced technical talents

Sea-related enterprises, universities and research institutes should be encouraged to build a scientific and technological innovation platform, and establish collaboration with well-known research institutes actively at home and abroad. To establish effective working carrier for the introduction of senior talents, there is a need to establishing the Graduate school, postdoctoral workstation, Opening Laboratory and other institution in the key areas of marine development.

(3) Policy measures to encourage innovation in marine science and technology

Improving the model of appraising marine science and technology personnel, strengthen the orientation of the innovation and application, making the access to innovations , intellectual property rights to be an important criterion for approval, acceptance, funding and awards of projects.

(4) Rationally allocating university personnel, optimizing personnel structure

In terms of the current situation of the talents in Zhejiang, improving the relevant policy about the flow of talents aiming to optimize the personnel structure and the allocating talents reasonably, creating a more optimized and relaxed social environment for speeding up the development and utilization of marine human resources.

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