The Prediction of Shanghai Service Outsourcing Talents Demand Based on Grey Model

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Abstract

This paper builds the grey model base on the relevant data, forecasts Shanghai service outsourcing employees' demand by the application of the model, and put forward the countermeasures to realize the objective of prediction, at the same time provides the countermeasures and suggestions for Shanghai's service outsourcing talents-training.

Key Words: service outsourcing talents, demand forecasting, grey model

In recent years, under the push of Chinese government, service outsourcing gets a rapid development. Shanghai is one of the first 21 service outsourcing demonstration cities in China, plays an increasingly important role in the Chinese service outsourcing market. The outsourcing contract amount and offshore mount reached $6.618 billion and $4.379 billion respectively of Shanghai in 2013, has ranked first for three consecutive years of the 21 demonstration cities across the country. But the service outsourcing in Shanghai is still in the initial stage of development, compares with the developed countries' service outsourcing employees' number, the gap between them is still great. The lack of service outsourcing talents restricts the development of service outsourcing industry in Shanghai. Strengthen the research on the demand of service outsourcing talents in Shanghai will be a great significance to further strengthen the service outsourcing talents work, accelerate the development of service outsourcing industry and promote the economic development in Shanghai.

1 The Demand Forecasting of Service Outsourcing Talents Quantity

Now the qualitative forecasting methods such as the linear methods are the commonly used talent demand forecasting method in the domestic and overseas. This kind of method is basically looking for patterns in time series, prominently reflects the historical trend, and the trend reflects the influencing results of the comprehensive factors as well. The disadvantages of this kind of method are: the need of possessing abundant historical materials, and the data changing process must show some regularity. At the same time, the talents quantity changes will be affected by the uncertain factors such as economy, society and so on, makes the forecast result unreliable and difficult to adjust. But the main characteristic of grey prediction method is that the original data it requires is not so much and it is easy to collect, this prediction method is simple and has a high accuracy, so, using grey prediction method can solve this problem well.

1.1 Grey Forecasting Model Theory

So-called gray system is refers to the system of which part information is clear and parts not, the grey system theory stress on study the problem of "small sample, poor information not sure" and the object of "denotation clear, connotation not clear". Grey theory prediction accuracy is higher when is used to forecast analysis especially in short data sequence (historical data is less) and has obvious rising trend, so the grey prediction has extensive application in the field of human resources. The changing of service outsourcing talent quantity demand influenced and restrained by various complex factors such as economy, society, GM model prediction method can solve the problem of the the great error between the predicted value and actual value calculated by linear prediction method, and this method does not require too much raw data, so it can make up for the lack of talents historical statistical data.

This paper uses grey theory, takes the number from 2008 to 2012 of Shanghai service outsourcing industry as the original data, set up the grey mode to forecast the number of service outsourcing industry in Shanghai in 2017.

1.2 The Establishment Analysis and Prediction of GM (1, 1) Model

Shanghai service outsourcing employees' data in 2008-2012 as shown in table 1 (data collected and sorted from China outsourcing network):

Table 1

Year	2008	2009	2010	2011	2012
Employee (ten thousand)	6	10.43	14.23	20.14	23.3

Set $x^{(0)}=(\ x^{(0)}(1)、x^{(0)}(2)、x^{(0)}(3)、x^{(0)}(4)、x^{(0)}(5))\ =(\ 6、10.43、14.23、20.14、23.3)$, establish the below GM (1, 1) model:

Step 1: Establish the accumulation generation column data

$x^{(1)}=(\ x^{(1)}(1)、x^{(1)}(2)、x^{(1)}(3)、x^{(1)}(4)、x^{(1)}(5))\ =(\ 6、16.43、30.66、50.8、74.1)$

Step 2: Determine the model

According to the formula $\alpha = \begin{pmatrix} a \\ \mu \end{pmatrix} = \left(B^T B \right)^{-1} B^T Y_n$,

Of which: $B = \begin{bmatrix} -\frac{1}{2}\left[X^{(1)}(1)+X^{(1)}(2)\right] & 1 \\ -\frac{1}{2}\left[X^{(1)}(2)+X^{(1)}(3)\right] & 1 \\ \cdots & \cdots \\ -\frac{1}{2}\left[X^{(1)}(n-1)+X^{(1)}(n)\right] & 1 \end{bmatrix}$, $Y_n = \begin{bmatrix} X^{(0)}(2) \\ X^{(0)}(3) \\ \cdots \\ X^{(0)}(n) \end{bmatrix}$, result in: $\alpha = \begin{bmatrix} -0.2557 \\ 8.2078 \end{bmatrix}$ that is

$a = -0.2557, u = 8.2078$. Substituting the value of a, u into $\dfrac{dX^{(1)}}{dt} + aX^{(1)} = u$, get the grey model GM (1, 1)

differential equations: $\dfrac{dX^{(1)}}{dt} - 0.2557\, X^{(1)} = 8.2078$

That is: The grey model GM (1, 1) of Shanghai service outsourcing talents demand is:

$$\hat{x}^{(1)}(k+1) = [x^{(0)}(0) - \frac{u}{a}]e^{-\hat{a}k} + \frac{u}{a} = 38.1016 e^{0.2557k} - 32.1016$$

Step 3: Analysis and check the model

(1) Using the above model calculate the simulation values

$\hat{x}^{(0)}(k) =(\ \hat{x}^{(0)}(1)、\hat{x}^{(0)}(2)、\hat{x}^{(0)}(3)、\hat{x}^{(0)}(4)、\hat{x}^{(0)}(5))\ =(\ 6, 11.1006, 14.3347, 18.5110, 23.9040)$

(2) Calculate the residuals and correlation coefficient

According to the absolute error formula: $\varepsilon^{(0)}(k) = \left| x^{(0)}(k) - \hat{x}^{(0)}(k) \right|$,

The relative error formula: $q(k) = \dfrac{\varepsilon^{(0)}(k)}{x^{(0)}(k)} \times 100\%$, the correlation coefficient formula:

$\eta(k) = \dfrac{\min\left\{\varepsilon^{(0)}\right\} + \rho \max\left\{\varepsilon^{(0)}\right\}}{\varepsilon^{(0)}(k) + \rho \max\left\{\varepsilon^{(0)}\right\}} (k = 1,2,\cdots,n)$, ρ is the resolution, $0 < \rho < 1$, general, $\rho = 0.5$, Computing

parameters such as fitted values (forecast values), correlation coefficient and error, as shown in Table 2.

Table 2 Fitted Values (Forecast Values), Correlation Coefficient and Error Parameters, Etc

Year	Serial Number k	Actual Values $x^{(0)}(k)$	Forecast Values $\hat{x}^{(0)}(k)$	Absolute Error $\varepsilon^{(0)}(k)$	Relative Error $q(k)$	Correlation Coefficient $\eta(k)$
2008	1	6	6	0	0	1
2009	2	10.43	11.1006	0.6706	6.4295	0.5484
2010	3	14.23	14.3347	0.1047	0.7356	0.8861
2011	4	20.14	18.5110	1.629	8.0885	0.3333
2012	5	23.3	23.9040	0.6040	2.5922	0.5742

When $\rho = 0.5$, calculating correlation, thus, the degree of fitting (data) of the prediction model is better, as shown in Figure 1:
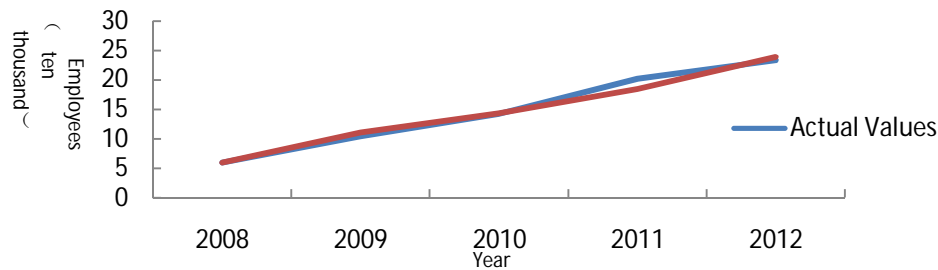

Figure1The Actual Value Compared With the Simulation Value Trend Chart

(3) The accuracy test. In order to guarantee the accuracy of the prediction results of the model, it is necessary to take the test method and way. Based on the general grey model of testing method namely posterior differential method, we use C and P value according to the calculation can determine the accuracy of the model.

The original sequence of variance: $s_1^2 = \dfrac{1}{n}\sum_{k=1}^{n}(x^{(0)}(k)-\overline{x})^2 = 39.5251$

Residual error sequence of variance: $s_2^2 = \dfrac{1}{n}\sum_{k=1}^{n}(\varepsilon^{(0)}(k)-\overline{\varepsilon})^2 = 0.3338$

The ratio of a posteriori difference: $C = \dfrac{S_2}{S_1} = 0.0919$

The little error of frequency: $P = p\left\{\left|\varepsilon^{(0)} - \overline{\varepsilon}\right| < 0.6745\, S_1\right\}$

Generally, according to table 3 inspect the model fitting, we can use the built model to forecast if the residual error, correlation degree and a posteriori difference all can pass the test, otherwise the residual error correction is required to improve the accuracy of the model.

Table 3 Model Fitting Precision Registration Form

Accuracy Class	Level 1 (Good)	Level 2 (Qualified)	Level 3 (Barely Qualified)	Level 4 (unqualified)
P	>0.95	>0.80	>0.70	≤0.65
C	<0.35	<0.50	<0.65	≥0.65

Because $\left|\varepsilon^{(0)} - \overline{\varepsilon}\right| = (0.6017, 0.0689, 0.497, 1.0273, 0.0023)$, but $0.6745\, S_1 = 4.2405$, It is observed that $\left|\varepsilon^{(0)} - \overline{\varepsilon}\right| < 0.6745\, S_1$, so P=1, compared to Table 6, P>0.95 and C<0.35, so it can conclude that: The model accuracy grade is Level 1, it is reliable to us the model forecast results.

Step 4: Model prediction

By residual test, correlation degree test and posterior difference test, as we see, this model has excellent accuracy, we can use the model predict the outsourcing talents demand of Shanghai, prediction results are obtained as shown in table 4.

Table 4 Shanghai Outsourcing Talents Demand Prediction

Year	2013	2014	2015	2016	2017
Quantity	30.87	39.86	51.47	66.47	85.84

It can be seen from the results that in the recent years, the number of Shanghai service outsourcing workers has an upward trend year by year, that will reach 0.8584 million in 2017.

The main reason why the number of service outsourcing employees increased is that service outsourcing is an emerging industry and an important part of modern service industries. And the growing service outsourcing practitioners' team in Shanghai also reflected the constant optimization of the industrial structure of Shanghai, the Shanghai's optimization of industry structure and the government's emphasis on service outsourcing industry development increase a bigger demand for service outsourcing practitioners. But according to current situation of service outsourcing talents supply and demand in recent years, the Shanghai service outsourcing talents supply and actual demand has a certain gap, therefore it needs the government, enterprises and schools and all aspects take corresponding measures to strengthen the cultivation of talents, to increase the talents supply.

2 Counter measures

2.1 From the School Level

2.1.1 Innovate Education Pattern in Colleges and Universities

First, expand the university autonomy of curriculum setting. Encourage the qualified colleges construct related discipline according to the requirements of the development of service outsourcing industry , and set all kinds of professional course dynamically, refining training professional direction. Encourage affiliated and local colleges and universities carry on the service outsourcing talent training together. Second, promote college credit hours swap mechanism actively. Convert students' practice time in the enterprise for credits or hours, to encourage students participate in the activities of enterprise. Third, promote the cooperation between universities and service outsourcing enterprises actively. Bring the service outsourcing practice into the teaching course system, realize the effective docking of talent supply and demand and the resource sharing.

2.1.2 Realize the Demand Docking between Higher Vocational Colleges and Outsourcing Enterprise

The establishment of a "win-win" talent training mode is the first thing to realize the demand docking between higher vocational colleges and outsourcing enterprise. The key to realize the college-business cooperative education model is to find the common interests of both sides, especially to find the point of enterprise's interests, then design the cooperation pattern according to the interests of the enterprise. At the same time, enterprises need to participate in research and set training target, teaching plan, teaching content and way of cultivation, and it should also undertake some of the practical teaching tasks. In addition, higher vocational colleges can also adopt directional training mode, such as: ordering personnel training mode, that is the employment training mode, school and enterprise sign training agreement, make personnel training plan, organize the teaching together, students after graduation go to the enterprise directly.

2.1.3 Realize the Docking of Teaching Content and Outsourcing Jobs

Higher vocational colleges should further increase the cultivation force of service outsourcing practical talents, according to the special requirements of service outsourcing industry development and enterprise undertake the service outsourcing, Higher vocational colleges should increase the adjusting intensity in discipline construction, teaching content and curriculum provision, adjust the curriculum, updating the teaching contents, accelerate the interdisciplinary practical talents training. By establishing the effective mechanism and channels, integrate the demand of the service outsourcing enterprises and university students' employment demand closely.

In the practice teaching should pay attention to simulate the real service outsourcing enterprise environment and operating rules, base on service outsourcing enterprises' strong technical background, take the project development as the main line, introduce the project development whole process, strengthen and training the talents fully in accordance with the company process management and service outsourcing talents standard.

2.1.4 Realize the Connection of Teachers and the Occupation Instructor

The teacher selected way should be accepted between the two sides, including ways send by the school, enterprises and external hired. Service outsourcing talents training needs a high level of "double type" teachers. As a teaching, he should not only be familiar with the service outsourcing theory and practice, but also must possess a good professional practice ability, good language expression ability and coaching ability of job skills, he can guide the students' post actual operation effectively, to ensure the realization of the best education effect of the talents training mode.

2.1.5 The Preparation of Their Own Quality and Employment Information

The professional knowledge that service outsourcing needs is not profound, learning professional course in the university is alright. Of course, actual requirements of professional quality may not be the same, college students should take in some vocational training when have understanding of the fitted jobs. In addition, service outsourcing industry has a higher requirement with the foreign language, the better the foreign language is, the more likely successful in this industry. Sophomore, junior students should pay attention to the related development of the service outsourcing industry from now on, determine their own development direction according to the information.

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2.2 From the Enterprises and Institutions Level

2.2.1 Innovate the Service Outsourcing Enterprise Training Mode

Service outsourcing enterprises are encouraged to establish practice base. Support the business acceptance of colleges students during the period of school training, and create a good training conditions and environment for students, offer certain subsidy according to the credit system in colleges and universities charge standard. Encourage strong enterprises to embed their business in the service outsourcing professional courses of college, vocational college, open up the talented channel of colleges and universities, training institutions and enterprises, realize seamless link of "graduate is employment", improve the efficiency of personnel training. Especially to encourage international outsourcing companies and institutions, training agencies to build service outsourcing talent training base, introduce advanced training concept and mode.

2.2.2 Improve the Quality of Training Institutions Comprehensively

Training institution is the main channel of service outsourcing talents, promote institutions for training mode innovation, improve the training quality is particularly important. First, training qualifications and standards should be established. Second, we must vigorously introduce the foreign service outsourcing professional training institutions, take advantage of its overseas channels and globalization of teachers, through the establishment of overseas training center, all kinds of simulation true scene and actual operation training mode, improve the level of the internationalization of domestic service outsourcing talents rapidly, create conditions to improve the ability to undertake international outsourcing. Third, we need to gradually improve the quality of domestic training institution, hierarchy and level. Encourage the entrust training, directional training mode innovation, finance can increase subsidies appropriately to the training institutions which introduce advanced technological equipment and the high-end course, the key is the high-end training and overseas training.

2.3 From the Government Level

2.3.1 Increase the Financial Subsidies to the Service Outsourcing Training

First, increasing the subsidy standards of training institutions. Second, give service outsourcing enterprises who undertake the colleges' students practice and new staff training a appropriate subsidies, at the same time expand the finance subsidy policy coverage to secondary vocational school. Third, change the training reward fund declaration time to September.

Colleges and training institutions generally reflect the college diploma issued time is the end of June, and the employment agreement signed time is generally in July and August, September is possible to count accurately. Four, set up the special talents training to support the Midwest service outsourcing, increase the service outsourcing talent training in the Midwest.

2.3.2 Strengthen the Organization Planning, Management and Propaganda Work of Training of Service Outsourcing

Relevant local government departments should establish service outsourcing work leading group, set up joint meeting mechanism, strengthen the business, education, labor and social security, taxation and other departments' communication, coordination and cooperation, standardize management of the service outsourcing training market. Increase the propaganda of service outsourcing industry, promote influence, attract and gather talent resources more widely.

2.3.3 Strengthen the Preferential Policies of Service Outsourcing Talents Introduction

Establish service outsourcing talents introduction strategy and channel, form the mechanism of high-end talent globalization configuration. Through the methods such as project cooperation, regular home communication makes full use of overseas talent resources. Especially strengthen the introduction work of high-end service outsourcing talents, emphatically introducing overseas industry leading personnel, such as senior project managers, senior technical and management personnel who have many years experience engaged in service outsourcing, familiar with international outsourcing market. We will improve the talents introducing mechanism, environment and reward policy. State and local governments should give corresponding support, and properly solve the life problems of settlement down, children education, household register and so on.

2.3.4 Strengthen the Construction of Service Outsourcing Training Public Service Platform

First, through the construction of information technology platform such as service outsourcing talents website, service outsourcing talents database, digital campus, and the ways of regular organizing service outsourcing talent recruitment, BBS, release authority report, set up service outsourcing talent supply and demand information service platform, strengthen the communication mechanism of enterprises, colleges and universities, training institutions. Second, encourage service outsourcing leading enterprises, multinational company with the internal training center opening toward society, become a public service platform of the service outsourcing talents training. Third, play the role of intermediary organizations such as the service outsourcing association, establish a society training system. By organizing regular training, holding service outsourcing industry skills contest, improve the students' attention and appeal, and expand the scale of basic service outsourcing talents.

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