A Structural and Comparative Study of Work Satisfaction of Chinese Scientists

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Abstract. This study was based on the questionnaire survey of China Association for Science to research the work satisfaction of Chinese scientists. Cronbach and factor analysis methods were first used for testing the reliability and validity of the questionnaire, the mean and percentage were used for analyzing scientists’ work satisfaction in all aspects, and finally the factor score and t-test were used for comparing the differences in work satisfaction of scientists from Chinese research institutes, universities and enterprises. Conclusions showed that the questionnaire had good reliability and validity, the scientists were satisfied with expertise applications and interpersonal relationships and dissatisfied with wages, benefits and opportunities for further study, and those from universities had higher overall satisfaction, while those from enterprises had lower overall satisfaction.

Introduction

Since the reform and opening-up, Chinese economy has kept faster growth in the past thirty years and achieved good results. However, it has begun to face many new problems over time. In the context of economic globalization, China’s economic growth mode with high energy consumption, high pollution, high export, high investment, low added value, low-paid labor and low-end industry is not sustainable and needs to be changed. China must march toward the high end to develop knowledge-intensive industries. In the implementation of innovation-driven strategy, scientists play a vital role. According to the information and incentive economics, an organization (the principal) has multiple possible choices rather than one universally effective incentive for the employees (agents). The most effective incentive method must be selected according to the specific institutional environment and the characteristics of preferences of agents [1]. Therefore, the analysis of the characteristics of agents’ preferences and the institutional environment as well as agents’ work satisfaction and influencing factors is the prerequisite for the selection and optimization of incentive mode. Studies have indicated that the level of research performance is directly affected by work satisfaction; that is, the higher the overall satisfaction, the higher the research performance [2]. Therefore, the analysis of the work satisfaction of scientists provides some supports for the decision-making of Chinese innovation-driven strategy.

Literature Review

The concept of work satisfaction was first proposed by Taylor in 1912, which was defined by Hoppock in 1935 in his doctoral thesis Work Satisfaction as Employees’ Feeling about the Work Environment as well as Physical and Psychological Satisfaction. Locke (1976) defined work satisfaction as a positive emotional state from the organization members upon their work or work experiences [3].

Many scholars have studied satisfaction factors. Porter (1961) argued that the work satisfaction factors mainly included security assurance, social harmony, self-esteem, independence and self-realization [4]. Vroom (1964) categorized the work satisfaction factors into the superior,
business management, working conditions, remuneration, job content, promotion and colleague [5]. Brown (1994) introduced organizational variable [6]. In the empirical study on work satisfaction in China, Zhang Xiao and Xu Hao studied the work satisfaction of logistics employees [7] [8], Li Jiali studied that of social workers [9], Yao Zhifu and Zhang Yiwen studied that of migrant workers [10], and Liu Fengyu and Zhang Jincheng studied that of private enterprise employees [11].

In the existing studies in China on work satisfaction, there is almost no empirical study that takes scientists as samples. This study sampled scientists, analyzed their overall work satisfaction and compared the work satisfaction of scientists from universities, research institutes and enterprises. This study not only has important practical significance but also fills the empirical study gap to some extent.

Data and Scale Design

The data used in this paper were from the special survey of values and outlook on life of Chinese scientists for the first time by China Association for Science and Technology, covering 31 Chinese provinces, autonomous regions and municipalities. From July 2010 to September 2010, a total of 19,350 questionnaires were issued to 219 survey sites set by China Association for Science and Technology and 18,276 were collected, accounting for 94.4%, in which 16,577 were valid, accounting for 85.7%. In these 16,577 questionnaires, those from research institutes, universities and enterprises were selected as the study samples, in which 1,762 were from research institutes, 3,111 from universities and 4,707 from enterprises. From the perspective of gender, men and women respectively accounted for 57.2% and 42.8% of the samples; from the perspective of age, scientists under the age of 50, 40 and 30 respectively accounted for 90.1%, 61.9% and 24.9%.

The work satisfaction of scientists was measured mainly from expertise application, a variety of incomes, opportunities for further study, benefits, working facilities and conditions, organizational/industrial rules and regulations, interpersonal relationships, opportunities for technical title and administrative post promotion. Likert scale was used to divide the work satisfaction into five levels, very satisfied, relatively satisfied, basically satisfied, relatively dissatisfied and very dissatisfied. The score 1 represented very satisfied, and the lower score represented the higher satisfaction.

Empirical Study

Reliability Test

The degree of internal consistency of questionnaire results is called reliability. Prior to the analysis of questionnaires, in order to ensure their reliability, it needs to be tested first. In this paper, SPSS 17.0 was used for data processing, Cronbach’s Alpha (coefficient \( \alpha \)) was used to analyze the reliability, and 0.9 was selected as the standard to evaluate the level of reliability, as shown in Tab. 1. As can be seen from Tab. 1, the coefficient \( \alpha \) of the questionnaire exceeds 0.9, indicating that the questionnaire has high reliability.

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.914</td>
<td>9</td>
</tr>
</tbody>
</table>

Validity Test

After the reliability analysis, the validity analysis of the scale should also be carried out to test the validity of the questionnaire. In this study, factor analysis method was used. Before the factor analysis of scientists’ satisfaction, KMO and Bartlett tests were carried out for the data first. KMO statistic was 0.916, and Bartlett Test of Sphericity rejected the null hypothesis of unit correlation matrix (Sig<0.001). These two results indicated that the data had high partial correlation, while
there were common factors between correlation matrices, therefore they were very suitable for factor analysis.

The factor analysis of the work satisfaction of scientists from research institutes, universities and enterprises was carried out and the factor was extracted in line with the characteristic value more than one so that the explained variances were obtained as shown in Tab. 2:

Table 2. Explained Variance of Work Satisfaction.

<table>
<thead>
<tr>
<th>Items</th>
<th>Initial feature</th>
<th>Extraction of square and loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Variance %</td>
</tr>
<tr>
<td>1</td>
<td>5.350</td>
<td>59.447</td>
</tr>
<tr>
<td>2</td>
<td>.851</td>
<td>9.457</td>
</tr>
<tr>
<td>3</td>
<td>.611</td>
<td>6.793</td>
</tr>
<tr>
<td>4</td>
<td>.565</td>
<td>6.277</td>
</tr>
<tr>
<td>5</td>
<td>.451</td>
<td>5.012</td>
</tr>
<tr>
<td>6</td>
<td>.343</td>
<td>3.814</td>
</tr>
<tr>
<td>7</td>
<td>.320</td>
<td>3.557</td>
</tr>
<tr>
<td>8</td>
<td>.292</td>
<td>3.246</td>
</tr>
<tr>
<td>9</td>
<td>.216</td>
<td>2.398</td>
</tr>
</tbody>
</table>

Extraction method: principal component analysis.

As can be seen from Tab. 2, only one factor was extracted and its contribution reached 59.477%, representing a large proportion of the overall information. Only one factor meant high data quality, and the nine items reflected the situation of one facet, and this factor was directly named as work satisfaction factor. On the whole, the questionnaire had high structural validity.

Rank of Work Satisfaction

Based on the factor analysis, the work satisfaction of scientists was ranked in this section so that the aspect where the scientists were more satisfied could be clearly understood. The items in Tab. 3 were ranked on the basis of the mean (M) of each question in two levels, respectively 2.5-2.85 points and 2.85-3.2 points. Tab. 3 also provided the percentage of the answer of each question.

The first level was 2.5-2.85 points, covering three items, satisfaction with expertise applications, satisfaction with working facilities or conditions and satisfaction with interpersonal relationships. Scientists had the highest satisfaction with expertise applications and interpersonal relationships, 2.54 and 2.64 on the average (from very satisfied to very dissatisfied, the lower the score, the higher the satisfaction). As can be seen, the percentage of options “very satisfied” and “relatively satisfied” with expertise applications and interpersonal relationships both exceeded 40%.

The second level was 2.85-3.2 points, covering six items, satisfaction with a variety of incomes, satisfaction with opportunities for further study, satisfaction with benefits, satisfaction with rules and regulations of the organization and the industry, satisfaction with opportunities for technical title promotion and satisfaction with opportunities for administrative post promotion. Scientists were relatively dissatisfied with a variety of incomes, opportunities for further study and benefits, relatively 3.09, 3.16 and 3.17 on the average. Seen from the percentage of each option, the scientist dissatisfied with these three aspects reached 25.2%, 29.6% and 26.6%.
Table 3. Rank of Work Satisfaction.

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Mean</th>
<th>Very satisfied</th>
<th>Relatively satisfied</th>
<th>Basically satisfied</th>
<th>Relatively dissatisfied</th>
<th>Very dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expertise applications</td>
<td>2.64</td>
<td>7.8</td>
<td>35.4</td>
<td>43.5</td>
<td>11.2</td>
<td>2.1</td>
</tr>
<tr>
<td>A variety of incomes</td>
<td>3.09</td>
<td>3.6</td>
<td>21.5</td>
<td>43.4</td>
<td>25.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Opportunities for further study</td>
<td>3.16</td>
<td>4.6</td>
<td>19.3</td>
<td>39.2</td>
<td>29.6</td>
<td>7.3</td>
</tr>
<tr>
<td>Benefits</td>
<td>3.17</td>
<td>3.9</td>
<td>18.1</td>
<td>43.4</td>
<td>26.6</td>
<td>8</td>
</tr>
<tr>
<td>Working facilities or conditions</td>
<td>2.84</td>
<td>5</td>
<td>27.7</td>
<td>48.8</td>
<td>15.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Rules and regulations of the</td>
<td>2.89</td>
<td>4.1</td>
<td>25.4</td>
<td>50.9</td>
<td>16.3</td>
<td>3.2</td>
</tr>
<tr>
<td>organization and the industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpersonal relationships</td>
<td>2.54</td>
<td>5.8</td>
<td>41</td>
<td>47</td>
<td>5.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Opportunities for title promotion</td>
<td>2.94</td>
<td>4.1</td>
<td>25.2</td>
<td>47.9</td>
<td>18.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Opportunities for post promotion</td>
<td>3.06</td>
<td>3.9</td>
<td>19.5</td>
<td>49.3</td>
<td>21.8</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Comparative Analysis of Work Satisfaction

To compare the work satisfaction of scientists from research institutes, universities and enterprises, each factor coefficient was first multiplied by the variance contribution of each factor and each individual factor’s composite score was calculated in the form of summation, then all samples were divided into three sub-sample groups of research institutes, universities and enterprises, t-test was used for calculating the difference between them, and if significant, the satisfaction of each sample group was compared through the mean of sample groups. SPSS17.0 was still used for the calculation of the above process. See Tab. 4 for the results:
Table 4. Differences in Work Satisfaction.

<table>
<thead>
<tr>
<th>Workplace</th>
<th>Mean of composite score of satisfaction factors</th>
<th>t-test sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research institutes</td>
<td>-0.0212</td>
<td>0.00</td>
</tr>
<tr>
<td>Universities</td>
<td>-0.0446</td>
<td></td>
</tr>
<tr>
<td>Enterprises</td>
<td>0.0375</td>
<td></td>
</tr>
</tbody>
</table>

As can be seen from Tab. 4, t-test sig was less than 0.001, suggesting significant differences in research institutes, universities and enterprises of scientists satisfaction; the score of the option “very satisfied” was designed as 1 that was minimum and “very dissatisfied” as 5 that was maximum, i.e. the lower the composite score of factors, the higher the satisfaction. The results showed that the mean composite score of satisfaction factors was universities, research institutes and enterprises in order from low to high. This indicated that the scientists from universities had the highest work satisfaction, those from enterprises had the lowest satisfaction and those from research institutes had moderate satisfaction.

Discussion

In this study, the structure of work satisfaction of Chinese scientists was tested, the satisfaction factors were ranked and the work satisfaction of scientists from research institutes, universities and enterprises was compared to draw the following three conclusions: first, the work satisfaction of scientists from research institutes, universities and enterprises was centralized on the structure, the questionnaire included nine items, satisfaction with expertise applications, satisfaction with income, satisfaction with opportunities for further study, satisfaction with benefits, satisfaction with working facilities or conditions, satisfaction with rules and regulations, satisfaction with interpersonal relationships, satisfaction with title promotion and satisfaction with job promotion, but the dimensionality reduction of factor analysis showed that these nine items could be represented by one factor, which indicated that the questionnaire had high quality, scientists’ satisfaction with these nine items had strong correlation and they together represented scientists’ overall work satisfaction. Second, Chinese scientists had relatively high satisfaction with expertise applications and interpersonal relationships and relatively low satisfaction with a variety of incomes, benefits and opportunities for further study. A lot of scientists chose research work because of their expertise as well as relatively free environment and simple interpersonal relationships of Chinese research institutes, universities or corporate research departments; as highly educated people, Chinese scientists had a far lower level of wages than developed countries, and the income of many young researchers or teachers was even less than customer service staff of financial institutions. In addition, due to larger scientific research pressure, scientists could not get a lot of opportunities for further study. Third, Chinese scientists from research institutes, universities and enterprises showed significant differences in work satisfaction. Scientists from universities had the highest satisfaction and those from enterprises had the lowest satisfaction. Research institutes, universities and enterprises had different systems and work cultures, which precisely led to differences in overall satisfaction. Although scientists from Chinese universities in the initial stage enjoyed lower wages, they had relatively flexible working time as well as free selection of research field and arrangements work and leisure time; in contrast, scientists from enterprises often enjoyed a relatively higher income in the initial stage, but they had relatively fixed working hours, their research field must conform to the leadership arrangements, and they face relatively high scientific research pressure. Because of this, scientists from universities had relatively high satisfaction and those from enterprises had relatively low satisfaction.
Conclusion

This study is based on the research of extensive survey data and filled the gap of research on scientists’ work satisfaction to some extent, which also lays a foundation for the future comparative study of the change in scientists’ work satisfaction based on time series. The case that scientists from enterprises have relatively lower work satisfaction than those from universities and research institutes provides a reference for the government in the future development of human resource strategy.

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References


