

# Study on the Effectiveness of Point-Factor Job Evaluation System in Operation Position

Xinbo Sun<sup>1</sup>, Neng Luo<sup>2</sup>

School of Business Administration, Northeastern University, Shenyang, China

<sup>1</sup>xbsun@mail.neu.edu.cn; <sup>2</sup>nenglou825@163.com

**Abstract-** In order to establish a reasonable and scientific internal pay system, this paper makes an in-depth study on the application process of point-factor job evaluation approach. Questionnaire survey and statistical analysis methods are used to determine the factors of job evaluation system. Also, it focuses on the weight determination using improved AHP method. Then, it is proposed that the order of positions relative value in some benchmark enterprises should be utilized to verify the result. Finally, a pay system of the industry of refining of gold are constructed, which are accord with the characteristic of operation positions. All the work is based on the practice in specific enterprises, so the effectiveness of the method and the data is testified.

**Keywords-** Point-Factor; Job Evaluation; Analytic Hierarchy Process; Effectiveness Study; Operation Position

## I. INTRODUCTION

Human resource management is faced with the severe challenges in Knowledge Economy Times. As a matter of fact, knowledgeable and technological competition among countries is the competition of human resource management level<sup>[1]</sup>. Reasonable compensation system is a significant objective of human resource management in enterprises, and job evaluation is the foundation for the establishment of fair and reasonable compensation system. Job evaluation, which is also called analysis of job value, refers to the process of confirming relative value between positions by means of collecting information of positions at all levels and evaluating positions from four aspects: labor complexity, labor responsibility, labor intensity and labor condition.

Job evaluation is a kind of technology which locates the position of each job in the internal compensation structure systematically. It takes assessment results of relative importance of task in the whole work as standards. Regardless of personal capability or performance, job evaluation is based on the systematic analysis and comparison of requirements to laborers in a certain specific position under normal circumstances, and it aims at the establishment of relative value system of internal positions in enterprise. Post relative value, based on the results of job evaluation, determines the payment grade, which works as a standard of position compensation. Payment grade can objectively reflect the relative value of each position, and have functions of compensation balance and internal justice for the purpose of fair distribution<sup>[2-6]</sup>.

## II. RESEARCH REVIEW

### A. Research Review on Point-Factor Approach

Currently, point-factor approach, which is widely used throughout the world, is one of comparatively important methods of job evaluation among various methods<sup>[7,8]</sup>. Some scholars at home and abroad have made relevant researches on point-factor approach. Most of foreign researches are focused on the application of this method. Biman Das and Alberto Garcia Diaz (2001) have identified relativity not only among elements but also elements and post values in the aspect of statistics based on the establishment of job evaluation elements system<sup>[9]</sup>. A. Spyridakos, Y. Siskos and D. Yannacopoulos (2001) have put forward a multi-criteria evaluation method against obscurity and inaccuracy of post duty description occurred when a scope enterprise conducts job evaluation. In essence, this evaluation method is to change deterministic process of element weights into linear programming problem of acquiring judgment bias of each element weight. Meanwhile, this method is not applied to make an intensive research on deterministic process of elements and its foundation, but to confirm optimal weight by the means of interactive approach<sup>[10]</sup>. Craig Skenes and Brian H. Kleiner (2003) have made a systematic analysis of point-method-based index system of Hay job evaluation method. In brief, this index system includes skill, resolution capability and responsibility. It also takes the affects that staff's motivation has on job evaluation into account<sup>[11]</sup>. Through a large amount of experiments, Daniel E. Martin, Donna Wiley and Peter J. Legree (2007) found that race difference, altogether with gender difference and difference of cultural adaptability, would probably result in different treatment on compensation<sup>[12]</sup>. Based on traditional point-factor approach, Albert Corominas, Anna Maria Coves, Amaia Lusa and Carme Martinez (2008) have built up ISOS job evaluation system by introducing the relationship between job evaluation and gender, which aims at elimination of gender discrimination<sup>[5]</sup>.

Domestic researches are comparatively less than foreign ones on point-factor approach. For the high complexity of confirming index weights, Yu Shunkun (2006) has adopted an improved analytic hierarchy process to make an analysis.

Rationality of judgment matrix can be enhanced by reducing AHP scale and adding intermediate mean value as sub-scales<sup>[13]</sup>. In order to realize objectivity of index weight, Gu Xiaoyan (2009) has adopted structural equation model to confirm element weight, which can make enterprise compensation more externally fair with the combination of benchmarking management for industrial data<sup>[14]</sup>. Sun Meilan and Zou Shuliang etc. (2008) adopted questionnaire survey and statistic analysis to explore the selection of job evaluation factors, which improves selection of evaluation factors to be more scientific and reasonable<sup>[15]</sup>. Wang Lingfeng (2010) put forward a thought that proportional framework, formed by average price of organizational internal representative position in the external labor market in the past few years, can be mapped on the internal labor market in order to confirm grading points and weights of factor. His idea succeeds in filling up deficiencies including inconsistency of internal and external equity and lack of objectivity on confirming grading points and weights<sup>[16]</sup>.

Despite some of the domestic researches on selection of evaluation factors for point-factor approach, factor weights, sub-factor grading design and job evaluation marking, point-factor approach is still restricted somewhat on practicality in practice due to unsystematic researches. Hence, it is required to make a deep-going research on the whole process of establishment of point-factor job evaluation system.

### *B. Theoretical Analysis and Practical Application of Point-Factor Approach*

Point-factor approach evaluates each position's value through a few factors. Currently, it is a job evaluation method that is widely used among domestic consulting companies by virtue of comparatively high accuracy and reasonable cost. The design core of point-factor is to select job evaluation factor based on weighing factors (labor amount and quality), and adopt a certain number of points (score) to express each factor weighting. Then, in accordance with predetermined criteria, it is required to compare and evaluate each factor to acquire the score. The total score can also be acquired by means of weight sum and be changed into volume of money according to specific compensation grade. Compensation amount in each grade can be acquired through this method. Even though this method is comparatively excessively detailed in practice, it can avoid considerably subjective arbitrariness so as to make the confirming process of post salary more scientific and reasonable<sup>[15]</sup>.

Selection of evaluation factors, confirming of each factor weight and sub-factor grading mutually play a significant role in the actual design process of point-factor job evaluation system<sup>[13]</sup>. When conducting job evaluation with point-factor approach, it is usual to confirm factors and weights in terms of designer's experience and intention of corporate management level. However, this behavior generally lacks motivated theoretical supports. Therefore, corporate staffs are often dubious during the period of implement. In avoidance of the above-mentioned questions, systematic analysis and statistical survey are applied to conduct selection of evaluation factors and grading of sub-factors when conducting job evaluation in the gold smelting industry. Improved analytic hierarchy process can be applied to confirm factor weights. Research thinking is put forward to confirm effective evaluation level. It is also applicable to systematically demonstrate the effectiveness of point-factor job evaluation system.

## III. CONSTRUCTIVE PROCESS OF POINT-FACTOR JOB EVALUATION SYSTEM

### *A. Determination of Evaluation Factors*

When applying point-factor approach to conduct job evaluation, it is required to evaluate positions of the same category and figure out post relative values. Then, make a comparison of positions of different categories and figure out all post relative values, by virtue of which compensation grade can be classified. Therefore, it is required to divide all positions in enterprise into different categories and confirm different but reasonable evaluation factors for each category, so that evaluation personnel can make a more accurate and complete analysis of post values through those evaluation methods.

In practice, all positions in the gold smelting industry can be divided into four categories according to position characteristics and actual situation: management category, operation category, technical category and affair category.

#### *1) Selection of Evaluation Factors:*

It is necessary to start from enterprise actual conditions when selecting evaluation factors. It is aimed to not only express position characteristics and differences of positions of different categories but also values of position labor in order to improve application value of job evaluation. Hence, it is forbidden to omit or repeat evaluation factors. It is required to choose a number of evaluation factors from all respects to realize complete and scientific evaluation by means of multi-factor comprehensive evaluation<sup>[14]</sup>.

In light of position characteristics and actual situations in the gold smelting industry, altogether with descriptions and requirements in the Job Description, four factors are chosen that can affect and determine position situation of labor and labor amount: labor complexity, labor duty, labor intensity and labor condition. These four factors can reflect position characteristics comparatively completely and scientifically. Therefore, they can serve as job evaluation factors.

#### *2) Determination of Sub-Factors:*

The above-mentioned aspects can generally reflect position characteristics in the macro-perspective. In order to measure post

values more obviously and clearly, it is applicable to separate evaluation factors into several sub-factors, which can reflect a specific characteristic of position<sup>[17]</sup>. In pursuance of the principle of non-reproducibility and non-omission, 33 sub-factors are extracted and concluded from job evaluation factors in the gold smelting industry with clear definitions.

On this basis, in order to choose reasonable evaluation factors for operation positions, 15 above-scale enterprises in the gold smelting industry have been surveyed by means of questionnaire, the results can be seen in the Table I (Ellipsis: Questionnaire and Survey Data). 601 pieces of questionnaires were dispatched which resulted in 96.5 % (580) sample return. The scope of survey covers positions of management category, operation category, technical category and affair category in the surveyed enterprises. According to factor selective methods listed on the Reference [15], 20 chosen sub-factors form the decision tree of confirming evaluation factor weights of operation positions in the gold smelting industry.

TABLE I CONDITION OF SURVEYED OBJECTS

	Total	Enterprise Scope	Quantity
Surveyed Enterprise	15	A: below 500 people	2
		B: 501-1000 people	6
		C: above 1000 people	7
Number of Surveyed People	601	<b>Category of Surveyed Object</b>	<b>Quantity</b>
		A: Management Category	46
		B: Operation Category	315
		C: Technical Category	179
		D: Affair Category	61

### B. Determination of Factor Weights

Factor weights can reflect the importance of this factor towards position total value. Therefore, the accuracy and reasonability of factor weights have a significant influence on the scientific nature, reasonability, credibility and effectiveness of job evaluation results. Currently, qualitative analytical method is widely used by Chinese enterprises. For example, factor weights, determined by Delphi method, are based on consultants' experience and experience of management level. Therefore, such kind of weights is very subjective, and the results are not enough scientific and reasonable. Generally, it will probably fail to acquire accreditation from ordinary staff members. Hence, quantitative and systematical analytical hierarchy process can make ultimate factor weights more creditable and effective.

#### 1) Establishment of Hierarchy Structure Model:

In the 1970s, analytic hierarchy process was put forward by T.L.Saaty, who was one of American famous operational researchers and professor in University of Pittsburgh. This process is a multi-objective decision-making method with the combination of qualitative analysis and quantitative analysis<sup>[18]</sup>.

When setting up hierarchy structure for evaluation factors of operation positions in the gold smelting industry, the target hierarchy is the evaluation factor system of operation positions; the rule hierarchy contains labor complexity, labor duty, labor intensity and labor condition; the project hierarchy consists of 20 job evaluation sub-factors. The established hierarchy structure model can be seen in Figure 1:

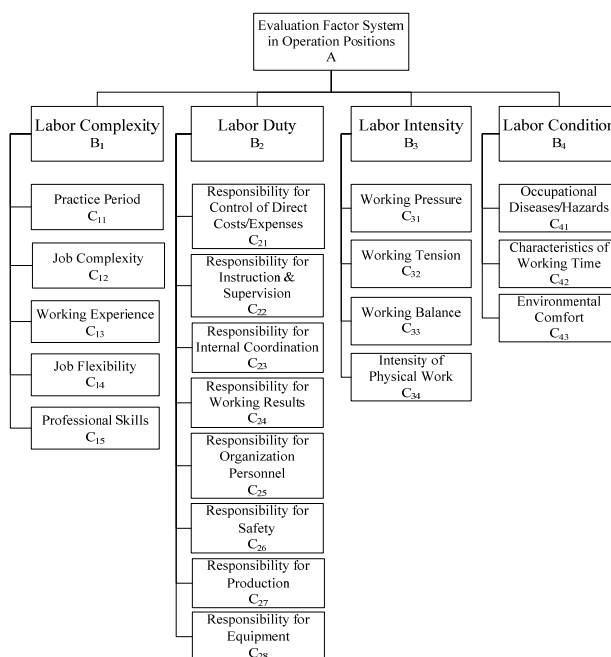


Figure 1 Decision Tree of Evaluation Factor Weights in Operation Positions/ Hierarchy Structure Model

## 2) Establishment of Judgment Matrix of Multiple Comparisons:

### a) Determination of Comparison scale:

According to relevant articles <sup>[18]</sup>, improved analytical hierarchy process can be applied to determine the comparison scale which is applicable to work out evaluation factor weights in operation positions.

### b) Determination of Judgment Matrix:

As shown in Figure 1, experts can determine relative importance of factors in the same hierarchy by means of multiple comparisons. Accordingly, these factors can be divided into several judgment matrixes: A-B hierarchy, B<sub>1</sub>-C<sub>1</sub> hierarchy, B<sub>2</sub>-C<sub>2</sub> hierarchy, B<sub>3</sub>-C<sub>3</sub> hierarchy and B<sub>4</sub>-C<sub>4</sub> hierarchy.

TABLE II JUDGMENT MATRIX OF A-B HIERARCHY

Target <i>A</i>	<i>B</i> <sub>1</sub>	<i>B</i> <sub>2</sub>	<i>B</i> <sub>3</sub>	<i>B</i> <sub>4</sub>	Single Hierarchical Arrangement Weight <i>W<sub>i</sub></i>
Labor Complexity <i>B</i> <sub>1</sub>	1	1/2	2/3	1	0.1813
Labor Duty <i>B</i> <sub>2</sub>	2	1	3/2	2	0.3734
Labor Intensity <i>B</i> <sub>3</sub>	3/2	2/3	1	3/2	0.2640
Labor Condition <i>B</i> <sub>4</sub>	1	1/2	2/3	1	0.1813

Note:  $\lambda_{\max}=4.0017$  R.I. =0.9 C.I. =0.0006 C.R. = 0.0007<0.10

TABLE III JUDGMENT MATRIX OF B<sub>1</sub> – C<sub>1</sub> HIERARCHY

Rule <i>B</i> <sub>1</sub>	<i>C</i> <sub>11</sub>	<i>C</i> <sub>12</sub>	<i>C</i> <sub>13</sub>	<i>C</i> <sub>14</sub>	<i>C</i> <sub>15</sub>	Single Hierarchical Arrangement Weight <i>W<sub>i</sub></i>	General Arrangement Weight <i>P<sub>ij</sub></i>
Practice Period <i>C</i> <sub>11</sub>	1	2/3	2/3	2/3	1/2	0.1342	0.0243
Job Complexity <i>C</i> <sub>12</sub>	3/2	1	1	1	1	0.2133	0.0387
Working Experience <i>C</i> <sub>13</sub>	3/2	1	1	1	1	0.2133	0.0387
Job Flexibility <i>C</i> <sub>14</sub>	3/2	1	1	1	1	0.2133	0.0387
Professional Skills <i>C</i> <sub>15</sub>	2	1	1	1	1	0.2259	0.0410

Note:  $\lambda_{\max}=5.0076$  R.I. =1.12 C.I. =0.0019 C.R. =0.0017<0.10

TABLE IV JUDGMENT MATRIX OF B<sub>2</sub> – C<sub>2</sub> HIERARCHY

Rule <i>B</i> <sub>2</sub>	<i>C</i> <sub>21</sub>	<i>C</i> <sub>22</sub>	<i>C</i> <sub>23</sub>	<i>C</i> <sub>24</sub>	<i>C</i> <sub>25</sub>	<i>C</i> <sub>26</sub>	<i>C</i> <sub>27</sub>	<i>C</i> <sub>28</sub>	<i>W<sub>i</sub></i>	<i>P<sub>ij</sub></i>
Responsibility for Control of Direct Costs/Expenses <i>C</i> <sub>21</sub>	1	1	1	2/3	2/3	1/2	1/2	1/2	0.083	0.031
Responsibility for Instruction & Supervision <i>C</i> <sub>22</sub>	1	1	1	2/3	2/3	1/2	1/2	1/2	0.083	0.031
Responsibility for Internal Coordination <i>C</i> <sub>23</sub>	1	1	1	2/3	2/3	1/2	1/2	1/2	0.083	0.031
Responsibility for Working results <i>C</i> <sub>24</sub>	3/2	3/2	3/2	1	1	2/3	2/3	2/3	0.119	0.044
Responsibility for Organization Personnel <i>C</i> <sub>25</sub>	3/2	3/2	3/2	1	1	2/3	2/3	2/3	0.119	0.044
Responsibility for Safety <i>C</i> <sub>26</sub>	2	2	2	3/2	3/2	1	1	1	0.170	0.063
Responsibility for Production <i>C</i> <sub>27</sub>	2	2	2	3/2	3/2	1	1	1	0.170	0.063
Responsibility for Equipment <i>C</i> <sub>28</sub>	2	2	2	3/2	3/2	1	1	1	0.170	0.063

Note:  $\lambda_{\max}=8.0039$  R.I. =1.41 C.I. = 0.0006 C.R. =0.0004<0.10

TABLE V JUDGMENT MATRIX OF B<sub>3</sub> – C<sub>3</sub> HIERARCHY

Rule B <sub>3</sub>	C <sub>31</sub>	C <sub>32</sub>	C <sub>33</sub>	C <sub>34</sub>	Single Hierarchical Arrangement Weight W <sub>i</sub>	General Arrangement Weight P <sub>ij</sub>
Working Pressure C <sub>31</sub>	1	1	2	1	0.2857	0.0754
Working Tension C <sub>32</sub>	1	1	2	1	0.2857	0.0754
Working Balance C <sub>33</sub>	1/2	1/2	1	1/2	0.1429	0.0377
Intensity of Physical Work C <sub>34</sub>	1	1	2	1	0.2857	0.0754

Note:  $\lambda_{\max}=4$  R.I.=0.9 C.I.=0 C.R.=0<0.10TABLE VI JUDGMENT MATRIX OF B<sub>4</sub> – C<sub>4</sub> HIERARCHY

Rule B <sub>4</sub>	C <sub>41</sub>	C <sub>42</sub>	C <sub>43</sub>	Single Hierarchical Arrangement Weight W <sub>i</sub>	General Arrangement Weight P <sub>ij</sub>
Occupational Diseases/Hazards C <sub>41</sub>	1	1	3/2	0.375	0.0680
Characteristics of Working Time C <sub>42</sub>	1	1	3/2	0.375	0.0680
Environmental Comfort C <sub>43</sub>	2/3	2/3	1	0.25	0.0453

Note:  $\lambda_{\max}=3$  R.I.=0.52 C.I.=0 C.R.=0<0.1

c) *Single Sequencing in Each Hierarchy and One-Off Check:*

According to above judgment matrix, maximum eigenvalue  $\lambda_{\max}$  of judgment matrix and correspondent single sequencing weight vector W<sub>i</sub> can be worked out. Meanwhile, random consensus proportion C.R. shall be calculated to conduct one-off check.

When  $C.R.<0.1$ , the consistency of judgment matrix is acceptable; when  $C.R.\geq 0.1$ , it is suggested to make a reasonable adjustment of judgment matrix, so that  $C.R.<0.1$ . Therefore, satisfied consistency can be achieved.

For Judgment matrix of A-B hierarchy:  $\lambda_{\max} = \sum_{i=1}^4 (AW)_i / 4W_i = 4.0017$ , average random consensus index R.I.=0.9, consensus index  $C.I.=(\lambda_{\max}-4)/(4-1)=0.0006$ . Considering consensus checking index  $C.R.=C.I./R.I.=0.0006/0.9=0.0007<0.10$ , this judgment matrix is with comparatively good consistency, and the judgment result is effective. The calculating results of judgment matrixes B<sub>1</sub>-C<sub>1</sub>, B<sub>2</sub>-C<sub>2</sub>, B<sub>3</sub>-C<sub>3</sub> and B<sub>4</sub>-C<sub>4</sub> can be seen in Table III-VI.

d) *General Sequencing and General Consistency Check:*

According to calculated results of single sequencing, it is applicable to work out general sequencing weights of evaluation factors in B and C hierarchies. Set the single sequencing weight of B hierarchy to A hierarchy as M, C hierarchy to B hierarchy is N. Then, the general sequencing weight  $P_{ij} = M \times N$ , ( $i = 1, 2, 3, 4; j = 1, 2, 3, 4, 5$ ), the specific weights can be seen in Table III-VI.

e) *Determination of Factor Point (Score):*

After determining general sequencing weights, a certain score can be ascribed to each factor. The sum of points of all factors is 1000. Points of each factor is 1000 multiply its general sequencing weight. Points of factor can be acquired after reasonable adjustment. See Table VII:

TABLE VII POINTS OF EVALUATION FACTORS IN OPERATION POSITIONS

Job evaluation Factor	Points	Weight
B <sub>1</sub> Labor Complexity	180	18%
B <sub>2</sub> Labor Duty	380	38%
B <sub>3</sub> Labor Intensity	260	26%
B <sub>4</sub> Labor Condition	180	18%

3) *Sub-Factor Grading and Valuation:*

After confirming points of sub-factors, it is required to classify each sub-factor into several grades. The number of grades depends on points of sub-factors and difficulty of defining each grade and distinguishing them from each other. After grading, it is also necessary to describe each grade and value it, which serves as scoring criteria of job evaluation<sup>[17]</sup>. On the basis of questionnaire, all sub-factors are graded and valued. Take gradation and valuation of “Working Experience” as example, see it in Table VIII:

TABLE VIII GRADATION AND VALUATION OF “WORKING EXPERIENCE”

<b>Working Experience: After having the basic requirement of the position, a worker has to use some special skills which are accumulated along with experience. Working experience refers to the time a worker has to spend to achieve such special skills</b>	<b>Points (Scores)</b>
● With in 3 months	8
● 3-6 months	13
● 6-9 months	18
● 9-12 months	23
● 1-2 years	28
● 2-5 years	33
● Above 5 years	38

#### 4) Result Revision and Validation:

In order to guarantee the effectiveness of job evaluation system, “Test scoring” was conducted to typical positions of different levels and categories in practice. Test scoring can make group members understand factor definitions and gradation. It is general to choose 7 to 8 benchmarking positions from each level in enterprise. According to grading descriptions, benchmarking positions can be evaluated with correspondent scores, position score can be acquired through the sum of each factor scores. The total score is the post relative value. When conducting test scoring, some members would probably put forward some questions. Through frequentative explanations and operations, staffs would make a considerable understanding of the whole process. Besides, it is required to analyze the differences between test-scoring results and group members’ expectation. If the difference is comparatively big, it is necessary to make an adjustment of evaluation factors and weights. Then, conduct a next test scoring<sup>[5]</sup>.

After making an adjustment of evaluation factors and weights, it is applicable to conduct formal scoring. After formal scoring, scores of all positions can be acquired. All scores can be arranged as a list of position scores. Compensation grade can be determined according to this list and compensation system was hereby established in the gold smelting industry, namely, corresponding relations between evaluation results and compensation grade & amount was set up in the operation positions (Ellipsis: Specific compensation system data). For example, job evaluation score of “monitor of blast furnace” is 670, the corresponding compensation grade is 4 and the compensation amount is 2, 550 RMB.

Finally, the author takes the leading enterprise in the gold smelting industry as the benchmark. After in-depth investigation, sequencing data of relative values in the operation positions are acquired to evaluate the effectiveness of formal evaluation results and fairness of evaluating members.

## IV. CONCLUSION

The practice of compensation management in the gold smelting industry shows the whole process of implement of point-factor job evaluation system. During this process, systematical analysis and statistical survey were applied to choose evaluation factors and grade sub-factors. Improved analytical hierarchy process was adopted to determine factor weights. It is also applicable to make an adjustment of evaluation factors and weights through test scoring. The application of these methods can make job evaluation system systematical, scientific and effective.

Methods and data in this article acquired from the practice of gold smelting industry demonstrate such a fact that point-factor job evaluation system can well guarantee the realization of internal fairness on compensation in the gold smelting industry, where post value serves as the core element to determine compensation, so that it is much easier to bring enthusiasm for work, improve working efficiency, guarantee the internal coordination in enterprise and intensively improve the management level. The insufficiency is that this article only discusses the application of point-factor job evaluation system in only one industry. It remains to be discussed the application in different industries and its credibility.

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