

# PERSONNEL EVALUATION (PE) SYSTEM DESIGN USING FUZZY THEORY

## — Part 1. Study of Japanese PE Based on Fuzzy-Theory for PE System Development —

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- I. Introduction
- II. Outline of Survey
- III. Survey Result
  - 1. Actual PE System
  - 2. PE
    - (1) Segmentation of Samples
    - (2) Appraiser
    - (3) Objective of Appraisal
    - (4) Dimentions
    - (5) Dimention Weighting
    - (6) Grading
    - (7) Evaluation Adjustment
    - (8) Data Processing
    - (9) Appraiser Training
- IV. Designing of Personnel Evaluation Model in Japan
- V. Conclusion
- VI. Materials

### **I. Introduction**

In this paper, the PE system is defined as a system for the evaluation of the absolute performance of employees as compared with company expectations. There are various means to evaluate management performance, i.e. financial analysis, productivity analysis and so on. In this paper, however, we limit the subject of evaluation to human behavior.

In today's ever changing corporate environment, an adequate yardstick for measuring employees' performance is vital. For example, Japanese corporations are feeling the need to change their seniority-based wage to a merit-oriented wage system,

according to Hanaoka's 1985-6 survey "Japanese PE and Seniority System."<sup>(1)</sup> In Japan, there is already a consensus that the traditional seniority system should be either modified or abandoned in order for corporations to survive. To accomplish this change, establishment of a fair and objective PE system is more crucial than ever.

The survey asked Japanese personnel managers what type of PE system they would want. Out of 30 answers, 17 called for a job-performance based wage. An equal number wanted to clarify the standard of appraisal, 13 called for an absolute evaluation system and 10 wanted a system based entirely on performance. The number of answers may not be adequate enough for discussion of details, but the general desire for a performance-oriented appraisal system is obvious.<sup>(2)</sup>

What's important in an ideal PE system? For one thing, the design of the system should be adequate and its application should be carried out appropriately; A comprehensive evaluation standard, fair evaluation by an appraiser and acceptable feedback for the appraisee are all important.

The problem with this "ideal" system is that it is the human being that has to be the appraiser. Even if we can create a perfect evaluation standard, different appraisers can give differing evaluations. Our society is composed of human beings. Human decisions are rather relative. The absolute is not really absolute —, it is "absolute" only when compared with "relative". Especially in the case of evaluations made by human beings it would seem that an absolute standard is possible. Although it might seem that human evaluations would be based on absolute standards — such standards conceived as absolute will in reality represent a relative category. In other words, evaluations made by human beings that include an element of fuzziness. People all have their own sets of values, emotional biases and other ambiguities, all of which could be defined as "fuzziness."<sup>(3)</sup>

Our assumption in this paper is that by measuring this fuzziness and its effect on PE, we can establish a fairer and more acceptable PE system. To understand the extent of ambiguity caused by fuzziness, we surveyed the actual application of PE systems in Japanese corporations. This paper summarizes the results of the survey and explores the way of measuring fuzziness for the sake of improving PE systems.

## **II. Outline of the Survey**

1. Sample = 500 companies listed on the Tokyo Stock Exchange chosen by random sampling.
2. Period = Ending May 30, 1988

3. Method = Attached questionnaire was sent to personnel dept.
4. Answer = 63. Demography as follows:

#### Capitalization

Less than 100 million yen	= 1 company
100 million – 1 billion	= 8 companies
1 billion – 5 billion	= 16 companies
More than 5 billion yen	= 38 companies

#### Employees

Less than 300	= 8 companies
300 – 1,000	= 15 companies
1,000 – 3,000	= 18 companies
More than 3,000	= 22 companies

### III. Survey Result

#### 1. Actual PE system

(1) Participating companies had the following systems:

Merit rating	95.2%
Performance appraisal	73.0%
Classification system (Shikaku-seido)	65.0%
Self-evaluation system	61.9%
Discussion meeting with superior	54.0%

In addition, they had management by objectives, managerial reports (Observation paper by superior), personality tests, training program evaluations, C.D.P. and others. The result proves that merit rating and performance appraisal is at the heart of PE.

Out of the 63 companies, 55.6% did not have any plan to modify their PE system, whereas 38.5% had a plan. Of those who gave negative answers, some had just undergone the revamping of the system. Therefore, the need for change appears to be substantial.

Changes were being made in following areas:

##### a. Merit rating and performance appraisal

- \* Diversification the appraisal standard to evaluate the different environment of each department and job type.
- \* Establishment of methods to adjust inter-departmental differences in evaluation.
- \* Shift to merit-oriented PE.

- \* Emphasis on Human Resource Development as an objective of PE.
- b. Classification System (Shikaku seido)
  - \* Establishing a standard of grade qualification for certain jobs that were born out of restructuring, diversification, etc.
  - \* Establishing qualifications that promote career development.
  - \* Revitalization of the classification system (utilization for HRD, modification of standard, etc.)
  - \* Reacting to social changes (introduction of equal-employment opportunity act concerning sexual discrimination, shift to merit-oriented system.)
- c. Others = 4 companies answered that total modification of their PE system is necessary. Other companies were suggesting the introduction of CDP, examination, a self-reporting system or PE system for HRD.

## 2. Personnel Evaluation

### (1) Segmentation of Samples

The term personnel evaluation includes the evaluation of potential, attitude and performance. Classification of appraisees were according to:

- |  |         |
|--|---------|
| a. Level of grades                       | 30 co's |
| b. Managerial or non-managerial position | 28 co's |
| c. Department                            | 10 co's |
| d. Division                              | 8 co's  |
| e. Clerical, general and managerial      | 5 co's  |
| f. Same classification for all employees | 3 co's  |

and other classifications. Most companies appeared to divide employees into clerical, general and managerial groups, classify further by assigning each individual to a grade category, and consequently evaluating him/her differently.

### (2) Appraiser

- |                       |       |
|-----------------------|-------|
| a. Immediate superior | 90.5% |
| b. Superior to a.     | 74.6% |
| c. Superior to b.     | 41.3% |

The appraiser is typically the immediate superior and his superior. Five companies listed managers who were not in the same line as the appraisee.

### (3) Objective of Appraisal

- |           |               |
|-----------|---------------|
| Pay raise | 60 co's 95.2% |
|-----------|---------------|

Grading	59 co's 93.7%
Bonus distribution	58 co's 92.1%
Promotion	44 co's 69.8%
Career development	31 co's 50.7%
Job rotation	22 co's 34.9%
Placement	19 co's 30.2%

Appraisal is usually used for pay raise, bonus and for promotion decisions.

#### (4) Dimensions

Standard used to evaluate non-managers are usually performance (result), potential and attitude. Each factor had the following sub-division.

##### a. Performance

- (a) 23 dimensions on evaluation of quality and quantity of work
- (b) 15 dimensions on result and achievement
- (c) 6 dimensions on effort on process

The above three factors were the most important.

##### b. Potential

- (a) 32 dimensions on leadership
- (b) 30 dimensions on knowledge and technique
- (c) 27 dimensions on planning ability and creativity
- (d) 26 dimensions on negotiation capability
- (e) 21 dimensions on decision making capability

##### c. Attitude

- (a) 22 dimensions on teamwork
- (b) 21 dimensions on responsibility
- (c) 15 dimensions on discipline
- (d) 14 dimensions on aggressiveness
- (e) 8 dimensions on self-assertiveness

To perform personnel appraisal according to the above dimensions, one has to understand the relationship among these dimensions. That is, it is necessary to determine the structure of the evaluation system. The relationships should be defined by the fuzzy binary relation<sup>(4)</sup>, and not in absolute terms of yes or no, {0, 1}. For "Fuzzy" system, it is important to define the actual relationships between the different dimensions.

## (5) Dimension Weighting

The majority of that is 63.5% of the 40 surveyed companies gave different weightings to each dimension (subcategory). Each company uses a different weighting ratios. In our following paper "Fuzzy-Theory Multi-Phase PE System Part II," we will introduce a way to automatically decide the appropriate weighting according to each company's characteristics.

## (6) Grading

(6-1) Measure for appraisal on use was as follows:

a. Ranking from 0 to 10	11 co's
b. Ranking from "poor" to "excellent"	19 co's
c. Comparison with average performer	none
d. Ranking from 0 to 5	27 co's
e. Ranking mean point from 0.0 to 5.0	2 co's
f. Others	11 co's

(Some companies use more than one measure. The total of companies exceed 40. Other measures included: combination of figure and definition, percentage from 0 to 100. 7 companies used A, B, C, D, E, which is equivalent to 1 to 5.)

(6-2) Q15 asked if there was any request to grade a point as 3.6 or 4.2 in a company that had only five grades of 1 to 5. To this follow-up question, 18 companies that answered "yes", gave the following answers:

a. Allowed "fine" grading	3 co's
b. Allowed the grading as 4 <sup>-</sup> or 4 <sup>+</sup>	3 co's
c. Declined	10 co's

The result suggests that evaluation should not be done on a binary basis such as 0 or 1 but rather on a basis that allows fuzziness for that is what by appraisers wanted.

## (6-3) On absolute grading factor

Another question was "It is generally agreed that appraisal based on an absolute factor such as the amount of sales result is fair evaluation. Yet, when appraising, there can be an adjustment after comparing one person with the other. Is this the case?"

(Q16)

a. Yes	48 co's 76.2%
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- b. No 10 co's 15.9%
- c. Others 3 co's
- d. No answer 2 co's

The result shows absolute grading often ends up being relative grading.

**(6-4) Accuracy of evaluation**

Q17 asked "In appraising A, B and C, is there contradiction/as one manager's relative grading differs from that of another's? If yes, how do you adjust the difference?"

- a. No 7 co's 11.1%
- b. Occasionally 41 co's 65.1%
- c. Sometimes 6 co's 9.5%
- d. Others 2 co's 3.2%

Total of b. and c. makes 74.6%, a majority that admits existence of contradiction in the system.

We followed-up with the question "What was the company's reaction?" and got the following result:

- a. Adjustment at a meeting of appraisers (20 co's)
- b. Appraisal of the superior manager stands ( 5 co's)
- c. Appraisal of immediate superior stands ( 1 co's)
- d. Change was made with agreement of immediate superior ( 1 co)

**(6-5) Deviation from Standard.**

Q18 asked "Does a manager who appraises a large number of employees give different grade at the early as compared with the late stage of appraisal?" Answers were:

- a. Yes 30 co's 47.6%
- b. No 28 co's 44.4%
- c. Others 2 co's

Again, half of the companies admit to the existence of errors inherent in using human appraisers. Countermeasure of those who answered "yes" were:

- a. Adjust in a meeting (4 co's)
- b. Ask the appraiser to realize the deviation and do it over (3 co's)
- c. Ask the appraiser to follow the manual (3 co's)
- d. Design multi-dimensioned standards to prevent such tendency (2 co's)
- e. Appraiser training (1 co.)

- f. Redo the appraisal one week later (1 co.)
- g. Insert a step to review the appraisal one week later (1 co.)
- h. Encourage to appraise all at once (1 co.)
- i. No countermeasure (2 co's)

One reason for all these contradictions is ambivalent expression of grades and diversification of standards. Our multi-phased PE system (5) is designed to overcome this weakness.

## (7) Evaluation Adjustment

### (7-1) Intra-department Adjustment

Q9 asked how difference in grades within a department are adjusted.

- a. No adjustment done ( 4 co's)
- b. Meeting of appraisers (23 co's)
- c. Appraisal of the nearest superior stands (17 co's)
- d. Appraisal of immediate superior stands ( 3 co's)
- e. Personnel manager decides (19 co's)
- f. A group such as personnel Appraisal Committee decides (21 co's)
- g. Other adhoc committee decides ( 5 co's)

### (7-2) Corporate-wide adjustment

Q10 asked if companies do intra-departmental or corporate-wide adjustment. 9 co's said No (14.3%) 52 co's answered "yes" (82.5%). Most corporations need intra-departmental or corporate-wide adjustment. They seem to pay extra attention to maintaining fair evaluation.

### (7-3) Adjustment method

Q11 asked how it is done.

- a. Committee (group) in charge (44 co's)
- b. Statistical processing (mechanical) ( 3 co's)
- c. Both of above (10 co's)

Great effort is paid to adjust intra-departmental difference. However, feedback of adjusted evaluation to appraisers and system to let them re-evaluate their evaluation is crucial. This system ideally should be built as part of a PE system. Fuzzy theory is expected to improve this aspect of PE system, too.



(7-4) Department in charge of corporate-wide adjustment

Q12 asked who is in charge of such an adjustment.

- a. Top management (25 co's) 31.6%
- b. Committee (12 co's) 15.2%
- c. Personnel dept. (39 co's) 49.4%
- d. Not done (3 co's) 3.8%

(Some corporations choose more than one answer and the total of 79 choices were made)

(8) Data Processing

55.6% of participating companies processed appraisal result in computer versus 41.3% which depended on human calculation. More and more companies are opting for computerized data processing.

(9) Appraiser Training

Q14 asked if they train appraisers.

- a. No (15 co's) 23.8%
- b. Only for new appraisers (33 co's) 52.4%
- c. Every year (7 co's) 11.1%

In addition there were such answers as:

- d. Occasionally (5 co's)
- e. When the system is modified (4 co's)
- f. Every three years (2 co's)
- g. Used to but not any more
- h. Periodically

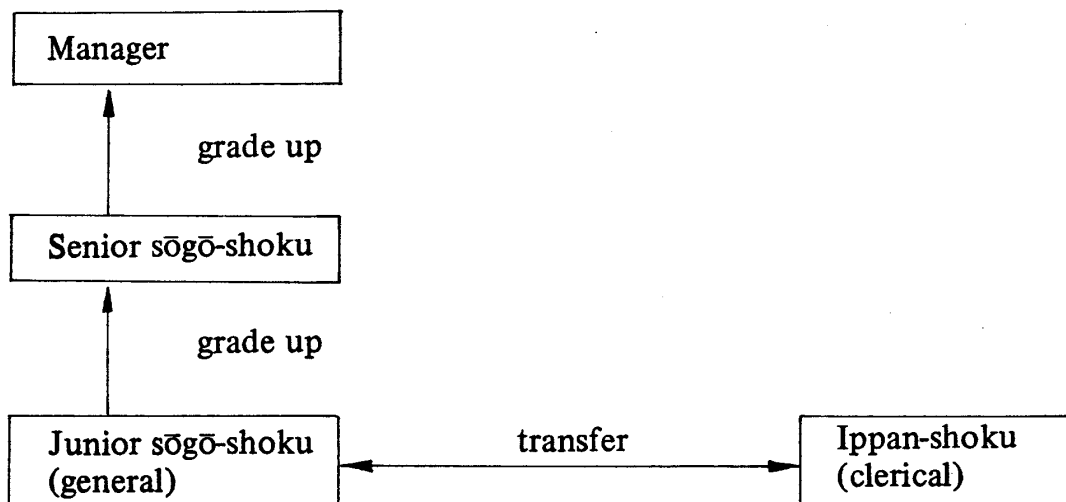
#### IV. Designing of Personnel Evaluation Model in Japan

Using the result of the survey, we conclude that personnel evaluation is at the core of PE system of Japanese corporations. The average framework of the evaluation for senior-general employees (senior non-managerial employees) would be as follows:

PE model for senior non-manager

(1) Object of evaluation (Sōgō-shoku = senior non-manager)

- \* Sōgō-shoku = 1. main trait of employee
- 2. accepted anytime, anywhere by rotation



(2) Appraiser(s) = immediate supervisor and his senior.

(3) Objective = pay raise (annual), bonus (twice a year), promotion (annual), CDP

(4) Dimensions, Weighting

a. Capability

Decision making (planning, creativity, decision making), w1

Drive (leadership, negotiation skill, Influence), w2

Knowledge (expertise, job-oriented information), w3

b. Attitude

(harmony, discipline, responsibility, aggressiveness, aspiration), w4

c. Performance

Persistence, w5

Qualitative achievement, w6

Quantitative achievement

(5) Yardstick

1. Inadequate

2. Needs improvement

3. Average

4. Fair

5. Excellent

\* Possible to chose mean point as 3.6

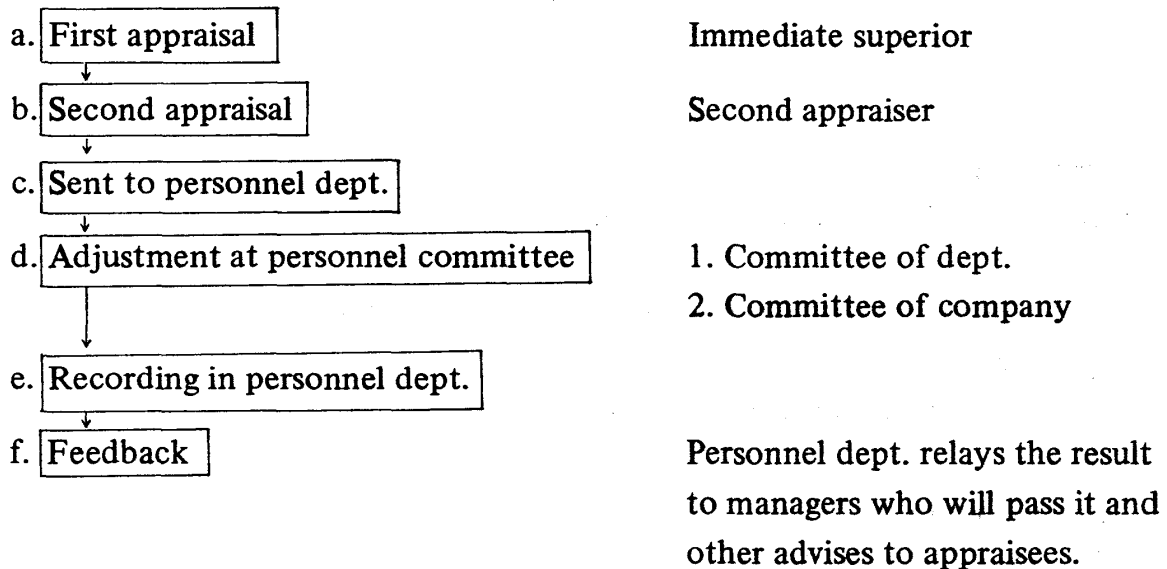
(6) Adjustment

- a. Intra-departmental = will be done by a personnel committee, of which the chairman is the department's general manager and members are appraisers and a person in charge of personnel.
- b. Inter-departmental = similar committee composed of general managers and a staff from personnel dept.

(7) Appraisal Training

- a. For new appraisers
- b. Every three years for appraisers

(8) Appraisal Process



**V. Conclusion**

This paper explored the possibility of integrating the different PE systems into single multi-phased PA system and incorporate Fuzzy-Theory into it.

The survey which was used as a tool to define the current PE in Japanese corporations revealed that most corporations have problems in that they have difficulty in establishing a convincingly fair and scientific appraisal system. While they preach the importance of the absolute appraisal standard, application of such standards is often relative.

We found that the current PE systems could be improved greatly by introducing the Fuzzy-Theory and by defining them as a multiphased PE system. Actual design of the system would be discussed in "Designing of Fuzzy-Theory PE System Part 2".

## NOTES

- (1) "Japanese Appraisal System and Seniority System", DAITO-BUNKA UNV. Economic Journal Vol. 44, Dec. 1987
- (2) "Personnel Management in Japan", M. Hanaoka, Hakuto Shobo Publishing, 1983, pp. 130–131
- (3) Zadeh L.A., "Fuzzy Sets", Information and control, Vol. 8, pp. 338/353, 1963
- (4) Warfield J.N. et al., A Unified Systems Engineering Concept, Battele M. Inst. 1972
- (5) Amagasa, Michio, "System Components", Daito-bunka Univ. Institute of Business Research Book III, Moriyama Publishing, pp. 7/84, 1986
- (6) Ibid, p. 11
- (7) Hwang Yoon, "Multiple Attribute Decision Making", Spriger-Verlag Berlin, Heidelberg, New York, pp. 92/115, 1970
- (8) Weight w1 to w6 should be assigned the most appropriate figures that varies on each corporations. We will elaborate on this at our coming paper "Fuzzy-Theory Part-2."

## VI. Materials

Questionnaire (all questions are multiple-choice)

Q1 Choose appraisal system currently in use in your company.

1. Qualification
2. Merit Rating (performance, attitude)
3. Sales
4. Self-evaluation
5. Supervisor observation
6. MBO
7. Man-to-man meeting
8. Report
9. Examination
10. Personality Test
11. Training Evaluation
12. CDP
13. Others

Q2 Do you have any plan to improve your appraisal system? If yes, describe how.

Q3 How do you classify appraisees

1. No classification
2. Workers and managers
3. Workers, staff and managers
4. Divisional-basis
5. Departmental-basis
6. Basis of levels
9. Others

Q4 Who's the appraiser?

1. Immediate superior
2. Superior to 1.
3. Superior to 2.
4. Other manager
5. Appraisee
6. Others

Q5 What is the objective of appraisal?

1. Grading
2. Promotion
3. Job rotation
4. CDP
5. Pay raise
6. Bonus
7. Others

Q6 What kind of criteria for appraisal do you have?

Q7 Do you assign different points to those standards? If yes, please elaborate how.

Q8 What's the scale of appraisal?

1. Choose 0 to 10
2. Choose "poor" to "excellent"
3. Compare with average
4. Choose 0 to 5

5. Choose mean point from 0.0 to 5.0
6. Others

**Q9 How do you adjust intra-departmental deviation?**

1. No adjustment
2. Discussion between appraisers
3. Second appraiser's stands
4. First appraiser's stands
5. Personnel Dept.'s stands
6. Adjust in a committee
7. Others

**Q10 Do you do inter-departmental or corporate-wide adjustment?**

**Q11 How do you do the adjustment?**

1. Committee
2. Statistically (Computer)
3. 1. and 2.
4. Others

**Q12 Who's in charge of corporate-wide adjustment?**

1. Top management
2. Committee or meeting of general managers
3. Personnel dept.
4. Not done
5. Others

**Q13 How do you process data?**

1. Human calculation
2. Computer
3. Others

**Q14 Do you do appraiser training?**

1. No
2. Only for new appraisers

3. Every year for all appraisers
4. Others

Q15 On a scale of, for example, 1, 2, 4, and 5, was there any request for grades as 3.6 or 4.2? If yes, how did you responded?

Q16 It is believed that appraisal should be done according to objective standards such as sales. Yet, when appraising, there can be an adjustment after comparing one person with the other. Is this the case in your company?

1. Yes
2. No
3. Others

Q17 In appraising employee A, B and C, is there such a problem as one manager's grading order contradicts that of another? If yes, how do you adjust it?

1. No
2. Sometimes
3. Often
4. Others

Q18 When one appraiser evaluates many people, do you think he actually uses different grading at the beginning and the end of the process? If yes, what counter-measures do you take?

Thank you for your cooperation.