Abstract

Every organization employs performance appraisal system in some form or the other. It serves multiple functions like employee development, compensation decision, employee satisfaction etc. Gone are the days, when this process was merely conducted as a ritual. The need of the hour is to remove the inherent contradictions in this process and employ state of the art techniques and technologies. This paper conceptually presents some of the avantgarde practices being followed by organizations to make the whole process of performance management more legitimate and meaningful. The Competency Based Performance Management System maps the current skills/competencies of employees to the requirements of the jobs and guides the development of new competencies based on continual feedback. The Separation Principles of TRIZ are used to resolve the inherent contradictions in the performance appraisal system to make it more effective and acceptable. The Artificial Neural network (ANN) approach learns both the model form and the parameters from the numerous predictor and criterion variables of the employee sample. This model than can be used to appraise the performance of employees. This learning of ANNs can be made faster by various heuristic algorithms like genetic algorithms, simulated annealing etc. The Fuzzy Expert System operating on Fuzzy Logic and Fuzzy Sets can fuzzify the vagueness and uncertainty in the performance labels, use the fuzzy inference rules to arrive at the performance rating and then further defuzzify the performance rating into crisp interpretation. The Knowledge Organizations of modern days, emphasize Systems thinking, Personal mastery, Mental models, Building shared vision, Team learning, Constructive continual feedback, Knowledge Sharing and Intrinsic and Group Rewards.

Keywords: Performance Appraisal; Competency Management; TRIZ; Separation Principles; Artificial Neural networks; Fuzzy Expert System; Knowledge Management

1 Introduction

Performance appraisal is one of the most controversial human resources management processes. It is enameled and at the same time vituperated by most managers. For better or for worse, most organizations employ some type of performance appraisal system. The basic elements of Performance Appraisal are Performance Improvement, Employee Development, Employee Satisfaction, Compensation Decisions and Communication skills. These seemingly contradictory aspects can be simultaneously enhanced by using leading-edge techniques and technologies like Competence mapping, TRIZ separation Principles, Artificial Neural Networks, Fuzzy Expert Systems and Knowledge Management etc.

2 Competency Mapping and Competency based Performance Appraisal System

Competency Mapping is the process of identification of the competencies required to perform successfully a given job at a given point of time and match these with the employee’s current capabilities. A job is broken down into constituent tasks and the required competencies (technical, managerial, behavioral, conceptual knowledge, an attitudes, skills, etc.) needed to perform successfully, are identified. Competencies can be grouped into four categories namely Technical, Managerial, Human and Conceptual. Competencies can further be combined together to form newer competencies. For example Team work Competency at organization level is the ability to identify, utilize and synergize the contributions of a project team. In competency mapping all details of the behaviors (observable, specific, measurable etc.) to be shown by the person occupying that role are specified.

Competencies can be identified by Functional Experts, HR Specialists, Job analysts, Psychologists, Industrial Engineers etc. in consultation with Line Managers, Current & Past Role holders, Supervisors, Reviewers, Customers, Subordinates and other stake holders. The various methods used in combination for competency mapping are Questionnaire, Interviews, Job Analysis workshops, Group assignments, Job Descriptions, Performance Appraisal Formats etc.

The Competency Based Performance Management System (ALD, 2009) identifies core positions within the organization and the competencies required (including soft skills).
for the positions. It assesses current competency levels of employees with multi-way feedback mechanisms, provides training and development for development of necessary competencies. It reflects the competencies required in the performance appraisal and provides continual feedback, recognition, and coaching. It looks ahead and assesses the competencies needed for future performance and initiates mechanisms to acquire that. This type of approach is fully consonant with resource based view of the organizations.

3  The use of TRIZ Separation Principles to resolve the contradictions of performance appraisal

TRIZ (pronounced as TREEZ) is the Russian acronym for the “Theory of Inventive Problem Solving”. This approach of solving technical problems evolved in 1946, when the Russian engineer Genrikh Altshuller studied thousands of patents and noticed certain common patterns. He noted that the evolution of a technical system is not a random process, but is governed by common objective laws. These laws can be used to consciously develop a new system by the process of determining and implementing innovations. His underlying principle that the inventiveness and creativity can be learned, has fundamentally altered the long standing psychological model of creativity. The four fundamental tenets of TRIZ (Dhamija, 2009) are Ideality (gradually reaching the ideal system), Resources (the recognition and use of undiscovered resources frequently resolves contradictions), Contradictions (these are resolved by the use of separation principles) and Repeating Patterns (not only are the same problem-solving principles used repeatedly, but there are patterns of invention that continuously repeat themselves). Using Separation Principles, the contradiction can be separated in time (separation in time) or space (separation in space). A system can be designed to have a different behavior at different levels or subsets (separation Between Parts and the Whole) or to change its behavior or response as a function of what is presented to it (Separation Upon Condition).

The TRIZ Separation Principles have traditionally been applied in engineering and manufacturing functions. There is no reason to think that these same Separation Principles cannot be applied to "soft" or organizational type problems as well. Following are the issues in performance appraisal process and their resolution using Separation Principles.

3.1 Evaluation vs Development

Whether performance appraisal should be done for deciding reward system of the employee or for identifying his/her development needs ? This can be resolved as follows:

- **Time**: Developmental and Evaluative performance appraisals should be done at different times.
- **Space**: Developmental and Evaluative performance appraisals should be done at different locations.
- **Condition**: Make training needs contingent on developmental performance appraisal and reward on the evaluative performance appraisal.
- **Parts/Whole**: Make developmental performance appraisal independent of the usual process of business profit making.

3.2 Risk vs. Job Security

Which employee should be rated higher, one who emphasizes on short term profit growth and succumbs to the pressure of never having a failing product/business or the one who exhibits a keen desire to risk their jobs to pursue new and risky ideas? This can be resolved as follows:

- **Time**: Make it mandated to spend time in an innovative centered position so that the risk is shared by all.
- **Space**: Make it mandatory to spend time at an innovation center away from the project site, where there are no penalties for "risky" ideas. This will build an individual as well as organizational capability to deal with the demands of organization constantly in the state of flux in this global village.
- **Condition**: Establish special long term rewards and incentives contingent on generation of new ideas so as to cover the risk element involved.
- **Parts/Whole**: Engender confidence by institutionalizing the performance appraisal methods like Balanced Scorecard approach and 360 degree appraisal, which ensure that the risk is compensated by other activities of the evaluation system and is shared among all the stakeholder.

3.3 Personal Vs Professional

The performance appraisal is often done on personal relationship rather that professional relationship. This can be resolved as follows:

- **Time**: Personal and professional relationship should be maintained at different times.
- **Space**: Personal and professional relationship should be maintained at different locations.
**Condition**: Make the appraisal contingent on the competencies and the attainment of the goals. Balance Scorecard approach makes the appraisal contingent on professional dimensions such as financial, customer, internal and learning.

**Parts/Whole**: Keep personal relationship intact while doing the organization wide 360 degree appraisal.

### 3.4 Objectivity vs Passion

Which employee should be rated higher, one who passionately generates new ideas or the one who looks at the realities of business and profit forecasting, and cost projections? This can be resolved as follows:

**Time**: Special techniques like DeBono’s Six Hats methods can be used to separate the meetings involving passion and objectivity.

**Space**: Separate idea generation locations should be earmarked

**Condition**: Separate the rewards for idea generation from usual rewards.

**Parts/Whole**: Kindle the idea generating brain storming sessions separately to reinvigorate the process of business profit making.

### 3.5 Competition vs Cooperation

Whether the performance appraisal should promote competition or cooperation among the employees. This can be resolved as follows:

**Time**: competition promoting individual activities and cooperation promoting group activities should be done at different times.

**Space**: competition promoting individual activities and cooperation promoting group activities should be done at different locations.

**Condition**: Make the individual appraisal contingent on the competitive spirit and group appraisal contingent on the cooperation spirit.

**Parts/Whole**: Promote organization wide cooperation while inculcating the competitive spirit in individually assigned tasks.

### 4 The use of Artificial Neural networks in Performance Appraisal

Information Technology has facilitated behavioral scientists working in organizations, access to unprecedented amounts of data. Along with this, the analytical capability and processing speed have also improved tremendously. The computational intensive methods, which were once used for complex problems of physical sciences, are now being increasingly used by organizational researchers as well. Artificial neural networks (ANN) constitute one such class of these powerful methods. An artificial neural network (ANN) is a non-linear statistical model (Scarborough and Somers, 2006) comprised of simple, interconnected processing elements, that can learn to approximate distributions, associations, and other features of the data, through iterative exposure to sample data.

Like a fitted regression function, but in much more powerful way, a trained neural network can learn to generalize pattern information to new data. Unlike regression, the ANNs can help uncover the form of relationship and the parameters of the relation simultaneously even when sample data show high dimensionality, multiple variable types, complex interaction effects or do not meet parametric assumptions. ANNs are specially helpful when other multivariate techniques fail due to weak relationships between independent and dependent variables (low effect size and poor model fit) and large unexplained variance.

In performance appraisal system plethora of predictor variables like length of service, termination records, promotion or demotion activity, compensation changes, and other performance criteria like sales and commission data, unit production, service transactions, accidents and disciplinary records, performance appraisal ratings, education and training, customer relationship, and other quantifiable measures of job performance can be simultaneously analyzed to decide about the appraisal and the compensation. The criterion variable could by all Balanced Scorecard variables related financial, internal, customer and learning. An employee sample containing data on these variables for all shades of employees ranging from high fliers to low risers, is divided into three parts namely training set, test set and validation set. The Neural Networks is first trained with training set through several iterations and epochs. The neural network finally learns the model form and the parameters of models. The trained neural network is then tested on test set for the criterion validity and the overfitting. Finally the model is tested with validation set for another validation check. The trained neural network can then take the data for an employee as input and give the scores of various criterion measures as well as the composite scores. This can be used to decide about the dimension-wise rewards and the composite rewards. High
fault tolerance and graceful degradation of model accuracy are two properties of neural network models that have propelled their deployment in the applications with highly noisy data.

4.1 The use of genetic algorithms and simulated annealing in training of neural networks

The known problems with the backpropagation neural networks are its slow learning rate, overfitting, and often getting stuck in the local minima. The local minima here means that neural networks has not learned fully and unable to proceed further. In order to find the global minima (solution) various heuristic algorithms like Genetic Algorithms and Simulated Annealing are devised. The mutation and cross-over operations of Genetic Algorithms (akin to similar named chromosomal operations in genetics) speed up the training of neural networks tremendously. The Simulated Annealing (akin to the physical annealing process of glass) comes to the rescue of neural network, when it gets stuck in the local minima. It algorithmically gives a gentle jolt to the network to come out of local minima and promotes its movement towards the global minima.

5 Performance Appraisal using Fuzzy Expert System

Most organizations use numerical values (like 7 in 10 point scale) or linguistic labels (like Good, Very Good, Outstanding etc.) in their performance appraisal system. However these scores are merely imprecise approximations as they are based on judgment making ability of the reviewer. The work achievement, knowledge gathered, ability acquired, competency and skills which are appraised by the reviewer are actually fuzzy concepts and can best be captured by the fuzzy logic and fuzzy sets. The fuzzy logic based appraisal system (Arbaiy and Suradi, 2007) actually represents these attributes in terms of fuzzy membership function and then uses fuzzy inference process to perform fuzzy reasoning. The vagueness and uncertainty are well modeled by the fuzzy sets. This type of system involves three phases: fuzzification, fuzzy inferencing and then defuzzification.

In the fuzzification phase the numerical value is converted to linguistic label and linguistic label is mapped onto several membership function graph like trapezoidal function to obtain the confidence value of that attribute. Similarly linguistic labels for the output variables like score etc are delineated. The fuzzy inference engine is developed which contains the fuzzy rules, which are if-then rules containing inputs with their confidence value and the fuzzy membership function value joined together with logical conjunction and disjunction operators. These fuzzy rules should be validated by the experts for the confidence value of their outputs and then they are built into the fuzzy inference engine. defuzzification involves finding the values that best represents the membership of fuzzy set. This is done in order to transform the linguistic labels back into the crisp interpretation. Various types of defuzzification methods being followed are Center of Gravity, Center of Sums and Mean of Maxima. This crisp interpretation gives the final rating of that employee. Thus the system exhibits human like fuzzy reasoning, but without any judgemental error on the part of the rater.

6 Performance Appraisal in knowledge Organizations : Knowledge Management

Different organizations structure their performance management systems differently. A competitively based firm may emphasize riddance of past performance inadequacies and encourage the continued performance at high levels. This system focuses on outputs rather than knowledge creation, and hence can not be used in knowledge organizations. Knowledge organizations (Debowskii, Debowski) work as a team on knowledge projects and emphasize continual learning and both short & long term goals. In such organization a performance development approach works, which encourages knowledge sharing and the development of employee as an organizational asset. It strives for continual and constructive discussions on learning and developmental needs of employees multi-way feedback mechanisms. The focus of review is less appraisal and more mutual communication. The basic tenets of this approach are similar to those of Peter Senge’s (Senge, 1994) learning organizations i.e. Systems thinking, Personal mastery, Mental models, Building shared vision and Team learning.

Continual multi-way Feedback is very important for knowledge workers. To orient the discussion more towards reviewee’s own assessments of needs, outcomes and processes, The reviewer lets the reviewee speak more. While traditional evaluative performance appraisal makes employee hide his weaknesses and creates the vicious circle of further degradation in performance, this learning oriented developmental performance appraisal, encourages development of competencies and enhances self-belief, motivation and commitment. It often makes more critical assessment without reviewee becoming defensive. This type of appraisal is not a ritual once a year, rather it becomes a regular ongoing discussion of needs identification, competency development and performance enhancement.

High intrinsic motivation is encouraged, but extrinsic rewards can also be offered to reinforce desired behaviors.
The rewards system should be clear and transparent. Group rewards may be stronger incentives to maintain relationship and knowledge networks. Effective performance management system in knowledge organizations needs to encourage a uniform and shared understanding of organization strategy and policies.

A complete integrated system combining the TRIZ and Knowledge Management (Ming and Beilei, 2008) can be implemented, that can not only help the organization innovate but also can effectively store the innovative achievements into the knowledge base of knowledge management system, which can then be effectively used for future projects.

**Conclusion**

This is high time for the organizations to rethink and restructure their performance management systems by incorporating new age techniques and technologies like Competency Based Performance Management System, TRIZ separation principles to resolve the contradictions, Artificial Neural Networks to model the non-linearities of the process, Fuzzy Expert System to capture the vagueness and uncertainty. The Knowledge Organizations need to emphasize knowledge sharing, continual feedback for employee development and intrinsic and group rewards. This will open new vistas for serving the twin purpose of making the organizations more effective and productive and the employees more satisfied and committed.

**References**


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