Techniques of performance appraisal management essay

Business, Management

Performance Appraisal of employees plays a very critical role towards the growth of any organization. It has always been a tough task for any industry or organization as there is no unanimous scientific modus operandi for that. Performance Appraisal system is used to assess the capabilities and productiveness of the employees. In assessing employee performance, performance appraisal commonly includes assigning numerical values or linguistic labels to employees performance. However, the employee performance appraisal may include judgements which are based on imprecise data particularly when one employee tries to interpret another employee's performance. Thus, the values assigned by the appraiser are only approximations and there is inherent vagueness in the evaluation. By fuzzy logic perspective, the performance of the appraisee includes the evaluation of his/her work ability, skills and adaptability which are absolutely fuzzy concepts that needs to be define in fuzzy terms. Hence, fuzzy approach can be used to examine these imprecise and uncertainty information. Consequently, the performance appraisal of employees can be accomplished by fuzzy logic approach and different defuzzification techniques are applied to rank the employees according to their performance, which shows inconsequential deviation in the rankings and hence proves the robustness of the system.

Chapter 1

INTRODUCTION

Information Technology(IT) organizations are regarded to be one of the " hot sectors" for investment in India. Indian software services are increasing at a

extraordinary pace in terms of both profit and global development of customers. IT Organizations requires the proficient employees. It has been noticed that when employees wish to leave an organization, it is plausible that they engage in deviant behaviors or reduce their efforts for performance. Employee deviance and low performance orientation and citizenship behaviors can not only lead to poor individual performances but also bad for the organization's overall-well being. With the business of IT Organizations heavily dependent on on-site clients, these behaviors can, in turn, leads to poor customer relationships (Krishnan et al., 2010). In large organizations, performance appraisal of employees has always been a hectic and complex exercise for the Management and Department of Human and Resources (HRD). On the other hand performance appraisal plays an important and critical role in managing employees effectively, especially in the light of recent economic ups and downs globally, which has compelled both private and public organizations to improve their performances and save resources wherever possible (Armstrong et al., 2006). Performance Appraisal is used in the organizations to evaluate the effectiveness and efficiency of the employees. The need of performance appraisal arises because every person has a different personality, and different situational, social and psychological traits. It brings out the difference of performance among the employees working in an organization. The development of performance appraisal has four distinct phases. It is called TEAM (Technical, Extended, Appraisal and Maintenance) approach (Kohli et al., 2008). Different person's views for employee appraisal are: From supervisor's perspective: It would be helpful to improve the employee's job performance.

It would be helpful for making administrative decisions about the employee. From employee's perspective: It would probably be an appraisal that would fully capture all the employee has contributed in the job to the employer. From society's view: It would be an appraisal that fairly assesses the employee's performance and is used justly in the employment situation to make the organization more useful to society (Kondrasuk, 2011). Employee's appraisal system not only tells about the performance of employees but it also tells about quality of Human Resource Management functions. The functions of Human Resource Management are recruitment activities and wages. Human Resource Management shows that proper timing and quality realization of employees' appraisal creates great assets not only for an organization but also for its employees. Each category of employees such as clerical and manually working employees must be appraised so as to compete in the present business environment (Blstkova, 2010).

Performance appraisal is generally done in systematic ways which are as follows:

The supervisors measure the pay of employees and compare it with targets and plans. The supervisor analyses the factors behind work performances of employees. The employers are in position to guide the employees for a better performance.

The purpose of performance appraisal are :

CommunicationAppraisals need to provide an opportunity for formal two-way communication between management and the employee concerning how the organization feels the employee is performing. Information for evaluative

decisionsInformation for evaluative decisions is required by the organization for knowing how employees are performing so that they can take fair and equitable actions with their workforce, to improve organizational productivity. And Motivation for developmentMotivation for development means appraisals can motivate by providing opportunity for employees to improve performance over time. Personal biases and stereotyping are the two most significant appraisal problems. Others problem include halo error, similarity error, proximity error and attribution error. The process of evaluating employee performance can actually lead to higher levels of job satisfaction and productivity . There is the difference between the Performance Management and Performance Appraisal i. e. Performance Management identifies measures, manages and develops the performance of people in the organization. It is designed to improve worker performance over time whereas Performance Appraisal is the part of the performance management process that identifies, measures and evaluates the employee's performance and then discusses that performance with the employee. Performance should be accurately measured so employees will know where they can improve. Knowing where to improve should lead to training employees to develop new skills to improve. To be an accurate measure of performance, the measure must be valid and reliable, acceptable and feasible, specific, and based on the mission and objectives (Lussier et al., 2012).

Techniques of performance appraisal:

The various methods and techniques used for performance can be categorized as the following traditional and modern methods:

Essay Appraisal Method

This traditional form of appraisal, also known as " Free Form Method" in which the superior writes a brief narrative describing the employees performance. The description is an evaluation of the performance of any employee based on the extreme behavior and often includes examples and evidences to support the information.

Straight Ranking Method

This is one of the oldest and simplest techniques of performance appraisal. In this method , the all the employees are ranked from the best to the poorest on the basis of their overall performance.

Paired Comparison Method

A better technique of comparison than the straight ranking method, in this method each employee is compared with every other employee and after all the comparisons, the employees are given the final rankings.

Critical Incident Method

In this method of performance appraisal, the appraiser has to maintain the log of each employee and its behavior. Then the evaluator rates the employee on the basis of critical events and how the employee behaved during those incidents. It includes both negative and positive points

Field Review Method

In this method, a senior member of the HR department or a training officer discusses and interviews the supervisors to evaluate and rate their respective subordinates. This method helps to reduce the superior's personal bias.

Checklist Method

The rater is given a checklist of descriptions of the behavior of the employees on job. The checklist contains a list of statements on the basis of which the rater describes the on the job performance of the employees. Sample questions for checklist method: Does he respect his superiors? Yes NoDoes he make mistakes frequently? Yes No

Graphic Rating Scale

In this method, an employee's quality and quantity of work is assessed in a graphic scale indicating different degrees of a particular trait. The factors taken into consideration include both the personal characteristics and characteristics related to the on the job performance of the employees. For example a trait like Job Knowledge may be judged on the range of average, above average, outstanding or unsatisfactory.

MODERN METHODS OF PERFROMANCE APPRAISAL

Assessment centre

Employees are evaluated over a period of time; say one or three days, by observing their behaviors across a series of selected exercises or work samples. Generally employees are given an assessment similar to the job

they would be expected to perform if promoted. The trained evaluators observe and evaluate employees as they perform the assigned jobs and are evaluated on job related characteristics.

Behaviorally Anchor Rating Scales:

Behaviorally Anchor Rating Scales(BARS) is a relatively new technique which combines the graphic rating scale and critical incident method. Various performance levels are shown along a scale with each described in terms of employee's specific job behavior such as good or bad(for e. g. the qualities like inter personal relationships, adaptability and reliability, job knowledge etc). These statements are developed from critical incidents. In this method, an employee's actual job behavior is judged against the desire behavior by recording and comparing the behavior with BARS. Developing and practicing BARS requires expert knowledge.

Human Resource Accounting Method

Human resources are valuable assets for every organization. Human resource accounting method tries to find the relative worth of these assets in the terms of money. In this method the performance appraisal of the employees is judged in terms of cost and contribution of the employees. The cost of employees include all the expenses incurred on them like their compensation, recruitment and selection costs, induction and training costs etc whereas their contribution includes the total value added (in money terms). The difference between the cost and the contribution will be the performance of the employees. Ideally, the contribution of the employees should be the greater than the cost incurred on them.

360 degree Performance Appraisals

360 degree evaluators for an employee can be his/her peers, managers, subordinates, team members, customers, suppliers-anyone who come into contact with the employee and can provide valuable insight and information or feedback regarding the " on-the-job" performance of the employees. 360 Degree Performance Appraisal may includes: 1. Self appraisal2. Superior appraisal3. Subordinate appraisal4. Peer appraisalSelf appraisal gives a chance to look at his/her strengths and weaknesses, his achievements and judge his own performance. Superior's appraisal forms the traditional part of the 360 degree performance appraisal where the employees' responsibilities and actual performance is rated by the superior. Subordinates appraisal gives a chance to judge the employee on the parameters like communication and motivating abilities, supervisor's ability to delegate the work, leadership qualities etc. Also known as internal customers, the correct feedback given by peers can help to find employees' ability to work in a team, co-operation and sensitivity towards others. Self assessment is an indispensable part of 360 degree appraisals and therefore 360 degree Performance appraisal have high employee involvement and also have the strongest impact on behavior and performance. It provides a " 360-degree review" of the employees' performance and is considered to be one of the most credible performance appraisal method (Sharma S. et. al(2012).

Management by Objectives (MBO)

This method can be used to measure the performance of employees. The work of (Peter Drucker, 1955) postulate the theory of Management by

Objective, by which performance could be measured against goals set by the employees themselves. The objectives or achievements referred to variously as objectives, targets, goals, KRAs or Key Performance Indicators, Work achievement or the Quantity of Work. (Sudarsan, 2009).

Graphic Rating Scale

Here the factors such as quantity of work, quality of work, knowledge of job, attitude, dependability and cooperation are taken.

720 Degree Performance Appraisal

In this method, which tells that in the first appraisal, employee performance is measured, analyzed and targets are set and after a short period his performance is measured again and proper feedback and guidance are given to ensure that the employee achieves the target and this technique is free from personal biases (Anupama et al., 2011).

1. 2 Limitations in different Performance Appraisal Techniques:

1. Essay Appraisal Method:

Time consuming. Effective writers are very difficult to find.

2. Straight Ranking Method:

Suitable for small workforce. Workers strengths and weakness cannot be easily determined.

3. Paired Comparison Method:

Large number of comparisons required when dealing with many employees.

Suitable for small workforce.

4. Critical Incident Method:

Time consuming and laborious to summarize and analyze the data. Difficult

to convince people to share their critical incidents through a survey.

5. Field Review Method:

The " outsider" may not be aware of the job requirements, work culture and

work environment. The outsider has not observed the employee at work and

does not know his on-field behavior and performance, except from the report

submitted by the employee's supervisor, which may be biased. Time

consuming.

6. Checklist Method:

When the weighted checklist is used, the appraiser has no knowledge of the

assigned weights and may give an employee a different evaluation that

intended.

7. Assessment Centre Method:

Expensive and difficult to manage. Requires a large staff. Requires a great

deal of time. Only a limited number of people can be processed at a time.

Much cognitive loads to assessors.

8. Behaviorally Anchored Rating Scale Method:

Scale independence may not be valid/ reliable. Behaviors are activity oriented rather than result orientedVery time consuming for generating BARS. Each job will require creating separate BARS scale.

9. Human Resource Accounting Method:

There are no specific & clear-cut guidelines for finding cost and value of human resources of an organization. The method measures only the cost to the organization but ignores completely any measure of the value of the employee to the organization. The life of human resources is uncertain and therefore, valuing then under uncertainty seems unrealistic.

10. Management by objectives:

Difficult to employees agree on goals. Misses intangibles like honesty, integrity, quality, etc. Interpretation of goals may vary from manager to manager, and employee to employee. Time consuming, complicated, lengthy and expensive.

11. Graphic Rating Scales

Here each characteristic is equally important in evaluation of the employee's performance.

12. 360 Degree Performance Appraisal:

Time consuming and very costly. Sensitive to organization and national culture. Difficult to implement in cross-functional teams. Maintaining confidentiality may pose challenge in small organizations.

13. 720 Degree Performance Appraisal

Exceptional Expectations for the process. Insufficient Information. Design process downfallsFailure to connect the process. Insufficient training and process understanding. Focus on negatives and weaknesses. Requires commitment of top management and the human resources(time, finance, resources, etc)Paperwork (computer entry overload). Rater inexperience and ineffectiveness. Therefore, the first and most important task in the performance appraisal is assessing the performance of the employees. As, usually, employees are involved in various kinds of activities that directly or indirectly influence the overall performance of an organization, evaluation of performance has never been an easy task. There are two types of measures used in performance appraisal: Objective measures and Subjective measures. Objective measures can easily be drawn into a number like number of projects completed by the employee but here we are considering the Subjective measures that are not directly quantifiable like motivation, leadership, etc. A lot of research on Performance Appraisal System has been discussed for years; however, many organizations still languish from the uncertainty of measuring the performance of employees. The intention of this analysis is to measure the performance appraisal of employees by fuzzy set theory which will generate the accurate data and with the increase in speed. The proposed model is supposed to work in two stages: firstly, identifying the critical factors, where all the critical factor directly or indirectly influence the performance of employees and secondly, developing a fuzzy expert system to manipulate those critical factors of employees with the help of fuzzy rule base and hence evaluating the performance of

employees. The influential certainty of each feature evaluated from experts is also reveiwed.

Chapter 2

Review of Literature

Abraham(2005) explains about the basic steps that leads towards the development of rule based expert systems such as problem solving using heuristics, rule base systems, inference engine in rule based system, Expert System Development, Fuzzy Expert System, Modeling Fuzzy Expert System, Illustration of Fuzzy Expert System Design and Adaptation of Fuzzy Inference System and also explains the various advantages of expert system such as results are achieved faster than human, less help from expert at different places on same time, expert system is more consistent as their results do not vary every time. By Problem Solving using Heuristics, it means finding the certain solutions that lead towards the results, but it does not guarantee to provide best solutions. In the Rule Base System, describes the architecture of expert system which shows that the knowledge base, inference engine and user interface are main components. There exist the two methods to store the knowledge in the knowledge base i. e. in the form of rules and frames. But in rule based system expert knowledge is kept in the knowledge base in the form of if then rules which helps in decision making. Inference engine is used to provide answers by using either of inference methods such as forward chaining and backward chaining. User Interface is used for designing, updating and using expert system. In expert system development, it tells about the steps that must be follow to create

the expert system such as first the actual requirements must be gathered, then to store and capture all the components of knowledge base, then expert system components are constructed and results are implemented and procedure for maintenance and review is formulated. Expert Systems could be developed using specialized software tools called shells. Fuzzy Expert System are required to handle the uncertainty, the human way of thinking, reasoning and perception process. A fuzzy expert system is a combination of fuzzy membership functions and rules. There exist the various operations that can be applied to fuzzy sets. Fuzzy expert system architecture have the following components: the Fuzzification interface, a fuzzy rule base, an interface engine and Defuzzification interface and the most used fuzzy interface systems are Mamdani interface and Takagi and Sugeno interface. The difference in these two techniques lies in aggregation and Defuzzification procedures. Chen et al., (2006) When the research was conducted on Chinese Engineering Managers, three factors were considered: Behavioral Performance: Indicates manager's enthusiasm and endeavour in the job. Personal Motivation: Indicates manager's motivating approaches and methods. AndOranizing task: Organizing task and human assets. Engineering Managers show a binary role as an Engineer and Manager in their departments. There are two types of behaviors related with the job. Direct behavior, labelled as task performance which includes technical management performance and leadership performance. Indirect behavior, named as contextual performance includes personal relationship faciliation and job dedication. The factor analysis technique is used to calculate the performance which shows that Chinese Managers perform better in oranizing

task than Behavioral Performance and Personal MotivationHsu, B. F. et al. (2007) discusses about organizational goals are met by teamwork and each team member must have five factors to benefit the team and organization . These five factors are Conscientiousness, Agreeableness, Openness to Experience, Extroversion, Emotional Stability. By Conscientiousness, it describes who is responsible, dependable, persistent and organized. In addition, a conscientious person would have a high level aspiration to achieve goals. Therefore, conscientiousness is one kind of personality trait, which implies both competency and achievement. Work teams with a higher aggregation of conscientiousness members might accomplish more knowledge sharing because this would not only mean that its members generally have good job skills, but would also means that its members are like to help each other and to do extra role behavior to benefit the team and organization. By Agreeableness, it means the the highly agreeable people tend to be cooperative, warm and trusting. If there exist a high ratio of agreeable members within a team, there would be high level of cooperation among members. Aggreable team members are sympathetic towards each other and eager to help. By Openness to Experience, it points out that the people who are open to experience are curious about both inner and outer worlds, and their life's are experimental richer. This personality type is associated with positive attitudes towards new experiences because open individuals are curious, broad minded, cultured and intelligent. Therefore, open minded individuals might be very eager to seek out new knowledge. By Extroversion, it is the main personality index of interpersonal tendencies. Extroverts are social able, enthusiastic, energetic and optimistic. This

personality captures one's comfort level with the relationships. It points out that the extroverts not only like people, preferring large groups and gatherings; they are also assertive, active and talkative. Extroverts are positively affective, therefore are liker to have positive emotions and contribute to greater team satisfaction. By Emotional Stability, here people tend to be calm, self confident and secure; in contrast, emotional unstable people tend to usually experience negative feelings, like fear, anxiety, and insecurity. Moon, C. et al. (2007) describes some factors for performance evaluation that are 1. Service rating which includes completeness of Job Objectives, service rating on job assignment. 2. Multi-Area Aptitude such as creativity , organizational contribution , management capability, achievement, job expertise, teamwork. 3. Growth potential which includes planning, communication, group discussion, information system usage. 4. Innovation which includes innovative scores. Hajiha (2007) designs the fuzzy expert system to assign the jobs to individuals which will tell that the individual is capable of doing which job. The fuzzy expert system works by evaluating individual's scores and applying the obtained results to the fuzzy rule base, fuzzy merits are obtained for different individuals. Then the linear assignment technique is used to defuzzify merits to achieve an optimal job assignment. Mamdani inference mechanism is used here. Lai(2008) describes that the technology is transferred from international firms and research institutes to small-medium enterprises so that the small medium enterprises can compete in the global environment. When the technology is transferred, its success and failure depends upon the technology, culture and people. So the effectiveness of technology transfer can be measured by

using Analytical Hierarchy Process (AHP) and the fuzzy set theory. The influential factors considered are industrial feature, organizational feature, talent feature and technology feature for analyzing the effectiveness of technology transfer. Mamdani inference method is used and triangular membership function is taken as input and bell shaped membership function is taken as output. When the results are generated, technology feature is the most important feature. Sudarsan, A. (2009) discusses the use of Management by Objectives (MBO) and Key Result Areas (KRAs) can be used to measure the performance of employees. The work of (Peter Drucker, 1955) postulate the theory of Management by Objective, by which performance could be measured against goals set by the employees themselves. The objectives or achievements referred to variously as objectives, targets, goals, KRAs or Key Performance Indicators, Work achievement or the Quantity of Work . It also discusses about frequency of appraisal . Organization may appraise their employee annually, half yearly and quarterly. Gallagher, et al., 2010) tells that the IT Professionals must not only include technical skills, but they also include non-technical skills as well to evaluate the performance of employees. Technical Skills includes:- Foundation Skills, Operational Skills, Essential Skills. Foundations Skills such as Programming, System Testing, Desktop Support/Helpdesk, Database Design/Management, Operating Systems, Voice/Data Telecommunications. Operation Skills such as Operations, Service Hosting, Continuity/Disaster Recovery, Mainframe/Legacy. Essential Skills such as System Analysis, System Design, IT Architecture/Standards. Non Technical Skills includes:- Project Management Skills, Problem/Opportunity Skills, Relationship Skills .

Project Management Skills such as Project Leadership, Project Planning/Budgeting/Scheduling, Project Integration/Program Management, Project Risk Management. Problem/Opportunity Skills such as Company Specific Knowledge, Functional Area Process Knowledge, Industry Knowledge, Business Process Design/Re-engineering, Change Management/Organizational Readiness. Relationship Skills such as User Relationship Management, Communications, Negotiations, Managing Stakeholder Expectations. Blstkova (2010) describes that employee's appraisal system not only tells about the performance of employees but it also tells about quality of Human Resource Management functions. The functions of Human Resource Management such as recruitment activities and wages. Human Resource Management shows that proper timing and quality realization of employees' appraisal creates great assets not only for an organization but also for its employees. 360 Degree Performance Appraisal technique is be used to evaluate the performance of employee in which employee himself and HR manager participate in the appraisal for strategic decision making process. When the employee himself participates in the appraisal, the results will be more appropriate because employees are familiar with the goal of their appraisal, they are likely to become identified with the results. When the HR manager is involved in the appraisal, subjectivism is eliminated in the employees appraisal by involving more subjects in employee's appraisal in every category. Each category of employees such as clerical and manually working employees must be appraised so as to compete in the present business environment. Krishnan(2010) explains about the employees with the intention to quit an

organization become less productive or even dysfunctional for the organization. When the employees stays in the system irrespective of his or her ill feeling then the employee show dissatisfaction by alcoholism, sabotage, absenteeism, work slowdowns, calling in sick, arriving late, making errors and avoiding active involvements that can be seen as part of neglect and reduced loyalty. Intention to quit does lead to less performance orientation, higher organizational deviance and the less organizational citizenship behavior. Employee deviance, poor performance orientation and lack of citizenship behaviors can have many serious implications for the organization beyond just the poor performance of a few individual. It can lead to loss of employee morale and thus damage the work culture in the organization. Manager's play a very important role in this scenario. The manager's training and his or her utilization of practices such as counseling, development planning, and career planning and his or her supporting the subordinate through various initiatives such as mentoring can help increase the subordinate's engagement. A proactive HR department that can help employees find alternative opportunities within the organization can help reorient the employee from the immediate negative environment that is creating intention to quit which will bridge the gap that are causing intention to quit. Rezaei (2010) constructed a rule based inference system for classifying inventories into different classes according to their multi-criteria importance. While the traditional inventory classification considers only one criterion (annual dollar usage) and classifies items into only three classes. Implementation of this method in real world situation is simple and easier to understand by inventory managers because it is constructed based on

natural language. Analytical Hierarchy Process is be used for comparison purposes and advantages and disadvantages of the rule based inference system is also discussed. Anupama (2011) describes that there are different performance appraisal techniques depending upon the type of organization, size of organization and also the period when it is used. The existing techniques such as critical incident method, weighted checklist method, paired comparison analysis, graphic rating scales, essay evaluation method, behaviorally anchored rating scales, performance ranking methods, Management by Objectives method, 360 Degree Performance Appraisal Method, Forced ranking and Behavioral Observation Scales have the limitation that it does not guide the employee after the appraisal. So a new technique is introduced such as 720 Degree Performance Appraisal which tells that in the first appraisal, employee performance is measured, analyzed and targets are set and after a short period his performance is measured again and proper feedback and guidance is given to ensure that the employee achieves the target and this technique is free from personal biases. Wilbanks, L.(2011) discusses about the difficulty faced by manager's in writing performance appraisal of medium performers because it is easy to write performance appraisal of top performers but the medium performers need the appraisal that will encourage improvement so the manager must write appraisal for them effectively . It can be started with employee self assessments. Manager's often use employee self assessment as the basis for performance appraisal . In self assessment , employee must track all the data of year long what he is doing and accomplishing . In self assessment writing , the employee don't have to write a narrative detail but mainly

describe why your accomplishments were important to the company and why you should be rewarded for them . In self assessment writing , the employee should also write a visible project that negatively affected the company in which project employee is part of . The first step in evaluating the employees that the manager must be honest with himself and with them , need to be fair even if he don't like the employee , keep it impersonal and focused on the job, not on personality . In the negative performance appraisal, the manager need to assess what is about this person that's causing manager and (probably others) to have a negative reaction. If the manager assesses the performance of employees honestly, it will result into productive team members. Sameena (2011) developed the fuzzy load balancing algorithm to balance the workload in the distributed environment so that the total throughput of the system can be maximized. And then the different Defuzzification techniques are explained and used to compare the results. The results shows that Centroid of Area, Mean of Maximum and Bisector Method shows consistent results then Largest of maximum and Smallest of Maximum because Largest of maximum and Smallest of Maximum takes the two extremes i. e. smallest or largest values for the calculation of the crisp value. Neogi (2011) used the cascaded fuzzy inference system to generate the performance qualities of some university non-teaching staff that are based on specific performance appraisal criteria. From fuzzy logic perspective, the performance of the emloyee involves the measurement of his/her ability, competence and skills which are actually fuzzy concepts that can be captured in fuzzy terms. Therefore, the performance appraisal system can be examined using fuzzy logic approach

because fuzzy system can handle the imprecision and uncertain information. Kondrasuk(2011) tells about the format of ideal performance appraisal. Ideal performance appraisal is a process that involves setting expectations (of the supervisor and subordinate), having the subordinate perform to achieve the expectations, of appraising and feeding back the results, and applying the results of the assessment in ways that benefit the organization, the supervisor, and the subordinate involved. Ideal performance appraisal has two purposes: Administrative decisions (based on standards and objective results, should be made first and quickly) and Development aspects (based on individual goals are made later and take more time). Both assess objective and subjective aspects of the employee's job performance. This paper also discusses the problems that are occurring in performance appraisals. Performance Appraisal systems are improved by rectifying common shortcomings (eg. Reducing biases, training those involved, using formats with research substantiation). However the most important changes require: Clarifying the goals of performance appraisal. Focusing on both results and behavior appraisal. Adding an appraisal category. Better timing. Better involving constituencies. It provides the different persons views for employee appraisal such as: From supervisor's perspective: It would be helpful to improve the employee's job performance. It would be helpful for making administrative decisions about the employee. From employee's perspective: It would probably be an appraisal that would fully capture all the employee has contributed in the job to the employer. From society's view: It would be an appraisal that fairly assesses the employee's performance and is used justly in the employment situation to make the organization more

useful to society. Pavani, S. et al. (2012) developed fuzzy inference system with different input parameters such as knowledge, speed of delivery, presentation, overall impression and explanation and take the output parameters such as poor, good and excellent to evaluate teachers' performance using two different membership functions such as triangular and trapezoidal and compared the performance which shows that in both the cases the performance in percentage obtained is more or less similar. So it concludes that the shape of membership function is not playing much role to evaluate the performance in positive or negative direction. Sharma(2012) explains about the performance appraisal and career development and also describes different methods are used for performance appraisal of employees. Performance Appraisal has the " now" orientation impact and career development has a " future" orientation impact. HR professionals can play a vital part in establishing and nurturing the relationship between performance appraisal and career development by keeping the concept of " talent development". By talent development, it means promoting employees' skills and knowledge and can best be achieved by displaying concern for current performance as well as future contribution. Sapra, N.(2012) tells that the performance appraisal have two types of uses such as developmental uses such as improving work performance, communication expectations, determining employee potential and aiding employee counseling and administrative uses included promotions, lay-offs, transfers and terminations, and validation of hiring process. It also explains the common objectives of performance appraisal such as reviewing past performance, goal setting for future performance, and employee development. In many

organizations, appraisal results are used to help determine reward outcomes. It helps in identifying the " better performers", employee who will get majority of availability merit pay increases, bonuses and promotions. It also help in identifying the " poor performers" who may require some form of counseling or in extreme cases, demotion, dismissal or decrease in pay. Appraisal address a " whole person development" and not just job skills or skills required for promotion. Some commonly used methods of performance appraisal are: 90-degree Appraisal(The employee evaluates himself and shows his strengths and achievements or his boss evaluates him), 180-degree Appraisal(The employee and the boss evaluates his performance on a monthly basis), 270-degree Appraisal(The method where in the employee is evaluated by 3 persons, himself, boss and co-workers), 360-degree Appraisal(also known as ' multi-rater' feedback, where feedback about employee's performance comes from a supervisor/superior, co-worker, client/customer, subordinates and the self-assessment of the employee himself) and 720-degree Appraisal(In this method, the 360-degree appraisal is done, where the performance of the employee is analyzed and having a good feedback mechanism, the boss sits down with the employee again a second time and gives him feedback and tips on achieving the set targets). Chaudari, O. K. et al.(2012) developed a Fuzzy Expert System for evaluating teachers at technical degree institutions of India. The fuzzy expert system consider the various aspects of performance measures of teachers like Students' feedback, Results , Students attendance, Teaching learning process, Academic development of teacher and other performance like Personal skills and abilities, etc. that have the deep influence on the

teachers' performance in technical institutions. Fuzzy model is designed to combine the knowledge for decision making in educational institutions.

Chapter 3

Present Work

Studied the research papers which are mentioned in the references and the problem is defined and then factors are selected on the basis of which performance evaluation is to perform. The objectives and scope are also explained. And then the research process is also explained.

3. 1 Problem Formulation

As already discussed in the Chapter1 that there exist limitations in the performance appraisal techniques. So a new expert system is designed and implemented to remove all the limitations. From fuzzy logic perspective, the performance of the employee involves the measurement of his/her ability, competence and skills, which are actually fuzzy concepts that can be captured in fuzzy terms. Accordingly, fuzzy approach can be used to handle these imprecision and uncertainty information.

Fuzzy Expert System

There are many real world problems like intelligent control systems, process diagnostion, fault detection, medical diagnosis, site evaluation, strategic planning, for which solutions are something more than simple reasoning; requiring some expertise to solve. So the use of expert system, a computer system capable of representing and reasoning about some knowledge rich domain with a view to solving problems and giving advice (Jackson, 1990)

became very popular. The main difference of Expert System over any other conventional software applications is its effective reasoning capability as they process knowledge instead of data or information (Darlington, 2000). Expert System are very advantageous where the problem area is vast and complex and almost impossible to solve with the help of conventional approaches. Lotfi A. Zadeh (1965) introduced the concept of fuzzy set theory. Fuzzy logic act as an wonderful idea to near the interspace between human reasoning and computational logic. Fuzzy logic can be used to handle vague, ambiguous or imprecise information. A fuzzy expert system consist of fuzzy membership functions and rules. In case of crisp environments, a classical set A, A in X is defined as a collection of elements or objects $x \in X$, where X be space of objects and x is a generical element such that x can either belong or not belong to the set A. A fuzzy set A in X is defined as a set of ordered pairs $A=\{(x, \mu A(x))| \ x \in X\}$ where $\mu A(x)$ is the membership function for fuzzy set. Here x can have any value between 0 and 1 such that x has belongingness and non-belongingness upto some extent (Abraham, 2005). Thus, unlike crisp sets, in fuzzy set membership is a continuous concept. Generally fuzzy sets are very useful in representing linguistic variables. For example, Speed can be considered a fuzzy linguistic variable whose members can be Slow, Fast, Very fast etc. Fuzzy expert system is such an expert system which uses fuzzy logic instead of Boolean logics in its knowledge base and drives conclusion from user inputs and fuzzy inference process. Fuzzy Logic rules are generally expressed in the form of IF…THEN and AS…AND…THEN. For example," If it is very humid today and also very hot, THEN there is a higher chance of rain". Or," As it is very humid today

AND also very hot, THEN there is a higher chance of rain". Clearly, this type of representation is more valid in real life applications, which is a strength of fuzzy expert system. Fuzzy Expert System is used for decision making like assigning jobs to individuals (Hajiha et al., 2007), technology transfer from large organizations to small organizations (Lai et al., 2008) and for inventory classification (Rezaei et al., 2010).

3. 1. 1 Architecture of Fuzzy Expert System

A typical fuzzy expert system has following three modules (Fasanghari et al., 2010): Fuzzy Knowledge Base: Knowledge Base is made up of rule base and database where rule base consist of fuzzy If-then rules and the database defines the membership functions of the fuzzy sets used in the fuzzy rules (Rezaei et al., 2010). A knowledge base combines the knowledge of multiple human experts. Knowledge Base stores all relevant information, data, rules, cases and relationships used by the expert system. The rules are of following formIf X is high AND Y is low then Z is medium. Where X and Y are fuzzy linguistic input variables and high, low are possible linguistic values of X and Y respectively. Similarly Z is a fuzzy linguistic output variable and medium is its linguistic value. The antecedent decribes to what degree the rule applies where the rule consequent assigns a membership function to each one or more output variables (Abraham et al., 2005). Interference Engine: The interference engine seek information and relationship from the knowledge base and to provide answers, predictions, and suggestions in the way a human expert would. The interference engine must find the right facts, interpretations and rules and assemble them correctly. Two types of

interference mechanisms are commonly used. Backward chaining is the process of starting with the conclusions and working backward to the supporting facts. Forward chaining starting with the facts and work forward to the conclusions. The basic inference system can take either fuzzy inputs or crisp inputs, but the outputs it produces are always fuzzy sets. Deffuzification of results is also done in this module. The defuzzification task extracts the crisp output that best represents the fuzzy set. With crisp inputs and outputs, a fuzzy inference system implements a nonlinear mapping from its input space to output space through a number of fuzzy if-then rules. The two most popular fuzzy inference system are: Mamdani Fuzzy Inference System and Takagi-Sugeno Fuzzy Inference System. The difference between these two fuzzy inference system lie in the consequents of fuzzy rules and thus their aggregation and defuzzification procedures differ accordingly. According to Mamdani, fuzzy inference system, the rule antecedents and consequents are defined by fuzzy sets and has the following structure: if x is A1 and y is B1 then z1 = C1Figure 3. 1 : Mamdani Fuzzy Inference System using min and max for T-norm and T-conorm operators (Abraham et al., 2005). There are several defuzzification techniques: 1. Centroid of area(COA):-The centroid defuzzification method selects the output crispy value corrosponding to the center of gravity of the output membership function which is given by the expression: 2. Bisector of area(BOA):- The bisector is the vertical line that divide the region into two sub-regions of equal area. It is sometimes, but not always coincident with the centroid line. The output is given as: 3. Mean of Maximum(MOM):- In this method for defuzzification only active rules with the highest degree of fulfillment are

taken into account. The output is computed as: 4. Smallest of Maximum(SOM):- It selects the smallest output with the maximum membership function as the crisp value . In other words in Smallest of Maximum choose smallest among all z that belong to [z1, z2]. 5. Largest of Maximum(LOM):-Largest of maximum takes the largest amongst all z that belong to [z1, z2] as the crisp value called . Centroid of areaBisector of areaMean of max. Smallest of max. Largest of max.

Figure 3. 2 : Different Defuzzification methods for a particular function

User Interface: This module provides all the interactions of the users with the system. This module is used to accept inputs from the users, display the results or outcomes of the inference process. Explanation facility is the major characteristic of any Expert System. This module interprets and explains the reasoning outcomes. Fuzzy Toolbox of MATLAB interface is used for this purpose. The broad architecture of the proposed fuzzy inference system for the performance appraisal of employees is depicted in the following figure 2. 1. Appraisal TeamFuzzy Knowledge BaseFuzzy Inference EnginePerformance AppraisalCritical factors influencinempValues for different parametersUser InterfaceFigure 3. 3 : Architecture of Fuzzy Inference System for Employee Performance AppraisalEvery organization has a seperate Appraisal Team from HR department to evaluate the performance of employees in their organization. The team first identifies those critical factors, which directly or indirectly influenced employees' performance for the given period for which the appraisal is being carried out. After deciding those factors, they set up values for those parameters for all the employees being appraised. Providing

values to some of these parameters sometimes may be a tedious task, in that case team might have to conduct some test or interview or they have to mark directly based on the superior remarks. After that all the details are stored in fact base by using some user interface. Then the parameters are fuzzify and fuzzy knowledge base is created, which is basically a collection of fuzzy rules. This fuzzy rule construction is the most important task in this model as the overall performance of the system depends highly on the robustness of this rulebase. To develop this rule base it is always advised to hire a knowledge engineer who elicits knowledge from the domain experts and transfer those elicited knowledge into rule base. Then those fuzzy rules are process on the facts in the working memory in the fuzzy interference engine by applying fuzzification method. At the end of the outcome of the fuzzy interference engine are defuzzified to rank the employees based on their performance.

3. 2 Objectives

The objective of employees' performance appraisal in this proposed paper is: To identify the performance appraisal factors for evaluation. To evaluate and validate the proposed system.

3. 3 Methodology

General design of the proposed fuzzy expert system for employee performance involves the following steps depicted in figure 3. 1. Figure 3. 4: Fuzzy Inference Process for Employee Performance AppraisalAs mentioned earlier, design and implementation of the proposed model has been

discussed below according to the design procedure depicted in figure for employees of IT Organization.

3. 1 Identification of Critical Factors

This is the initial and one of the most important stages in developing any Fuzzy Expert System. It is found that there are many factors that directly or indirectly contribute in evaluating the performance of employees. Table 3. 1 shows the descriptions of Performance Appraisal influential factors and sub-factors in the study. Some of the factors are taken from the University of Arizona, Pinellas County and many other Organizations:-Table 3. 1: Description of Influential Factors and Sub-FactorsFactorsSub-FactorsDescriptionGeneral PerformanceIndividual QualityIt contains qualities of an individual such as adaptability, motivation, innovation, initiative, responsibility, Work habits, analytical skills. Soft SkillsIt includes communication skills, stress tolerance. Job Related SkillsIt includes customer focus, customer service and job knowledge. Management SkillsExtent to which employee demonstrates effective management abilities and overall results. It includes judgment, planning and organizing, problem solving and decision making, productivity, quality of work, quantity of work, resourcefulness and time management. SupervisoryCost EffectivenessThe extent to which employee seeks best use of materials, equipment, and staff to maximize efficiency and effectiveness. Delegation and Supervisory SkillsThe extent to which the employee shows the ability to effectively authorize work and supervise subordinates. Staff RelationsThe extent to which the employee effectively oversees and facilitates staff. Supervisory

FeedbackDegree to which employee prepares thorough and objective annual appraisals i. e. provides informal performance feedback on a regular basis. Team BasedConsensus BuildingThe extent to which the employee builds and maintains work relationships and contacts needed to effectively address problems and opportunities associated with their position. TeamworkThe degree to which the employee works well in a team setting. Working with others/CooperationExtent to which employee works effectively with customers, co-workers and the public. In figure 3. 2, all the critical factors considered are depicted as a heirarchy and table 3. 2 gives sample record of 10 employees from Adobe Systems, Noida in the range of 0 to 10 for those factors :

Performance Appraisal

General Performance

Supervisory Factors

Individual QualitySoft SkillsJob Related SkillsManagement SkillsCost EffectivenessDelegation & Supervisory SkillsStaff RelationsSupervisory FeedbackConsensus BuildingTeamworkWorking with others/Cooperation

Team Based Factor

Figure3. 5: Hierarichal Structure of Performance Appraisal System

Table 3. 2 Sample records of employees in IT Organization.

Employee Id. Individual QualitySoft SkillsJob Related SkillsManagement SkillsCost EffectivenessDelegation & Supervisory SkillsStaff RelationsSupervisory FeedbackConsensus BuildingTeamworkWorking with

others/ CooperationE14. 65. 46. 83. 42. 75. 86. 77. 42. 432. 712. 69E28. 99. 88. 76. 88. 38. 77. 69. 38. 78. 18. 4E32. 34. 55. 66. 77. 65. 82. 28. 76. 93. 37. 6E46. 28. 67. 53. 13. 25. 75. 16. 96. 93. 37. 6E57. 84. 33. 37. 82. 17. 92. 44. 54. 13. 26. 5E67. 83. 22. 93. 22. 34. 17. 68. 33. 25. 67. 9E72. 34. 55. 66. 78. 38. 77. 69. 37. 15. 64. 2E87. 84. 22. 17. 75. 74. 67. 86. 45. 46. 78. 7E94. 65. 46. 83. 42. 72. 37. 37. 57. 37. 78. 2E106. 74. 35. 35. 87. 67. 88. 48. 38. 78. 18. 43. 2 Fuzzification:- Fuzzification is the process of converting crisp inputs to fuzzy values. When uncertainty arises due to ambiguity or vagueness in dealing with a variable, then that variable is considered fuzzy and can be represented by a membership function. When the inputs generated from a piece of hardware or drive from sensor meaurement then these crisp numerical values could be fuzzified in order for them to be used in a fuzzy inference system (Ross, 2005). In this phase, the critical factors identified for performance evaluation are considered as inputs for the fuzzy inference system and are represented in the form of fuzzy linguistic variables with their member elements. Then each variable is assigned with fuzzy membership using triangular membership functions. Table 3. 3 is prepared after discussion with various experts in different IT organizations.

Table 3. 3 : Different fuzzy linguistic variables and their fuzzy elements

Critical FactorsFuzzy linguistic input variable with membership rangeFuzzy linguistic output variable with membership rangePoorGoodExcellentPerformance in terms of General Performance(0-10)PoorAverageGoodGeneral PerformanceIndividual Quality (0-10)0-32. 7-7. 67. 2-100-21. 7-54. 6-8Soft Skills (0-10)0-2. 52. 2-7. 87. 4-10Job Related

Skills (0-10)0-3. 12. 8-7. 77. 3-10Management Skills (0-10)0-3. 63. 2-7. 97. 6-10SupervisoryPoorGoodExcellentPerformance in terms of Supervisory(0-10)PoorAverageGoodCost Effectiveness (0-10)0-2. 82. 5-7. 97. 5-100-2. 52-5. 24. 7-8. 5Supervisory Skills (0-10)0-3. 32. 9-7. 26. 8-10Staff Relations (0-10)0-2. 92. 5-7. 36. 9-10Supervisory Feedback(0-10)0-3. 63. 2-8. 17. 7-10Team BasedPoorGoodExcellentPerformance in terms of Team Based (0-10)PoorAverageGoodConsensus Building (0-10)0-3. 32. 9-7. 87. 5-100-2. 31. 8-5. 34. 8-8. 3Teamwork (0-10)0-3. 53. 2-8. 37. 8-10Working with others/ Cooperation (0-10)0-2. 92. 4-8. 58. 1-10

Chapter 4

Results and Discussions

Figure 4. 1 shows Fuzzification step for General Performance based on three main factors as Individual Quality, Soft Skills, Job Skills and Management Skills based as inputs and General Performance as final output of the inference system. C: UsershelloDesktopgeneral main. tifFigure 4. 1: ' General Performance' input variable in Fuzzy Expert SystemFigure 4. 2 shows Fuzzification step for final Performance Appraisal based on three main factors as General Performance, Supervisory and Team Based as inputs and Final Performance Appraisal as final output of the inference system. C: UsershelloDesktopperformance appraisal main. tifFigure 4. 2: Fuzzification of inputs for final Performance Appraisal3. 3 Fuzzy Rule Construction: In fuzzy Inference System, based on the knowledge provided by the domain experts, decisions are made and outputs are generated. Collection of this type of knowledge generates a fuzzy knowledge base which is a collection of some

fuzzy IF-THEN rules. In this proposed system, 253 such type of fuzzy IF-THEN rules is generated by experts. C: UsershelloDesktop ule base of general performance. tifFigure 4. 3: Fuzzy Rule Base view for evaluating ' General Performance' Factor. C: UsershelloDesktopsurface of general performance. tifFigure 4. 4: Surface view of the rule base for evaluating ' General Performance' factor. Figure 3. 5 shows rules for ' General Performance' based on Individual Quality, Soft Skills, Job related Skills and Management Skills input parameters in MATLAB rule viewer. Figure 3. 6 shows a sensitive surface view of the same rule base. Some sample IF-THEN rules for ' General Performance' from the rule base are given below: i) If Individual Quality is Poor AND Soft Skill is Poor AND Job Related Skill is Poor and Management Skill is Poor THEN General Performance is Poor. ii) If Individual Quality is Poor AND Soft Skill is Good AND Job Related Skill is Poor and Management Skill is Good THEN General Performance is Poor. iii) If Individual Quality is Poor AND Soft Skill is Good AND Job Related Skill is Good and Management Skill is Good THEN General Performance is Average. iv) If Individual Quality is Poor AND Soft Skill is Good AND Job Related Skill is Excellent and Management Skill is Excellent THEN General Performance is Excellent. v) If Individual Quality is Poor AND Soft Skill is Excellent AND Job Related Skill is Excellent and Management Skill is Poor THEN General Performance is Good. vi) If Individual Quality is Good AND Soft Skill is Poor AND Job Related Skill is Good and Management Skill is Excellent THEN General Performance is Good. vii) If Individual Quality is Excellent AND Soft Skill is Good AND Job Related Skill is Poor and Management Skill is Good THEN General Performance is Poor. viii) If Individual Quality is Excellent AND Soft Skill is Good AND Job Related Skill is

Excellent and Management Skill is Excellent THEN General Performance is Excellent. Etc. C: UsershelloDesktop ule base of performance appraisal. tifFigure 4. 5: Fuzzy rule base viewer for final Performance Appraisal. In this fashion, rule bases are prepared for other factors mentioned in figure according to the specification mentioned in table. Based on the fuzzy outcomes of these intermediate evaluations, final inference system is designed. Figure 3. 7 shows the rule base for final appraisal system with three broad factors: General Performance, Supervisory and Team Based as inputs and Final Performance Appraisal as final output of the inference system. Figure 3. 8 shows a sensitive surface view of the same rule base. C: UsershelloDesktopsurface of performance appraisal. tifFigure 4. 6: Surface view of the rule base for Final Performance Appraisal3. 4 Fuzzy Inference Module Generation: This module deals with the fuzzy inference engine, which is guided by fuzzy rules. The standard Max-Min (Mamdani) inference algorithm has been used in this fuzzy inference process, as it is considered to be most popular used fuzzy inference strategy (Ngai, 2003). 3. 5 Defuzzification: The process of obtaining a single number that represent the best outcome of the fuzzy set evaluation is called Defuzzification. There are various methods available for this purpose like Centroid, Bisector, Mean of Maximum (MOM), Smallest of Maximum (SOM), Largest of Maximum (LOM) etc. In this study, all these Defuzzification methods are applied using MATLAB to rank the employees mentioned in Table according to their performance appraisal. 3. 6 Evaluating and Ranking the Employees based on their performance: Finally, using different Defuzzification techniques, employees mentioned in Table 3. 2 are ranked based on the defuzzified

value of their performance appraisal. The rankings are displayed in Table 3.

4. C: UershelloDesktopCentroid Method. tifFigure 4. 7: Surface view of the

rule base for Final Performance Appraisal for centroid method for Centroid

MethodC: UershelloDesktopBisector Method. tifFigure 4. 8: Surface view of

the rule base for Final Performance Appraisal for centroid method for

Bisector MethodC: UershelloDesktopmom. tifFigure 4. 9: Mean of Maximum

(MOM)C: UershelloDesktoplom. tifFigure 4. 10: Largest of Maximum(LOM)C:

UershelloDesktopsom. tifFigure 4. 11: Smallest of Maximum (SOM)Table 4.

1: Rankings of different employees after Defuzzification

Employee ID.

General Performance (0-10)

(0-10)

Supervisory (0-10)

Team Based (0-10)

Defuzzified Performances and Rankings

Centroid

Ranks

Bisector

Ranks

MOM

Ranks

LOM

Ranks

SOM

E16. 36. 62. 384. 9434. 934. 8536. 533. 2E28. 758. 988. 878. 4418. 418. 3518. 518. 2E33. 351. 254. 314. 964. 934. 845. 853. 8E47. 746. 594. 314. 962524. 926. 922. 9E56. 311. 263. 351. 5101. 551. 571. 791. 3E62. 886. 586. 554. 8884. 934. 7555. 474. 1E73. 358. 986. 544. 8794. 844. 6564. 884. 5E82. 466. 578. 854. 9244. 934. 846. 143. 5E96. 36. 67. 444. 9154. 934. 8536. 143. 6E106. 327. 228. 874. 8974. 934. 7555. 663. 9From Table 4. 1, we can find those faculty members who were considered for performance appraisal using this proposed model are ranked based on their performance

records mentioned in Table 3. 2 using different Defuzzification methods. For example, according to the Table 3. 2, employee E2 had the best scores in the form of General Performance, Supervisory, and Team Based and as expected, according to the Table 3. 4 he ranked top among 10 faculty members in all Defuzzification techniques. In the same way Employee, E5 ranked last in all Defuzzification techniques, which obviously proves the robustness of this model.

Chap 5

Conclusion and Future Scope

This paper proposed a novice method for evaluating performances of employees in IT organization. The method can easily be extended to evaluate performances of employees of any industry, based on some critical factors, which directly or indirectly influence their performances. As it is always advised to elicit knowledge from any domain expert to construct the rule bases in developing any expert system, different higher authorities and HR personnel had been consulted to form those fuzzy rules for our fuzzy knowledge base. Later, after construction of those fuzzy rules, different personnel from administrative, HR and other higher authorities verified those. Finally, the results were shown to them again and the response was very satisfactory. This work can be extended further by introducing uncertainty principle to deal with those rules.

Chapter 5

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