Evaluation of Construction Firms Using Human Performance

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Abstract- *Construction industry is the labor intensive industries where human capital is the greatest asset of the organization. However it has been observed since long that human workforce in an organization also represent the most complex resource to manage compared to any other resources that are required for satisfactory completion of a project. In general, construction industry often experiences complexities in meeting project completion schedule and finance due to non availability of sufficient number of skilled labors and staff to carry out the planned work. This work is focused on conducting five different site surveys of human resources with different classes and experience for evaluating the data using AHP, Psychological method and 360 degree evaluation method to find better human resource for better productivity in construction.*

Keywords- Human Resource Management, Human performance factors and evaluation, Analytical Hierarchical Process, Analytical Network Process, 360 evaluation method, psychological method.

I. INTRODUCTION

Human resource is one of the most vital resources involved in the proper functioning of an organization. Human resource can also be referred to as human capital. The term capital denotes wealth, money, property owned by an individual or an organization. Human capital refers to overall skill and knowledge of the total workforce of an organization that can be utilized to achieve long term goals. An employee is a rare resource, immutable, non-substitutable and a valuable. There is a requirement for managing human resources according to the stage of growth in the organization. Thus effective management of human capital improves the productivity and overall wealth of an organization. In modern era the Human Resource Management plays an important role in motivating the labor force to work in a productive manner. Since Construction industry is having an extremely large work force, it is a tedious job to identify various facts that affect the human performance so this study aims at identifying the factors that affect the actual performance of human force and the various tools for evaluation.

HUMAN PERFORMANCE FACTORS:-

Some of the factors which affect performance of human industry are discussed below.

1. Adaptability

Adaptability is a predisposition to consciously maintain an integration of person and the environment and constitutes the attitudes, competencies and behaviors that individuals use to fit into different professions.

2. Job knowledge

Job knowledge can be referred as a specific set of responsibilities to a particular job. The collective job knowledge of an organizations a human resource asset which has an immense value.

3. Judgment

Judgment is defined as the application of the accumulated knowledge and experience gained through a relevant accounting or auditing training, by making use of the ethical standards, resulting in making informed decisions about the courses of action that are appropriate in specific circumstances.

4. Productivity

Productivity referred as the Output/Input.

5. Motivation

Motivation is the important factor which helps employees to work every day efficiently.

II. PROBLEM STATEMENT

This practical investigation seeks an evaluation of human performance depending upon the factors affecting on

how human resources will be allocated for the better results in construction industry.

1. Cost and time overrun
2. Poor Human Performance
3. Lack of Job Knowledge

III. OBJECTIVES

The main queries that are addressed and evaluated in this study are:

- To Human resource practices followed in the Indian construction industry and Availability of skilled labour.
- To study and identify the factors for human performance in construction industry.
- To find the parameters for class level employee evaluations.
- To evaluate and compare the employee performance with different methods like AHP, Psychological and 360 degree evaluation method and recommend the best one.
- To improve job satisfaction.

IV. LITERATURE REVIEW

1] Varun .V et. "Factors and Methods for Performance Evaluation of Human Resource in Construction Industry" International Journal of Scientific Engineering and Research (IJSER) volume 4,March 2016,P.P.2347-2378.

System discussed the effective management of this human capital to improve the productivity and wealth of organization as well as to maintain equilibrium between the workers and management. The study identifies the factors that can be used for evaluation of human capital in construction industry and various Multi Criteria Decision Making Techniques used for performance evaluation of Human Resource. Human resource management is an art of motivating the human force for achieving the organizational goals. However for the construction industry with its extremely large work force identification of the needs of the workers and its fulfillment is a tedious job. The study aimed at identifying the various factors that affects the actual performance of workforce in the construction industry and the various methods of analysis used for their evaluation. The review suggests that use of Multi criteria decision making techniques like Analytical hierarchical process, Analytical network process and TOPSIS methods are more superior in evaluating human performance than traditional techniques like reward system, psychological methods and 360 evaluation

techniques. Since both qualitative and quantitative data can be analyzed by using the MCDM techniques.

2] Antonio Aragon "The mediating effect of strategic human resource practices on knowledge management and firm performance in AEDEM". Volume 24,March2015,P.P.138-148.

System explained an integrative model that examines strategic human resource practices as a catalytic mechanism influencing the effectiveness of knowledge management. The findings confirm that knowledge management strategies positively influence firm performance through certain high work performance practices selective staffing, intensive training, active participation, comprehensive performance appraisal, and performance-based compensation highlighting the mediating role of human resource management in this relationship and the need to align human resource practices with organizational strategies. This study provides empirical evidence to support the idea that a knowledge management strategy, acting as a coordinating mechanism, indicates the need for enterprise-level strategic human resource practices. Human resource management can then plays mediating role and, therefore, determine of the effectiveness of knowledge management strategies and their contribution to the competitiveness of the company. Human resource management can then plays mediating role and, therefore, determine of the effectiveness of knowledge management strategies and their contribution to the competitiveness of the company.

3] V. Shahhosseini "Competency-based selection and assignment of human resources to construction projects" volume 18, April 2011, P.P.163-180.

Author explained human resource management policies and practices, construction firms need to define this purpose, human resources are classified into four types of main personnel: Project Manager, Engineer, Technician, and Laborer. Then the competency criteria model of each main personnel is developed. Decision making is performed in two stages: a fuzzy Analytic Hierarchy Process (AHP) for evaluating the competency criteria, and an Adaptive Neuro-Fuzzy Inference System (ANFIS) for establishing competency IF-THEN rules of the fuzzy inference system. Finally, a hybrid learning algorithm is used to train the system. The proposed model integrates a fuzzy logic qualitative approach and neural network adaptive capabilities to evaluate and rank construction personnel based on their competency. Results from this system in personnel staffing show the high capability of the model in making a high quality personnel selection. The hierarchical structure of competency criteria is consistent for

different kinds of personnel, project manager, engineer, technician or laborer.

4]Akiko Ueno ''Developing a conceptual model illustrating how HRM practices support each other in order to improve service   quality'' PublishedbyElsevierLtd.Volume148,July2014,P.P.24-31.

System found that there were six HRM practices, which are most crucial in supporting service quality. The purposes of this paper are, firstly, to clarify the individual relationships among the six HRM practices and to examine how those previously, each individual relationship has tended to be considered in isolation in the literature. Therefore, in this paper, the various inter-relationships were unified into a single model. In this new conceptual framework, the six HRM practices are inter-linked so that each of them may have a joint function in supporting service quality. The model can therefore be used to identify problem areas in order to improve service quality. For example, since all of the six HRM practices are important in supporting each other, if one or more of these practices are considered to be unsatisfactory, the model will indicate potential practices which may have been causing the problems or which might have been affected by the substandard practices. Since the six HRM practices are not stand along items, it is important to pay proper attention to all six practices in order to support service quality. As these inter-relationships are not specific to a certain type of service business, the model is likely to be applicable to a wide range of service industries. These inter-relationships have tended to be discussed in isolation in the literature.Here, these various interrelationships were combined into a single mode

5] Jason E. Barg ''Motivating Workers in Construction''in Hindawi Publishing Corporation Journal of Construction Engineering Volume 33, June2014,P.P.1-11.

This review found fifty two published articles that addressed to worker productivity in close context to construction. Twenty two of these works were not presented in this paper because they did not directly relate to construction worker motivation. The thirty articles that did address this topic were tabulated, categorized, and reviewed. Of these articles, nine addressed motivation models, five addressed worker environment/culture, nine addressed worker incentive and empowerment, and seven addressed worker management. The findings show that the body of work regarding construction worker motivation is limited and that no motivational model has been widely used, in the construction industry.

V. METHODOLOGY

Step1:-Survey of different construction firms and selection five construction firms.

Step2:-Data collection

Step3:-Study and Analysis of data

Step4:-Analysis of different techniques for better human performance in construction firms.

Step5:-Selection of techniques is according to construction firm requirements. (AHP, Psychological Method, 360 degree evaluation method)
Step 6:-Examination of all three techniques.

Step7:-Final results and comparison of all three selected methods.

Step 8:-Application in the construction field.

1 ANALYTICAL HIERARCHY PROCESS

"A structured technique for dealing with complex decisions based on mathematics and psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. The AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions. It is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare and education. "The purpose of the AHP is to assist people in organizing their thoughts and judgments to make more effective decisions. The Analytic Hierarchy Process (AHP) provides the objective mathematics to process the inescapably subjective and personal preferences of an individual or group in making decisions. Fundamentally, the AHP works by developing priorities for alternatives and the criteria used to judge the alternatives. First priorities are derived for the criteria in terms of their importance to achieve the goal, then priorities are derived for the performance of the alternatives on each criterion. These priorities are derived based on pair-wise assessments using judgments, or ratios of measurements from a scale if one exists. Finally, a weighting and adding process is used to obtain overall priorities for the alternatives as to how they contribute to the goal."

AHP is a Heuristic Algorithm

The Analytical Hierarchy Process is termed as an "Heuristic Algorithm".

An "algorithm" is "a procedure for solving a mathematical problem(as of finding the greatest common divisor)in a finite number of steps that frequently involves repetition of an operation; broadly: a step-by-step procedure for solving a problem or accomplishing some end, especially by a computer."

A "heuristic algorithm" is one that "provides good approximate but not necessarily optimal solutions to a given model [or problem]. Often (but by no means always) in employing such an algorithm one may be able to precisely measure the 'goodness' of the approximation." (Moore & Weatherford, Decision Modeling With Microsoft Excel, 6thedition. Page)

AHP Procedures

Step 1. Developing the weights for criteria.

- developing a single pair-wise comparison matrix for the criteria;
- multiplying the values in each row together and calculating the nth root of said product;
- normalizing the aforementioned nth root of products to get the appropriate weights;
- Calculating and checking the Consistency Ratio (CR).

Step 2. Develop the ratings for each decision alternative for each criterion.

- developing a pair-wise comparison matrix for each criterion, with each matrix containing the pair-wise comparisons of the performance of decision alternatives on each criterion;
- multiplying the values in each row together and calculating the nth root of said product; normalizing the aforementioned nth root of product values to get the corresponding ratings;
- Calculating and checking the Consistency Ratio (CR).

Step 3. Calculate the weighted average rating for each decision alternative. Choose the one with the highest score.

2. PSYCHOLOGICAL METHOD

With the help of this method we conduct the rating of interviews, psychological tests, and discussion with supervisors etc. Using the data obtained employee's intellectual and emotional quotient is analyzed. However this method is costly and effectiveness of the evaluation is largely dependent on the skill of the psychologist. But this method helps to understand the extent of motivation and dedication the employee has to his organization. This process include the below phases

Step 1: Collect the interview data for all classes with interviewers rating of 0 to 9 depending upon the job knowledge.
Step 2: calculate the sum of all n samples ratings as x.
Step 3: Generate weight for each class using below formula

$W = ((x*100 / n/100))..........(1)$
Step 4: sort all classes base on current weight.

3.360 DEGREE EVALUATION

In this method we analyzed the whole year performance data of employee, the team leader or project leader collect the performance parameter of each employee of 360 days. Human Resource manager, co- workers and all those who can provide useful information about the employees .This technique is widely used since multiple rating helps is giving accurate information .The 360 degree evaluation also helps in the all-round development of the employee to the needs of the organization and achieving its strategic goals. This process include the below phases.

Step 1: Select the Select the feedback tool and process
Step 2: Choose the raters
Step 3: Use the feedback
Step 4: Review the feedback, like monthly, quarterly as well as semester basis.

Monthly cost = (Hourly rate * no. of hours work in month)
Actual cost = (Output cost - Monthly cost)
Weight = (Actual cost - Monthly cost)
Step 5: Manage and integrate the process into a larger performance management system

4. DATA COLLECTION

The data was collected from different construction firms from owners, project engineers, managers through questionnaire survey. We have collected survey data from 5 different firms for all methods. The survey consisted of detailed information about the firm and human performance factors .Respondents were asked to rate factors of human performance on descriptive scale which was presented to them. The firms were classified according to their experience

criteria in construction industry into 5 different classes. Classification of firms is as follows:-

Table 1: Classification of Firms base on classes

Sr. No	Class	Experience
1	A	Up to 3 years
2	B	Ranging between 3 to 6 years
3	C	Ranging between 6 to 9 years
4	D	Ranging between 9 to 12 years
5	E	More than 12 years

VI. RESULTS AND DISCUSSIONS

1 ANALYTICAL HIERARCHY PROCESS:-

The highest score and priority vectors are summarized in Table 2.The human performance on site has been rated by project manager.

Table 2: Analysis of classes with respect to Human Performance factors

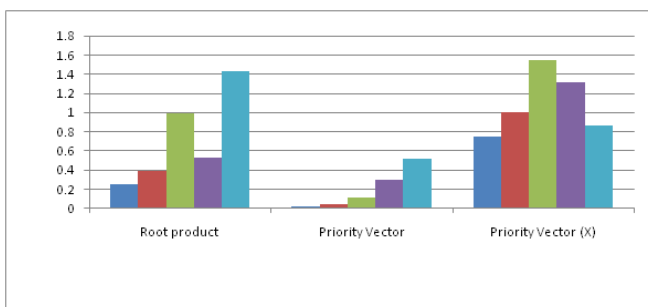|	Judgment	Adaptability	Motivation	Job Knowledge	Productivity	Score
P.V	0.026	0.045	0.116	0.295	0.516	0.998
Class D	0.032	0.592	0.030	0.465	0.033	0.185
Class A	0.056	0.197	0.045	0.266	0.057	0.123
Class B	0.142	0.106	0.120	0.180	0.171	0.166
Class C	0.261	0.059	0.305	0.057	0.224	0.177
Class E	0.506	0.044	0.498	0.029	0.513	0.346
Total	0.997	0.998	0.998	0.997	0.998	0.997

Figure 1: Calculation of Vectors

2. PSYCHOLOGICAL METHOD:-

Sum rule value is calculated according to every class and basic five factors. The above Table 2 shows the class wise data evaluation base on the collected data by project manager as well as team leader, it has generated base on the collected Data, first we collect ratings for all which is given by interviewer and project manager. Then apply sum rule formula from equation (1).

Table 3: Data Evaluation of Psychological Method by Project Manager as well as Team Leader

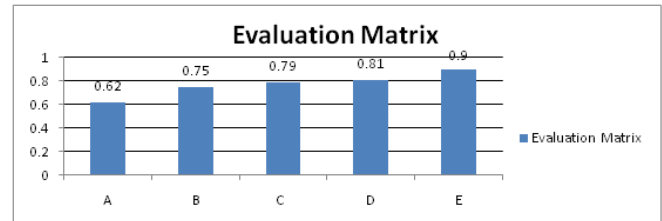| Methods and classes	Adaptability	Motivation	Judgment	Productivity	Job Knowledge	Sum rule Value
Up to 3 years	25	29	31	24	32	0.62
Ranging between 4 to 6 years	32	31	36	36	34	0.75
Ranging between 7 to 9 years	35	35	34	36	38	0.79
Ranging between 10 to 12 years	38	35	37	34	39	0.81
More than 12 years	41	42	40	39	41	0.90

Figure 2:-Psychological Method Class wise Data Evaluation

VII. CONCLUSION

A proposed evaluation was conducted in various construction companies and site by preparing a questionnaire for the accomplishment of the research objective. The most common observations considered as each employee performance, we also identify some mandatory things behind this research. We collect multiple organization rating bases on different employee class with experiences. The multiple reviews has given to AHP for identification for calculate weighting as ranking. The final ranking shows the most effective attribute when we find the better human resource to good productivity in construction. After the ending system around achieve all the objectives on satisfactory level. For the future enhancement we can focus multiple type of organization review for evaluation the human performance.

- Human resource practices followed in the Indian construction industry availability of skilled labor.
- Factors for human performance in construction industry is studied and identified.
- The various techniques related human performance management is analyzed.
- Evaluations of construction firms using human performance factors are done.
- Job Knowledge is highly rated by all classes and proves to be the most important factor which firms consider in human performance among all other factors.

VIII. ACKNOWLEDGEMENT

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