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Project Incentive System: A New Approach

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Abstract: Salary Incentive in management systems is normally applied to increase morality of the workers and consequently productivity of an institute. In this paper, a new approach is presented to estimate monthly wage of workers according to their efforts. The approach applies Analytical hierarchy process (AHP) to evaluate weight percentage of each worker subject to affected criteria on the project objectives. A numerical illustration is given to demonstrate the applicability of the proposed approach by applying a linear programming model. The approach is reliable for top-level manager who wishes to improve institute efficiency by applying a well-organized wage incentive system.

Keywords: Wage incentive system, Project management, AHP, productivity

1. Introduction

Normally, productivity can be determined according to two affecting factors namely effectiveness and efficiency, which are qualitative and quantitative respectively. Motivation may increase both of them. Thus a well organized program may help a manager to increase productivity of an institute.

This fact would be more important in the case of a project, where the employees know that they may be unemployment at the end of project after going project life cycle. Thus, developing an approach to be able to increase motivation and consequently productivity is highly desirable to avoid any stopping operation by workers. In this paper designing an organized wage incentive system is considered as one of the best factors which may be increased motivation continuously.

In spite of the importance of the mentioned problem, there are few references available in the literature around designing a wage incentive system which is focused in this paper.

2. The problem

Once a manager wants to increase efficiency (and consequently productivity) of his/her institute, it is desirable to design wage incentive system. It helps the manager to improve morality among the workers and increase degree of job satisfaction.

Consider that a company has n (n = 1, 2 , …, N) employee, which efficiency of each one is differ from the others. Also there is some restrictions such as predetermined budget and wage limitation for each worker that could be defined as an interval (range). The objective is to determine wage amount according to described conditions.

Because of involving the problem into some qualitative parameters in human resource, and also finding wage amount, in next section an AHP based method is developed to cover the problem.

3. The proposed approach

3.1. Analytical hierarchy process (AHP)

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This technique is especially appropriate for application to evaluations problems in which qualitative factors exist. It can be characterized as a multi-criteria decision technique that can combine qualitative and quantitative factors in the overall evaluation of the alternatives. This section provides an introduction to AHP with an emphasis on the presentation of the general methodology. No attempt is made to provide the mathematical foundations for AHP; rather the interested reader may refer to [1] and [2] for more detail. The AHP determines the priority any alternative has on the overall goal of the problem under consideration. The analyst/user creates a model of the problem by developing a hierarchical decomposition presentation. At the top of the hierarchy is the overall goal is looking to satisfy. The lower levels then represent the progressive decomposition of the problem. An analyst completes a pair-wise comparison of all elements in each level relative to each of the program elements in the next higher level of the hierarchy. The composition of these judgments fixes the relative priority of elements in the lowest level (usually solution alternatives) relative to achieving the top-most objective. Four Steps normally are used to solve a problem with the AHP methodology:

- Building up a decision "hierarchy" by breaking the general problem into individual criteria.
- Gather required data for the decision criteria and alternatives and encode using the AHP relational scale. (pair wise comparison input)
- Estimate the relative priorities (weights) of the decision criteria and alternatives.
- Perform a composition of priorities for the criteria, which gives the rank of the alternatives (usually lowest level of hierarchy) relative to the top-most objective. Many example applications of AHP can be found in the literature. For instance, see [3] and [4].

3.2. The proposed approach

As it is discussed earlier, the problem under consideration includes finding wage amount for each worker on the basis of his/ her effort made.

The approach used in this paper is to apply AHP for estimating weight percentage of each worker and after that to determine wage amount. In designed AHP, number of alternatives is equal to number of workers and also two criteria are defined. The first one is degree of experience and the second one is worker performance. Although both criteria are qualitative, the second one will obtained on the basis of worker skills, ability & etc. however, it is open to a designer to consider more criteria in the proposed AHP. After finding weight percent for each worker, the obtained results will be used in linear programming method. In figure 1, schema of the proposed approach is given.

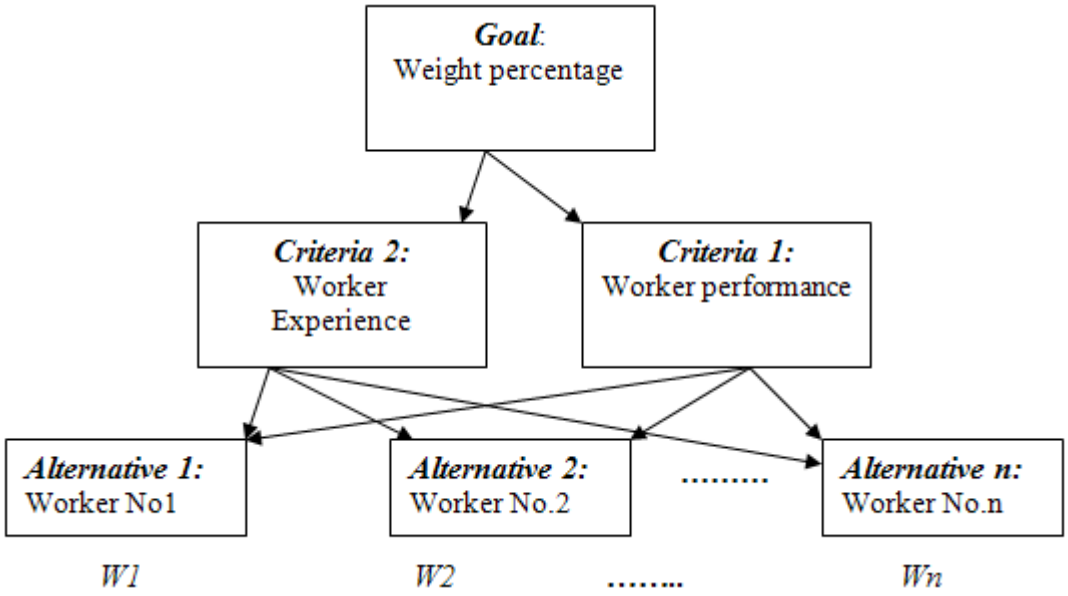

Fig 1. Representation of the proposed approach

Finally wage amount for each worker at the project life cycle should be calculated as follows:

$$\text{Max } Z = W1 * X1 + \ldots + Wn * Xn$$
$$L1 <= X1 <= U1$$

$$L2 <= X2 <= U2$$
$$\ldots\ldots$$
$$Ln <= Xn <= Un$$
$$X1+X2+X3+\ldots+Xn <= B$$
$$X1, \ldots, Xn >= 0$$

Where, Xi indicates monthly wage amount of each worker. L and U indicate lower bound and upper bound of wage which has been pre-specified by the managers. B is pre-determined budget which is deterministically known.

4. An illustrative example

4.1. Data gathering

Consider a manager wants to implement wage incentive system in his institute with four workers. Also imagine that minimum and maximum amount of wage are considered as 150 and 300 unit respectively. Total budget is predetermined and equal to 1000 unit. Table 1 and 2, indicate the comparative data on the basis of worker experience and worker performance respectively. It is clear that this data are obtained qualitatively on the basis of mentioned notes in section 3.1 [4].

Table 1. Comparative data on the basis of worker experience

	Worker No.1	Worker No.2	Worker No.3	Worker No.4
Worker No.1	1	5	4	3
Worker No.2	1/5	1	¼	½
Worker No.3	¼	2	1	3
Worker No.4	1/3	4	1/3	1

Table 2. Comparative data on the basis of worker performance

	Worker No.1	Worker No.2	Worker No.3	Worker No.4
Worker No.1	1	2	1/2	7
Worker No.2	1/2	1	1/3	5
Worker No.3	2	3	1	8
Worker No.4	1/7	1/5	1/8	1

Also comparative data between two criteria are given as it is shown in table 3:

Table3. Comparative data between two criteria

	Worker performance	Worker experience
Worker performance	1	2
Worker experience	½	1

4.2. Problem solving

After running AHP model in expert choice software, weight percent of each worker is obtained as given in table 4:

Table4. Weight percent of each worker

Worker name	Weight percentage
Worker No.1	0.37
Worker No.2	0.14
Worker No.3	0.41
Worker No.4	0.08

Wage amount can also be determined according to solving the following linear programming model:

$$\text{Max } Z= 0.37*X1+ 0.14*X2+0.41*X3+0.08*X4$$
$$150 <= X1 <= 300$$
$$150 <= X2 <= 300$$
$$150 <= X3 <= 300$$

150<=X4<=300
X1+X2+X3+X4<=1000
X1, …, Xn>=0

4.3. Model discussion

As it is well indicated, wage amount for each worker estimated on the basis of AHP based method. Thus this approach allows manager to use qualitative parameters (criteria) to estimate desired quantitative variable (wage). Furthermore, after finding results by applying AHP it is needed to check consistency index (CI). This index should be less that 0.1 as it is satisfied in this numerical example. If CI is more than 0.1, it means that the results are not extracted truly. In this case, it is needed to focus and review on data more precisely and changes the data on the basis of real situation to achieve problem validation and verification.

5. Conclusion remarks and further research

In this paper an AHP based method is employed to estimate wage amount for workers of an institute that whishes to increase efficiency and consequently productivity index trend. In the designed AHP, worker experience & performance are defined as two criteria and numbers of alternatives are equal to the number of workers involved in the wage incentive system. The results show payable monthly amount of each worker on the basis of his/her effort with acceptable consistency index. Further research could be focused on using fuzzy logic to evaluate important criteria; also considering goal programming instead of using linear programming is desirable in real cases.

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