Linear Programming for Job Evaluation

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ABSTRACT
Administration deals with the issue of calculating the value of the work because of its importance in the selection of employees.

There are two different methods the (QUANTITATIVE) technique and (QUALITATIVE) technique.

In this research we have addressed ourselves to one of the quantitalive method, in order to Calculate the (RELATIVE FACTORS IMPORTANCE) to the value of work, by using linear programming method ,to build a linear model characterized by realistic values of results obtained but not including the value of the wage paid (PERFORMANCE EVALUATION) in any relation of the model proposed.

The important results derived from the research is the possibility of assessing the efficiency of performance in a more equitable and less time and efforts of the adoption of this approach of research, using custom software calculator to solve this kind of problems.

Keyword: Linear programming, Goal programming, job evalution, management Science.

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البرمجة الخطية في احتساب قيمة العمل

الخلاصة

تعني الادارة بمسألة احتساب قيمة العمل لاهمية ذلك في انتقاء وتقييم العاملين. فهناك اسلوبان مختلفان هما الاسلوب الكمي (QUANTITATIVE) والاسلوب النوعي (QUALITATIVE) يعالجان كيفية احتساب قيمة العمل.

في هذا البحث تم التطرق إلى احد الأساليب الكمية في احتساب القيم النسبية للعوامل المهمة (RELATIVE FACTORS IMPORTANCE) لقيمة العمل باستخدام اسلوب البرمجه الخطية (LP) في بناء نموذج خطي يتميز بواقعية قيم النتائج المستحصلة من خلال عدم تضمين قيمة الاجر المدفوع (RELATIVE WORTH OF JOB) في اي علاقة للنموذج المقترح .

ومن النتائج المهمة المستخلصة من البحث، هي امكانية تقييم كفاءة الأدارة PERFORMANCE) (EVALUATION بشكل اكثر عدالة وبجهود وزمن اقل باعتماد اسلوب هذا البحث وباستخدام برامجيات الحاسبة المخصصة لحل هذا النوع من المشاكل.

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INTRODUCTION

M anagement had become increasingly aware of job evaluation, which is used by many organizations today for rationalizing their internal wage structures. Two distinct approaches have evolved over time the qualitative and the quantitative. The former considers job as a whole, while the latter, job is conceptualized as a combination of several compensable factors. Methods falling under the former are job comparison and grade description; while the latter approach are point system and factor comparison. The quantitative approach is found to be used more often; perhaps because of it is more objective than qualitative approach,[5].

An objective approach to determine factor importance was initiated by charnes et al. [6]. Many other models and applications such as Rehmus and Wagner [11], Alan [1], Bruno [4], and Kalro et al. [10] have been reported, where all these models are related to the relative worth of jobs to the salary paid.in[2].

The design of system for determining the weight of job factor from sets of paired comparison decisions by considering only a small sub-sampal of jobs. [3],present a job evaluation problem characteristics including the existence of multiple factors that influence the evaluation and the available data include fussiness while the description responsibiblities and requirements of the jobs are usually not precisely determind. In this paper, a new approach had been considered, to formulate an LP model to evaluate the relative factors importance on job evaluation, based on not to relate the relative worth of jobs to the salary paid, in order to have more applicable results to the reality.

CONVENTIONAL METHODS

Bradley [5] states, that the aim of a job evaluation study "is to determine the value of a job relative to all other jobs within the same organization. The importance of that job to the organization as a whole can thereby be established, and it can be placed in the appropriate position within an overall job-grade structure".

As we mentioned before, job evaluation methods are usually classified to Qualitative and Quantitative methods. In the former, each job is evaluated as a whole by a committee on the basis of a written job description, which is prepared to a standard format. These methods are relatively straightforward, easy to explain to participants, and quick to implement. However, they suffer from a number of serious drawbacks. There is a lack of clearly defined and objective criteria for the job comparisons, which leads to difficulties when inquiries are made as to why a job has been allocated to a particular grade. Further, it is usually difficult to find sufficient committee members with experience of all the jobs. Moreover, the methods do not indicate the degree of difference between jobs, but merely show their relative importance.

The basic quantitative methods requires an evaluation committee and a selection of 'bench-mark' jobs. However, objective criteria are provided for the comparisons by identifying factors which are most important in determining the differences between the different jobs. Skill, responsibility, physical effort and work conditions are often used and broken down into sub-factors. The sub-factors are then rated in terms of their importance. Elizur [8] has criticized these methods for their lack of clear principles to be used in selecting factors and 'bench-mark' jobs and for the absence of a theoretical justification of the subsequent

mathematical manipulations. Also, he analyzed all the jobs, avoiding the problem of selecting 'bench-mark' jobs.

Model Development

In order to measure the factors importance, a comprehensive list of attributes were specified by the project team. This ensured that all aspects of all jobs were included , but it was expected that some would be found to be superfluous and discarded later. *the final attributes were grouped into dimensions, such as skill, responsibility, physical effort and working conditions see[8].

ASSUMPTIONS AND NOTATIONS

(a) Define X_{ijk} be the relative importance of factor j, on job i belong to grade (k) (unknown.).

(b) Define W_{ijkr} be the given relative weight and obtained by the breakdown of each factor j of job i belong to grade (k), into (r) sub factors.

(c) Define L_{ijk} and U_{ijk} be the defind highest and lowest allowable relative worth of the factor j on job I belong to grade (k).

(d)   Define P_{ik} be the given priority to job i, belong to grade (k).

(e) Assume that the relative worth of job (i) belonging to grade (k) is given by the functional form:

$$\sum_j W_{ijk} X_{ijk}, \quad \forall i \in (k), \forall k.$$

(f)   Assume that the factor importance is implicit in the current grade structure.

Because of the team thoughts had different ahitudes see[9] ,[10].

Formulation

The problem is conceptualized as a classification problem so that we expect the formulation should result in factor weights that clearly distinguish amongst job in different grades.

The objective function of the formulation is to maximize the relative worth of jobs with highest priorities, as follows:

Maximize:-

$$\sum_k \sum_i p_{i.k} \sum_j (\sum_r w_{ijkr}) x_{ijk} \dots \dots \dots (1)$$

J=1,…,k , I=1,…. k

I=1,…..k

Subject to:

$$w_{ijk} x_{ijk} \leq U_{iJk'} \quad \forall i,j,k \dots \dots \dots \dots (2)$$

$$w_{ijk} x_{ijk} \geq L_{iJk'} \quad \forall i,j,k \dots \dots \dots \dots (3)$$

$$\sum_j w_{ijk} x_{ijk} - \sum_j w_{ijk} x_{ijk} \geq \emptyset, \forall i,k \dots \dots \dots (4)$$

$$\sum_j w_{ijk} x_{ijk} - \sum_j w_{ijk} x_{ijk} \leq \emptyset, \forall i,k \dots \dots \dots (5)$$

$$\sum_j x_{ijk} \leq 1, \forall i,k \dots \dots \dots (6)$$

$$x_{ijk} \geq \emptyset, \forall\ i, j, k \ldots \ldots \ldots \ldots (7)$$

where s,$\in(r)$, corresponing to the lowest and highest relative weight. Constraints [2] &[3] express that for every relative importance factor j on job i belong to grade {k}, its relative worth is in fact must less than or equal to its highest allowable relative worth, and must greater than or equal to its lowest allowable relative worth, respectively. Constraints [4]&[5]express that the relative worth of every job i belong to grade {k}, is greater than or equal to its minimum relative worth and less than or equal to its maximum relative worth, respectively. Constraint [6] express that the sum of all relative importance factors j for every job i at every grade {k}, must *not exceed one*. The *nonnegativity* values o-f factors importance are expressed in [10]

Model Implementation and Discussion

To illustrate the working of the model, the data used has been obtained from which training institute of R.&D. center in which The highest and lowest relative worth of each factor are presented in Table(1).

Linear programming [LP] model has been formulated, to evaluate the relative factors importance on job evaluation, based on a new approach, in which salary paid has not been considered in any relation in the model structure obtaining more applicable results to the reality, which is one of the most advantages in our model over the previous models, since the task of job evaluation by relating relative worth of job to the salary paid in a single LP model would not reflect the reality, as a relationship of worth to salary is often nonlinear (NLP) models, see (9), (10) & [11]. The results are presented in the Table(1).

The most significant of this paper, is to conduct further researches based on our approach to obtain more fair scales, in which we believe that, personal effects could be minimized, saving time and manpower efforts, implementing Computer Software Packages oriented for solving such problems.

Discussion

From the above table , by using our approach, the standard weights, and allowable relative worth are fixed before any implementation to our model, to get the required values, evaluate the performance of the imployes.

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Table(1)
(Data Collected and Results)

Factor Importance		Relative weight	Allowable Relative worth		Values Calculated
j		W_{ijk}	L_{ijk}	V_{ijk}	X_{ijk}
Learning	3	Difficult	0.1	0.5	0.111
	2	Medium			
	1	Easy			
Skill	3	High	0.2	0.7	0.222
	2	Medium			
	1	Low			
Responsibility	5	Centre wide	0.1	0.6	0.111
	4	Dept. wide			
	3	Class wide			
	2	Group wide			
	1	Others			
Academic Degree	3	Ph. D.	0.3	1.0	0.333
	2	Master			
	1	Others			
Work Experience	3	(10-) years	0.2	0.8	0.222
	2	(5-10) years			
	1	(0-5) years			