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Review paper

Personnel Management in Agro-based Industry from a Goal Programming Perspective

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Abstract

The much anticipated productivity and better performance of any industry counts on the proper utilization of human resources. Any agricultural industry involves different types of employees in field and factory. Moreover the overall management is monitored by administrative staffs. In this paper a model is developed so that payroll cost per month is minimized and at the same time the production target is also achieved. The study is based on the information from an agro-based industry. The developed model is given in the Appendix.

Keywords: G.P. Model, personal management, deviational variables, system constraints. **2010 Mathematics Subject Classification**: 90C29.

Introduction

In recent years, the study of optimization techniques and its application in industrial problems has drawn the attention of a large number of researchers. Optimal allocation of land, resources and mainly human resources were studied by different authors in their researches. Researchers have developed analytical models for shift-by-shift allocation decisions for final assignment of nurses and non-professional personnel to hospital units. Trivedi and Warner[1], Warner and Prawda[2] studied in this regard. Wolfe and Young[3,4] developed a model for determining nurse staffing in a hospital unit.

Kumar and Trivedi[5] proposed a mixed integer goal programming model for nursing service budgeting by taking into account part-time, full time and overtime nurses on week days as well as weekends. Pal and Sen[6] used goal programming procedures for proper allocation of teaching personnel to teaching departments of academic activity of a university. We find more literature of human resources allocation[7,8,9,10]. Till date very less effort has been given to study personnel management/human resource allocation in agro-based industries with different types of staffs. This study is concerned with that in an industry where Management seeks to minimize the total payroll costs, while maximizing human resources utilization.

Statement of the Problem

Any agro-based industry appoints a large number of employees of different grades. The involvement of employees in factory, field and an administration make an important factor for management for smooth running of the system. We can also find workers who are considered on daily basis. The management of any industry is always willing to utilize the employees for optimal returns in terms of production and profit.

Overview of Goal Programming

Goal programming has been developed and flourished for more than the last 50years. GP is a variation or modification of linear programming. It was first introduced by Charnes et al. in 1955[11], more explicitly defined by the same authors in 1961[12], and further developed by Ijiri[13] during the 1960's.

A goal which is under achieved has negative deviation and the goal which is over achieved has positive deviation of the desired goal. If the objective is to exceed stated goals, the objective function will only contain a negative deviational variable, d^- . If the objective is to be under the stated goal, the objective function will contain a positive deviational variable, d^+. The goals are prioritized and proper numerical weights are assigned to each goal within the same priority level. Each problem constraints can be considered as a goal from which the decision-maker determines which will be the best possible solution. Therefore, the objective of the goal programming problem is to minimize the sum of these deviations from the desired goal levels according to the pre-emptive priority and numerical weights assigned to them in the objective function.

GP Model Development

To develop a GP model, the following symbols and variables are defined

Symbols and Variables: x_i= The number of workers in i th type of work (ie variables are taken corresponding to Factory In charge, Head staff, Electrician, Excise clerk, Daily wages labour, Field Asst., Field staff, Field laborers, Crèche, Manager, Deputy Manager respectively). (i=1,2,3,…….11)
s_i= Salary of each worker in i-th type of work.
B_T= The total budget allotted for the salary of all workers.
T = The total number of workers in the system.
β_1 =The desired number of workers in factory.
β_2 =The desired budget for the daily wages labour in factory.
β_3 = = The desired time to be utilized in factory.
β_4=The desired number of administrative staffs.
β_5 = The desired budget for the factory staffs.
β_6= The desired budget for the field staffs.
β_7=The desired budget for the administration staffs.
β_8=The desired budget for the crèche.
t_i= The over time used by each x_i workers in factory.
t=The desired time allowed by management for overtime.
d_j^-=The negative deviation from *j*-th goal.
d_j^+=The positive deviation from *j*-th goal.
x_i's ≥ 0 d_j^-, $d_j^+ \geq 0$ and $i = 1,2,3 \ldots 11, j = 1,2, \ldots 10$

System Constraints: Budget allocation for the salary of staffs: In the process, the management already had set their budget for the whole process. So the total amount available for payroll is limited per month and it can be stated as

$$\sum_{i=1}^{11} s_i x_i \leq B_T$$

Total number of workers in the process: The at most number of total individuals that can be afforded by the management in specified budgeted salary can be stated as

$$\sum_{i=1}^{11} x_i \leq T$$

Goal Constraints: The LGP model constraints with deviational variables are formulated as follows:
P_1: Minimum payroll goal (Priority 1): To achieve the minimum payroll cost for budget planned, the management wishes not to spend more than allotted budget. The constraints willing to minimize the overachievement can be stated as,
$\sum_{i=1}^{11} s_i x_i + d_1^- - d_1^+ = 0$

P_2: Utilization of factory staffs (Priority 2): Achievement of the proper utilization of factory staffs is to be considered. Lesser number of workers is desired but more staffs can also be hired and used in case of higher demand, so both underachievement and overachievement will come into consideration and it can be expressed as,
$\sum_{i=1}^{5} x_i + d_2^- - d_2^+ = \beta_1$

P_3: Budget for the daily wages labour in factory (Priority 3): As these workers of factory are not taken in permanent basis, so the budget allocation for this particular case is to be considered separately and desired to be minimized and it can be expressed as,
$s_5 x_5 + d_3^- - d_3^+ = \beta_2$

P_4: Overtime (Priority 4): When the demand in market is higher, overtime is allowed in the factory but it is desirable to get it minimized from management point of view to control their allotted budget, the constraint can be expressed as
$\sum_{i=1}^{5} t_i x_i + d_4^- - d_4^+ = t$

P_5: Number of workers in field (Priority 5): It is desired to have lesser number of workers in the field and so the goal constraint to restrict the overachievement of workers in field which can be expressed as,
$\sum_{i=6}^{8} x_i + d_5^- - d_5^+ = \beta_3$

P_6: Number of administrative staffs (Priority 6): It is desired to have lesser number of employees in the administration and the constraint to minimize the overachievement can be expressed as,
$\sum_{i=10}^{11} x_i + d_6^- - d_6^+ = \beta_4$

P_7: Budget for the factory staffs (Priority 7): To achieve the minimum budget for the factory staffs, the goal constraint to minimize the positive deviation from the goal may be stated as,
$\sum_{i=1}^{4} s_i x_i + d_7^- - d_7^+ = \beta_5$

P_8: Budget for the field staffs (Priority 8): The desire is to achieve the minimum budget for the field staffs. The goal constraint to minimize positive deviation may be stated as,
$\sum_{i=6}^{8} s_i x_i + d_8^- - d_8^+ = \beta_6$

P_9: Budget for the administration staffs (Priority 9): Achievement of the minimum budget for the administrations staffs is desired. The goal constraint is to minimize positive deviation from goal may be stated as,
$\sum_{i=10}^{11} s_i x_i + d_9^- - d_9^+ = \beta_7$

P_{10}: Budget for the crèche (Priority 10): These workers of field are to look after the children of women-labourers, they are not regular basis workers and so the budget allocation case for them is considered separately by management and as well another desired constraint to minimize the overachievement can be expressed as,
$s_9 x_9 + d_{10}^- - d_{10}^+ = \beta_8$

Objective function is
Min $Z = P_1 d_1^+ + P_1(d_2^- + d_2^+) + P_3 d_3^+ + P_4 d_4^+ + P_5 d_5^+ + P_6 d_6^+ + P_7 d_7^+ + P_8 d_8^+ + P_9 d_9^+ + P_{10} d_{10}^+$

Results and Discussion

The developed model can be validated with the data available from respective industry by using different optimization techniques available in literature and a justification can be found that which method is the best suited one for the said model. Moreover the manual calculation for the solution to the model may not be very easy. So the use of software likes LINGO, Micro -management Software etc will be of immense help.

Conclusion

The G.P. model has been developed to help in decision-making in an agro-based industry personnel management. G.P is applied with a computer program to find the satisfactory solution of personal management problem. As the variables in this model are number of employees in different jobs, so the study of integer behavior will be meaningful in the proposed model.

The study will be better if we rearrange the ranking of priority from author's notion of thinking and the present work can be extended to a new direction. Moreover the introduction of other constraints (goal as well as structural) in the present model with the change of time, situation will also improve it for better solution. The model can further be improved in future with inclusion of new variables depending on the seniority of employees. The study can be applied to other industries having the similar constraints especially where time and resources are limited.

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