# Role of Operations Research in Industrial Relations : A Case Study of a Public Enterprise

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One of the greatest challenges faced by the managements of public enterprises in the country today is maintaining healthy industrial relations (IR). We do not have standardized approaches or techniques for dealing with IR problems. Interestingly, Operations Research (OR) offers a fresh new approach for maintaining healthy industrial relations. Operations research as a discipline emerged sometime around World War II in a military context to develop strategies for military action. However, the principles involved were so universal that soon the discipline grew and its applications transcended towards business and industry. In the developed countries OR has made considerable strides in all functional areas of modern organisations, be it, production, marketing, finance, personnel etc. In the developing countries, however the applications of OR have not yet be encouraging. A survey on applications of OR in different functional areas of management was carried by the authors and the findings of this/survey presented in the national seminar on "Review of research in management" organised by the Shanti Prasad Jain Advanced Management Centre under the aegis of Faculty of Management Studies, University of Delhi, in February 1982. The major finding of the survey was that while areas like production, marketing and finance were amenable to use of OR techniques to some extent, the personnel and industrial relations area is practically unexplored and hence provides an excellent avenue for research.

## Characteristics Of OR

There does not exist a single definition of OR. It has been defined by certain authors

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as the application of scientific methods to the study of alternatives in a problem situation with a view to providing a quantitative basis for arriving at an optimum solution in terms of the goals sought. Yet another has defined OR as a scientific approach to decision making that involves the operations of organisational systems. The aforesaid definitions try to give some insight into the nature of OR. Firstly, they stress the use of scientific method and quantitative data for dealing with a problem situation. This is in contrast to the hither-to recognized approach of applying pulls and pressures by opposing groups many times without having relevent quantitative data at hand for tackling the issues of IR. Further, by definition, OR approach necessitates the logical representation of the problem situation and seeks to define the objectives sought and develop effectiveness criteria for achieving the objectives. This offers another deviation from the existing practices in dealing with IR because in this approach the objectives of the organisational system as a whole assume key importance; conflicting objectives of sub-systems, say Union and Management may be formulated as constraints. In other words, the viewpoints of all groups can be suitably represented in some kind of an OR model either as constraints or components of a total objectives.

While some of the characteristics of OR have been outlined in the above discussions, there are certain other important characteristics which deserve merit. First, OR is applicable to all problems that concern how to conduct and co-ordinate operation or activities within an organisation. Thus all functional areas such as production, marketing, finance, personnel etc. can form the subject matter of OR approach. Secondly, OR approach strives to identify the best possible course of action within the specified constraints and in line with the objectives sought. Thus, it doesn't offer piece-meal benefits, provides intrinsically what is best achievable given the circumstances of the situations. Thirdly, OR has a primary focus on decision-making. This characteristic is of significance since many approaches of dealing with IR these days rely on not making any decisions till the problems assume alarming proportions. In a way, OR compels the decision making process to take its course.

Fourthly, the solutions offered by OR can be analysed; their economic implications clearly understood and explained to the rival groups to see for themselves the inevitability of accepting the solution that has emerged.

**Case Study**

In this section, a very simple illustrative application of an OR technique has been presented. The problem under scrutiny is essentially a staff scheduling problem in an industrial canteen yet there had been seeds of a possible IR dispute in the situation. Thus it can be viewed as a typical application in the area of IR. The industrial canteen is located within the premises of a large sized factory of a public sector undertaking employing about 3000 employees and is managed by the welfare department of the factory. A number of services are provided by canteen to the employees as part of the welfare activities. These include serving tea at the various works-posts, providing lunch service at staggered hours and dinner service for night shift employees within the canteen premises.

The employees of the factory are required to come in various shifts. The employees involved in production and those doing production related activities are detailed for production shifts A and B (shift A from 6.30 AM and shift B from 3.00 P.M. to 11.00 P.M.) and the administrative staff for General Shift (from 8.30 AM to 5.00 PM). In addition, the staff of essential services like canteen security, etc., is scheduled round the clock in three essential shifts, A, B and C (Shift A from 5.00 AM). The demand on the canteen employees varies because they have to serve a number of shifts.

(i) **Activities of Canteen Employees**

The canteen employees are engaged in various activities related to providing the above services to the factory employees. The organisation of the canteen staff and the main function of the each category of staff in the canteen are as indicated in Table-I :

TABLE I

**Organisation of Canteen Staff**

| *Designation* | *No.* | *Main function* |
|---|---|---|
| Canteen Officer | 1 | To monitor the performance of the canteen services; overall incharge of the canteen. |
| Canteen Stewards | 3 | To Supervise the canteen arrangement in various shifts. |
| Store Keepers | 4 | To control the receipt and issue of canteen consumables. |
| Cooks | 7 | To prepare vegetables, rice and other preparations in the canteen. |
| Helper-Bearers | 61 | To assist the cooks in preparation, serve tea, etc., at worksposts, cook chappatis, arrange counter service, etc. |
| Janitors | 21 | To clean utensils, keep the canteen tables and premises clean, wash the cooking area, etc. |

(ii) **The Problem**

For a long time, a considerable percentage of overtime is being booked for the canteen staff particularly, the helpers/bearers. The canteen officer feels that there is a requirement of additional helpers/bearers to cater for the increasing workload, but he wishes to keep the total strength to the minimum. He also has a problem in scheduling most appropriate number of helpers/bearers in various shifts round the clock to ensure that

the requisite srength is available for all the activities to be carried out throughout the day.

A detailed analysis of various activities being carried out during each hour of the day by the helpers/bearers has been done (see Annexure-I). This analysis shows the hour-wise manpower requirement as indicated in Table-II below :

TABLE II

**Hourly Requirement of Helpers/Bearers in Canteen**

| *Hours* | | *Total hourly requirement* |
|---|---|---|
| *From* | *To* | |
| 5.00 A.M. | 6.00 A.M. | 14 |
| 6.00 A.M. | 7.00 A.M. | 16 |
| 7.00 A.M. | 8.00 A.M. | 22 |
| 8.00 A.M. | 9.00 A.M. | 30 |
| 9.00 A.M. | 10.00 A.M. | 29 |
| 10.00 A.M. | 11.00 A.M. | 34 |
| 11.00 A.M. | 12.00 Noon | 33 |
| 12.00 Noon | 1.00 P.M. | 37 |
| 1.00 P.M. | 2.00 P.M. | 35 |
| 2.00 P.M. | 3.00 P.M. | 10 |
| 3.00 P.M. | 4.00 P.M. | 8 |
| 4.00 P.M. | 5.00 P.M. | 7 |
| 5.00 P.M. | 6.00 P.M. | 11 |
| 6.00 P.M. | 7.00 P.M. | 7 |
| 7.00 P.M. | 8.00 P.M. | 7 |
| 8.00 P.M. | 9.00 P.M. | 7 |
| 9.00 P.M. | 10.00 P.M. | 7 |
| 10.00 P.M. | 11.00 P.M. | 3 |
| 11.00 P.M. | 5.00 A.M. | 4 |

As against the hourwise requirements, the helpers/bearers of the canteen can be scheduled in any of the shifts. The availability of helpers/bearers at any hour of the day can be known by totalling up the deployment in the shifts which are concurrently operating at that hour. For instance, the total number of helpers/bearers available at 9.00 AM will be the helpers/bearers scheduled in production shift, A, General shift and essential shift A.

The problem before the canteen officer is to determine the optimum number of helpers/bearers to be called in different shifts for carrying out all activities at various hours during the day.

(iii) **The Integer Linear Programming Model for the Problem**

The aforesaid problem can be formulated in the form of an integer linear programming model as follow.

Let

$x_1$=No. of helpers/bearers to be called in Essential Shifts A (5.00 AM to 1.00 PM)
$x_2$=No. of helpers/bearers to be called in Production Shifts A (6.30 AM to 3.00 PM)
$x_3$=No. of helpers/bearers to be called in General Shift (8.30 AM to 5.00 PM)
$x_4$=No. of helpers/bearers to be called in Essential Shift B (1.00 PM to 9.00 PM)
$x_5$=No. of helpers/bearers to be called in Production Shift B (3.00 PM to 11.00 PM)
$x_6$=No. of helpers/bearers to be called in Essential Shift C (9.00 PM to 5.00 AM)

Then the objective function is to

Minimize $Z=x_1+x_2+x_3+x_4+x_5+x_6$

It is desirable that all the manpower requirements occurring at various hours during the day are fully met. These conditions can be expressed as follows :

| | | | | |
|---|---|---|---|---|
| $x_1 \geq 14$ | Manpower requirement | between | 5.00 AM & | 6.00 AM |
| $x_1+x_2 \geq 16$ | ,, | ,, | ,, | 6.00 AM & 7.00 AM |
| $x_1+x_2 \geq 22$ | ,, | ,, | ,, | 7.00 AM & 8.00 AM |
| $x_1+x_2+x_3 \geq 30$ | ,, | ,, | ,, | 8.00 AM & 9.00 AM |
| $x_1+x_2+x_3 \geq 29$ | ,, | ,, | ,, | 9.00 AM & 10.00 AM |
| $x_1+x_2+x_3 \geq 34$ | ,, | ,, | ,, | 10.00 AM & 11.00 AM |
| $x_1+x_2+x_3 \geq 33$ | ,, | ,, | ,, | 11.00 AM & 12.00 Noon |
| $x_1+x_2+x_3 \geq 37$ | ,, | ,, | ,, | 12.00 Noon & 1.00 PM |
| $x_1+x_2+x_3 \geq 35$ | ,, | ,, | ,, | 1.00 PM & 2.00 PM |
| $x_1+x_2+x_3 \geq 10$ | ,, | ,, | ,, | 2.00 PM & 3.00 PM |
| $x_3+x_4 \times x_5 \geq 8$ | ,, | ,, | ,, | 3.00 PM & 4.00 PM |
| $x_3+x_4+x_5 \geq 7$ | ,, | ,, | ,, | 4.00 PM & 5.00 PM |
| $_4x+x_5 \geq 11$ | ,, | ,, | ,, | 5.00 PM & 6.00 PM |
| $x_4+x_5 \geq 7$ | ,, | ,, | ,, | 6.00 PM & 9.00 PM |
| $x_5+x_6 \geq$ / | ,, | ,, | ,, | 9.00 PM & 10.00 PM |
| $x_5+x_6 \geq 3$ | ,, | ,, | ,, | 10.02 PM & 11.00 PM |
| $x_6 \geq 4$ | ,, | ,, | ,, | 11.00 PM & 5.00 PM |

$x_1, x_2, x_3\ x_4\ x_5\ _6 \geq 0$ and to be integers.

## ANNEXURE 1

**Hourly Requirement of Helpers/Bearers in Canteen for Various Activities**

| *Hours* | *Prepairing tea/ breakfast etc.* | *Service of tea/ breakfast at workshops* | *Help cooking & choppati making* | *Counter arrangement and lunch/dinner service* | *Service in executive canteen* | *Total* |
|---|---|---|---|---|---|---|
| 5 a.m. to 6 a.m. | 5 | 7 | 2 | — | — | 14 |
| 6 a.m. to 7 a.m. | 2 | 7 | 5 | — | 2 | 16 |
| 7 a.m. to 8 a.m. | 2 | — | 18 | — | 2 | 22 |
| 8 a.m. to 9 a.m. | 2 | — | 25 | — | 3 | 30 |
| 9 a.m. to 10 a.m. | 1 | — | 25 | — | 3 | 29 |
| 10 a.m. to 11 a.m. | 2 | — | 20 | 6 | 6 | 34 |
| 11 a.m. to 12 noon | 1 | — | 11 | 15 | 6 | 33 |
| 12 noon to 1 p.m. | 2 | — | 11 | 15 | 9 | 37 |
| 1 p.m. to 2 p.m. | 2 | 5 | 4 | 15 | 9 | 35 |
| 2 p.m. to 3 p.m. | — | 7 | — | — | 3 | 10 |
| 3 p.m. to 4 p.m. | — | 7 | — | — | 1 | 8 |
| 4 p.m. to 5 p.m. | 4 | — | 2 | — | 1 | 7 |
| 5 p.m. to 6 p.m. | 3 | 7 | 1 | — | — | 11 |
| 6 p.m. to 7 p.m. | — | — | 7 | — | — | 7 |
| 7 p.m. to 8 p.m. | 1 | — | — | 6 | — | 7 |
| 8 p.m. to 9 p.m. | 1 | — | — | 6 | — | 7 |
| 9 p.m. to 10 p.m. | — | 7 | — | — | — | 7 |
| 10 p.m. to 11 p.m. | 3 | — | — | — | — | 3 |
| 11 p.m. to 5 a.m. | 4 | — | — | — | — | 4 |

**Conclusion**

The above case illustrates the application of the technique of integer linear programming in problem areas that have a bearing on industrial relations. The solution obtained by

applying the relevant OR technique is significant because it is an optimum solution from the point of view of costs; this also regulates the overtime of employees, at the same time it suggests regularisation of casual staff. Thus the solution is extremely valuable from IR point of view since it attempts to avoid the possibility of industrial disputes erupting while at the same time optimizing the costs.

There are many other OR techniques which can be usefully applied in problem areas of IR. For instance, goal programming which achieves attainment of multiple objectives with varying priorities. The relevant IR objectives while formulating a goal programming model can be to ensure that the capacity augmentation by overtime is restricted to a certain percentage. Again, simulation applications in the areas of staffing ensure that an optimum manpower strength is available for carrying out the desired activities at best aggregate system performance. This ensures that problems such as excessive workload on employees or too much idle time do not take place. Yet another interesting application is that of replacement analysis in staffing; which can provide an optimum recruitment policy in an organisation that would ensure availability of trained personnel to take over jobs as and when retirements take place and as and when new jobs are created.

Apart from problems associated with staffing, overtime regulation etc; IR problems usually relate to wage levels and bonus etc. The problem then is basically that of allocation of resources of the organisation as a whole into different channels such as acquiring capital assets, working capital requirement; employees remuneration etc. The situation is apt for successful application of a linear programming or goal programming technique by suitably formulating the model.

Then there is the interesting technique of game theory which perhaps is most suited to IR problems. This technique recommends the best strategies which should be followed by analysing the expected response of the other group to different strategies and evaluating the resultant output. In situations of actual or imminent breakdown of industrial relations, this technique can bring wisdom to the parties concerned and compel them to case the situation,