INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 5 - V7I5-1245)
Available online at: https://www.ijariit.com

Application of Operations Research in Human Resource Management

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ABSTRACT

We wanted to see how operational research may be used in the subject of Human Resource Management in this study work. It has long been a known fact that when work is done without the use of any scientific equipment, humans are prone to make mistakes. After conducting extensive research in the field of human resource management, we discovered that training, selection, recruiting, and other activities in many businesses are based on bias and partial perspectives. We also discovered that the average capital invested in training and development programs is significantly more than it should be. This prompted us to link the concept of organizational research to Human Resource Management, namely, maximizing happiness at the lowest possible cost. With this goal in mind, we set out to study previous articles to learn more about how firms are already employing Operations Research techniques. Operations research (OR) is a problem-solving and decision-making analytical method that is effective in the management of businesses. Problems are broken down into simple components in operations research, and then mathematical analysis is used to answer them in predetermined steps. The future of decision-making is Operations Research. In this context, operational research serves a critical role in enhancing management productivity and ensuring that scarce resources are managed more effectively. The existing state of the art in India is compared to its potential in terms of economic incentives and disincentives, social, cultural, and political considerations, computer availability and usage, OR staff availability, and current management approaches.

Keywords— *Operations Research Project, HR, HRM, NMIMS Project in OR*

1. INTRODUCTION

In this research paper we will be talking about techniques of Operational Research in Human Resource Management like Linear Programming, Markov Analysis, Goal Programming and Hungarian Assignment method. Linear programming is a mathematical method for optimizing operations given restrictions. Firstly, Linear programming- Linear programming's basic goal is to maximize or minimize a numerical value. Linear programming is a popular technique for determining the most efficient use of resources. When a linear function is exposed to multiple restrictions, it is maximized or reduced using linear programming, a mathematical modelling technique. This method has been used to guide quantitative judgments in business planning, industrial engineering, and, to a lesser extent, social and physical sciences. Secondly, Markov analysis- Given the current state of a variable, the Markov analysis procedure involves determining the likelihood of a future action. A decision tree can be built, and the likelihood of an outcome estimated once the probabilities of future actions at each state have been identified. Thirdly, Goal programming- Goal programming is an optimization technique for solving issues with many objectives that are inherently incompatible and frequently clash in a decision-making horizon. Lastly, Hungarian Method-The Hungarian Method is a polynomial-time algorithm created by Harold Kuhn to solve assignment problems. The assignment problem is a variant of the transportation problem in which the number of providers and consumers is equal, and the supply (ai) and demand (bj) quantities are defined as 1.

1.1 Effective Maintenance and Manpower Planning Strategy:

Study of this strategy was about optimum allocation of maintenance crew of The Cocoa Processing Industry in Akure, Ondo State of Nigeria, which keeps machinery used for cocoa processing in operable condition. Wide variety of data has been analyzed, such as maintenance budget, maintenance cycle, production capacity and waiting time of production facilities in case of failure. It was analyzed based on manpower cost, machine depreciation cost and the spare past costs which were assumed to be proportional to the number magnitude of breakdowns. Software namely "Quantitative System for Business- QSB (Version 3.0)" was used to solve this Linear Programming model.

The data was collected by questionnaires and oral interview method among the employees in the maintenance section of the firm. The data collected included the following:

-Number and list of all the machines
-Types of maintenance applied
-Budget on the maintenance
-Factors affecting maintenance
-Present level of manpower planning in maintenance department
-Maintenance cycle of each of the machines
-The waiting time of each of the machines

Close monitoring and observation of the maintenance operations was done over a period of two weeks to ensure the reliability of the data. There were periods time based or scheduled maintenance greyed out on the machines.
There were various factors affecting the maintenance operation of the firm which included,

-Understaffing of maintenance section
-Mismanagement of budgetary allocation
-Inadequate tools, equipment, and spare parts

Total number of employees in maintenance section including the maintenance manager were 19. All employees were divided into six groups, each consisting of three members, among them one acts as the supervisor. Total number of machines are 9.
Table is formed which consists of budget for the production section of the firm of which the maintenance section is subsequent for the year, maintenance cycle, production capacity and average waiting time of each machine.

Various assumptions are made during the analysis of collected data:

-Manpower cost is same for maintenance of each machine per hour.
-Depreciation cost of each machine is directly proportional to the rate of breakdown of machine.
-Spare parts cost associated with maintenance of each machine is directly proportional to the number of hours used during the maintenance.

Total manpower cost, spare part cost and depreciation cost was found. Table was formed which estimates the value of number of repairs in a year, maximum number of hours available for repair in a year and the percentage of production are available for each machine.

The main objective of this linear program question was to determine the crew size that will maximize the effectiveness of maintenance thereby maximizing the effectiveness of the production operation.

2. RESULTS

After solving the linear programming model using QSB software the optimal results show the frequency of machine breakdown and how maintenance crew must be allocated based on the results obtained from the optimal solution. During First maintenance cycle only 2 crew are needed while during Second cycle 4 crew are needed but during Sixth maintenance cycle 20 crew are needed which has 14 crew shortages as there are only 6 crew available in each section. For the smooth maintenance on the machines, we need in total 20 crews ready for any point in time as derived from the optimal result without the defective machines undergoing any unnecessary delay. Production capacity of the machines is not increased significantly but the waiting time has decreased for many machines after increasing the maintenance crew. The remaining crew members which were not employed in maintenance work can be transferred to the other work such as production section to promote efficiency and reduce overall cost of production. They should be given training to develop various skills which will be helpful in the firm, so that the crew can be posted as per the requirement. This will avoid the cost of keeping idle maintenance crews.

2.1 Inference

Manpower planning strategy showed how effectively optimal number of crew can be found which reduced the waiting time of machines. The production capacity didn't change much but information obtained about remaining crew members will be very useful asset for the company. All these findings can be used by management to predict the system operation and no doubt it will serve as a useful tool for future planning.

2.2 Human Resource Structure Examination by Markov Chain Simulation

Markov-chain model is used in multination companies to describe a general model of HR deployment of assemble line operators. This can be explained with the below scenario.

There are six levels of promotion: gadgets operator, excessive-priority operator, device technician, area service technician, assembly manager, operations manager. Employees can promote only to the next level of employment; therefore, the promotion matrix can

be described as a super diagonal matrix (P matrix), where, e.g., p4,4=0.80 which means that probability of not promoting the field service technician within the time window is 80%. Additionally, the p4,5=0.10 means, that the probability of promotion of field service technician to assembly supervisor is 10%. The parts of this matrix describe transitive stages of the deployment process. The employee's resins from the firm due to many reasons. This can be explained in a numeric way. The additional promotion matrix (A1 matrix) includes the soaking factors of this scenario describing the whole working model and reasons why employees end their job where e.g., a2,3=0.03 tells that 3% of the employees end their job by purpose of monetary instability. The company has following- machine operators -25, high-priority operators -17, equipment technicians -15, field service technicians -14, assembly supervisors -12 and operations managers –7. The corporation wants to reach, at the last of the time window for twenty months, a complete range of 280 employees, while they need twenty machine operators, forty-two high-priority operators, thirty-three equipment technicians, ninety-eight field service technicians, fifty-two assembly supervisors and thirty-five operations managers. The first row of the recruitment rate matrix gives the initial recruitment rate for the six different positions.

We can analyze the career path of the employees and the growth of the company's HR strategy and HR deployment system by the simulation of the described Markov chain system. The A.M.C simulation helps in calculating the distribution of human resources for future. In above case, by A.M.C simulation, the recruitment rate was changed. As the matrix shows that recruitment rate is dynamic due to the reason that it is a function of the total of employees and the recruited ones for a given position. By altering the promotion matrix, it is easy to change the career path of employees and redesign their distribution. The A.M.C simulation led to a redesigned human resource distribution. A.M.C simulation consequences of situation 1 with the initial dataset: Employees distribution by using the time window. Results of A.M.C simulation with the real dataset: deliberated and simulated quantity of employees in every group. The A.M.C simulation led to a reformation of human resource distribution.

3. RESULTS

The above-described Markov-chain model makes it possible to analyzed the deployment of human resource through time. analysis done using a Markov-chain based simulation method, makes it possible to simulate and analyze a given human resource strategy. More generally, analysis is focused on the mathematical description of the framework of human resource strategies. It is clear from the above analysis that Markov-chain simulation model makes it possible to optimize the Human resource structure. It is also used to optimize constrained problems both nonstationary and stochastic systems.

3.1 Inference

Markov analysis simulation showed how it is used to speculate the value of a variable whose predicted worth is only controlled by its present condition. It is a very helpful method for business managers and various resource professionals. Also, the Markov Chain model makes it possible to analyze the deployment of human resource through time, depending on the various parameters like recruitment rate.

3.2 A Goal Programming Approach to Human Resource Management

This strategy uses straight enhancement for circumstances wherein different objectives are included. Its essential objective is to lessen the chance expense of not accomplishing a non-focused on objective over a significant objective.

Giving health services as one of the fundamental elements of a health system is conceivable in the family physician program with the reference framework. In Iran, anticipating the execution of FPP and the reference framework is one of the central questions in health system general strategies, Iran's 20-year vision plan, and the fourth advancement plan. Following the execution of this arrangement in provincial regions, regardless of its benefits and hindrances referenced in logical texts and notwithstanding deficient inclusion of health systems in towns, this arrangement has been initiated in metropolitan regions with a populace of more than 20 thousand individuals since 2012. One of the fundamental objectives of the FPP was to diminish the health system costs because in the beyond twenty years expansion in the expenses of the health system has been twice more than the increment in the absolute file of the expenses in the country. One of the reasonable techniques for arranging and dispensing is objective programming which was proposed in 1961 as one of the multi-variation dynamic models in administration. Fars and Mazandaran territories, with a populace of around 7 million and 600,000 individuals, and as the primary urban areas which have executed the metropolitan family doctor plan comprise 10% of the number of inhabitants in Iran.

Their cross-sectional examination was directed during September and December 2014 in Jahrom, Iran. Objective and foundational imperatives show the given levels of each unbiased, and target work in the objective programming model is planned to decrease the absolute weight of unfriendly deviations is an attractive and bothersome deviation from the objective. Their Study tests comprised of 15 people who were educated specialists in FPP. Their members were chosen dependent on having something like four years of the board insight, being comfortable with UFPP, and readiness to partake in the Centre gathering and meeting. To gather the information in "the objective limitations, the goal work, and the choice factors" areas, a gathering was held. In the field study, data on monetary and managerial units of colleges was utilized. To take care of the issues and to examine the outcomes, the objective programming model and DS programming were utilized. To test the strength of the outcomes, decrease of vulnerabilities, ID of expected blunders in planning a model, and expanded comprehension of information and yield factors, they utilized the affectability investigation test.

4. RESULTS

The ideal number of metropolitan family doctors was 37 with two working movements and 15 with one working movement. In addition, the ideal number of doctors was 25 in general wellbeing places and 19 in private communities. What's more, the ideal number of family doctor associates was 52. Considering these outcomes, the genuine number of metropolitan family doctors was 33, 26, 25, 34 and, 57, individually.

4.1 Inference

GP model showed that portion of HR in FPP program was not ideal depending on decision-maker's perspectives. Subsequently, GP would have given a more ideal-portion when joined with mindset of managers and logical numbers, as it assists with managing objectives that can't-be totally accomplished, in such way that more significant-objectives are accomplished first, at cost of less significant ones.

4.2 Optimization of Rest Time of Crew

The goal is to maximize crew rest time on Air India flights between Mumbai and Delhi in order to maximize resource use, personnel planning, and cost efficiency. With eleven schedules from Mumbai to Delhi and return, the circumstance has been structured as an assignment problem. It is solved using the Hungarian method of assignment. Various scenarios were examined for various crew assignments and flight routes, revealing that the crew's rest time might be significantly reduced.Air India is India's flagship carrier airline, with a fleet of airline carriers serving 90 local and international destinations on four continents. Indira Gandhi International Airport in Delhi and Chhatrapati Shivaji International Airport in Mumbai are two airports that are critical to Air India's domestic operations and have a significant impact on its scheduling. Air India's existing timetables were examined, and around ten of them were direct flights with a 2-hour travel time between the two cities. For the existing schedule, assumed all flights and crew are based in Delhi, a table was created that indicated the rest period for crew members at Mumbai was found to be 117 hours and 50 minutes. Two tables were constructed to calculate the rest period, one for the crew base in Delhi (layover in Mumbai) and the other for the crew base in Mumbai (layover in Delhi). By comparing the two tables, a new table was created with the shortest rest time for each flight combination. To maximize relaxation time, the crew was rescheduled using the Hungarian Assignment Method.

5. RESULTS

The predicted ideal rest time for the crew was 21 hours and 20 minutes, a reduction of roughly 80% from the previous rest time of 117 hours and 50 minutes. According to the findings, postponing might save over 96 hours of rest time. If the indirect cost of a rest period is Rs.1000 per hour, it translates to a daily savings of Rs 96,000, or a monthly savings of Rs 28,80,000 if 30 journeys are taken in a month.

5.1 Inference

Optimization of rest time of crew in the airline industry is very helpful because it will provide efficient time to rest for crew which is very important to reduce risk of fatigue.

6. CONCLUSION

Although Operations Research and Human Resource Management are two distinct professions that run concurrently, their combination can yield significant improvements in the scope of decision-making for business leaders in terms of effectively managing their personnel. Optimization, rather than any random, human process, gives them the proper feeling of direction to distribute resources in the right region, based on a mathematically established criterion. HRM picks the best people for the organization through recruitment, training, and development, and they play a key role in achieving strategic goals. HRM performance appraisal improves the efficiency of a company It not only focuses on an organization's overall strategic aim, but also manages its human capital. It also assists in keeping track of globalization and the consequences or benefits it may have, while also monitoring and upgrading the organization's HR policies and processes. Not only must the HR department attract, recruit, select, train, and develop the personnel, but it must also assist in monitoring through various means. Despite the fact that Operations Research has introduced the entire corporate world to the glories of scientific management and the severe reliance on objective models for decision making, it is important to remember that models and simulations can never account for the human aspect. As a result, an excessive and unwavering dependence on these approaches, with no regard for the human component, can be harmful in the long run, resulting in mistakes made by businesses and other organizations.

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