



M.K.Singh
Faculty BBA

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Advantages and drawbacks of Linear Programming

Linear Programming (LP) is a particular type of technique used for economic allocation of 'scarce' or 'limited' resources, such as labour, material, machine, time, warehouse space, capital, energy, etc. to several competing activities, such as products, services, jobs, new equipment, projects, etc. on the basis of a given criterion of optimality. The phrase scarce resources mean resources that are not unlimited in availability during the planning period. The criterion of optimality generally is either performance, return on investment, profit, cost, utility, time, distance, etc.

Linear programming is a mathematical modeling technique in which a linear function is maximized or minimized when subjected to various constraints. This technique has been useful for guiding quantitative decisions in business planning, in industrial engineering, and—to a lesser extent—in the social and physical sciences.

The word linear refers to linear relationship among variables in a model. Thus, a given change in one variable will always cause a resulting proportional change in another variable. For example, doubling the investment on a certain project will exactly double the rate of the return. The word programming refers to modelling and solving a problem mathematically that involves the economic allocation of limited resources by choosing a particular course of action or strategy among various alternative strategies to achieve the desired objective.

Applications of the method of linear programming were first seriously attempted in the late 1930s by the Soviet mathematician Leonid Kantorovich and by the American economist Wassily Leontief in the areas of manufacturing schedules and of economics, respectively, but their work was ignored for decades.

During World War II, linear programming was used extensively to deal with transportation, scheduling, and allocation of resources subject to certain restrictions such as costs and availability. These applications did much to establish the acceptability of this method, which gained further impetus in 1947 with the introduction of the American mathematician George Danzig's simplex method, which greatly simplified the solution of linear programming problems.

ADVANTAGES OF LINEAR PROGRAMMING

Following are certain advantages of linear programming:

1. Linear programming helps in attaining the optimum use of productive resources. It also indicates how a decision-maker can employ his productive factors effectively by selecting and distributing (allocating) these resources.
2. Linear programming techniques improve the quality of decisions. The decision-making approach of the user of this technique becomes more objective and less subjective.
3. Linear programming techniques provide possible and practical solutions since there might be other constraints operating outside the problem which must be taken into account. Just because we can produce so many units does not mean that they can be sold. Thus, necessary modification of its mathematical solution is required for the sake of convenience to the decision-maker.
4. Highlighting of bottlenecks in the production processes is the most significant advantage of this technique. For example, when a bottleneck occurs, some machines cannot meet demand while other remains idle for some of the time.
5. Linear programming also helps in re-evaluation of a basic plan for changing conditions. If conditions change when the plan is partly carried out, they can be determined so as to adjust the remainder of the plan for best results.

Drawbacks of linear Programming

1. There should be an objective which should be clearly identifiable and measurable in quantitative terms. It could be, for example, maximisation of sales, of profit, minimisation of cost, and so on, which is not possible in real life.

2. The activities to be included should be distinctly identifiable and measurable in quantitative terms, for instance, the products included in a production planning problem and all the activities can't be measured in quantitative terms for example if labour is sick, which will decrease his performance which can't be measured.
3. The resources of the system which are to be allocated for the attainment of the goal should also be identifiable and measurable quantitatively. They must be in limited supply. The technique would involve allocation of these resources in a manner that would trade off the returns on the investment of the resources for the attainment of the objective.
4. The relationships representing the objective as also the resource limitation considerations, represented by the objective function and the constraint equations or inequalities, respectively must be linear in nature, which is not possible.
5. There should be a series of feasible alternative courses of action available to the decision makers, which are determined by the resource constraints.
6. While solving an LP model, there is no guarantee that we will get integer valued solutions.

For example, in finding out how many men and machines would be required to perform a particular job, a non-integer valued solution will be meaningless. Rounding off the solution to the nearest integer will not yield an optimal solution. In such cases, integer programming is used to ensure integer value to the decision variables.

- Linear programming model does not take into consideration the effect of time and uncertainty. Thus, the LP model should be defined in such a way that any change due to internal as well as external factors can be incorporated.
- Sometimes large-scale problems can be solved with linear programming techniques even when assistance of computer is available. For it, the main problem can be fragmented into several small problems and solving each one separately.

- Parameters appearing in the model are assumed to be constant but in real-life situations, they are frequently neither known nor constant.
- Parameters like human behaviour, weather conditions, stress of employees, demotivated employee can't be taken into account which can adversely effect any organisation
- Only one single objective is dealt with while in real life situations, problems come with multi-objectives.

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