

Maximization during a Product Mix Bakery Using Linear Programming Technique

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ABSTRACT

Operations research, a linear programming approach was extensively used by locating proof to denoting human resource decision problems. but, many resolute to do greater use of the research technique, therefore, companies on the way in which the parts of something are arranged and locating it hard in distribute scarce sources in a manner in order to make certain earnings maximization or price minimization. Linear Programming is a broadly used mathematical modeling technique designed to help managers in making plans and choices making relative to useful resource allocation. This take a look at applied linear programming method to decision making supposed to determine the quantity of Bread that the firm must produce in a day to maximize income, concern to constraints within the production process. Facts on amount of primary raw cloth used in production of large, medium and small size bread according to day were accrued from the extract of the monetary record of the bakery. The hassle became formulated in mathematical term and solved the use of pc software referred to as Linear Programming Solver (LIPS).

Keywords: Operations Research, Optimization Problem, Maximization, Minimization, Linear Programming.

1. INTRODUCTION

The purpose of each organization, business enterprise or company is to construct income as it is contract its non-stop exists and productiveness. In this present days, model economic activity concerned with the processing of raw materials and manufacture of goods in factories in any respect fields faced challenges of manufacturing solutions (motors, garments, breads and so forth.) of right pleasant, amount and at correct time and greater mainly at low price (minimizing cost) and maximize the profit for their existence and development. The purpose of this work is to use operations research as a mathematical

form to get profit income of producing industries which include bakery industries, and to appoint the use of R statistical software to carry out the evaluation. Cake is a baked meals made from flour that is damp, shape, and evidence with the addition of yeast. Cake is a convenience food made from wheat flour derived from bread wheat, the technology of which back to the historical Egyptians at approximately 4000BC. Different uncooked stuff for bread making aside from graham flour encompass glucose baking fats, yeast, vegetable oil, salt and water. Hard wheat flour is used for bread making because of gas produced with the aid of yeast throughout proofing and baking.

Decision making is an important aspect in business environment has grown to be a complex project. In this present days, however, the selection inventor frequently tries to obtain a set of a couple of targets in an environment of inconsistency pursuits, not properly given statistics, limited assets, and limited analytic capacity. excessive price of era, materials, labour blue, competitive pressures, electricity consumption and so many one of a kind perspective significantly raise the problem of managerial choice – making. Know-how and technology are converting hastily, the brand new problems with little or no precedents always upward thrust. To successfully deal with the hassle of optimization of the restrained resources in this advancing worldwide age, selection makers cannot have enough money to make selection by using in reality applying their private reviews, bet work or instinct, because the consequences of wrong choices are critical and pricey. Subsequently, an knowledge of the applicability of quantitative strategies to choice making is of essential importance to decision makers. For instance, coming into the incorrect markets, generating the incorrect merchandise, presenting irrelevant services can have horrific outcome at the organizations.

Linear programming in line with is an analytical approach used to justify many managerial choices as consider the allocation of financial resources. Operations research may be described as an analytical method for scope of the pleasant allocation of a industry's constrained sources to achieve greatest aim, also described it as an accumulation instrument used to analyzed restrained optimization troubles in which the goal characteristic is a linear characteristic which may be maximized or minimized situation to linear constraints. Linear programming is a mathematical method used in Operations studies to solve specific types of troubles along with allocation, transportation and venture troubles that allows a preference or alternatives between alternatives publications of action.

Usually, the goal feature can be of maximization of earnings or minimization of prices or labor hours. Moreover, the version additionally includes positive systematic constraints which can be set of conditions that choicest solution should justify. Examples of the structural constraints include the raw material constraint, production time constraint and professional exertions constraints to say some. A most reliable answer is an answer that fulfills both the limitations of the problem and the set of targets to be met. The main reason of this take a look at is to indicate the pragmatic use of linear programming

methods in a production company, and additionally to effectively estimate which of the business enterprise's merchandise ought to receive greater attention or produce extra in different to maximize earnings.

2. OPERATIONS RESEARCH TECHNIQUE

Operations research may be described as a analytical approach for figuring out the first-class allocation of a firm's restrained capital to achieve most appropriate purpose. it is also a mathematical method used in Operation research (OR) or management Sciences to resolve precise kinds of troubles inclusive of allocation, transportation and challenge problems that allows a choice or alternatives among opportunity publications of movement. The time period "linear", as stated by means of, implies proportionality, which means that the elements in a state of affairs are so linked that they seem as straight line while graphed.

At the same time as the "programming" suggests the solution technique which may be completed with the aid of an iterative procedure in which a researcher advances from one approach to higher solution till a final answer is reached which can't be advanced upon. This very last solution is named the most advantageous solution of the LP hassle. This painting demonstrates the pragmatic use of linear programming techniques in a manufacturing. Linear Programming being the most outstanding or method, its miles designed for models with linear objective and constraint functions.

A LP model can be designed and solved to determine the satisfactory route of movement as in a product mix problem to the to be had constraints. Typically, the goal function can be of maximization of earnings (that is the focus of this challenge) or minimization of expenses or hard work hours. Moreover, the model also includes positive structural constraints that are set of conditions that the optimum solution should justify. Examples of the structural constraints include the raw cloth constraints, production time constraint, and professional hard work constraints to say a few. An ideal solution is a solution that fulfills each the limitations of the trouble and the set objective to be met., labored on utility of linear programming for top-quality use of raw substances in bakery. Carried out linear programming in minimization of price of animal feed for the reason that animal feed became recognized as a primary component within the typical price of animal manufacturing on the way to maximize earnings. Labored on the optimizing income with the linear programming model.

3. PROCEDURE FOR SIMPLEX METHOD

In this section we try to discuss about the procedure for simplex method. This is as follows:

Step-1: Check whether the objective function of the given linear programming problem is maximization or minimization. If it is minimization then we convert the given problem by using the formula

$$\text{Min } Z = (-\text{Max}(-Z))$$

Step-2: Check whether all b_i 's ($i=1,2, \dots, n$) are non-negative if any one of the b_i is negative by multiply the corresponding inequality of the constraints by (-1). So we get all b_i 's are non- negative.

Step-3: Convert all the inequalities in to equations by introducing slack or surplus variables in the constraints the cost of their slack or surplus variable is zero.

Step-4: obtain the initial basic feasible solution to the problem in the form of

$$X_B = B^{-1}.b$$

Step-5: compute the net equation $Z_j = C_j$ ($j=1,2,\dots,n$) by using the relation

$$Z_j - C_j = \Sigma C_B(a_{ij}) - C_{ij}$$

To check the sign of $Z_j - C_j$

1. If $Z_j - C_j \geq 0$ then the initial basic feasible solution X_B is an optimum basic feasible solution.
2. If at least one $Z_j - C_j \leq 0$ proceed to the next step

Step-6: if there are more than one negative $Z_j - C_j$ then choose the most negative of them i.e., the entering variable corresponding column is key column.

Step-7: To maintain the feasibility of the solution in each iteration the following steps need to be followed:

1. In each row find the ratio between the solution column value and the value in the key column then select the variable from the present set of basic variable with respect to the number ratio such variables in the corresponding row is called key row.
2. The value of the intersection of the key row and key column is called the key element or pivotal element.

Step-8: Convert the leaving element to unity i.e.,

$$\text{New pivot row} = \frac{\text{current pivot row}}{\text{pivot element}}$$

i.e., $\text{New row} = \text{current column} - \text{it's pivotal column coefficient}$

$\times \text{new pivot row}$

Step-9: Go to step-5 and repeat the procedure until the optimum solution is obtained.

4. PROPOSED METHODOLOGY

The origin of data for this paper was collected from Sweet magic Bakery, Eluru City. The material collected was based on the types of bread been produced by the bakery which are medium-sized bread, large sized bread and extra – large-sized bread respectively. The data collected were supported the main material used per unit of production of the sort of breads produced within the bakery as shown table 1 below:

Table 1. Major Staple per Unit of Production of Bread.

	Medium	Large	Extra large	Material available
Smash	5kg	10kg	15	10,000kg
Glucose	0.5kg	0.10kg	0.15kg	2000kg
Ghee	0.10kg	0.15kg	0.25kg	1000kg
Profit income	30	50	150	

5. DATA ANALYSIS

A linear programming model for maximization of objective function type can be stated mathematically as follows:

$$\text{Maximize } Z = C_1X_1 + C_2X_2 + C_3X_3 + \dots + C_nX_n \dots \quad (1)$$

Subject to

$$a_{11}X_1 + a_{12}X_2 + \dots + a_{1n}X_n \leq b_1 \dots \quad (2)$$

$$a_{21}X_1 + a_{22}X_2 + \dots + a_{2n}X_n \leq b_2 \dots \quad (3)$$

$$a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mn}X_n \leq b_m \dots \quad (4)$$

$$\text{and } X_1 \geq 0, X_2 \geq 0, \dots, X_n \geq 0 \dots \quad (5)$$

Where $X_1, X_2, X_3, \dots, X_n$ are decision variable to be maximized. They represented the varied sort of bread production i.e $X_1 =$

medium, $X_2 =$ Large, $X_3 =$ size

(ii) $C_1, C_2, C_3, \dots, C_m, \dots, C_n$ are the unit profit of the different type of bread production

(iii) a_{ij} are the input- output coefficient

(iv) b_1, b_2, b_m is the available limited resources.

(v) Z is that the objective function to be maximized. The maximization of Z is administered in order that the m constraints are satisfied

Subject to:

$$\text{Maximize (Z)} = 30X_1 + 50X_2 + 150X_3 \quad (6)$$

$$5X_1 + 10X_2 + 15X_3 \leq 10,000 \quad (7)$$

$$0.5X_1 + 0.10X_2 + 0.15X_3 \leq 2000 \quad (8)$$

$$0.10X_1 + 0.15X_2 + 0.25X_3 \leq 1000 \quad (9)$$

$$X_1, X_2, X_3 \geq 0 \quad (10)$$

6. CONCLUSION

This paper has been able to analyze the current activity of bread production in Sweet magic Bakery adopting operations research Technique, it is observed that optimal solution is being obtained at $X_3 = 667$ and $Z_{\max} = 100,000$ from single iteration, while X_1 and X_2 did not have any significant impact on the optimal solution. It is worthy of note that X_1, X_2, X_3 are the decision variables which represent medium-sized bread, large bread and extra-large sized respectively. The slack variables S_5 and S_6 weren't taking into consideration within the outcome as they need no value. From the findings, for the bakery to make a maximum profit of 100,000rs/-, they should produce 667 loaf of extra-large bread and reduce or stop the production of medium and enormous bread as they are doing not contribute to the utmost profit the bakery makes within the face of the constraints they operate upon.

7. REFERENCES

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