PATNA WOMEN'S COLLEGE 1940

IRIS
Journal for Young Scientists
ISSN 2278 – 618X **(Print)**
ISSN 2278 – 6384 **(Online)**

http://www.patnawomenscollege.in/journal

Application of Linear Programming Model in A Bag Manufacturing Unit in Patna

• **Shivangi Prabha** • **Nisha Modi** • **Nidhi Kumari**
• **Moon**

Received : November 2017
Accepted : March 2018
Corresponding Author : Moon

Abstract : *A study was conducted to find out the maximum profit level that can be attained by a small scale industry producing different bags with the same raw materials. The raw materials which were taken into account were rexine , lining and the labour hour consumed. Data were collected from two branches of the same industry and solved to get the value of the number of each bag it should produce in order to maximize its profit.*

Keywords: *Product mix industry, linear Programming, decision variables, constraint, objective function.*

Shivangi Prabha
B.Sc. III year, Statistics (Hons.),
Session : 2015-2018, Patna Women's College,
Patna University, Patna, Bihar, India

Nisha Modi
B.Sc. III year, Statistics (Hons.),
Session : 2015-2018, Patna Women's College,
Patna University, Patna, Bihar, India

Nidhi Kumari
B.Sc. III year, Statistics (Hons.),
Session : 2015-2018, Patna Women's College,
Patna University, Patna, Bihar, India

Moon
Head, Dept. of Statistics, Patna Women's College,
Bailey Road, Patna–800 001, Bihar, India
E-mail : moon1511.sona@gmail.com

Introduction:

A firm is faced with the problem of inventory management of raw materials and finished products. The objective function in inventory management is to minimize inventory cost and the constraints are space and demand for the product. Many business and economic situations are concerned with a problem of planning activity. In each case there are limited resources at our disposal and our problem is to make such a use of resources so as to yield the maximum production or to give the maximum profit etc. This part of profit maximization along with cost minimization to attain the state of optimality in an industry is the part where linear programming model comes to action. Managers can select the best solution with the help of LP by evaluating the cost and profit of various alternatives

A general linear programming problem includes a set of simultaneous linear equations (or inequations) which represent the conditions of the problem and a linear function which expresses the objective function of the problem (Prasad, 2014).

A method for linear programming in general was worked out in 1947 as a result of the scientific work of Dantzig. Since then the application of linear programming has spread rapidly and today it is perhaps the most effective mathematical tool that can be applied to the solution of economic and industrial problems (Prasad, 2014)

Earlier also many researchers have worked on this topic (Yahya et. al., 2012 ; Modibbo et al., 2015). Both of them applied simplex method for solving linear programming problem of resource allocation in a product mix industry.

In this project we have considered the two branches of Shamma Bag Manufacturing Company in Patna City to escalate its profit.

Graphical approach for finding the solution of LPP has been used here to get the maximum profit. The conclusions drawn from all these researches can be used as a guidelines but the respective industries for achieving the optimum profit level.

Materials and Methods:

The data used for this work were collected as extracts from records of a small scale industry in Patna City, Patna on its main product line (bags) and two different types of sales packages adopted for selling it in 2017. The marketing strategy of the company is to ensure a reduction in the selling price per unit of bag as the amount of rexine used in each bag increases. This was designed to encourage wholesale purchase of the bag by the user.

The particular technique which was used for this was LPP. Linear programming is a technique for determining an optimum schedule of interdependent activities in view of the available resources (Swarup et al., 2014).

The main feature of Linear Programming is to determine the quantity of several products to be produced, knowing their per unit contribution and amount of limited resources available with an objective to maximize the total profit subject to all constraints. However, most real world problems are close enough to linear problem. It is precisely for this reason and in this context that LP is good enough for everything (Chandrasekhar, 2014).

Data on the two basic raw materials used for the manufacturing of the bags were available in the records of the two branches of the industry. These raw materials were rexine, lining and labour hours consumed.

In manufacturing each unit of the bag. Information on the quantity of each raw material available in stock per day was obtained. Data regarding the profit that the industry gains by selling each bag was also obtained. However information regarding one or two raw materials having lesser cost like thread for sewing and chain or other materials used for designing were not obtainable and there effects were ignored in the analysis. Therefore, the only cost element considered for bag production was the cost of two main raw materials and the labour hour consumed.

Results and Discussion:

Two branches of Shamma Bag Manufacturing Company i.e. branch A and B situated in Noorani Bagh and Paschim Darwaja Patna City area respectively were considered. The values of various constraints for the production of per bag as obtained for branch A and B are shown in the Table 1.

Table 1. Observation obtained for branch A and B regarding raw materials and Profit Coefficients

Branch	Particulars	Model M	Model N
A	Profit	70Rs./bag	85Rs./bag
	Rexine	2.5 m/bag	4 m/bag
	Lining	2 m/bag	2.5 m/bag
	Labour Hours	50min/bag	38min/bag
B	Profit	80 Rs./bag	90 Rs./bag
	Rexine	2 m/bag	2.5 m/bag
	Lining	1.5m/bag	2 m/bag
	Labour Hours	60min/bag	40min/bag

Total available raw materials and labour hours as collected from the data of the industry are shown in Table 2.

Table 2. Observation for availability of restricted resources for branch A and B

Particulars	Branch A	Branch B
Rexine	600 meters	650 meters
Lining	550 meters	600 meters
Labour Hours	9,500minutes	9,600minutes

The objective functions are the constraint functions for the three branches are shown below in Table 3.

Table 3. Constructed objective function and constraints function for branch A and B

Branch	Objective Function	Constraint Function
A	$Z = 70x + 85y$	$2.5x + 4y \pounds 600$ $50x + 38y \pounds 9500$ $2x + 2.5y \pounds 550$
B	$Z = 80x + 90y$	$2x + 2.5y \pounds 650$ $60x + 40y \pounds 9600$ $1.5x + 2y \pounds 600$ $y \pounds 110$

In order to maximize the objective function let x be quantity of bags of model M and y be quantity of bags of model N were produced and sold from production unit A and B respectively.

All these data were plotted on a linear graph in order to get the feasible region and the optimum basic feasible solution which is in the final result of the research.

All the inequalities were first converted into equations and plotted on the graph. The shaded area OABC was the feasible region and the point B was the optimum basic feasible solution. This is shown in Figs. 1 and 2 for the branches A and B respectively.

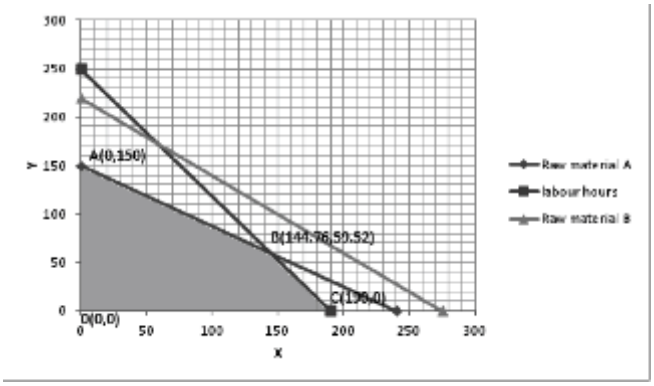

Fig. 1. Optimum Feasible Area of LPP for Branch A

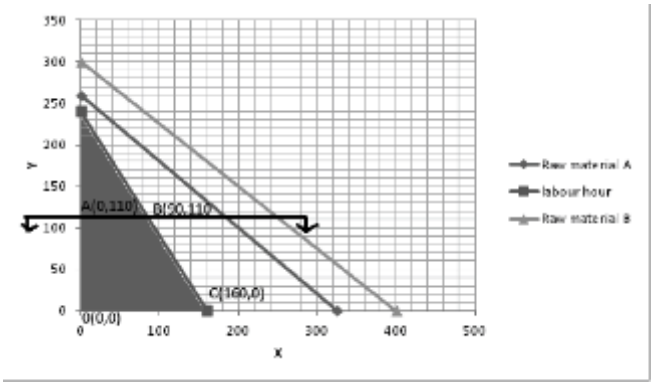

Fig. 2. Optimum Feasible Area of LPP for Branch B

So, in order to attain the maximum profit the branch A of the industry should produce 145M and 60N bags. Similarly branch B should produce 90M and 110N bags respectively.

This trend was not exhibited in past by the industry. It was just making production in a random manner. There was no significant proportion for the number of each bag produced. In order to attain the maximum profit level and use their limited resources in the best possible way it should make productions according to the result of the research.

Conclusion:

The application of linear programming methods for optimal resources allocation in a product mix industry have been demonstrated in the work. This is evident from the result obtained for the profit maximization type of the LP model fitted to the data collected on bag manufacturing from a small scale industry in Patna City, Patna.

The results of the LP model fitted to the data collected from the industry are only based on the amount of two raw materials and the labour hours consumed for the production. But if the marketing elements are implemented into LP formulation and analysis, the results reported here might be different and more appropriate. It was observed that they were using old technique for the production. They should adopt higher technologies for better production. It will also help them to minimize time for making particular amount of bags. Automatic sewing machine results better in compared with manual sewing. Nonetheless, results of the work could still serve as a useful guide to the management of the concerned industry in the formulation of production and marketing strategies for its product.

Acknowledgements:

We are beholden to Dr. Sister Marie Jessie A.C., Former Principal, Patna Women's College for giving us the opportunity to do this project. We are highly indebted to our supervisor, Ms. Moon for her guidance and constant supervision. We are also thankful to the faculty members of our department for their help and support. Above all we are thankful to the research committee for providing the facilities and financial support.

References:

Chandrasekhar S. (2014). Operation Research models and methods. Universities Press (India) Private Ltd., pp. 26-43.

Modibbo U., Sam Son O., Hafisu KR. (2015) Profit Maximization in a Product Mix Company using Linear Programming approach to Resource Allocation. International Journal of Sciences : Basic and Applied Research (IJSBAR). 24:46-52.

Prasad Lalji (2014). Linear Programming. Paramount Publication.pp.34-37.

Swarup Kanti, Gupta P.K and Man Mohan (2014). Operation Research. Seventeenth Edition. Sultan Chand and Sons. Pp.39-42,65-68

Yahya W.B., Garba M.K., Lge S.O. and Adeyosoye A.E. (2012). Profit Masimization in a Product Mix Company using Linear Programming. European Journal of Business and Management. 4(17): 126-128