Application of Linear Programming for Profit Maximization of a Sanitary Ware Company

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Abstract-

The efficient utilisation of resources at every level of production is a hallmark of industrial development strategy. Effective management decision-making processes are used in the sector to ensure resource analysis and efficient usage. The product mix optimization problem can be solved using a quantitative decision-making method called linear programming. Understanding the notion underlying the product mix optimization challenge is critical to the industry's success in terms of addressing consumer needs, branding, focusing on core business, and inventory management. Profitability of apparel manufacturing companies is largely determined by the efficient allocation and utilisation of available production time, materials, and labour resources. As a case study, this paper looks at a sanitary ware company in Jaipur. The company has provided the monthly held resources, product volume, quantity of resources utilised to manufacture each unit of product, and profit per unit for each product. The information gathered was utilised to calculate the linear programming model's parameters. TORA software was used to solve the model.

Keywords- Linear Programming Model, Objective function, Constraints, Decision variables, Simplex method, Maximization, Sanitary ware industry, TORA.

INTRODUCTION-

Companies all across the world have struggled with optimising production inputs. In a competitive market, a company's capacity to manufacture high-quality items at the lowest possible cost is critical to its survival. Organizations around the world face shortages of production inputs and low capacity utilisation, which can result in low production outputs, according to Ezema and Amakom. Companies must develop a management style that will govern their operations and resource use. The cost of materials and resource utilisation has a considerable impact on the profit of the sanitary ware sector. Linear programming is an operational research technique for allocating production resources in the most efficient way possible for a company's best practises. It is the most extensively utilised tool for determining the most efficient use of resources. At different phases of production, different goods demand varied amounts of production

resources, resulting in different costs and revenues. As a result, the linear programming problem (LPP) technique will be utilised to find the product mix that maximises total profit at a given period. It is the most effective way for selecting an optimal solution from a set of options in order to satisfy a given objective function that is constrained by numerous constraints and restrictions. Second, it maintains consistency in the eyes of the target market by shaping the image of the industry and its brand. Finally, the industry maintains its concentration on its primary business. In order to reach more clients, the industry may be tempted to create new product lines.

From 2018 to 2025, the global sanitary ware market is expected to grow at a CAGR of 5.0 percent, from $9,194 million in 2017 to $13,616 million in 2025.

Nowadays, sanitary products are created from a range of materials, each with its own set of advantages. Ceramic sanitary wares, on the other hand, have numerous advantages over other materials and are also cost effective. In today's society, it is widely accepted. Washbasins, closets, urinals, sinks, bathtubs, and hoppers are among the products available in the ceramic sanitary goods category. It has excellent weathering resistance, chemical erosion resistance, mechanical strength, and abrasion resistance. It is preferred over other materials for sanitation. In the not-too-distant future, the prospect of replacing these things with new materials appears to be bleak.

Assumptions-

i) It was assumed that the unit will operate on a single shift basis for 300 days per year. The firing procedures, on the other hand, must be carried out in three shifts until the firing cycle is complete in all aspects.
ii) It will take 1-2 months of trial production to reach full plant capacity.
iii) Margin money might range from 8% to 12% depending on the locality and business model used by the entrepreneurs, such as self-employment or commercial ventures.
iv) The project's operational period is estimated to be roughly 10 years, based on the rate of technological obsolescence and the loan repayment period.
v) The profile's land costs, building costs, machinery and equipment costs, raw materials and consumables costs, salary and pay costs, and other spending costs are based on current prices at the time of creation.

CERAMIC SANITARY WARE
Company Margin= 30%
Distributor Margin= 8%
Retailer Margin= 10-12%
Daily sales of faucets= Rs. 400000
Avg Price = Rs. 15000

METAL SANITARY WARE-
Company Margin= 33%

Distributor Margin= 8%
Retailer Margin= 11-13%
Daily sales of sanitary ware= Rs. 900000
Avg Price= Rs. 10000

METHODOLOGY-

The data collected here is purely based on face to face interviews with the company owner. Table 1, 2 summarises the relevant details on the quantity of resources utilised per unit of each product throughout the course of year.

Table 1- CERAMIC SANITARY WARES

Particulars	monthly sales	Yearly stock
Hindware	400	3600
Jaguar	550	3140
Cera	350	3200
Somani	350	2900
Kajaria	200	1400

Table 2- METAL SANITARY WARE

Particulars	Monthly sales	Yearly stock
Hindware	350	2400
Jaguar	450	4540
Cera	350	2080
Grohe	300	2860
Kajaria	100	1000

Data presentation and analysis for sanitary ware company-

Let x1 be numbers of units of ceramic sanitary wares.
Let x2 be numbers of units of metal sanitary wares.

Let Z represent the total profit to be maximized.

The linear programming problem for the above data is given by,

Maximization:

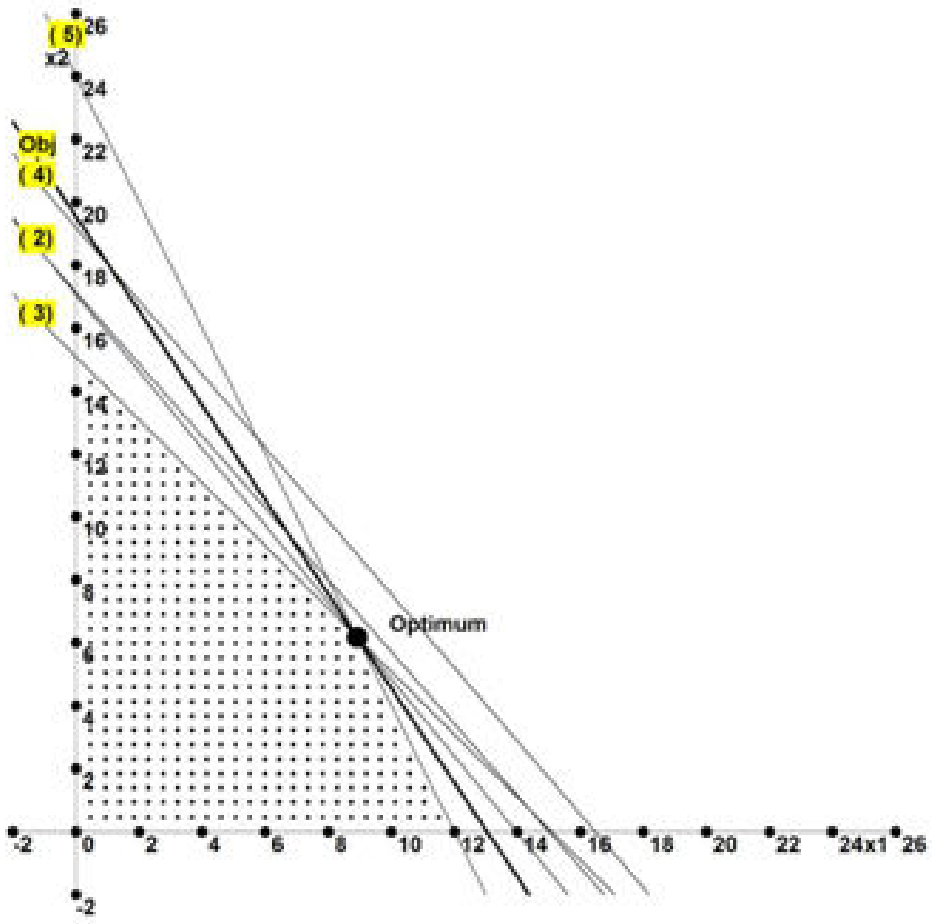
X_1	X_2
1200	800

$Z = 1200x_1 + 800x_2$

Subject to Constraints-

1. 400x1 +350x2 <= 6000
2. 550x1 +450x2 <= 7680
3. 350x1 +350x2 <= 5280
4. 350x1 + 300x2 <= 5760
5. 200x1 + 100x2< = 2400

GRAPH-



We get an optimal solution of above model by using simplex method:

Objective value = 15635

$X_1 = 9$

$X_2 = 6$

CONCLUSION

So according to me the optimum solution comes at 9 units of ceramic sanitary ware and 6 units of metal sanitary ware at Rs. 15635

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