

Application of Linear Programming Problem to Maximize the Profit of Baker's Paradise, a native Bakery

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Abstract: Linear programming has a central part established in operation research study for managers, providing a strong analytical data tool to enhance the decision-making procedure, and the management of logistics. LP is especially useful for allocation of resources, planning of the manufacturing process and logistics management. In the field of OR, LP helps managers to derive mathematical models which indicate the intricate business problems using linear links. By expressing the decision variables, setting the constraints on the basis of the availability of resources and deriving the objective function which is in line with the objectives and aims of the firm, managers can utilize LP to discover the best and the cost-reducing solutions. The systematic technique given by LP enables managers to have a quantitative foundation for making decisions, aiding them to assign resources productively, streamline the procedures and boost the complete efficacy. This arithmetic model has proven to be crucial for managers looking for making data driven choices.

LP unearths practical and numerical data-based application in the bakery sector by helping the owner to optimize the numerous functioning facets. In a bakery, LP may be used to increase the profits with the help of effective manufacturing plans. The decision variables will indicate the various products to be manufactured, with the constraint being the availability of resources, labor hour, oven time, demand etc. the objective function will generally be the maximization of the gains earned by the firm or may be for reducing the costs of the bakery. LP is a very effective model which when utilized by bakeries, will allow them to know the right quantity of resources they should use, and the correct number of units of food items they ought to produce to derive the best results and the highest profitability.

Keywords: Maximize profit, minimize cost, allocation of resources efficiently, bakery, linear programming problem, simplex method, graphical representation, optimal solution.

INTRODUCTION

Linear Programming:

In the field of math, linear programming is a practice of optimizing the functions by employing constraints. The major goal of LP is to either maximize the profit or minimize the expenses. It includes linear functions that are disposed to constraints which are in linear equations or inequality form. It is thought to be a crucial method which is utilized to identify the optimal usage of resources. The term linear indicates the connection amidst multiple variables having a degree as one, while programming means the technique of choosing the best answer from the numerous alternatives. LP is a vast technique made use of in mathematics, economics, telecommunication, business, operations research and production fields. Linear programming is termed as the problem of maximizing or that of minimizing a given linear function, which is associated with specific linear constraints. These may be either equalities or in the form of inequalities. The problem of optimizing includes the derivation of the profit or the loss. LPP are crucial part of optimization questions, which enables the discovery of the feasible area and optimize the answer to gain the largest or the smallest value for the function.

It is a technique of considering various inequalities which are relevant to a particular situation, and to calculate the best value which is needed to be derived using these restrictions. A few assumptions that are made while forming an LPP include:

- The constraints have to be in quantitative terms.
- The connection among constraints and the objective function will have to be linear.
- The linear function must be optimized.

The basic elements of LP include decision variables, the constraints, given data and the objective function. The restrictions must be in numerical form. The objective function of a sum must be stated in a quantitative manner. The relation among two or more

than 2 variables must be linear. This suggests that the degree of the variable should not exceed 1. There needs to be finite and an infinite input as well as output data. If the function contains infinite factors, then the optimal solution will not be feasible. The value of the variable must either be positive or be zero. It must not be a negative number. The decision variables shall decide the amount of output. It provides the ultimate answer for the question. It is the first stage to forming an LPP.

LPP is a problem which is related to identifying the optimal value of a specific linear function. This may be maximum or minimum value. The linear function which is taken will be thought as the objective function. This may have numerous variables and must satisfy all the given set of constraints. It is utilized to derive the optimal answer for several situations like that of production problems, transportation, diet problems, assignment etc. LPP may be solved using various techniques like graphical method, the simplex practice or using tools like that of R, Excel etc.

1. Simplex method:

It is a famed practice to solve LPP. It is an iterative procedure to derive the feasible optimality answer. Here, the value of the primary variables will keep changing to derive the highest value of the objective function. The algorithm is quite simple –

- Take a problem, write down the inequality conditions and the problem's objective function.
- Convert these inequalities into that of equality by introducing slack variable.
- Form the starting simplex table. Pen the objective function in the last row, where each of the inequality is written in its own row. The problem thus takes an augmented matrix shape.
- Find the highest negative entry of the last row which aids in finding the central column. It describes the biggest coefficient which is present in the objective function that helps to maximize the value swiftly.
- Compute by dividing. To get the quotient, the entries of the far right column is divided by that of the numbers in the 1st column, except the last row. The least answer is the pivotal row. The intersecting number is considered the key element.

- This process is continued till each element in the column is zero.
- When there are negative values in the last row, the solution comes to an end. Till then the procedure is repeated.
- Finally, the solution is determined with the help of the simplex table.

2. Graphical Method:

This procedure is utilized to optimize a linear programming problem consisting of two variables. Whenever a question had 2 decision variables, graphical practice is the easiest and fastest method to get the optimal solution. Here, the inequalities are subjected to a set of restriction or constraints. These inequalities shall be plotted on the graph on the XY plane. After plotting all of these inequalities in the graph, the region which intersects will help in identifying the feasible region. This area will give the optimal solution and will also tell what the values are which the model will be able to take.

Baker's Paradise:

Baker's Paradise is a fine bakery which was established in Basaveshwarnagar, Bangalore in 2020. The bakery, despite being small, hit off with its tasty products which became popular quite instantly. The bakery offers various items like personalized cake, birthday and anniversary cake, pastries, cream cone, wheat and white bread, wheat rusk and rava rusk, various flavored biscuits, chips, wafers, seasoned cashew, various traditional Indian sweet, carrot cake, fruit cake, potato bun, masala bun, nippat, frayems, mixtures etc. the bakery also has a joint chats and juice shop where several fruit juices, milkshakes, chats like samosa, bhelpuri, panipuri etc. are served. The bakery is largely loved by the localities who find its simplicity and home like products appealing.

Having begun during the Covid pandemic, the initial sales of the bakery was a bit difficult because of increased health and hygiene concerns. But with its delicious cuisines, hygienic products, which were also healthy because of less oil, sugar and Maida usage, the bakery was able to upscale its products quite swiftly. The owner proudly has become a favorite among the people and has gained hundreds of loyal customers. Baker's Paradise has now spread its food product line to offer various new items like sugar free sweets and

biscuits, chocolates, ice cream etc. the bakery also takes bulk orders during festival celebration. Despite its small size being a threat to be liability for the firm, the bakery was able to successfully attract customers to its quaint and beautiful shop.

In the busy confinement of the native bakery, the process of production of biscuit unveils the mixture of precision as well as creativity. Generally, flour, wheat, sugar, eggs, butter, ghee and a small quantity of leavening elements like baking powder, salt etc. converge into a bowl to prepare a dough. They prepare these flakey biscuits and make them soft and tasty. The bakery produces several types of biscuits like butter biscuit, spiced biscuit, ragi biscuit, coconut biscuit, jaggery biscuit, cashew biscuit etc. the most in demand product is their plain Maida biscuit which is buttery soft and tasty. Another of their most demanded product is their cream cone. The cooking starts with the frying of light and airy cone, having a golden crispy exterior. These cones are then filled with pastry cream and is topped with strawberry or cherry jam. The final delicacy is sprinkled with powdered sugar to give it a finishing touch. Since this is one of a unique kind of product, not available in many stores, the bakery is famed for this food item with its exquisite taste and affordable price.

LP in a bakery:

LP is a very efficient model, which when used in a bakery, will aid the owner to properly allocate his resource ingredients as well as his employees' work hours to the products produce, purchase and stock the appropriate amount of raw material, price the products effectively and efficiently, analyze the demand, understand the proper quantum that will lead to the highest level of profit and thus gain success in the business. Right from understanding the right product mix and use of eggs, flour, sugar, butter, oil, nuts etc. to the comprehension of the manhours, the oven time etc., LP is one of the most useful algebraic equipment that will help in deriving the best results in the context of a bakery.

Objectives:

- To help bakery maximize profit.
- To help the bakery to use the right amount of resources to achieve the highest level of profit.
- To enable the appropriate allocation of ingredients to the making of the food.

- To improve efficacy of the activities, allocating the right amount of time for each product and preventing over or understaffing.

Review of literature:

1. (Phanindra G, November, 2023):

The paper talks about how LP can be used to better the efficiency in the production centre of a bakery. The author makes use of the two methods of graph and solver by forming constraints and objective function. The findings show that the perfect recipe can be blended by utilising mathematical tool of LP to make the most effective utilisation of resources and thus helps the bakery industry understand how it can use the perfect amount of resources to get the maximum efficacy while baking cakes.

2. (J Sandhiya, May 05, 2023):

The paper is on the hands-on application of LPP, throwing focus on its wide usage. The findings say that it is famed for use in bettering the assignment and planning as well as reducing the costs and scaling the gains. It acts as an efficient application in boosting the efficacy, bringing down the costs and increasing profits, showing its relevance in calculating complicated challenges in real life situations. The paper underlines the flexibility and the real-world importance of LP in answering the optimization problems in the numerous backgrounds, showing its useful role in bettering the functioning procedure and the usage of the resources.

3. (Ayyasamy V, December, 2022)

The paper probes into the sophisticated function of LP, discovering the intricate answering and formulation of the model. The paper tells about the efficacy of the modernised LP in bettering the firm's ability to allocate the materials, plan and make choices. It highlights the model's wide spread use, displaying its adjustability to complex settings. It stresses the vitality of including advanced model for handling the shades of problems and boosting the proficiency of the numerous segments, providing useful vision for researchers and mathematicians.

4. (Singh, April 7, 2022):

This study on LPP solution by the utilization of simplex method offers an inclusive overview of the model's usage for augmentation. It showcases the

efficacy of this method in finding solution to complicated LPPs, underscoring its competence and its scalability. The conclusion talks about how the practice effectively navigates the wide answer spaces, finding the right answers at the time of following the restrictions. The practice is shown to be a sturdy equipment in tackling the worldly enhancement problems, highlighting its relatedness and usability in various studies, right from OR to assigning the resources and planning process during manufacture.

5. (Rajendra Kunwar, April 2022):

This co-authored paper introduces LPP and delves the on-time use. The writer probe into the technical usage of LPP in the industry. The paper offers vision into the way which LP is used in order to better the choices taken in situation like allocation of inputs, deciding the manufacture and monetary management. The synopsis encapsulates the importance of the subject in attending the true challenges and stresses its pivotal part in deriving the optimal explanations for complicated hitches.

6. (Sujata Pradeshi, March 2022):

The research used the simplex technique in the LP field to assess the student learning period at the time of Covid-19. By bettering the allocation of time, the paper attempted to better the effectiveness of the online mode of education. The discussions suggests that proper scheduling noticeably enhanced the student involvement and their educational performance. The simplex method offered a proficient computational method, showcasing its value in adaptation of learning tactics to the hurdles felt by the lockdown, giving major views for home education optimization.

7. (N K Oladejo, December 2020):

The research explores the appliance of LP in augmenting portfolio choices for industries. With this strategy, the paper tries to bring up the income while taking into consideration the constraints like that of risk tolerance and the limit on funding. The results show that LP offers a systematic method to enhancing the portfolio, enabling offices to undertake rightful choices which strike a balance amid risk and the return. The paper stresses on LP's efficacy in forming well-spread portfolios customised to an entity's special monetary goals, thus paving way to strategic, planned and enhanced investment techniques.

8. (Tasnia Biswas, December 2020):

The tabloid explores the use of LP for advancing the nurse rostering in a coronavirus unit of a city hospital. The dialect tries to strike the perfection in scheduling the procedures to enhance the proficiency and upkeep high premium worth of care for the patients. The discussion shows that LP offers an efficient outline for nurse rostering, helping in proper assigning of the inputs and schedule planning. The approach along with streamlining the procedure, also offers improved quality of taking care by making sure that the staffing number is adequate. The paper emphasizes the potential of this practice as a useful application in management of healthcare, especially in the period of the crisis in the form of the pandemic.

9. (Sarbjit, February 2018):

This paper on LP revels around the model's use for the optimization practice. It underscores the versatility of LP in allocating the ingredients, planning and in minimizing the expense. It tells that the model acts as an instrumental tool in making choices, providing a systematic method to intricate problem solution. It underlines the relation of LP in various fields, stressing on its central part played in deriving the optimal answer and in bettering the productivity.

10. (Raja, November 01, 2017):

The investigation travels through the usage of the recurrent neural networks in the process of sensitivity analysis in LPP. It shows a novel method of leveraging RNN to properly assess the effect of parameter deviations and differences in an optimal key. The results tell that the RNN practice offers correct and quick sensitivity assessment answers, outrunning the old school practices. This innovative use of RNN shows promising capability for boosting the proficiency and the correctness of sensitivity analyzation in LP, providing a good view to optimizing methods.

11. (Akpan N P, October 2016):

The research investigates the usage of LP in order to optimize the utilization of ingredients and resources in a bakery. By utilizing LP model, the paper maximizes the offering output, while at the same time taking into account the ingredient availability and the capacity of manufacturing. The findings show that LP allows for correct assignment of the resources, bringing down the

wastage and the expenses. The practice boosts the efficacy in production planning, outcoming in an optimal product mix. The paper highlights the practicality of this model in the bakery sector, providing a systematic approach for increasing the output while going through with the constraints, thus giving way to better resource administration and gains.

12. (Aberé Mojisola Anne, December 12, 2020):

It talks about the utilization by firms of LP in making choices by using an unreal instance. The paper demonstrates the way in which LP helps in enhancing the resources to be allotted, the production that needs to be planned and the gains that must be increased. The results show that by the usage of LP models, industries will be able to get cost-effective results, align their functioning and improve the complete gains. The hypothetical instance writes down the practical advantages of using LP as a formidable tool for taking rightful choices in an intricate working environment, providing an orderly way of optimizing the inputs and achieving the firm's aims.

13. (Bhaskar, May 04, 2012):

This project on LPP probes the utility of this optimizing method in the resource's assignment and the production choices. The paper makes use of mathematical practices to form and solve the LPPs, keeping in mind the specific details of an industry, underlining the effective profits and the reduction of expenditure derived from rightful choices. The findings highlight the vitality of LP in bringing together the functions, heightening the gains and attending to the resources limits. The paper provides major vision for firms looking for making data-centric decisions to improve their performance and profitability with the help of tactical use of LP methods.

14. (Juan Wu, 2012):

The investigation traverses the utility of LP for rightful funding choices in this power era. The study makes use of a LP model heighten the generation's set proficiency, taking into account aspects like expense, capacity and the effect on nature. Findings show that it offers a methodical practice to find the right mix of this power generation funds, stabilizing the economic and the ecological factors. It helps give vital intuitions for planners in the sector of energy, giving a numerical

methodology for orderly fund planning which is in line with the monetary and the sustainable goals.

15. (M Zangiabadi, January 01, 2007):

The review suggests a technique for answering LPP having fuzzy parameters by utilizing multi or various aimed LP tactics. The method looks into the uncertainty in the given parameters by including fuzzy rational and forming the question as a multi objective betterment activity. The discussion recommends that this practice efficiently handles the fuzzy equations, giving a sturdy answer for making choices in an unpredictable setting. The usage of multi aimed optimization boosts the technique's capability to stabilize the conflicting and varying objectives. This unique approach provides help in evolving the practice of betterment, especially in situations wherein the parameters are not precise, providing a rational tool for choice support in intricate system.

16. (Schulze, September 2000):

The paper delves into the function of LP for augmenting, emphasizing on its usefulness in the various industries. It shows the model's proficiency in the proper assignment, planning and managing or handling the expenditure. The results underscore the model's capability to align choices, boost the functioning effectiveness and heighten the gains. It highlights LP to be a crucial tool for companies, providing a right path to complicated problem finding and proper tactical decision making, finally leading to better productivity and competitiveness.

Research Methodology:

The paper has been written using both primary and secondary data.

Primary data:

This is the data which is collected firsthand by conducting investigation, surveys etc. with the help of questionnaires, interviews etc. This refers to the fresh or raw data which is collected for the first time in order to research about a particular topic. In this paper, the primary data was gathered by collecting information from the baker Baker's Paradise by interviewing the owner about the functioning operations of the firm. The primary data which was collected mainly consisted of –

- The most popular items that the bakery sold. This proved to be its plain biscuit and cream cone.

- The next information collected was the usage of ingredients for each in the preparation of these two items and the total amount of resources or raw material which was available per day.
- This was followed by receipt of information on the amount of time that was used to prepare each time, the oven time, man hours etc. and the total working hours available per day in the bakery.
- The next piece of information was about the amount of profit that the firm was able to earn by selling these two products.
- The interview also gained information about the history and the dealings of the bakery.

Secondary data:

This refers to the information which has already been gathered for a particular study and has been published. The secondary data for this paper was gathered to seek information about Linear Programming. The sources used included articles, text books, Google, Wikipedia, Research papers etc.

Analysis and Interpretation

The manufacturer of Baker’s Paradise cooks 2 major types of food items, Biscuit and cream cones. Maida or all-purpose flour is used in the quantities of 100gms and 150gms respectively, while 100gms and 50gms of butter for biscuit and cream cone respectively is used for production. Biscuit requires 200gms of sugar powder while cream cone requires 100gms. The labor hours needed for biscuit and cream cone are 30 minutes and 15 minutes respectively. Cream cone requires an additional ingredient of 100gms of cone for filling in the pastry cone. A total of 20kgs of flour, 5kgs of butter, 15kgs of sugar powder and 4kg of cream supply is available in the bakery per day. The total labor hours that the factory can afford to utilize for its production purpose is 18hrs per day. The profits earned on the production of biscuit and cream cone is Rs15 and Rs10 respectively. (Biscuits are sold in a pack consisting of 5 units.) The baker is looking for maximizing his profits by producing the apt amount of each of these items to get the optimal profit.

Ans 1:

Convert the grams into kg and minutes into hours by dividing by 1000 and 60 respectively.

Profit	15	10
	Biscuit(X)	Cream Cone(Y)
Maida/All-purpose flour	0.1kg	0.15kg
Butter	0.1kg	0.05kg
Sugar powder	0.2kg	0.1kg
Cream	-	0.1kg
Labor	0.5hrs	0.25hrs

Step 1: Decision Variables-

Let X = Number of units of Biscuits (Each pack contains 5 biscuits).

Y = Number of units of Cream Cone.

Step 2: Inequalities

a. Ingredient constraints:

$$0.1x + 0.15y \leq 20$$

$$0.1x + 0.05y \leq 5$$

$$0.2x + 0.1y \leq 15$$

$$0.1y \leq 4$$

b. Time constraint

Solution using excel:

Maximise Z			X	Y		
Decision variables			Biscuits	Cream Cone		
Values			16	40		640
Coefficients			15	10		

$$0.5x + 0.25y \leq 18$$

Step 3: Objective Function:

$$\text{Maximize } Z = 15x + 10y$$

Subject to

$$0.1x + 0.15y \leq 20$$

$$0.1x + 0.05y \leq 5$$

$$0.2x + 0.1y \leq 15$$

$$0.1y \leq 4$$

$$0.5x + 0.25y \leq 18$$

$$.x, y > 0.$$

						LHS		RHS
		C1(Maida)		0.1	0.15	7.6	≤	20
		C2(Butter)		0.1	0.05	3.6	≤	5
		C3(Sugar powder)		0.2	0.1	7.2	≤	15
		C5(Cream)		0	0.1	4	≤	4
		C4(Labour)		0.5	0.25	18	≤	18

x	16
y	40

Maximize Z = Rs.640,

When x = 16 and y = 40.

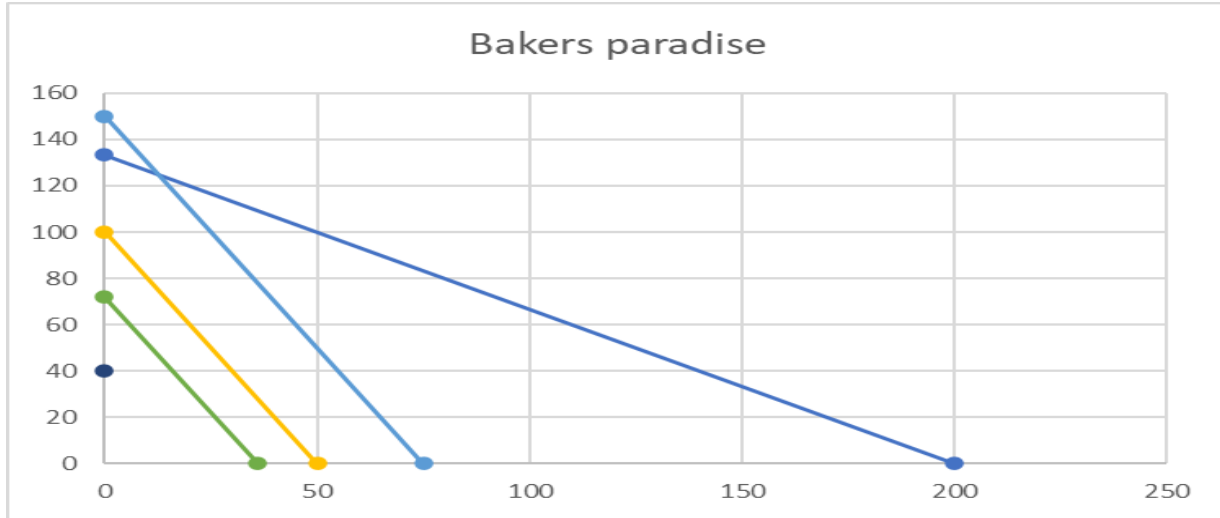
Graphical representation: [=MMULT(MINVERSE(),)]

	X	Y		
c1	0.1	0.15	≤	20
c2	0.1	0.05	≤	5
c3	0.2	0.1	≤	15
c4	0.5	0.25	≤	18
c5	0	0.1	≤	4

c1	0	133.3
	200	0
c2	0	100
	50	0
c3	0	150
	75	0
c4	0	40
c5	0	72
	36	0

X	Y	Z= 15x + 10y
0	0	0
36	0	540
16	40	640
0	40	400

Scale: x – 1cm = 50 units, y – 1cm = 20 units.



Therefore,
Maximize $Z = 640$, when $x=16$ and $y=40$.

The shaded region represents the feasible region.

Findings:

Linear programming acts as a treasured algebraic tool for optimizing the operations held in a bakery. Keeping in mind a bakery, the prime aim of LP is to increase the firm’s gains by tactically devising the quantum of each item of the bakery to be cooked. It consists of taking into account numerous constraints like that of the accessibility of the ingredients, the manufacturing capacity, keeping in mind aspects like that of oven time and the manpower which is available. The LP model’s main aim is to have a stability among maximizing the overall income and deduction of the overall expenses, offering an orderly method of getting gains.

The assignment of ingredients is extremely vital part of LP in that of a bakery, concentrating on reducing the expenditure involved in the purchase of raw materials. The decision variables are described to specify the amount of every material to be bought, whereas the constraints indicate aspects such as the upper and the lower limits of use and the budget restrictions. The objective function’s major purpose is to maximize the profits of the bakery by producing that number of the products that will help in taking the profits to the highest level. In this instance the constraints are related to that of the food ingredients like that of Maida, butter, sugar etc. which is needed to produce the two product which are biscuits and cream cones. The paper considers these two items since these are the most favored foods of the bakery.

The findings show that per day, the bakery will be able to earn a profit of Rs.640 when it indulges in the production of 16 biscuit packets and 40 cream cones. As for the right usage of the resources, the bakery must use 7.6kg of all-purpose flour, 3.6 kgs of butter, 7.2kgs of powdered sugar, 4kgs of cream in filling the golden cones and employ 18 hours of labor to efficiently manufacture its goods at a reduced cost while at the same time achieving the most possible highest profit.

SUGGESTIONS

- The bakery can order its raw materials in bulk in order to reduce the purchase cost by getting discounts.
- The bakery can spend a little of its revenue to market its products. Since the bakery is a small local outlet presently, it will benefit and will be able to easily attract customers by advertising its cream cone, a unique and tasty delicacy.
- Since the profits of biscuit is higher and the sales of cream cone is larger due to its popularity, the bakery can try to increase its cost at a minimal level without driving away its customers.
- The owner can try and employ LPP for reducing his costs.
- The bakery can take customers’ feedback in order to understand how customers feel about their variety of products, and focus on that which is liked by people.

CONCLUSION

Linear programming is a robust application in the bakery segment of business to upscale its profits, minimize its expenditures and effectively assign its raw material and labor. LP enables the bakery owner to find the optimal manufacturing mix in order to grow its gains. By accounting the profit margins of various items like that of biscuits and cream cones, and the accessibility of the resources like that of food ingredients, man hours and oven time, LP can account the apt combination of the items to manufacture so as to get the upper-level profit. This makes sure that resources are allotted in the most gaining way, which is crucial for the prosperity of the bakery.

Next, the bakery can aid in management of stock level. These shops usually deal with ingredients that are perishable, and thus LP will help them to decide what quantity of raw materials they have to order so as to prevent spoilage, overstocking and to bring down purchase expense. This paves way to heightened profit. Following this, LP can also help in knowing the optimal strategy of pricing. By being able to factor the cost of manufacture, the predicted demand and the wished gains, LP will help in setting the proper price levels for the bakery. This makes sure that the revenue is increased while the operating expenses go down.

Linear Programming is thus a vital equipment for owners of bakery to undertake right decisions with regard to the manufacturing capacity, planning, stocks, pricing and all the crucial aspects that determine the profitability of the firm. LP helps in making data driven approach to properly handle the resources and boost the gains in a competitive industry. This research paper thus effectively integrates LP model into the bakery, Baker's Paradise by helping them to grow their profits to the highest level achievable and allocate their labor and resources efficiently and order the right level of inventory, when they indulge themselves in the production of their 2 most like products, biscuits and cream cone.

REFERENCE

[1] Abere Mojisola Anne, O. S. (December 12, 2020). Application of Linear Programming to a firm;s decision making: Hypothetical Example.
 [2] Akpan N P, I. I. (October 2016). Application of Linear Programming for Optimal Use of Raw Materials in Bakery .

[3] Ayyasamy V, D. M. (December, 2022). A Study on Advanced Linear Programming Problems and Models.
 [4] Bhaskar, V. (May 04, 2012). Project On Linear Programming Problems Uploaded .
 [5] J Sandhiya, N. M. (May 05, 2023). A Study On Linear Programming Problems In Real Life Applications.
 [6] Juan Wu, X. G. (2012). Optimization Research of Generation Investment Based on Linear Programming Model.
 [7] M Zangiabadi, H. R. (January 01, 2007). A method for solving linear programming problems with fuzzy parameters based on multi-objective linear programming technique.
 [8] N K Oladejo, A. A. (December 2020). Linear Programming and Its Application Techniques in Optimizing Portfolio Selection of a Firm.
 [9] Phanindra G, A. J. (November, 2023). Optimizing cake production: A real-world application of linear programming for bakery efficiency.
 [10] Raja, D. (November 01, 2017). Sensitivity analysis of linear programming problem through a recurrent neural network.
 [11] Rajendra Kunwar, H. P. (April 2022). An introduction to linear programming problems with some real-life applications.
 [12] Sarbjit, S. (February 2018). Note on linear programming technique .
 [13] Schulze, M. (September 2000). Linear Programming for Optimization .
 [14] Singh, A. (April 7, 2022). Linear Programming Problem Solving Simplex Method –.
 [15] Sujata Pradeshi, S. G. (March 2022). Student learning time analysis during COVID-19 using linear programming - Simplex method .
 [16] Tasnia Biswas, A. S. (December 2020). A Linear Programming Problem Analysis for Improving the Process and Quality of Nurse Rostering in the Covid-19 Unit a City Hospital.