IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET)
ISSN(P): 2347-4599; ISSN(E): 2321-8843
Vol. 4, Issue 8, Aug 2016, 7-12
© Impact Journals

MULTI OBJECTIVES OPERATIONS DECISIONS BY USING GOAL PROGRAMMING FOR A SMALL SCALE ENTERPRISE

DINESH KUMAR[1] & SRIDHAR K[2]

[1]Scholar, Chhatrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India

[2]Professor in Mechanical Engineering, Chhatrapati Shivaji Institute of Technology, Durg, Chhattisgarh, India

ABSTRACT

The abnormal economic conditions, global competition, customer's aspiration has a major impact on the performance of the enterprises. Operation decisions are essential for proper planning in order to achieve the goal of the enterprise. In this paper, an attempt to an attempt is to make to arrive the operation decisions in a Small Scale enterprise. Real world problems are mainly based on multiple objectives rather than single objective. Application of a multi-objective programming model like goal programming model is an important tool for studying various aspects of management systems. Some multiple goals have decided in this paper. To arrive the specified goals of the enterprise, goal programming concept is followed. Mathematical model is formulated as per the goals and solution methodology is given. Thus the methodology to be followed by the enterprises for operation planning is reflected in this concept.

KEYWORDS: Simplex Method, Goal Programming Mathematical Model

INTRODUCTION

A firm must plan its fabricating activities at a variety of levels and operate these as a system. Planners must make decisions on output rates, employment levels and changes, inventory levels and changes, subcontracting. It is the extension of simplex method that is the part of linear goal Programming Model. The goal programming (GP) technique has become a widely used approach in Operations Research (OR). GP model and its variants have been applied to solve large-scale multi-criteria decision-making problems. Goal programming is a branch of multinucleate optimization, which in turn is a branch of multi-criteria decision analysis (MCDA). This is an optimization programmed. It can be thought of as an extension of linear programming to handle multiple, normally contravening aim measures. Each of these measures is given a goal or target value to be achieved. Unwanted deviations from this set of target values are then minimized in an accomplishment function. The type of model that can be appropriate for management will include model that can be used to represent management plans in numeric or algebraic forms.

LITERATURE REVIEW

Ukamaka Cynthia Orumie [25] presented a survey of current methods for LGP and limitation of LGP in general. The question that one would ask at this point is: "Which procedure is the best?" Nasruddin Hassan [15] goal programming model is found to be useful for small and medium enterprises to gauge their profits based on their labour, machine use and raw materials requirements. Of course this study can be further extended with regard to the flavor varieties of the products such as chocolate, strawberry and vanilla and to other SME's with their own unique constraints in accordance to their required goals peculiar to their trade. The number of goals to be considered can also be increased based on the desirability of the decision maker in relation to their aspired objectives. D.C.BRAUER [5] presented problem in this paper is a comprehensive inventory and distribution model for a single distribution center serving multiple customers. This model lends itself to application through use of linear mixed-integer programming techniques available on standard mathematical programming software such as LINDO the original model was easily transformed into a preemptive goal programming formulation. A.K. Bhargava [1] deal with fuzzy goal programming model and find out that is useful for small and medium enterprises to gauge their profits based on their labour, machine use and raw materials requirements with the aspiration levels to be imprecise in nature. The number of goals to be considered can also be increased based on the desirability of the decision maker in relation to their aspired objectives.

PROBLEM IDENTIFICATION

The data has collected from JAYAKA BAKERY. This is a small bakery shop in Durg Chhattisgarh especially famous for Bread, Toast, Cake, Cream roll & cold drinks. They perform task in manually manner. Hence for each bakery shop their primary objectives are increase profit. Table 1 shows present production system. This enterprise has decided some goals that show in table 2. And also they have given priority to all goals. Sometimes also suffer from uncontrollable production loss.

METHODOLOGY

GP model is a simplified interpretation of a real system and Goal programming concept has used according to priority of shopkeeper. Its include trades man rank their priority and they get the result according to their priority. The goal programming concept clarify that their priority will be achieved or will not be achieved. Table from 1 to 2 is shown the specification, cost structure &other detail.

Table 1: Specification of the Item

S. No.	Product	Profit (Rs)	Price (Rs)	Cost (Rs)	Baking &Drying Time	Finishing& Packing time	Weight/unit	Production rate/month
1	Bread	5	15	20	3min	1min	400gm	2651unit
2	Toast	7.5	22.5	30	5min	1min	200gm	3849unit
3	Cake	8.75	26.25	35	30min	5min	200gm	1189unit
4	Cream roll	2.5	7.5	10	5min	2min	50gm	1185unit

The general form of a GP problem may be expressed as

Minimize

$$\sum_{i=1}^{m} d_i^+ + d_i^-$$

subject to

$$\sum_{j=1}^{n} a_{ij}x_j - d_i^+ + d_i^- = b_i$$

$$x_j + d_i^-, d_i^+ \geq 0$$

where d_i^- is the amount by which goal i is underachieved, d_i^+ is the amount by which goal i is overachieved, $x_{j(j=1.2.3......n)}$ are the variables in the goal equations, $b_{i(j=1.2.3......m)}$ are the targets or goals, and a_{ij} are the coefficient of the variables.

Table 2: Priority for Goal Programming

Priority	Factor	Goal
First priority	Production of cake	1300 unit
Second priority	Total Profit	60,000Rs
Third priority	Production of Toast	4100 unit
Fourth priority	Production of Bread	3000 unit
Five priority	Production of Cream roll	1500 unit

Let,

D_{uc} = amount by which the production of Cake goal is under achieved,

D_{oc} = amount by which the production of Cake goal is over achieved,

D_{up} = amount by which the Profit goal is under achieved,

D_{op} = amount by which the Profit goal is over achieved,

$D_{u\,t}$ = amount by which the production of Toast goal is under achieved,

D_{ot} = amount by which the production of Toast goal is over achieved,

D_{ub} = amount by which the production of Bread goal is under achieved,

D_{ob} = amount by which the production of Bread goal is over achieved,

D_{ucr} = amount by which the production of Cream roll goal is under achieved,

D_{ocr} = amount by which the production of Cream roll goal is over achieved,

Then the objective function and constraint for the goal programming model are

Minimize $Z=P_1 D_{uc} + P_2 D_{up} + P_3 D_{u\,t} + P_4 D_{ub} + P_5 D_{ucr}$

Subject to $5x_1 + 7.5x_2 + 8.75x_3 + 2.5x_4 + D_{up} - D_{op} = 60{,}000$ (profit goal)

$x_1 + D_{ub} - D_{ob} = 3{,}000$ (Bread goal)

$x_2 + D_{u\,t} - D_{ot} = 4{,}100$(Toast goal)

$x_3 + D_{uc} - D_{oc} = 1300$(Cake goal)

$x_4 + D_{ucr} - D_{ocr} = 1500$(Cream roll goal)

$3x_1 + 5x_2 + 25x_3 + 8x_4 + S_1 = 72840$(Drying and backing constraint)

$x_1 + x_2 + 5x_3 + 2x_4 + S_2 = 14880$ (Finishing and Packing constraint)

The P's used here are called pre-emptive priority factors; in the goal programming algorithm that follows it is assumed that the priority ranking is absolute i.e., P_1 goals are more important than P_2 goal and P_2 goal and P_2 goal will not be achieved until P_1 goal have been achieved; same is true for P_3, P_4 and P_5 goal. Table 3 & 4 is shown initial basic feasible solution and optimal basic feasible solution.

Table 3: Initial Basic Feasible Solution of Goal Programming

		0	0	0	0	0	0	P2	0	P4	0	P3	0	p1	0	p5	0		
Cb	**Basis**	**x1**	**x2**	**x3**	**x4**	**s1**	**s2**	**Dup**	**Do**	**Du**	**Dob**	**Dut**	**D**	**Duc**	**Do**	**Du**	**Do**	**b**	**Q**
p2	**Dup**	5	7.5	8.75	2.5	0	0	1	-1	0	0	0	0	0	0	0	0	60000	6857.143
p4	**Dub**	1	0	0	0	0	0	0	0	1	-1	0	0	0	0	0	0	3000	Infinite
p3	**Dut**	0	1	0	0	0	0	0	0	0	0	1	-1	0	0	0	0	4100	Infinite
p1	**Duc**	0	0	1	0	0	0	0	0	0	0	0	0	1	-1	0	0	1300	1300
p5	**Ducr**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	-1	1500	Infinite
	s1	3	5	25	8	1	0	0	0	0	0	0	0	0	0	0	0	72840	2913.6
	s2	1	1	5	2	0	1	0	0	0	0	0	0	0	0	0	0	14880	2976
p5	Cj	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
	Zj	0	0	0	1	0	0	0	0	1	-1	0	0	0	0	1	-1		
	Cj-Zj	0	0	0	-1	0	0	0	0	0	1	0	0	0	0	0	1		
P4	Cj	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
	Zj	0	0	0	0	0	0	0	0	1	-1	0	0	0	0	0	0		
	Cj-Zj	-1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		
P3	Cj	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0		
	Zj	0	1	0	0	0	0	0	0	0	0	1	-1	0	0	0	0		
	Cj-Zj	0	-1	0	0	0	0	0	0	0	0	0	1	0	0	0	0		
p2	Cj	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
	Zj	5	7.5	8.75	2.5	0	0	1	-1	0	0	0	0	0	0	0	0		
	Cj-Zj	-5	-8	-8.75	-2.5	0	0	0	1	0	0	0	0	0	0	0	0		
p1	Cj	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0		
	Zj	0	0	1	0	0	0	0	0	0	0	0	0	1	-1	0	0		
	Cj-Zj	0	0	-1	0	0	0	0	0	0	0	0	0	0	1	0	0	Initial b.f.s	

Table 4: Optimal Basic Feasible Solution of Goal Programming

		0	0	0	0	0	0	P2	0	P4	0	P3	0	p1	0	p5	0	
Cb	**Basis**	**x1**	**x2**	**x3**	**x4**	**s1**	**s2**	**Du**	**Dop**	**Dub**	**Dob**	**Dut**	**Dot**	**Duc**	**Doc**	**Ducr**	**Docr**	**b**
p2	**Dup**	0	0	-0.5	0	-3.03	0	1	-1	0	0	0	0	29	-29	0	0	1355
p4	**Dub**	0	0	-1	0	-2.5	0	0	0	1	-1	0	0	0	0	0	0	1470
0	**x2**	0	1	-0.6	0	-1.3	0	0	0	0	0	0	0	-5	5	0	0	4750
0	**x3**	0	0	1	0	0	0	0	0	0	0	0	0	1	-1	0	0	1300
p5	**x4**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	-1	1500
0	**Dot**	0	0	-0.6	0	-1.3	0	0	0	0	0	-1	1	-5	5	-1.9	1.9	650
0	**x1**	1	0	1	0	2.5	0	0	0	0	0	0	0	0	0	0.5	-0.5	1530
p5	Cj	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	Zj	0	0	0	1	0	0	0	0	1	-1	0	0	0	0	1	-1	
	Cj-Zj	0	0	0	-1	0	0	0	0	0	1	0	0	0	0	0	1	
P4	Cj	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	Zj	0	0	-1	0	-2.5	0	0	0	1	-1	0	0	0	0	0	0	
	Cj-Zj	0	0	1	0	2.5	0	0	0	0	1	0	0	0	0	0	0	
																		Optimal b.f.s

RESULTS AND DISCUSSIONS

Table 5: Result of Goal Programming

Priority	Factor	Goal	Achieved	Remarks
First priority	Production of cake	1300 unit	1300 unit	Achieved
Second priority	Total Profit	60,000Rs	58645Rs	Underachieved
Third priority	Production of Toast	4100 unit	4750unit	Overachieved
Fourth priority	Production of Bread	3000 unit	1530unit	Underachieved
Five priority	Production of Cream roll	1500 unit	1500 unit	Achieved

CONCLUSIONS

Mathematical Programming model is developed to arrive the multiple objectives with goal programming concept. This technique is based on the simplex method for finding the near optimum solution of single dimensional or multidimensional objectives function subject to a set of linear constraints. Goal programming asks management of the organization to set some estimated targets for each goal and assign priorities to them i.e., to rank them in order of importance.

REFERENCES

1. Ukamaka Cynthia Orumie, Daniel Ebong, A Glorious Literature on Linear Goal Programming Algorithms, *American Journal of Operations Research*, 2014, 4, 59-71.
2. Nasruddin Hassan, Afifah Hanim Md Pazil, Nur Sakinah Idris and Nurul Fazilah Razman *A Goal Programming Model for Bakery Production*, *Advances in Environmental Biology*, 7(1): 187-190, 2013
3. D.C.Brauer and G.Naadimuthu, A Goal programming model for aggregate inventory and distribution planning, *Mathl. Computer. Modeling Vol. 16, No. 3*, pp. 81-90, 1992
4. A.K. Bhargava, S.R. Singh and Divya Bansal A Fuzzy Goal Programming Model for Bakery Production, *International Journal of Computer & Mathematical Sciences Volume 3, Issue 4* June, 2014.
5. Nabendu Sen and Manish Nandi Goal Programming, its Application in Management Sectors– Special Attention into Plantation Management: A Review, *International Journal of Scientific and Research Publications*, *Volume 2, Issue 9*, September 2012.
6. D.Barnett, B. Blake and B. A. Mc Carl. Goal programming via multidimensional scaling applied to Senegalese subsistence farms. *Int. J. of Advanced Manufacturing Technology* (2006), 20(4): pp. 1-10.
7. D. Ghosh, D.K. Sharma and D.M. Mattison. Goal programming formulation in nutrient management for rice production in West Bengal, *International Journal of Production Economics* (2005), 95: pp. 1-7.
8. E.B.Kenneth and E. T. Bartlett...Resource al1ocation through Goal programming, *Journal of range management* (1995), 28(6).
9. H. Jafari, Q.R. Koshteli and B. Khabiri. An Optimal Model Using Goal Programming For Rice Farm. *Applied Mathematical Sciences (2008*), 2(23): pp. 1131-1136.