APPLICATION OF GOAL PROGRAMMING MODEL FOR OPTIMIZATION OF FINANCIAL PLANNING: CASE STUDY OF A DISTRIBUTION COMPANY

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Abstract Every management have the task of achieving multiple financial goals such as capital structure, dividend payout policy, and growth of earning over certain planning. This study presents a financial planning to achieve such incommensurable and incompatible goals using goal programming. Maximizing the both capital structure and growth in earnings are the main goals of this study. In this paper we would discuss the application of Goal Programming in optimization of financial planning for an organization called SVR, Karnataka, India, as a case study. The results of this study are calculated and verified using the LINGO 18.0 Software. Also, we talk about the post optimal analysis. Hence the proposed model can be considered as a route map for making financial decisions and to develop strategies to deal with various economic outlines.

1 Introduction

Financial Management helps an organization to utilise their Finance most profitably which can be achieved with three conducts namely investment decision, Finance decision and dividend decision. The scope of financial management indicates the possible sources of growing finance from various resources. Financial planning is primary component of the modern approach of Financial Management. It is a year-round activity that requires the support of accurate financial reporting and analysis which starts before the commencement of a venture and carries on throughout its lifetime. It is a vital activity for all businesses. Financial Planning estimates the sources and possible application of accumulated funds. The primary objective of financial planning is ensuring a regular and suitable supply of funds for the organization and allowing for optimum utilization of the same. Here we explore financial planning as a decision making framework and how it can play a vital role in focusing priorities in short and long term. Also, to make decisions in the perspective of financial security as well as proper allocation of resources.

Goal Programming provides a way of finding a single optimal solution for conflicting objectives simultaneously. Ease of use and simplicity of Goal Programming has resulted in growth of its popularity in several areas such as: management of human resources, transportation, site selection, production, accounting and financial resource management, marketing and quality control, agriculture and forestry, and telecommunication.Goal Programming provides more flexibility for modelling the estimation process;Today, Goal programming is alive more than ever, supported by a network of researches and practitioners continually feeding it with theoretical developments and applications, all of these with resounding success. Many scientific papers cover an impressive number of areas and disciplines.

In this paper we used the weighted Goal programming model to obtain a satisfactory solution mainly for the following two decision making situations:

1. One decision maker for the overall goals and one decision maker for each subsystem.

2. Many conflicting decision makers.

Objectives of this study is to apply Goal programming model to financial estimation of an organization to achieve the goals of optimum utilization of funds available for its improvement and to assist decision makers of the organization in proper allocation of operating cost.

2 Literture Review

2.1 The Goal Programming Model

The idea of goal programming was first suggested by Chames and Cooper in 1961. During 1961 – 1970 there was only one goal programming application article in the literature, by Charnes et al.(1963). The Goal programming models was popularized with the applications by Lee (1972, 1973), Lee and Clayton; Lee et.al. 1978 and Ignizio(1978). Another interesting development is the utilization of goal programming as a statistical tool for estimation. Recent studies suggest that goal programming could be an alternative to the conventional statistical methods.

2.2 Application of Goal Programming in Financial Decision

The earliest example of goal programming implementation in financial management is in the field of budgeting by Chames et al. (1963). They used the goal programming formulation to show the balance sheet extension of break-even analysis. Lin (1979) extended that analysis to an example of two products, with contribution margin and sates as the two goals. Sheshai et al. (1977) assumed a piecewise linear variable cost function and a step function for fixed cost. They used 0—1 integer programming to compute break-even point for a two-product example with a no-priority goal situation.

Jones (1979) applied goal programming to small-firm financing decisions. He discussed the concept of sensitivity analysis on rotation priority with five goals. Arthur and Lawrence (1985) developed a model to analyze and to make financial decision. Their approach considers the multiproduct environment, overtime levels, and effects of capital utilization.

3 Data Source

To develop and apply a Goal Programming model for optimization of finance planning we collected data from S V Rangaswamy & Company Pvt. Ltd. #2, 3rd Cross, Kalasipalayam New Extension Bangalore, Karnataka, India 560002, which is one of the senior Manufacturing and distribution company in India.

3.1 About Company

S V Rangaswamy & Company Private Limited is a Private incorporated on 02 December 1964. It is classified as Non-govt Company and is registered at Registrar of Companies, Bangalore. It is manufacturing and trade of Liquid Filling Machines, Powder Bagging Machines, Batching systems for Oil, Powders and Polymers, Oil Vending machine, Checkweigher, Weighbridge, Bulk Density Meter. Also It is a distributed company that involved in other wholesale Includes specialized wholesale not covered in any one of the previous categories and wholesale in a variety of goods without any particular specialization.

4 Methodology

A model is a simplified representation of a real system and phenomenon. It is a formal description of a real system. The general linear goal programming model with 'p' goals and 'q' constraints may be stated as follows. This paper suggested the combination weights method and pre-emptive method to construct the model.

These two methods or algorithms convert multiple goals into a single objective function.

Minimize $Z^1 = \sum_{i=1}^{p} M_i R(dev^- + dev^+)$

Subject to the linear constraints

$\sum_{j=1}^{q} a_j * x_i + (dev_i^- + dev_j^+) = B_i$ where $i = 1, 2, ...p$

and $x_i, dev_i^-, dev_i^+ \geq 0$

Where Z^1 is the sum of the deviations from all desired goals the M_i are non negative constant representing the relative weight to be assigned to the deviational variables are dev^-, dev^+, within a priority level. The R is the priority level assigned to each relevant goal in rank order $(i.e. R1 > R2...... > Rq)$. The $a_i j$ are constants attached to each decision variable and the B_i are the right-hand side values $(i.e. goals)$ of each constraint.

5 Model Formulation (With Priorities) And Application

5.1 Target Value of Goals

The target value of the goals of the budget of the company are :

* Increase revenue by at least 0.6829 Billion per year.

* Manage expenses less than 0.0649 Billion per year.

* Increase Net Profit by at least 0.0199 Billion per year.

* Increase fixed asset at least 0.0198 Billion per year.

* Reduce loans up to 0.0101 Billion per year.

* Increase Equity Shares on average of 500 per year. i.e., 0.0092 Billions.

* Increase the value of financial statement managing constraint at least by 0.7949 Billion per year.

SVR & Co. PVT .Ltd., is selected as the case study in this paper. The data of financial statement including Revenue, Expenses, Net profit, Fixed assets, Loans and Equity shares are obtained from the SVR & Co. PVT. Ltd annual report. The details are summarized in Table 1.

Table 1. Summarized SVR & Co. PVT. Ltd financial statement from 2015 to 2019 (In Crores).

Item (or)	Year					Total
Goal	2015	2016	2017	2018	2019	
Revenue	471159580	498375549	488554255	492311940	620819297	2571220621
Expenses	47190452	51149163	77635618	53900032	56474107	286349372
Net Profit	15176564	16180426	17144661	16534258	18430494	83466403
Fixed Assets	21078867	20880673	20005744	19158140	18357994	99481418
Loans	31360735	32673474	18242709	4651290	7551249	94479457
Equity Shares	750000	800000	850000	875000	900000	4175000
Total	586716198	620059285	622432987	587430660	722533141	3139172271

Table 2 gives a summary of SVR & Co. PVT. Ltd. Financial statements in coded values with weights between 2015 and 2019 in RM billion. The purpose of coding the values is to enable analysis with small figures.

Table 2. Coded values for summarized SVR and Co. PVT. Ltd financial statement from year 2015 to 2019 (In billion).

Item (or) Goal	Year					Total
	2015	**2016**	**2017**	**2018**	**2019**	
Revenue	0.4711	0.4983	0.4885	0.4923	0.6208	2.5712
Expenses	0.0471	0.0511	0.0776	0.0539	0.0564	0.2863
Net Profit	0.0151	0.0161	0.0171	0.0165	0.0184	0.0834
Fixed Assets	0.0210	0.0208	0.0200	0.0191	0.0183	0.0994
Loans	0.0313	0.0326	0.0182	0.0046	0.0075	0.0944
Equity Shares	0.0007	0.0008	0.0008	0.0008	0.0009	0.0041
Total(FMC)	0.5867	0.6200	0.6223	0.5873	0.7225	3.1391

The decision variables are:

X_1= The amount of financial statement in year 2015.

X_2 = The amount of financial statement in year 2016.

X_3 = The amount of financial statement in year 2017.

X_4 = The amount of financial statement in year 2018.

X_5 = The amount of financial statement in year 2019.

The goal constraints;

$0.4711X_1 + 0.4983X_2 + 0.4885X_3 + 0.4923X_4 + 0.6208X_5 \geq 0.6829$ (Revenue Constraint)

$0.0471X_1 + 0.0511X_2 + 0.0776X_3 + 0.0539X_4 + 0.0564X_5 \leq 0.0649$ (Expenses Constraint)

$0.0151X_1 + 0.0161X_2 + 0.0171X_3 + 0.0165X_4 + 0.0184X_5 \geq 0.0199$ (Net Profit Constraint)

$0.0210X_1 + 0.0208X_2 + 0.0200X_3 + 0.0191X_4 + 0.0183X_5 \geq 0.0198$ (Fixed Assets Constraint)

$0.0313X_1 + 0.0326X_2 + 0.0182X_3 + 0.0046X_4 + 0.0075X_5 \leq 0.0101$ (Loans Constraint)

$0.0007X_1 + 0.0008X_2 + 0.0008X_3 + 0.0008X_4 + 0.0009X_5 \geq 0.0092$ (Equity Shares Constraint)

$0.5867X_1 + 0.6200X_2 + 0.6223X_3 + 0.5873X_4 + 0.7223X_5 \geq 0.7947$(Financial statement Managing)

$$X_1, X_2, X_3, X_4, X_5 \geq 0 \text{(Non negativity constraints)}$$

Goal Programming Formulation:

Let,d_i^- =the negative deviation variable for under-achieving the ith goal

d_i^+ = the positive deviation variable for over-achieving the ith goal.

The weighted pre-emptive goal programming model can be formulated as:

The Objective function:

Minimum Z : $2 * P_1(d_1^-)$:Maximize the Revenue $+P_2(d_2^+)$:Minimize the Expenses $+P_3(d_3^-)$: Maximize the Profitability $+2 * P_4(d_4^-)$:Maximize fixed assets $+2 * P_5(d_5^+)$:Minimize the Loans $+10 * P_6(d_6^-)$:Maximize the equity share $+P_7(d_7^-)$:Maximize the proportion of the values of the items in the financial statement.

And the respective constraints are

$$0.4711X_1 + 0.4983X_2 + 0.4885X_3 + 0.4923X_4 + 0.6208X_5 + d_1^- - d_1^+ = 0.6829$$

$$0.0471X_1 + 0.0511X_2 + 0.0776X_3 + 0.0539X_4 + 0.0564X_5 + d_2^- - d_2^+ = 0.0649$$

$$0.0151X_1 + 0.0161X_2 + 0.0171X_3 + 0.0165X_4 + 0.0184X_5 + d_3^- - d_3^+ = 0.0199$$

$$0.0210X_1 + 0.0208X_2 + 0.0200X_3 + 0.0191X_4 + 0.0183X_5 + d_4^- - d_4^+ = 0.0198$$

$$0.0313X_1 + 0.0326X_2 + 0.0182X_3 + 0.0046X_4 + 0.0075X_5 + d_5^- - d_5^+ = 0.0101$$

$$0.0007X_1 + 0.0008X_2 + 0.0008X_3 + 0.0008X_4 + 0.0009X_5 + d_6^- - d_6^+ = 0.0092$$

$$0.5867X_1 + 0.6200X_2 + 0.6224X_3 + 0.5874X_4 + 0.7225X_5 + d_7^- - d_7^+ = 0.7947$$

$$X_1, X_2, X_3, X_4, X_5, d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+, d_4^-, d_4^+, d_5^-, d_5^+, d_6^-, d_6^+, d_7^-, d_7^+ \geq 0$$

6 Solution and Discussion of Findings

We got the following values for the variables by solving the problem using $LINGO$ 18.0 software.

$X_1 = 0.000000$

$X_2 = 0.8272231 X 10^{-01}$

$X_3 = 0.000000$

$X_4 = 0.2589823$

$X_5 = 0.8282579$

$d_1^- = 0.000000$	$d_1^+ = 0.000000$
$d_2^- = 0.000000$	$d_2^+ = 0.000000$
$d_3^- = 0.000000$	$d_3^+ = 0.9449820 X 10^{-03}$
$d_4^- = 0.000000$	$d_4^+ = 0.2024305 X 10^{-02}$
$d_5^- = 0.000000$	$d_5^+ = 0.000000$
$d_6^- = 0.8181204 X 10^{-02}$	$d_6^+ = 0.000000$
$d_7^- = 0.000000$	$d_7^+ = 0.6938798 X 10^{-02}$

7 Optimal solution

The findings reveal that the value of z is not equal to zero. This means that the optimum solution satisfies the goals P1, P2, P3, P4, P5, P6 and P7 which are Revenue, Expenses, Net Profit, Fixed Assets, Loans, Equity Shares and Financial Managing constraint. We have almost achieved all the goals that have been set, few with negligible deviation. The values of positive deviation and negative deviation for P1 until P7 are as mentioned above. The first priority, P1 is to maximize the total revenue of the organization.The result shows that the value for negative deviation, d_1^- is zero; and positive deviation, d_1^+ is also zero, therefore, the goal is fully achieved. Likewise, the goal of Expenses reduction (P2) is also fully achieved since the both values of d_2^+ and d_2^- are zero. For goal 3 (P3), the value of d_3^- is zero while the value of d_3^+ is $0.944982 * 10^{-3}$. This shows that the net profit goal (P3) overachieved and the net profit of the organization can be increased by 0.0199 Billion per year. Besides, the goal of maximizing the Fixed Assets (P4) is also achieved since the value of d_4^- is zero and the value of d_4^+ is $0.2024305 X 10^{-02}$. This indicates that the fixed assets of the organization can be increased by 0.0198 billion per year. And also, the value of d_5^+ and d_5^- is zero, so it can be concluded that minimizing the loans (P5) is achieved. However, the goal 6 (P6) which is maximizing the equity shares is slightly under achieved by the value $d_6^- = 0.8181204 * 10^{-02}$. This shows that the goal P6 has not been achieved completely whose target value is 0.0092 billion. Lastly, the goal of maximizing the proportion of the values of the items in the financial statement, P7 is also achieved because the value of d_7^- is zero and the value of d_7^+ is $0.6938798 * 10^{-02}$. This shows that the proportion of the values of the items in the financial statement can be increased by 0.7947 billion per year.

8 Conclusion

In this Study, the goal programming technique has been applied to the financial planning of an organization called SVR & Co. PVT. Ltd., for the next financial year based on the current data. The goals have been set up as per the requirements of the organization which are maximizing the revenue, reducing the expenses, increasing the net profit, increasing the fixed assets, decreasing the loans and maximizing the equity shares. Upon solving the model proposed, all the goals that have been examined are achieved except for the fixed assets. This explains that the financial performance of the organization is in better condition. The proposed model can be a reference in decision-making and in designing a plan to deal avec complex economic scenarios for any organisation.In addition, the proposed model may be a tool or solution framework that helps to build a plan blueprint for organisatiosor other financial entities and define their desired aspiration standard or benchmark that can be reached in the future.

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