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PLANNED WEIGHTED GOAL PROGRAMMING FOR LOAN SANCTIONING PROBLEM

V. Kesava Reddy*, Dr. S. Sunitha, Dr. Y. Raghunath Reddy

[*] Department of Science and Humanities St. Martins Engineering College, Secunderabad, India
Department of Mathematics Rayalaseema University, Kurnool, A.P. India
Department of OR & SQC Rayalaseema University, Kurnool, A.P.India

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ABSTRACT

This paper produces the detailed discussion of Planned Weighted Goal Programming Model for Loan Sanctioning Problems. It also analyses an effective method for allocating types of loans along the approaches in credit unions. It also exhibits the management as examined with different conflicting objectives of investors and borrowers.

KEYWORDS: Goal programming, Loan Sanctioning.

INTRODUCTION

Credit unions are nonprofit membership organizations, regularly organized by employees of a company or members of a church community or trade union. Authentically, credit unions have charged lower interest rates on loans and lower fees than banks, and paid higher interest on deposits. The United States Congress has declared them exempt from federal tax. This tax exemption assists credit unions to provide services at a lower cost. Credit unions were designed mainly as a selection to traditional banks. Unlike credit unions, banks are instructed to pay taxes before distributing dividend to their stake holders. On the other hand, credit unions repay their income to the members in the form of dividend. Strong growth in the credit unions is accredited to paying higher dividends than competitors.

The management in Credit Unions, Banks, Mutual Funds, Investment Services and Insurance Companies, usually face the problem of deciding the investment amount in different types of available schemes. The whole objective of the management is to increase the expected return on investment, given a set of legal policy or risk restrains (Sharma et al 2002). The management faces the problem of determining the invested amount for Sanctioning in different types of available loan schemes. A group of members who are borrowing a particular type of loan wants to get maximum allocation to that particular scheme. Thus, the contradiction arises in the interest of all such groups of borrowers. In this case also the management tries to equalize the interest of all the groups.

In practice, linear programming (L.P) models have generally proved to be the most useful quantitative approach to managerial decision as a result of the technique's computational efficiency and general availability. However, the models developed to date have one common attribute that they are specified in such a way that the management is assumed to maximize a single objective function subject to the restrictions which the management and regulatory agencies place on the optimization process. It is not possible for the models to have multiple goals unless they are measured in the same units. An important technique that has been developed to reinforce LP is called the goal programming (GP).

The GP technique was developed to handle multi-criteria situations within the general frame work of LP. The essential feature of this technique is the achievement of the best possible solution, which comes close to fulfilling the stated goals given the constraints of the problems.

Aghili.et al.[1] have been discussed Small bank balance sheet management: Applying two-stage programming mode*l* **Booth et al.[2]** have been developed Alternate programming structures for bank portfolios **Booth et al.[3]** have been discussed Goal programming models for managing interest-rate risk, **Booth et al.[4]** have been

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proposed Managing interest-rate risk in banking institutions **Buchanan et al.[5]** have been discussed A comparative evaluation of interactive solution methods for multiple objective decision models. **Cohen et al.[6]** have been developed Linear programming and optimal bank asset management decisions **Cohen et al.[7]** have been proposed Programming bank portfolios under uncertainty **Cohen et al.[8]** have been developed Linear programming models for optimal bank dynamic balance sheet management **Szegi.et al. [9]** have been proposed Mathematical Methods in Investment and Finance **Eatman et al.[10]** have been discussed A multiobjective linear programming model for commercial bank balance sheet management. Evans **G.W et al.[11]** has been developed An overview of techniques for solving multiobjective mathematical programs **Ignizio et al.[12]** has been discussed A review of goal programming: A tool for multiobjective analysis **Korhonen et al.[13]** has been developed A dynamic bank portfolio planning model with multiple scenarios, multiple goals and changing priorities **Lee et al.[14]** have been discussed Optimization of tax switching for commercial banks **Tayi et al.[15]** have been developed Bank balance sheet management: An alternative multi-objective model **Zanakis et al.[16]** have been proposed Categorized bibliographic survey of goal programming **Schweser et al.[17]** have been discussed financial statement analysis Vol. 3. **Berger et al.[18]** have been proposed efficiency derived from the profit function **Vassiloglou et al.[19]** have been developed A study of the relative efficiency of bank branches: an application of data envelopment analysis **Oral et al.[20]** have been discussed An empirical study on measuring operating efficiency and profitability of bank branches**. Manandhar et al .[21]** have been develope *The* evaluation of bank branch performance using data envelopment analysis a framework.

Fixler et al. [22] have been proposed. The productivity of the banking sector: integrating financial and production approaches to measuring financial service output. **Baxter et al .[23]** have been discussed The Recent History of Personal savings in British Columbia The Urban Futures Institute Report;

DATA OF THE PROBLEM

The manager in the Credit Union consists of Rs.300 millions fund for a planning year to allocate for 15 types of loans to its members for next year. An average annual rate of return is used for the different types of loans/investment. Other loans include share, Savings, Money Manager Secured, and Stock Secured Loan. Visa loans include classic, Gold, Student Visa, Platinum Visa and Secured Visa. The various revenue producing investments together with annual rates of return are summarized in Table 1.

Table 1: Credit Union Data

Sl.No	Type of Loan	Annual Rate of return (%)
1.	Home Equity Loans – Fixed Rate	9.55
2.	30 year Fixed Rate Mortgage	8.77
3.	20 Year Fixed Rate Mortgage	8.60
4.	15 Year Fixed Rate Mortgage	8.27
5.	3 Year Adjustable Rate Mortgage	9.65
6.	1 Year Adjustable Rate Mortgage	8.62
7.	Personal Loans (Preferred & Signature)	13.45
8.	Money Manager Secured Loan	8.50
9.	Classic/ Gold/ Platinum Visa	14.75
10.	New Auto/ Truck	7.25
11.	Used Auto/ Truck	8.25
12.	New Boat Recreational Vehicle	9.95
13.	Used Boat Recreational Vehicle	10.95
14.	New Motorcycle	10.45
15.	Used Motorcycle	11.28

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MODEL FORMULATION

The GP is a technique for solving problems with multiple, incommensurable and conflicting objectives. The users are generally provided a target or aspiration level of achievement to each objective and prioritized all objectives according to their importance in the decision making environment.

Finally, it finds the best possible solution that fulfills so many goals in the decision making context. The GP model has been described in detail by and others.

The general GP model can be represented as:
Find Y (Y_1,Y_2,……, Y_N) so as to,
Minimize P_1 ($w_{i1}{}^{-}d_{i1}$ -$^{+}w_{i1}{}^{+}d_{i1}{}^{+}$),
Minimize P_2 ($w_{i2}{}^{-}d_{i2}$ -$^{+}w_{i2}{}^{+}d_{i2}{}^{+}$),
……
Minimize P_j ($w_{ij}{}^{-}d_{ij}$ -$^{+}w_{ij}{}^{+}d_{ij}{}^{+}$),
……..
Minimize P_J ($w_{iJ}{}^{-}d_{iJ}$ -$^{+}w_{iJ}{}^{+}d_{iJ}{}^{+}$), i = 1, 2, ….m m
Subject to,
$f_i(Y) + d_i^- - d_i^+ = b_i$, i=1, 2, …, m
and w_{ij}^-, w_{ij}^+, d_{ij}^-, d_{ij}^+, d_i^-, d_i^-, $Y \geq 0$
d_{ij}^-, $d_{ij}^+ - d_i^-$, $d_i^+ = 0$
for I = 1,2…..m, j=1,2,…K.
where $f_i(.)$, i – 1, 2, ……, m, is the i-th function (linear) of decision vector Y. b_i is the aspiration level of the i-th goal. P_j (j-1, 2,…,K; K ≤ m) is the j-th priority factor assigned to the set of goals that are grouped together with the problem formulation.

The Goals:
The management has set the goals in decreasing order of their importance as follows:

1. Total annual return is 15% of total loan amount.
2. Home equity loans must be at least 20% of all other mortgage loans.
3. 30-year fixed rate mortgage must be at least 30% of all other mortgage loans.
4. Preferred and signature loans must be at least 15% of the fund invested in all loans.
5. New and used boat recreational vehicle loans must be at least 20% of total loan amount.
6. New and used motorcycle loans may not exceed the new auto/truck loan.
7. Visa loans must be at least 4% of the total funds available for investment.
8. Cash reserve must be at least 6% of all loan funds.

Variables:

Y_1 = Home Equity Loans – Fixed Rate,
Y_2 = 40-Year Fixed Rate Mortgage Loan,
Y_3 = 30-Year Fixed Rate Mortgage Loan,
Y_4 = 25-Year Fixed Rate Mortgage Loan,
Y_5 = 4-Year Adjustable Rate Mortgage Loan,
Y_6 = 2-Year Adjustable Rate Mortgage Loan,
Y_7 = Personal Loans (Preferred & Signature),
Y_8 = Money Manager Secured Loan,
Y_9 = Visa (Classic, gold, Platinum),
Y_{10} = New Auto/Truck Loans,
Y_{11} = Used Auto/Truck Loans,
Y_{12} = New Boat Recreation Vehicle Loans,
Y_{13} = Used Motorcycle Loans,
Y_{14} = New Motorcycle Loans,
Y_{15} = Used Motorcycle Loans,
d_i^- = Underachievement of goals or constraints in the i^{th} equation,
d_i^+ = Overachievement of goals or constraints in the i^{th} equation.

With the data defined in Table`1, the WGP model developed here is as follows:

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Objective Function:

Minimize $Z = 2d_1^- + d_2^- + 2d_3^- + 2d_4^- + d_5^- + d_6^- + d_7^- + d_8^- + d_9^-$

Subject to the constraints:

Funds Available

$$\sum_{i=1}^{15} Y_i + d_1^- = \text{Rs.300 millions}$$

Return

$$(0.15Y_i) + d_2^- - d_2^+ = \text{Rs.60 millions}$$

$$\sum_{i=1}^{15} Y_i$$

ity

$Y_1 + d_3^- - d_3^+ = 0.20$ = Rs.40 millions

6

30-year Mortgage $\sum Y_i$

$Y_2 + d_4^- - d_4^+ = 0.30$ = Rs.40 millions

16

Preferred and Signature $\sum Y_i$

$Y7 + d_5^- - d_5^+ = 0.15$ = Rs.30 millions

15

$\sum Y_i$

Boat Recreational Vehicle $i=1 (\neq 7)$

$Y_{12} + Y_{13} + d_6^- - d_6^+$ = Rs.60 millions

Motorcycle Loans

$-Y_{10} + Y_{14} + Y_{15} + d_7^- - d_7^+ = 0$

Visa Loans

$Y_9 + d_8^- - d_8^+ = 0.40$ Rs.30 millions

15

$\sum Y_i$

Cash Reserve $i=1 (\neq 9)$

0.06 $Y_i + d_9^- - d_9^+$ = Rs.40 millions

15

$\sum$

i=1

RESULTS AND DISCUSSION

In this paper, we made an attempt to demonstrate how viable weighted goal programming (WGP) is applied in solving loan management problems for the credit union. The WGP problem used in the study contains 15 decision variables, 17 deviational variables, and 9 constraints. The solution was generated in less than 0.3 seconds and took 6 iterations. The solution of the problem is as follows:

Table 2: RESULT ANALYSES

Home Equity Loans:		
Fixed Rate	=	Rs.27.60 millions
Mortgage Loans:		
30-years Fixed Rate	=	Rs.43.80 millions
1-year Adjustable Rate	=	Rs.147.52 millions
Personal Loans:		
Preferred & Signature	=	Rs.27.20 millions
VISA Loan:		
Classic, Gold, Student Visa	=	Rs.8.68 millions
Recreational Loan:		
Used Boat Recreational Vehicle	=	Rs.45.00 millions

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The above allocation of amount to different types of loans will satisfy the primary purpose of management. With this allocation and stated interest rate, annual return target is achieved. From the above result it is observed that no such amount is allocated for Secured Loan, Auto Loan and Motorcycle Loan.

CONCLUSION

In this research paper, it has been shown that the solution of multiple and conflicting objectives in a credit union problem can be solved by WGP technique, this approach is improved technique over single objective standard when multiple, incommensurable and conflicting objectives are involved. The model presented in this paper helps the management to determine the conflicting situation arising between the investor and borrower, and between borrowers.

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