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Evaluation of Asset and Liability Management of Companies in Malaysia with Goal Programming Model

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Abstract

The management of assets and cash flows to reduce the financial risk of an organization can be studied with asset and liability management (ALM). Since an organization has multiple goals to consider, a multi-criteria decision making (MCDM) with goal programming model can be adopted to study the financial strength while obtaining an optimal solution which satisfies the objectives and constraints. This study is aiming at developing a goal programming model to examine the financial management of a technology company, Malaysian Pacific Industries Berhad (MPI) with reference to various goals such as total assets, total liabilities, total equity, profit, earnings and total goal achievement. From this study, it is able to conclude that MPI has achieved all the goals according to the optimal solution from the goal programming model. Moreover, potential improvements of these target values are obtained to maximize assets, equity, profit and total goal achievements. The significance of this study is the identification of the financial position and improvement potentials for MPI in Malaysia.

Keywords: Asset, Liability, Goal Programming, Optimal Solution, Potential Improvement

1. Introduction

Technology has a very broad existence ranging from computing power to machine efficiency and automation. Technologies, which are built upon comprehensive and sophisticated data, are becoming more important in increasing the competitive advantage of an organization. They are becoming highly significant in the personal and professional lives of every individual as all aspects of businesses require direct or applied technologies for improved efficiency and time saving (Lohmuller & Petrikhin, 2018). In economics, technology is a macro factor in which its dynamic development and innovations are out of the management of enterprises. Nevertheless, humans are dictated and driven by technology in this global information age).

The adoption of technology in business environments has proven to be able to increase efficiency level as through the use of machines, outputs can be maximized in shorter time and with fewer human error so that the risk of operational dysfunction can be lowered down. Technology can automate certain functions and reduce the need for human resource, thus reducing the labor cost incurred to an organization. Technology also offers high performance consistency, thus increasing

reliability and accuracy (Subramanian, 2018). With the usage of technology such as communication systems allow instantaneous communication and the rapid transfer of data and information which permits high responsiveness to allow actions to be taken for quick rectification before a problem exacerbates.

Malaysia remains in the 35th position in the Global Innovation Index (GII) 2019 and is ranked the second in the upper middle-income country group just after China. Upon realizing the importance of technology and innovations, there has been great improvements in the Gross Domestic Expenditure on research and development (GERD) in Malaysian organizations. Besides, Malaysia has also recorded good performance in high tech net exports and creative goods exports (WIPO, 2020). The economy of Malaysia has also been highly driven by the electronics industry with high reliance on semiconductors and microprocessors. A great number of entrepreneurship programs also focus on micro digital businesses, digital contents, e-commerce, smart automation, cloud services and increased connectivity through the development of 5G in line with Industry Revolution 4.0 (IR 4.0) (Ismail, 2019).

Due to the importance of technological industry to the advancement of the nation, organizations in this sector should optimize their financial management particularly asset and liability management (ALM) which will have direct effects on their profits and earnings. Past studies have placed great emphasis on ALM in banks and financial institutions (Ahmadyan & Shahchera, 2018; Dash & Pathak, 2016; Kallur, 2016; Lam et al., 2017a; Lam et al., 2017b; Tee, 2017) but no studies have been applied on technology companies. Since organizations have many criteria and factors in consideration, Multi-Criteria Decision Making (MCDM) may be used to fulfil various goals. Therefore, formulation of a goal programming model will be done and applied to Malaysian Pacific Industries Berhad (MPI), whose nature of business includes producing and selling circuits, semiconductors, electronics and lead frames. MPI became one of the companies to trade under Bursa Malaysia since 1983 (Malaysian Pacific Industries, 2007). Goal programming model has been applied widely in financial institutions such as banks (Chen et al., 2017; Jahandideh et al., 2018) and insurance companies (Gharakhani et al., 2018). The aim of this paper is to study the goal achievement of MPI and its potential improvements using a goal programming model. Total assets, total liabilities, total equity, profitability, earnings and optimum management item are the common goals.

Section 2 of this paper will revolve around data and methodology while Section 3 consists of results and discussions. The final section will be the conclusion.

01. Data and Methodology

This section contains data and development of goal programming model.

2.1. Data

In this paper, financial management of MPI has been studied from year 2015 to 2019 with data collected from the company's annual reports.

2.2. Goal Programming Model

For MCDM problem, goal programming allows the aggregation of multiple attributes to obtain favorable solutions. MCDM problem involves finding the best solution based on multiple criteria (Lam et al., 2015a; Lam et al., 2016a; Lam et al., 2017a; Lam et al., 2017b; Lam et al., 2019). Goal programming model has been extended from linear programming for more strategic planning and decision making (Colapinto, et al., 2019). Organizations have to deal with many stakeholders including suppliers, customers, stockholders and competitors which levels up the complexity of management. Thus, organizations are aiming beyond profit maximization to consider maximizing their assets while keeping liabilities low. Goal programming model can assist corporate management teams in their strategic planning (Rifai, 1996).

When expressing the goals as constraints, the significance of each goal will be shown in the coefficient of each variable, with higher value indicating greater importance and vice versa. The following will be the formulation of goal programming models.

$$\min z = w_1 G_1 + w_2 G_2 + \cdots + w_i G_i \quad (1)$$

where $i = 1,2,3,\dots,n$.

subject to

$$\sum_{j=1}^{m}\left(a_{ij}x_j + d_i^- + d_i^+\right) = g_i \quad (2)$$
$$x_j, d_i^-, d_i^+ \geq 0$$

where,
z = objective function;
w_i = weights for $i = 1,2,3,\dots,n$;
d_i^- = negative deviation variable (under-achievement) for $i = 1,2,3,\dots,n$;
d_i^+ = positive deviation variable (over-achievement) for $i = 1,2,3,\dots,n$;
x_j = decision variable for $j = 1,2,3,\dots,m$;
a_{ij} = parameter for decision variable;
g_i = aspiration level for $i = 1,2,3,\dots,n$;
d_i^+ and d_i^- will be added to the equations to represent the over-achievements and under-achievements of goals (Winston, 2003).

There are six goals which have been studied simultaneously with goal programming model. Table 1 shows the six goals of financial management in a technology company.

Goal	Objective
1	Maximizing total assets
2	Minimizing total liabilities
3	Maximizing total equity
4	Maximizing profitability
5	Maximizing earning
6	Maximizing optimum management item

Table 1: Goals of Financial Management in Technology Companies

Table 2 consists of financial data extracted from MPI's annual reports. Then, Table 2 is transformed into Table 3 as coded configuration for the development of constraints and equations in the goal programming model.

Goal	Group (RM'000)					Total
	2015	2016	2017	2018	2019	
Asset	1386125	1370819	1630636	1695860	1708380	7791820
Liability	357959	200703	301679	290931	209148	1360420
Equity	1028166	1170116	1328957	1404929	1499232	6431400
Profit	122610	196821	218740	172443	160019	870633
Earnings	207615	268755	307268	241345	252500	1277483
Total	3102475	3207214	3787280	3805508	3829279	35463512

Table 2: Financial Data of MPI

Goal	Group (RM'000)					Total
	2015	2016	2017	2018	2019	
Asset	0.0014	0.0014	0.0016	0.0017	0.0017	0.0078
Liability	0.0004	0.0002	0.0003	0.0003	0.0002	0.0014
Equity	0.0010	0.0012	0.0013	0.0014	0.0015	0.0064
Profit	0.0001	0.0002	0.0002	0.0002	0.0002	0.0009
Earnings	0.0002	0.0003	0.0003	0.0002	0.0003	0.0013
Total	0.0031	0.0032	0.0038	0.0038	0.0038	0.0355

Table 3: Financial Data of MPI in Coded Configuration

Based on Equation (2), x_j signifies the total number of each element in each year as follows. Decision variables:

x_1 = total number of each element in the financial statement in 2015
x_2 = total number of each element in the financial statement in 2016
x_3 = total number of each element in the financial statement in 2017
x_4 = total number of each element in the financial statement in 2018
x_5 = total number of each element in the financial statement in 2019

The goal constraints obtained from each goal in the goal programming model is shown below.

Asset:

$$0.0014x_1 + 0.0014x_2 + 0.0016x_3 + 0.0017x_4 + 0.0017x_5 \geq 0.0078$$

Liability:

$$0.0004x_1 + 0.0002x_2 + 0.0003x_3 + 0.0003x_4 + 0.0002x_5 \leq 0.0014$$

Equity:

$$0.0010x_1 + 0.0012x_2 + 0.0013x_3 + 0.0014x_4 + 0.0015x_5 \geq 0.0064$$

Profit:

$$0.0001x_1 + 0.0002x_2 + 0.0002x_3 + 0.0002x_4 + 0.0002x_5 \geq 0.0009$$

Earnings:

$$0.0002x_1 + 0.0003x_2 + 0.0003x_3 + 0.0002x_4 + 0.0003x_5 \geq 0.0013$$

Total goal achievement:

$$\mathbf{0.0031x_1 + 0.0032x_2 + 0.0038x_3 + 0.0038x_4 + 0.0038x_5 \geq 0.0355}$$

Maximizing in the financial management of technology companies will be done on assets, equities, profits, earnings and optimum management item but liabilities will be minimized. Since the variables have values with uncertainties, both positive and negative deviation variables shall be added to the constraints to study if the goals are incremental or decremental. According to the goal constrains, the development and formulation of the goal programming model shall be the following.

Objective function:

$$\boldsymbol{Min = d_1^- + d_2^+ + d_3^- + d_4^- + d_5^- + d_6^-}$$

Subject to

$$0.0014x_1 + 0.0014x_2 + 0.0016x_3 + 0.0017x_4 + 0.0017x_5 + d_1^- - d_1^+ = 0.0078$$
$$0.0004x_1 + 0.0002x_2 + 0.0003x_3 + 0.0003x_4 + 0.0002x_5 + d_2^- - d_2^+ = 0.0014$$
$$0.0010x_1 + 0.0012x_2 + 0.0013x_3 + 0.0014x_4 + 0.0015x_5 + d_3^- - d_3^+ = 0.0064$$
$$0.0001x_1 + 0.0002x_2 + 0.0002x_3 + 0.0002x_4 + 0.0002x_5 + d_4^- - d_4^+ = 0.0009$$
$$0.0002x_1 + 0.0003x_2 + 0.0003x_3 + 0.0002x_4 + 0.0003x_5 + d_5^- - d_5^+ = 0.0013$$
$$0.0031x_1 + 0.0032x_2 + 0.0038x_3 + 0.0038x_4 + 0.0038x_5 + d_6^- - d_6^+ = 0.0355$$

$$\boldsymbol{x_1, x_2, x_3, x_4, x_5, d_1^-, d_2^-, d_3^-, d_4^-, d_5^-, d_6^-, d_1^+, d_2^+, d_3^+, d_4^+, d_5^+, d_6^+ \geq 0}$$

This goal programming model is computed with LINGO software which specializes in optimization modelling for linear programming, non-linear programming, goal programming and integer programming models (Lam & Lam, 2015; Lam & Lam, 2016; Lam et al., 2015b; Lam et al., 2015c; Lam et al. 2016b; Lam et al., 2017c; Lam et al., 2017d; Lam et al., 2018a; Lam et al., 2018b).

02. Results and Discussion

MPI's goal achievement for the respective goal with the optimal solution from the development of goal programming model is presented in Table 4.

Goals	Deviation Variable	Goal Achievement
G1	$d_1^- = 0$	Achieved
G2	$d_2^+ = 0$	Achieved
G3	$d_3^- = 0$	Achieved
G4	$d_4^- = 0$	Achieved
G5	$d_5^- = 0$	Achieved
G6	$d_6^- = 0$	Achieved

Table 4: Goal Achievement

Based on data in Table 4, assets (G1), equity (G3), profit (G4), earnings (G5) and optimum management item (G6) have negative deviation variables of zero value while liability (G2) has zero positive deviation value, thus it gives an indication that MPI has shown achievements in all the goals from 2015 to 2019. This implies that MPI has strong and stable financial performance. Potential improvements on the target values with reference to the optimal solution from the goal programming model that provides the positive value of deviation variables are shown in Table 5.

Goals	d_i^-	d_i^+
G1	0	$4.2754\ x\ 10^{-4}$
G2	0	0
G3	0	$4.2854\ x\ 10^{-4}$
G4	0	$4.7800\ x\ 10^{-5}$
G5	0	0
G6	0	$9.05\ x\ 10^{-4}$

Table 5: Potential Improvements

Based on Table 5, four potential improvements could be made for these goals. Potential improvements, which are incremental or decremental, can be determined from the positive and negative deviation variables. When a goal is to maximize, positive deviation variable shall determine the incremental value while vice versa happens when a goal is to minimize.

For the first goal in terms of asset (G1), the value of $d_1^+$is $4.2754x10^{-4}$ which means that MPI has to potential to expand the total assets by RM 0.00043 trillion in the next five years. The new modal value shall be RM 0.008220 trillion.

The second goal which is to minimize total liabilities (G2) is achieved by MPI and the positive and negative deviation variables have zero value. Hence, total liabilities will remain at RM 0.001360 trillion. The third goal which is to maximize total equity (G3) has been achieved by MPI since the negative deviation variable records zero value. Total equity can be further improved by RM 0.000429 trillion since $d_3^+$is $4.2854x10^{-4}$. The new value for total equity is RM 0.006860 trillion. Profit (G4) has also been achieved since $d_4^-$is zero. There is potential improvement for profit by RM 0.00005 trillion since the positive deviation variable is $4.7800x10^{-5}$. The final value of profit is RM 0.000919 trillion. The fifth goal is earnings which has been achieved by MPI and will stay at RM 0.001277 trillion for the next five years since both the positive and negative deviation variable records zero values. The final goal to maximize the optimum management item also achieved since there is zero value for negative deviation variable. There is potential to increase total goal achievement by RM 0.000905 trillion to reach RM 0.018637 trillion in the next five years as the positive deviation variable is $9.05x10^{-4}$.

03. Conclusion

This paper aims at developing a goal programming model for the examination and optimization of the financial management of MPI. The outcome of this paper shows that MPI has achieved the goals to maximize total assets, equity, profit, earnings and optimum management item and to minimize total liability. This paper has also provided recommendations for potential improvements according to the results from the optimal solution of the goal programming model. This paper has helped the organization to determine new target values for the financial goals for improvements.

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