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A LINEAR PROGRAMMING APPROACH FOR SELECTING AN OPTIMAL FIXED DEPOSIT INVESTMENT PLAN OFFERED BY SELECTED MALAYSIA BANK

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ABSTRACT

Investment decisions are inextricably tied to financial management decisions. Many people fail to invest because they lack fundamental knowledge of investments. Worse, banks do not give manual guidance in selecting an optimal Fixed Deposit (FD) plan, prompting clients to invest in a single maturity, a poor investment decision. This research used a linear programming (LP) model to help investors choose an optimal FD investment plan based on tenure and annual return rate. Based on the annual return rate of each bank in Malaysia, two banks are used for the short-term investment plan, while three are used for the long-term investment plan. This study proposed three investment packages. Plan 1 requires at least 20% of the money in each short-term bank and no more than 20% in each long-term bank. Plan 2 allocates no more than 20% of the money to short-term and 20% to long-term banks. Meanwhile, Plan 3 requires 25% of funds to be invested in short-term and 75% in long-term banks. To demonstrate this LP model, a computational experiment was conducted with RM50,000.00 of investment to see which plan gave the best result. Excel Solver Parameter Package was used to solve the investment problem. As a result, the investors are encouraged to invest in the third plan, which gives the investors an optimal maturity amount of RM52,067.19. More criteria for selecting an ideal investment plan can be included to further this study, and software to guide investors should be created.

Keywords*: Fixed Deposits, Investment Plan, Linear Programming.*

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1. Introduction

An investment is a payment made to acquire the securities of another entity to gain a profit (Bragg, 2021). There is a wide range of investment options, from simple bank deposits to more complex structured finance instruments. Capital market investments in Malaysia are diverse, including shares, unit trusts, warrants, bonds, and private retirement plans (securities). These products can be used by a wide range of investors and for a wide range of investment purposes such as short or long-term investments, study, retirement, general savings, and others (*MyGOV - The Government of Malaysia's Official Portal*, 2021).

From the diversification of investment options, one type of investment that is always missed in the investment's context is a Fixed Deposit (FD). This is due to its unpopularity among people as it does not give a higher return than stocks and cryptocurrency. FDs, according to Nordin, Jahar, and Abu (2021), are a type of savings account that yields a higher rate of interest and is a sort of financial investment instrument given by banks and Non-Banking Financial Companies (NBFCs) through which an investor may grow a lump sum over a certain period at a fixed rate of return while maintaining the highest level of safety. It is sometimes referred to as a "term deposit" or a "time deposit" in various countries. An investment in FD is the most frequent method of generating passive income. Besides, investments in FDs are more accessible and less hazardous than other investments. According to iMoney Editorial (2021), a few types of fixed deposits in Malaysia are listed in Table 1 below.

Table 1: Type of Fixed Deposit in Malaysia (iMoney Editorial, 2021)

Types of FD	Description
Short-term FD	The financial investment can be readily turned into cash within 3 to 12 months of maturity. It is appropriate for folks who want to save money quickly.
Long-term FD	Financial investment with a maturity of more than one year and up to five years. It is appropriate for those who benefit from a higher interest rate.
Islamic FD	A financial investment that generates returns without involving interest is based on the Shariah concept of Commodity Murabahah. It entails buying an approved Shariah-compliant commodity and selling it at a predetermined markup.
Foreign currency FD	This type of FD lets consumers save their funds in foreign currencies to safeguard them from exchange rate volatility.
Junior FD	A fixed deposit designed exclusively for younger savers to help them build a saving habit.
Senior citizens' FD	A fixed deposit is suitable for senior citizens over 60, such as retirees looking for ways to save money. This sort of fixed deposit provided a special interest rate.

In this study, the focus is on the short and long-term FD. According to IIFL Securities (2022), both FD types have advantages and disadvantages. It depends on individual preference and their investment objective whether to choose the long-term or the short-term investment. If wanted to preserve the money and be content with a low return, then go for a short-term investment. Meanwhile, if one is interested in a higher return and is willing to take a risk, invest in long-term investment. Moreover, long-term financial behaviour concerns retirement savings and investment, whereas short-term investment concerns emergency spending, as stated by Henager and Cude (2016).

According to Chauhan (2021), this pandemic appears to be an advantageous time for FD. This is due to the fact that FDs offer assured returns. FD can yield a set rate of return based on the current interest rate for the tenure committed. Although FD interest rates fluctuate due to various factors, once deposited funds are booked, they remain constant until maturity. Aside from that, FDs can be started with a small sum of money that must be deposited in any bank for a short-term or long-term period. This makes it not as complicated as other forms of investment. As a result, this money could be used as emergency aid during the pandemic or even as a long-term investment. This study could help people learn more about FDs and choose the optimal FDs plan for their future.

A journal by Suhaimi, Ghazali, and Razak (2019) discussed that an FD is a favoured choice for many first-time investors as it is considered a secure refuge compared to other investment options. It offers a high return, is simple to handle, promotes loyalty, and is insured by the government. An FD, in contrast to a savings account, does not allow access to the money that has been deposited, even if it earns interest daily and can be withdrawn at any time. People nowadays are more concerned with the profitability of fixed-deposit investments. The bank offers many fixed deposits; however, all investments only provide future profits and do not provide inflation protection. Furthermore, according to Wu et al. (2018), there is no need to keep tabs on stock prices or read any Share Trading books. Begin putting money away, open a fixed-income account, and collect interest when it matures. The authors also mentioned a 6-month FD with an RM5,000 minimum deposit and an annual interest rate of 3.6%. The initial deposit (principal) and interest at 3.65% per annum (p.a.) or an Effective Interest Rate (EIR) of 1.82% will be paid out over the first six months.

In Malaysia, different banks offer different fixed deposit plans. For instance, some banks might require a minimum deposit of RM5,000 for a one-month deposit and RM500 or RM1,000 for the rest of the tenure. For every fixed deposit made at the bank, investors must ensure that the bank is a member of Perbadanan Insurans

Deposit Malaysia (PIDM). PIDM acts as a protector of the bank deposits, and if in the event the bank goes bankrupt, the savings account is insured, PIDM will guarantee money up to RM250,000, including both the principal and interest. Thus, the fund is safe in the fixed deposit account (*PIDM - What Is the Deposit Insurance System (DIS)*, 2005).

This study mainly dealt with five Malaysia banks; Affin Bank Berhad, Public Bank Berhad, Bank Kerjasama Rakyat, Maybank Berhad, and Bank Islam Malaysia Berhad. Also, the maturity for the short term is fixed at 6 to 9 months. Meanwhile, maturity for the long-term was set at 12 to 24 months.

Aside from that, this study is based on the idea of an investor who has a certain amount of money and wants to spread it out by putting it in several FDs. As such, three plans are made to ensure that the total maturity amount is as high as possible. The conditions and limitations of each of the 3 plans are visualised in Table 2.

Table 2: Weightage for the proposed FD Plan

Plan	**Bank**				
	Short-term maturity		**Long-term maturity**		
	A	**B**	**C**	**D**	**E**
1	≥20%	≥20%	≤20%	≤20%	≤20%
2	≤20%	≤20%	≥20%	≥20%	≥20%
3	≤25%	≤25%	≥75%	≥75%	≥75%

In this study, a few criteria need to be considered to find the best investment plan among the three proposed in the above table. The criteria used in the selection process are the annual return rate and the investment tenure. Investors should look at interest rates and compare them to the other bank's interest rates before deciding. iMoney Editorial (2021) claimed that FDs consistently offer better returns than savings accounts. FD interest rates are also predetermined and are only paid at the end of the maturity period for these investments.

Furthermore, Patterson and Lygnerud (1999) stated in their research that long-term interest rates are assumed to be greater than short-term interest rates because the longer the investment period, the higher the risk to investors in terms of inflation, currency depreciation, and others. Moreover, the interest rate imposed on fixed deposits in Malaysia is between 1% and 3%. However, banks occasionally offer special or promotional rates for short-term fixed deposits with terms and conditions.

When investing in FD, the term is also an important thing to consider. FD is an investment with a flexible tenure that can be as short as seven days or as long as a few years. Different minimum deposits must be made depending on the period chosen by the investor. When an investor opens an FD account, they can choose a tenure based on preference. In research by Chen (2022), once the period has been chosen, investors decide to keep their money and not touch it for some time until the term expires. A penalty for early withdrawal will be assessed if they withdraw the funds before the maturity date. Therefore, it is better to make plans than lose money.

Apart from the above, Multi-criteria decision-making (MCDM) methods offer a valuable strategy for making decisions when there are multiple, sometimes contradictory criteria to take into account. MCDM is a decision-making procedure that considers various factors while reaching a decision. It is a subdiscipline of operation research that analysed numerous criteria in decision-making scenarios, as Chang et al. (2014) demonstrated. Yilmaz and Dağdeviren (2011) pointed out different ways to do MCDM. The relevant procedures have been developed and utilised in selection with varying degrees of effectiveness depending on the situation.

MCDM methods assisted decision-makers in determining their most preferred solution to an issue to obtain the most significant results for the decision-long-term maker's goal. Many researchers have conducted studies related to the selection process using the MCDM method, such as MCDM methods applied to the sustainable bridge design by Penadés-Plà et al. (2016), ELV recycling service provider selection by Zhou et al. (2016),

evaluation and selection of materials for particulate matter MEMS sensors by Huang et al. (2018), project portfolio management by Danesh et al. (2017) and selection of public projects alternatives by Miranda, Tereso, and Teixeira (2021). These processes have demonstrated that MCDM approaches are an excellent tool for evaluating and selecting problems with many criteria.

Since this research is dealing with solving problems with multiple and conflicting goals, there exist several methods to find an optimal solution for this project selection, such as Goal Programming (GP), Integer Programming (IP), Weighted Programming (WP), Linear Programming (LP), and Zero-One Goal Programming. Based on Leung and Chan (2009), most real-world issues are solved using a single-objective LP methodology or the LP model because it can handle numerous objectives and a single goal. However, in their research, De et al. (2018) preferred to use the GP technique in dealing with MCDM problems. The main difference between LP and GP is that the GP model does not directly maximise the aim, whereas the LP model does. Instead, it sought to reduce unfavourable deviations between a goal's desired level and the ideal solution. In the report of Leung and Chan (2009), many researchers and practitioners were becoming increasingly conscious of the occurrence of various objectives in real-world problems.

For this study, LP is found to be the most suitable method to use. Anne, Abiodun, and Olalekan (2020) stated in their research that linear programming is a mathematical approach to finding the best way to get the best results to allocate limited resources. It has become an essential field of optimisation in engineering and science and is used as a necessary tool by many businesses and industries. According to researchers Hasan and Arefin (2017), Leonid Kantorovich invented LP in 1939 during World War II to plan costs and returns so that the military could save money while making the enemy lose more. Since then, linear programming has been used in a variety of uses, as mentioned in the research of Ayo and Ehiabhi (2014). Linear programming, for example, has been used in management to solve portfolio selection, media selection, profit planning, and transportation problems.

In general, LP is a process used to maximise the value of different goals to some constraints. The goals may be to maximise profit or reduce expenditures that are the best values of the objective function among feasible ones and meet all the constraints, according to Kanu, Ozurumba, and Emerole (2014). The limited resources include workforce, skills, criteria, times, and material facilities. The decision-maker then looked for the best solution or outcome given the limited resources. The choice or outcome could be based on expenses, income, sales, return on investments, and the general societal welfare. The method involved putting a given problem into a form of a linear programming model with the variables identified and then solving the problem using the standard method.

According to Kanu et al. (2014), some primary conditions need to be adhered to solve LP problems. These conditions are divided into two categories: components and assumptions of the LP model. The components are then divided into four main categories. It consists of the goal function, decision variables, constraints, and parameters. LP problems must have measurable linear objective functions or criteria to be maximised. It must first be defined and then converted to a mathematical expression. Next, the decision variables are the options available to the decision-maker. They can be represented using alphabetical power units such as x_1, x_2 or x, y, z. The optimisation of scarce resources is expected in decision-making using LP. These limited resources are written as a constraint in LP. In the objective function, the value of the decision variables is limited by the constraints. Then the limits are indicated by linear equations or linear inequalities. Lastly, an LP model states the objective function and constraints mathematically. These mathematical statements included symbols for the decision variables as well as constant numerical values known as parameters.

Software such as Microsoft Excel, LINGO, CPLEX, and MATLAB can be used to solve the LP model. For this study, the LP model was solved with the help of the Excel solver parameter package. Microsoft Excel Solver was chosen because it is simple to use and has a high level of accuracy in solving complex problems. Based on Abdelwali et al. (2019), An Excel solver is a Microsoft Excel add-in designed to model and solve integer, linear, and nonlinear problems. Frontline Systems Inc. has prepared the solver in various versions with varying limits, which lets modellers assign different values to a range of cells in a spreadsheet without having to

write coding. With the Excel solver, as mentioned in Microsoft (2022), it is easy to find the best solution for the objective function of an optimisation model given the values of a formula objective cell and constraint cell.

The Excel Solver used the variable cell to determine the objective and constraints cell formulas. The solver then modified the values in the variable cell to meet the constraints and generated the output for the objective cell. It required three components to be defined, as stated in Goh (2019) research. First is an objective cell that must be either maximised or minimised. The objective cell corresponds to the objective function in the mathematical model. Following that is the variable cell, which should be equivalent to the spreadsheet cells representing the decision variable. Lastly, there is the constraint cell, which corresponds to the constraints imposed in the mathematical model.

Next, there were three options to select from GRG Nonlinear, Simplex LP, and Evolutionary. The function for each option is depicted in Table 3 below.

Table 3: Function of the options in the Excel Solver (Young, 2021)

GRG Nonlinear	Simplex LP	Evolutionary
The most commonly used method for solving nonlinear problems. This seeks the locally optimum solution.	This method is used to solve linear problems. The result is always a globally optimal solution.	The method for solving non-linear problems that are more complex and non-smooth. It seeks the optimum global solution, which causes it to take longer to run.

As the datasets used in this research are linear, Simplex LP was chosen to solve the linear programming problem. Many researchers used Excel solver in optimisation problems to identify the optimal solution either in maximisation or minimisation. Ezeokwelume (2016) research outlined the step-by-step instructions on installing the solver in Microsoft Excel to solve linear programming problems. He then applied the excel solver to solve the transportation problem example. Other researchers, such as Saleh and Latif (2009), used Excel Solver to solve linear programming problems, as do Ayo and Ehiabhi (2014).

The method reviewed above is believed to help one to plan their FD investment. Nowadays, many people are interested in putting their money into an investment and understand the value of doing so. However, they lack the knowledge to choose the best investment plan. Hence, they faced difficulties finding the best investment plan and relied on gut instinct and emotion to guide their selection. As a result, many people failed in their investments and incurred financial losses. Even worse, most banks in Malaysia do not provide a manual guide for deciding which investment plan is the best to distribute their money over a suitable time frame according to their budget. Furthermore, individuals who lack sufficient expertise are more inclined to invest their cash in a single maturity investment, which is a bad investment decision. Therefore, this study attempts a systematic approach to help people select the optimum FD plan using a solver in Microsoft Excel.

The objectives of this project are to identify a set of standard criteria for FD investment plan selection, to utilise a linear programming model for selecting the best FD plans, and to analyse the results from the formulated model.

2. Methodology

In the first phase, data is collected for making decisions. In the second phase, the LP is formulated and then used to find an optimal FD plan. The results are analysed in the third phase. The project's workflow is depicted in the following flowchart:

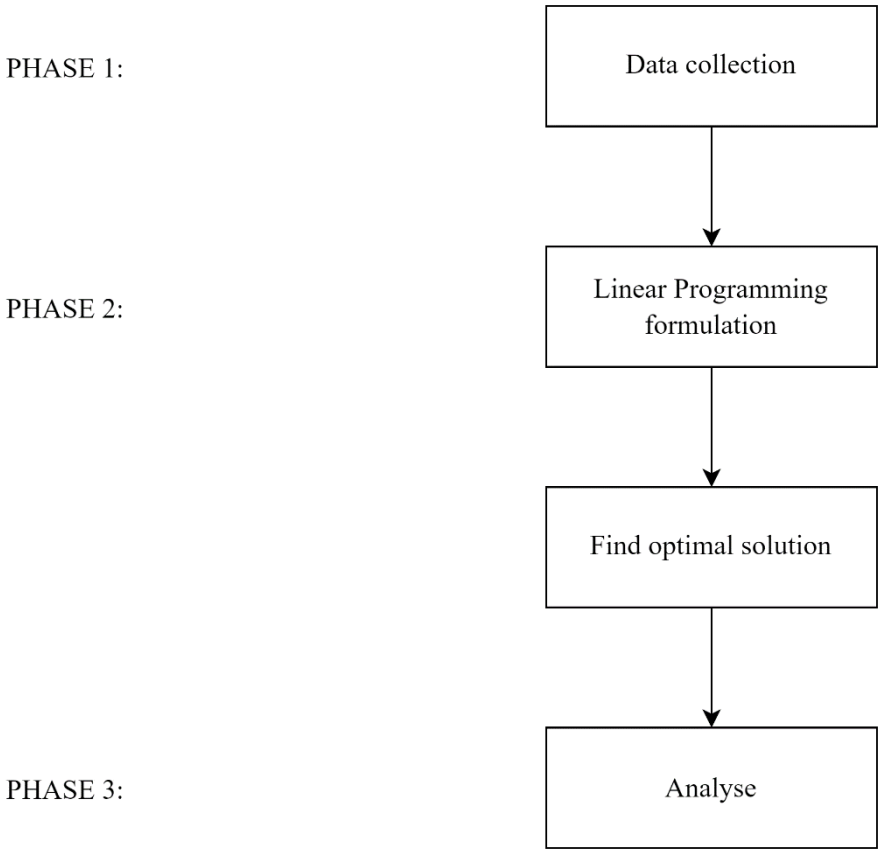

Figure 1: Flowchart of the project

2.1. Phase 1: Data Collection

In this phase, secondary data is used. Reputable web sources such as databases and articles are referred for information on tenure and annual return rates.

2.2. Phase 2: LP Formulation

To select the optimal FDs plan, the LP model (Oladejo, Abolarinwa, & Salawu, 2020) is formulated as follows:

Optimise: $f(x)$

Subject to: $\begin{cases} g_i(x) \leq b_i, & 1 \leq i \leq p \\ g_i(x) = b_i, & p+1 \leq i \leq k \\ g_1(x) \geq b_i, & k+1 \leq i \leq n \end{cases}$

$f(x)$ is the vector variable's objective function. $x = (x_1, x_2, \dots, x_n)^T$ reflects the efficacy rating of an outcome. x has the constraint function $g_i(x)(1 \leq i \leq m)$. The variable $x_j(j = 1,2, \dots, n)$ represents the decision-making problem's activity level. The term $b_i(1 \leq i \leq m)$ is the upper or lower limit of the ith constraint function. Constraint $x \geq 0$ confines the decision variables $x_j(j = 1,2, \dots, n)$ to real numbers that are not negative.

Both the objective and constraint functions are accurately specified in the form of linear equations, as both are linear.

From (1) and (2), linear programming can be written as follows:

$$f(x) = c_1x_1 + c_2x_2 + c_3x_3 + \cdots + c_nx_n = \sum_{j=1}^{n} c_jx_j \quad (1)$$

$$g_i(x) = a_{i1}x_1 + \cdots + a_{in}x_n = \sum_{j=1}^{n} a_{ij}x_j \quad (2)$$

From (1) and (2), linear programming can be written as follows:

Optimise $Z = c_1x_1 + c_2x_2 + c_3x_3 + \cdots + c_nx_n$
Subject to

$$\sum_{j=1}^{n} a_{ij}x_{j,} \qquad 1 \le i \le p$$
$$\sum_{j=1}^{m} a_{ij}x_j, \qquad p+1 \le i \le k$$
$$\sum_{j=1}^{n} a_{ij}x_{j,} \qquad k+1 \le i \le m$$
$$x_j \ge 0 \qquad \forall_j = 1,2,3,\cdots,n$$

Where a_{ij} represents the technical coefficient or constraint coefficient and c_j represents the cost coefficient or also known as the objective function coefficient. Meanwhile, b_i is the main parameter of the models. In addition, the inequalities sign can be changed according to the condition as follows:

Constraints:

$$\sum_{i,j=1}^{m,n} a_{ij}x_j \le \sum_{i=1}^{m} b_j \forall_{i,j} = 1 \cdots m, 1 \cdots n \quad \text{(less than or equal to)}$$
$$\sum_{i,j=1}^{m,n} a_{ij}x_j \ge \sum_{i=1}^{m} b_j \forall_{i,j} = 1 \cdots m, 1 \cdots n \quad \text{(greater than or equal to)}$$
$$\sum_{i,j=1}^{m,n} a_{ij}x_j = \sum_{i=1}^{m} b_j \forall_{i,j} = 1 \cdots m, 1 \cdots n \quad \text{(equality)}$$
$$x_j \ge 0 \qquad \forall_j = 1,\cdots,n \quad (\text{Non} - \text{negativity constraint})$$

2.3. Phase 3: Analysis

The LP is solved in the Excel Solver Parameter package. Thus, the result is interpreted based on the data analysis.

3. Results and Discussions

Excel solver is used to solve the LP problems. LP offers the optimum results for the instance problem with an RM50,000 investment. For the sake of a computational experiment, three FD plans are proposed, which are Plan 1, Plan 2, and Plan 3. These 3 proposed FD plans involve two types of maturity investment, which are short-

term and long-term. Plan 1 requires at least 20% of the money in each short-term bank and not more than 20% in each long-term bank. Plan 2 allocates not more than 20% of the money to short-term and 20% to long-term banks. The last plan, Plan 3, requires 25% of the funds to be invested in the short-term bank and the rest of 75% in the long-term bank.

For plan 1, the preference is that 20% of the investment is placed in each of the short-term and long-term banks, with at least 20% being placed in the short-term bank, which is equal to at least RM10,000.00 in Bank A and B, Meanwhile, not more than 20% of the investment being placed in the long-term bank, which is equal to not more than RM10,000.00 in Bank C, D, and E. According to the computational results in Excel, the optimal amount invested in each bank is equivalent to RM10,000.00, and the total maturity has amounted to RM51,276.25. Investing in bank A yielded an optimum return of RM97.50, while investing in bank B yielded an optimum return of RM153.75. Banks C, D, and E are the next in line, with RM500, RM210, and RM315 each. Table 4 below shows the result obtained.

Table 4: Result for Plan 1

Bank	A	B	C	D	E	Total
Tenure	6	9	24	12	18	
Maturity	Short	Short	Long	Long	Long	
Annual Return %	1.95	2.05	2.50	2.10	2.10	
Invest in A? (1-Yes, 0-No)	1	0	0	0	0	RM10,000.00
Invest in B? (1-Yes, 0-No)	0	1	0	0	0	RM10,000.00
Invest in C? (1-Yes, 0-No)	0	0	1	0	0	RM10,000.00
Invest in D? (1-Yes, 0-No)	0	0	0	1	0	RM10,000.00
Invest in E? (1-Yes, 0-No)	0	0	0	0	1	RM10,000.00
Amount Invested	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM50,000.00
Required Amount	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM50,000.00
Total Maturity	RM10,097.50	RM10,153.75	RM10,500.00	RM10,210.00	RM10,315.00	RM51,276.25

For Plan 2, the investment limitation is also 20% of the funds invested in each bank. However, the requirements for Plan 2 differ from Plan 1, where no more than 20% should be allocated to the short-term bank, meaning no more than RM10,000.00 should be invested in Bank A and B. At least 20% of the money is invested in long-term Banks C, D, and E, which equals at least RM10,000.00 each. As predicted by the algorithm, recommended investment amounts are RM0 in bank A, RM0 in bank B, RM30,000.00 in bank C, RM10,000.00 in bank D, and RM10,000.00 in bank E. As a result, RM52,025.00 was earned from this plan. Therefore, by investing in banks C, D, and E can expect to earn a return of up to RM1500, RM210, and RM315. The computational result of this plan is depicted in Table 5.

Table 5: Result for Plan 2

Bank	A	B	C	D	E	Total
Tenure	6	9	24	12	18	
Maturity	Short	Short	Long	Long	Long	
Annual Return %	1.95	2.05	2.50	2.10	2.10	
Invest in A? (1-Yes, 0-No)	1	0	0	0	0	RM0.00
Invest in B? (1-Yes, 0-No)	0	1	0	0	0	RM0.00
Invest in C? (1-Yes, 0-No)	0	0	1	0	0	RM30,000.00
Invest in D? (1-Yes, 0-No)	0	0	0	1	0	RM10,000.00
Invest in E? (1-Yes, 0-No)	0	0	0	0	1	RM10,000.00
Amount Invested	RM0.00	RM0.00	RM30,000.00	RM10,000.00	RM10,000.00	RM50,000.00
Required Amount	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM10,000.00	RM50,000.00
Total Maturity	RM0.00	RM0.00	RM31,500.00	RM10,210.00	RM10,315.00	RM52,025.00

For the last plan, Plan 3, the requirement is that not more than 25% of the money needs to be invested in the short term. At least 75% in the long term, resulting in a maximum investment of RM6,250.00 in Banks A and B and a minimum investment of RM12,500.00 in Banks C, D, and E. After all the parameters are substituted in the model, the result obtained is RM0 for Bank A, D, and E. In contrast, RM12,500.00 for Bank B and RM37,500.00 for Bank C. Consequently, the optimal objective function has a value of RM52,067.19. Therefore, for this plan's limitations, the investors will generate a return of RM192.19 from Bank B and RM1875 from Bank C. The results obtained are summarised in Table 6.

Table 6: Result for Plan 3

Bank	A	B	C	D	E	Total
Tenure	6	9	24	12	18	
Maturity	Short	Short	Long	Long	Long	
Annual Return %	1.95	2.05	2.50	2.10	2.10	
Invest in Short-Term? (1-Yes, 0-No)	1	1	0	0	0	RM12,500.00
Invest in Long Term? (1-Yes, 0-No)	0	0	1	1	1	RM37,500.00
Amount Invested	RM0.00	RM12,500.00	RM37,500.00	RM0.00	RM0.00	RM50,000.00
Required Amount	RM6,250.00	RM6,250.00	RM12,500.00	RM12,500.00	RM12,500.00	RM50,000.00
Total Maturity	RM0.00	RM12,692.19	RM39,375.00	RM0.00	RM0.00	RM52,067.19

The overall maturity amount achieved from each strategy proposed differs based on the provided mathematical formulation, as shown in Table 7 below. According to the LP model's computation using Excel's solver, the chosen plan has the highest overall maturity amount. According to this study, Plan 3 had the highest overall maturity value of RM52,067.19. Therefore, investors are advised to select Plan 3 to allocate their funds in Banks B and C to attain the most significant total maturity.

Table 7: The selection of FD in the case study

Plan	Bank					Total Maturity value
	A	B	C	D	E	
1	√	√	√	√	√	RM 51,276.25
2			√	√	√	RM 52,025.00
3		√	√			RM 52,067.19

4. Conclusions and Recommendations

4.1. Conclusions

A standard set of criteria for selecting FD investment plans has been identified to determine the optimal FD plan. The standard criteria used in this study are the FD's annual return rate and tenure. Standard criteria are interrelated because each FD investment tenure has its annual return rate. Each FD plan's total maturity is evaluated using these standard criteria. For selecting the best FD plan from five Malaysia banks, linear programming (LP) was utilised. Decision variables in the LP model are based on how much money will be invested into each of the five banks. The FD simple interest formula is used as an objective function in the LP model. This study has three different LP models since the three plans have its own constraints and limitations. Excel Solver Parameter Package is used to solve LP model. The anticipated outcomes are lucrative FD plans offered by selected Malaysia banks. The total maturity of each FD plan was different because each had its own set of constraints and conditions. With a total maturity of RM52,067.19, Plan 3 is the optimal FD plan out of the three, followed by Plan 2 (RM52,025) and Plan 1 (RM51,276.25). The results show that investors should invest diversely in each bank by combining short- and long-term FD. Thus, investors will be better led and understand the importance of diversifying their total investment amount to acquire the best total maturity.

4.2. Recommendations

To further this research, it is recommended that responses from respondents be collected, as there will be opinions and criteria that can be considered. The criteria may help investors determine which investments are optimal. The selection process will be more difficult if there are many criteria, but it is recommended since investors can choose the best strategy and banks. To make the selection procedure more convenient for the public, it is suggested that software be developed in the future. Investors can quickly learn about their investment plan from the software by filling out their personal and investing preferences. A comparison between one form of investment and another, or a comparison between the plans of one type of investment, will then be generated for the user by the software. In addition, it has been suggested that a system of interfaces be developed. The interface functions as an application that can be used and is very user-friendly as the investments can be made by everyone, regardless of age.

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