

System Dynamics Model for Financial Management among University Students

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ABSTRACT

Financial management defined as behaviour and perceptions about how financial is managed. Lack of sufficient knowledge on financial management will produce low savings, no budgeting, and failure to service debts on time and make impulsive buys. Low financial knowledge strongly resulted to higher level of debts. It is an urgency for Malaysians to improve their financial knowledge to improve their spending and investment habits especially among young adults. However, good practice of personal finances among students in Malaysia are still low whereby university students are found to have difficulties in managing their financial source. Therefore, the aim of this study is to assess university students' financial management skills. This study determines factors that influence the financial situation and examine consequences of financial situation for university students. Data were collected among university students and system dynamics model was developed using Vensim Software. The results revealed factors that associated with financial situation are financial knowledge and financial skills. The model indicated that the impact on increasing the number of people that fails to manage future need caused by financial knowledge factor, will cause a decline in the number of people that are aware about their financial management, and vice versa.

Keywords: Financial management, financial knowledge, system dynamics.

I INTRODUCTION

Financial management is mostly involves in managing cash flow and liability. Although important, this aspect of life is still under exposed among individual. Malaysia National Strategy for Financial Literacy 2019-2023 currently highlighted that 1 in 10 Malaysians believe that they are not disciplined in managing their finances, with 1 in 5 Malaysian working adults did not save in the previous six months (Financial Education Network, 2019). Based on the dire current condition, it also important to expose students especially in the tertiary education with sufficient knowledge on financial management as they will enter the working environment in the next phase of their life.

Financial knowledge is strongly correlated to financial behaviour. It has direct influence on both purchasing and saving habits among students (Beierlein & Neverett, 2013; Gudmunson et al., 2015; Norvilitis et al., 2006). Hilgert, Hogarth, and Beverly (2003) found significant relationships between financial knowledge and cash flow management, credit management, savings, and investment. On contrary, lack of sufficient knowledge on personal finances will produce low savings, no budgeting, failure to service debts on time and make impulsive buys (Leach, Hayhoe, & Turner, 1999). Norvilitis et al. (2006) also found that low financial knowledge strongly resulted to higher level of debts. Recently, former Malaysia Finance Minister, Lim Guan Eng urged Malaysians to improve their financial knowledge to improve their spending and investment habits (Star Online, (2019)). However, good practice of personal finances among students are still low. Mohd Rafi (2016) highlighted that university students are found to have difficulties in managing their financial source. Among factors that contributed to this concern includes ineffective financial habit. They have low savings mentality, poor record keeping, with some students have already accumulated credit card debts. The more students are aware of financial position, the less likely they are to be trapped in debts (Norvilitis, et al., 2006). Therefore, it is important to assess the financial management skills of university students. Thus, this study will assess university students' financial management skills through determining the factor influence the financial situation and examine the consequences of financial circumstances.

II LITERATURE REVIEW

Leskinen and Raijas (2006) identified demographic features (age, gender, education, values, attitudes, or habits), life phase and immediate surroundings (family and socialization), and macro environment (society, economic and cultural background) as key factors in acquiring financial skill. By assessing students' financial management skills, policy makers such as the university management can understand better on their current financial practices. Policy makers are also able to offer structured programs and better strategies for them (Falahati et al., 2011). Borden et al., (2008) believed that educational financial programs can be utilized to improve this knowledge and skills. Such programs can be in a form of seminars, workshops,

and printed brochures. It is important to assess the financial management skills of university students in the early years. Sound financial management skills among students will assist in reducing the number of cases of bankruptcy among young people in Malaysia, thus will improve domestic economy and the growth of economy in the future.

As understanding financial management among students deals with complex and dynamics inter relation between its contributing factors, system dynamics is deemed suitable to be utilized to illustrate better the overall system under study. Its cause-effect relationships accompanied by underlying mathematics and logic, time delays, and feedback loops can capture the underlying dynamics within this system. Work by Campbell (2014) utilized a simulation model as platform for self - directed financial economics learning for students, where macro and microeconomics are considered interchangeably in project financing decision making.

The used of system dynamics in financial environment started slowly, where Srijariya, Riewpaiboon & Chaikledkaew (2008) used system dynamics to construct, validate, and simulate a system dynamics financial model. They showed that this model can be useful tool for financial management, although difficult to construct. The argued that though difficult, it is more accurate in prediction, and able to provide larger and complex real world situations analysis compared to conventional method. To note, Nair (2013) begin incorporating simulation works with system dynamics modelling by considering dynamics variables such as net cash flow, gross income, net income, pending bills, receivable bills, debt, and book value to provide more accurate assessment of financial situation in a company. More recent, Vries and Egmond (2017) adopted system dynamics model that explored the creation of debts free money as an alternative to the current debts system. In the following sections, system dynamics approach will be utilized to investigate the complexity of interaction between financial management among university students with their underlying factors.

III METHODOLOGY

This study used system dynamics modelling as the method to illustrate the financial management among university students. A system dynamics model is based upon nonlinear dynamics and feedback control among variables. The causality relationship in system dynamics is useful in many areas of studies such as in housing area (Hashim et al., 2018), healthcare (Halim, Sapiri & Abidin, 2019) and food science (Rahim & Abidin, 2018), to name a few.

To date, the issue of financial management in Malaysia needs to be catered urgently, university students included. Lower understanding in financial

knowledge can pose risk of negative financial consequences. Figure 1 shows the impacts of lack of financial knowledge based on study from Leach, Hayhoe, and Turner, 1999. Hilgert, Hogarth, and Beverly (2003) further established significant relationships between financial knowledge and cash flow management, credit management, stress levels, savings, and investment. While Norvilitis et al., (2006) also agreed that low level of financial knowledge was strongly correlated to higher debts acquisitions. The listed impacts of financial knowledge in Figure 1 will be used as a guideline to further describe the factors that involved in assessing the university students' financial management skills.


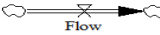
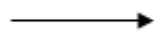


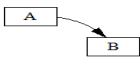
Figure 1. The Impacts Associated with Financial Knowledge.

A. Formulation of the Model

Model formulation refers to the construction of a model by using system dynamics software (Vensim) with accompanied equation as underlying fundamental. Table 1 briefly presents the elements, symbol, and description of system dynamics model.

Table 1. Elements in System Dynamics Model.

Elements	Description	Symbol
Stock	Known as levels, it acts as a reservoir to accumulate quantities and describe the condition of the system	
Flow	Flows function to increase (inflow) and decrease (outflow) the value of stock	
Connector	The connector represents the cause and effect link within the model structure	
Auxiliary	A link from one variable to another	

	variable. It is an intermediate variable used to break the flow equation into smaller parts	
Parameter	Variables with constant value over time	Capitalize Each Word

This diagram is the basic building blocks in a system dynamics model. Stocks represent accumulation of quantities that capture the state of a system, while flows consider accumulated quantity over a period of time. Figure 2 is an example of a stock and flow diagram in system dynamics model.

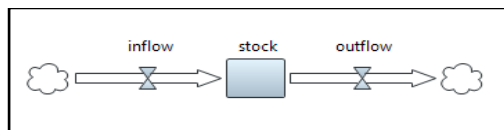


Figure 2. Stock and Flow Diagram.

B. Stock and Flow Diagram

Figure 3 shows the model of stock and flow diagram of financial management for university students.

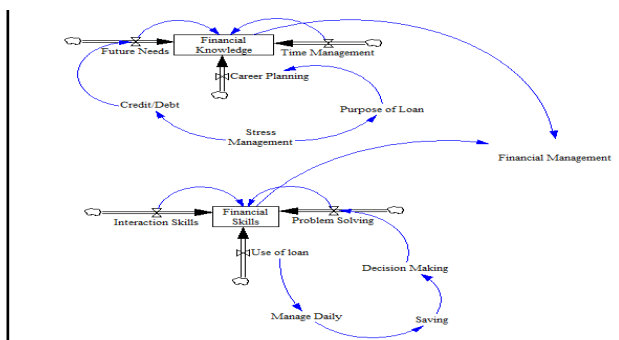


Figure 3. Stock Flow Diagram of Financial Management for University Students.

The stock and flow diagram in system dynamics model was developed based on findings of factor analysis in Che Mohd Khalid & Sapiri, 2019. Figure 3 summarizes the diagramming notations in the stock and flow model. Note that stocks representing factors of financial management i.e., financial knowledge and financial skills. The inflow are the future needs, time management, career planning, interaction skills, problem solving and use of loan. The auxiliaries are credit/debts, stress management, purpose of loan, manage daily, saving and decision making are used to compute the rate of every inflow item. The stock accumulates the effect of the flows and will remain unchanged if there are no flows to increase and decrease the current level of stock.

The stock and flow model in Figure 3 described when the number of people fail to manage credit/debts increase, it will decrease the future needs cause by financial knowledge factor. Alternatively, when the number of people fail to manage credit/debts will decrease, it will increase the future needs cause by financial knowledge factor. Besides, the increment of people understands the purpose of loan, it will also increase career planning in a certain period and manage to handle stress effectively.

On the other hand, when the number of people know on how to use of loan increase, it will increase the number of people can manage daily expenses and will increase the saving, caused by financial skills factor. In addition, when the number of people can make good decision increase, it will increase the number of problems that can be solved. Furthermore, when the number of problems that can be solved increase, it will also increase the interaction skills. Therefore, when the number of people have good financial knowledge and skills increase, it will increase the number of people aware about financial management.

IV ANALYSIS

Next, two validation tests are conducted which are behaviour reproduction test and policy evaluation test. For behaviour validation test, Ahmad et al., (2019) highlighted the aim is to develop confidence that the behaviour of the developed model can mimics real world behaviour. While policy evaluation test is conducted to seek for model improvement.

A. Validation of the Model

Validation of the system dynamics model involves behaviour reproduction test. In this test, the behaviour generated from simulated model should not diverge far away from the selected historical data. However, having the model that fit historical data does not mean that the model necessarily corrects in some case. Rather, it means that the model cannot be rejected (Sapiri et al., 2017).

Figure 4 and Table 2 are the baseline findings which are the outputs generated from the behaviour test of the system dynamics model.

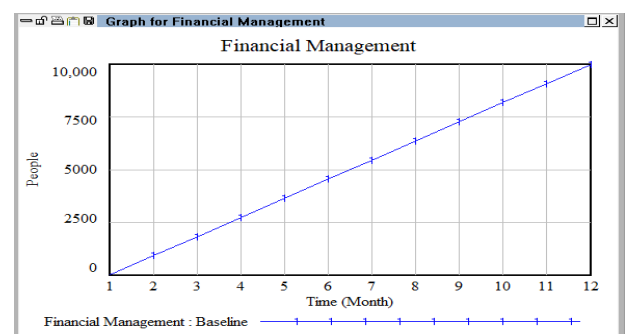


Figure 4. Behaviour of Financial Management Awareness among University Students.

Table 2. Result for Baseline Scenario.

Month	Baseline Scenario
1	13
2	919
3	1823
4	2732
5	3638
6	4544
7	5450
8	6357
9	7263
10	8169
11	9076
12	9982

Each equation dimensionally is consistent without the use of parameter having no real-world counterparts. And for the result, if the inputs change to extreme values, each equation will make sense. Figure 4 and Table 2 shows the number of people that are aware about their financial management within 12 months are increasing. Based on the results, most of the respondents were able to understand the financial knowledge and skills that will be applied to the financial management behaviour in daily life.

B. Intervention Scenarios

Once the established model passes through validation test, model evaluation is conducted to seek for model improvement through policy evaluation. The choice of policy evaluation depends on the purpose of the model. Several tools are available to conduct policy testing analysis, two most common are worst case scenario and optimisation approach (Stermann, 2000). In the worst scenario approach, changes are made in parameter values considering worst case scenario. On the other hand, policy optimisation requires setting the objective function such as maximises and minimises the parameter.

This study conducted intervention scenarios by changing several parameters in the model for policy evaluation. This intervention has been simulated in the same model to see the difference of behaviour between current (baseline scenario) and intervention scenario that has been conducted. Two scenarios are considered. In Scenario 1, parameter of variable *use*

of loan was changed. The purpose of choosing variable *use of loan* is because most of the respondents depends on their education loans. When the parameter *use of loan* was changed to small value (meaning the decrement number of respondents that know on how to use the loan), then it will cause the decrement of people that are aware about financial management as shown in Figure 5 and Table 3.

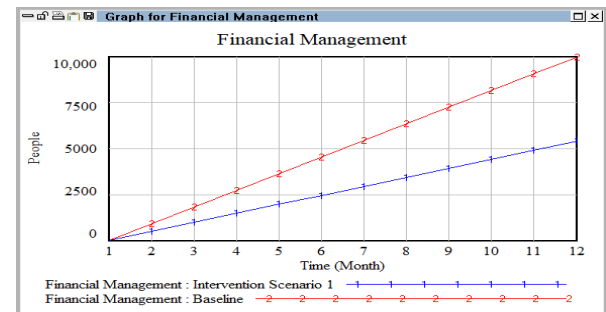


Figure 5. Result of Intervention for Scenario 1.

Table 3. Result of Financial Management of Scenario 1.

Month	Baseline Scenario	Intervention Scenario 1
1	13	12
2	919	503
3	1823	994
4	2732	1485
5	3638	1975
6	4544	2466
7	5450	2957
8	6357	3448
9	7263	3939
10	8169	4429
11	9076	4919
12	9982	5410

Majority of respondents are the recipients of education loans. Therefore, when they fail to manage their loans well, it will affect their financial situation. As respondents age increase, they will probably have more money under their control and become more mature and responsible about their personal spending. Student should know to differentiate between need and desire, to make sure that financial support is sufficient throughout their study duration. Need must come first before desire. Poor financial situations (Andrews & Wilding, 2004) and compulsive buying

(Brougham et al., 2011) contribute significantly to depression levels.

Next, in Scenario 2, parameter of the variable credit/debts caused by financial knowledge factor is changed. The purpose of choosing variable credit/debts because some of respondents have their own credit card. The parameter was change to small value (meaning number of people able to manage their credit/debts decrease), it will also decrease the number of people that are aware of financial management as shown in Figure 6 and Table 4.

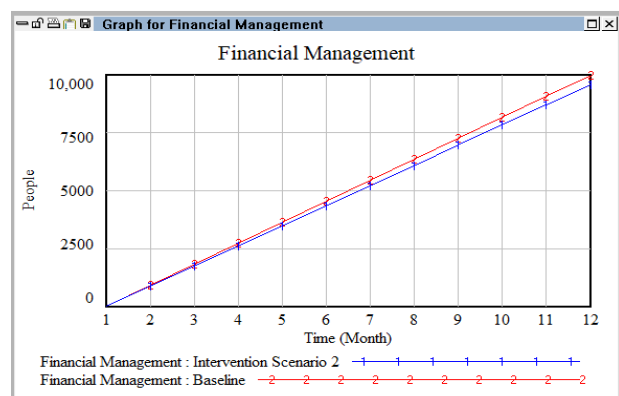


Figure 6. Result of Intervention for Scenario 2.

Table 4. Result of Financial Management of Scenario 2.

Month	Baseline Scenario	Intervention Scenario 2
1	13	12
2	919	881
3	1823	1749
4	2732	2617
5	3638	3485
6	4544	4353
7	5450	5221
8	6357	6089
9	7263	6957
10	8169	7825
11	9076	8693
12	9982	9561

The growing rate of credit/debit cards uses had dramatic impact on how individuals manage their personal finances. Today, tertiary students are more inclined to utilize online financial management products and services, compared to a more conventional in-house products favored by their

parents. This trend promotes better knowledge and awareness on financial products among students, on how to use this product and its benefits. Among this product is a credit card. Studies by Grable & Joo (2006) and Norvilitis et al. (2003) showed that student debt level have direct relation to financial stress levels. In which, financial stress causes the decline in academic performance and physical health among students (Gudmunson et al., 2015). Based on the results above, it is in line with the research by Goi and Nee (2008), in Malaysia, credit card bankruptcies tripled from 2006 to 2007 and study loan defaulters increased by 103 percent in the same period of time.

Results from both of intervention scenarios indicated that the model responds to parameter changes. Therefore, the system dynamics model of financial management for university students has passed the validation test and can be used for further amendments.

V CONCLUSION

The system dynamics model constructed in this study, displayed the information on financial management skills and the influence of university students on their financial management. This information can assist policy makers to reduce the number of cases of bankruptcy among young people in Malaysia. Therefore, the model can be use by financial educators to employ efficient methods in teaching financial matters. An effective program must be developed based on students' needs and should be presented in an integrated way to cover the wider population with a variety of life stages and characteristics. Indeed, the policy makers must take a more active role in educational planning by enhancing the importance of financial education during high schools and in the case of adult learning.

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