Journal of Namibian Studies, 34 S2(2023): 762–780 ISSN: 2197-5523 (online)

Validation of the Financial Model in the System Dynamic Model

Farin Ain Ismail Kassim [1], Siti Zaleha Daud [2], Zafirah Ab Muin [3], Mohd Nadzri Jaafar [4]

[1] Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia

drfarinain@gmail.com

[2] Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia

sitizalehadaud@utm.my

[3] Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia

zafirah2@utm.my

[4] Real Estate, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia

nadzrijaafar@utm.my

Abstract

In Malaysia, projects involving Public Private Partnerships (PPPs) for Higher Educational Institutions are often valued using the financial model. As a consequence, there would be a disagreement over value assessment among different financial models as well as a conflict between the partnerships. The System Dynamic Model (SDM) is developed to improve the financial model in order to settle disagreements. It applies to dynamic problems in a complex system of PPP financial models by simplifying it into one picture diagram. This article's primary focus is the validation of the financial model in the System Dynamic Model of the Public Private Partnership (PPP) of Higher Educational Institution Projects in Malaysia. It also focuses on several validation methodologies and their results. There are three methods of validation. Firstly, the structures, variables and flows are checked. Secondly, the real data (financial model) are compared with the System Dynamic Model and thirdly, interviews are conducted. The research findings showed a significant degree of similarity between the system dynamic model and financial model outputs. The percentage changes for projects are less than 5%, which is not significantly different from the output of the financial model. According to the interview findings, each of the

six interviewees supported the model and validated the System Dynamic Model. The partnership typically the public and private sectors can use the SDM by inserting the amount cost or rate to run the financial feasibility evaluation of projects. Thus, it might reduce the conflict between both parties. Another implication is the pattern of economic activities can be expanded, and new funders and private investment can be involved. The System Dynamic Model can attract new funders since the SDM has transparent accountability

Keywords: Malaysia, Financial Model, Dynamic Model, Public Private Partnership, System Dynamic Model

1. INTRODUCTION

This paper discusses the validation of the Financial Model in the System Dynamic Model of the Public Private Partnership (PPP) of Higher Educational Institution Projects in Malaysia. In terms of the application and description, Financial Model and System Dynamic Model vary in the ways that may be stated below.

Financial modeling is the theoretical formulation in a spreadsheet of a project, process, or transaction that deals with identifying important drivers and variables and a set of logical and quantitative connections between them [1]. The aim of the financial model is to examine financial performance in response to financial assumptions [2]. A financial model is mainly a tool for quantitative analysis [3]. The financial model is an approach to calculating NPV and finding value for money (VFM) which the model must fulfill the Public sector's requirements and Banker's requirements [4]. Many countries including the Euro, Asia, and South America, except in the United States follow the International Financial Reporting Standard (IFRS). This standard is set up by the International Accounting Standards Board, which is functioned to control the stability of account reports. In Malaysia, the Malaysian Accounting Standard Board announced a new accounting framework, which is named the Malaysian Financial Reporting Standards (MFRS) framework and has been recognized as a full International Financial Reporting Standards (IFRS) compliant framework on 19 November 2011 [5]. Thus, the financial models in Malaysia have followed the International Financial Reporting Standards (IFRS). The financial model is utilized to provide account holders with the most relevant data [6].

The principle of the System Dynamic Model, according to the System Dynamics Society [7] stated that System Dynamics is a computer-aided approach that is designed to analyze and solve the complex system through Software. The Software for developing System Dynamic Model that has been applied is Vensim PRO Software. The System Dynamic Model theory was developed by Forrester in the late 1950s [8] [9]. He created a set of techniques to simulate the complex, multi-loop

feedback, non-linear system. He divided his model into four aspects which are “Stock” which gathers all inflows and sources from where outflows come, “Flow” which delivers data information to and from the stock, “Converter” which reacts in a utilitarian role to select proper values and “Connector”. The illustration of a basic theory of the System Dynamic Model is shown in Figure 1. This system is used to solve the complex system [8] and generated the cause–effect relationships through stocks, flows, and feedback loops.

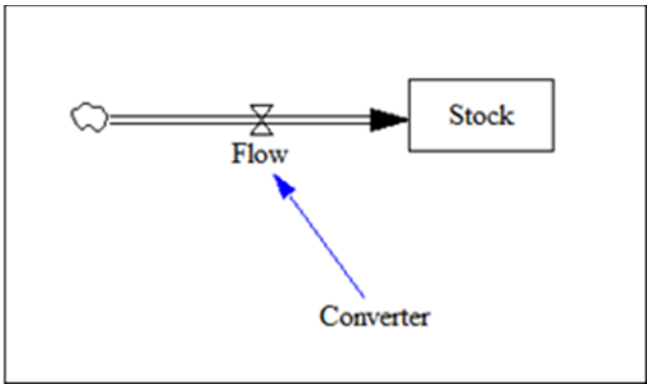

Figure 1: An example of developing System Dynamic Model using Vensim Software

In Malaysia, the financial model is frequently employed to assess projects involving Public Private Partnerships (PPPs) for Higher Educational Institutions. As a consequence, there would be a disagreement between the partnerships and disagreement about value estimation across different financial models. In order to improve the financial model and resolve disagreement, the System Dynamic Model (SDM) is developed. It applies to dynamic problems in a complex system of PPP financial models by simplifying it into one picture diagram. The approach begins with defining problems dynamically, proceeds through designing, mapping, and modeling stages (building a framework or causal loops diagram by inserting the input and output variables that have been taken from the financial model), then to steps for building the System Dynamic Model, then simulate the model via formula equation and analyze the model via sensitivity analysis and finally validate the System Dynamic Model. The financial model validation in the System Dynamic Model of the Public Private Partnership (PPP) of Higher Educational Institution Projects in Malaysia is the main aim of this research. Additionally, it concentrates on various validation approaches and their outcomes.

2. LITERATURE REVIEWS

A. Variables of the Financial Model

There are variables in a financial model that may be used to intentionally gather important project-related data. The selection of variables is according to the type of project. Not all variables are similar. The key variables in the transport infrastructure, are; the return of PPP projects, the discount rate on the sale of PPP projects, the length of the construction period, the length of the PPP contract, transaction exit costs and the growth factor for selling prices and costs [10].

Besides, another previous research made a comprehensive framework to set up key concession variables for PPP toll road projects as follows: toll rates, equity level, concession length and rate of return [11]. Another research [12] focused on the availability of payment which is a revenue to the private sector that comes from the government to assess the potential PPP projects. Other variables like the size of the investment, inflation rate and the construction period might give a big impact on the viability of the project [13]. The concession length is one of the greatest critical variables to the success of the project [14]. Moreover, the factors affecting the concession period, which the factors are the rate of return, interest rate, time, costs, toll rates, inflation rate, investors' capital investment, NPV and traffic volume [15]. Last but not least, the factors influencing concession pricing are the rate of return, total income, interest rate, length of the PPP concession, costs, Loan principle, capital fund, investor's capital investment, construction investment and base price [9].

There are four critical aspects that determine the financial viability of a highway project which are user fee, traffic volumes, concession period and capital costs [16]. Besides, the variables listed are as follows: assumptions of macroeconomic (interests rates and inflation), capital expenditure (any costs of bidding, construction and development phases of the project), costs of project company (costs after financial is closed such as administration staff, costs of external advisory, and insurance for construction phase), reserve accounts (IRR), Interests During Construction (IDC) (in debt and equity), contingency costs, operating and maintenance costs (operating, direct costs, subcontract payments, insurance and taxation, maintenance costs), soft facilities maintenance (cleaning, security, and catering), hard facilities maintenance, maintenance and services, lifecycle costs, costs of renewal operation, revenues (the public sector wanted to select VFM (Value for Money) of project) [4].

The Cash Flows consist of variables such as revenues of the project company coming as service payments from the users, subventions and different forms of support from the public sector, operating costs of the project company, construction cost, the expenses of building the asset,

tax (corporate taxes paid by the project company), equity capital invested in the project company, debt capital raised by the project company, interest on debt capital, depreciation of the asset and corporate tax rate [17].

B. Application variables of System Dynamic Model in PPP projects

In another major study [18] used System Dynamic Model to account for the existing uncertainties of variables. In another research study [19], SD modeling is useful for managing and simulation of processes with two major characteristics: (1) they involve changes over time and (2) they allow feedback-the transmission and receipt of information. Feedback is the core of a dynamic system. It could express the relationship structure of the whole system [20].

System Dynamics (SD) –based on a concession pricing model for PPP highway projects in China [9], the aim of this study is to develop a reliable, objective, and systematic model for determining a rational concession price for PPP highway projects based on pro forma financial statements developed during the feasibility study period. The reason why the System Dynamic Model was developed is capable to perform the price setting. The variables of pricing parameters and price risk factors of PPP highway projects were first identified and compiled through a comprehensive literature review. Then, the System Dynamics model was developed and the effectiveness of the model was verified by a real toll tunnel project located in China. The test result shows that the proposed model is reliable, accurate, and suitable for application by practitioners for concession price determination. The SDM is an objective-oriented simulation methodology to model complex systems [19]. In their research study, the complex interrelated structure of different factors affecting a BOT project is modelled using the System Dynamics approach. The qualitative model of the BOT project is constructed with cause-and-effect feedback loops. Then, the relationships between different factors are determined and the quantitative model of the project is built.

A Concessionaire Selection Decision Model Development and Application for the PPP Project Procurement [21]. The objective of this study is to develop a theoretical approach that is able to solve the common issues of the current PPP project concessionaire selection methods. This model is proposed to estimate the beneficial effects of bidding proposals on project NPV over time and to see how efficiently the risk effects can be reduced and the NPV performance can be improved. Then, which PPP concessionaire with the best project NPV performance is selected. Next is analyzing sustainability in low-income housing projects using system dynamics [22]. The study focuses only on two elements of the sustainability of a project such as “lifecycle” and “environmental and economic”. The study has claimed that there is no sustainability during the lifecycle. Thus, the System Dynamic model is

then developed. It is capable of considering the dynamic nature and interactions among major variables affecting the assessment of economic and environmental performances of selected green materials. Furthermore, it helps the government or contractors to decrease Life Circle Cost while achieving maximum Leadership in Energy and Environmental Design (LEED) material credit points for Low Income Housing projects. The study uses case study in Egypt to explain the practical features of the proposed model.

Next is the dynamic modelling of the quantitative risk allocation in construction projects [18]. This research developed System Dynamic Model to quantify all the factors affecting the risk allocation process and integrated Fuzzy Logic into the system dynamics modelling structure to account for the existing uncertainties. By using the SDM, the project cost is simulated at different percentages of risk allocation. The optimum percentage of risk allocation is determined as a point at which the project cost is minimized.

Lastly, it is the dynamic modelling of the relation between bidding strategy and construction project performance [23]. A bidding strategy is very important to win the project's contract. The study reviewed the factors that affect construction bidding strategy and construction project performance. Then the System Dynamic Model (SDM) is developed as a method to develop a management simulation. This study believed that this model helps the study of dynamic complexity, comprehend the source of policy confrontation and design more effective policies. This model is successful to solve the problems of complexity. By using SDM, the bidding strategy is enhanced by 13.67% from 10.55% and the project performance is improved

C. System Dynamic Model versus Financial Model

System Dynamic Model is built in Vensim/ Stella Software. It is Dynamic mapping. It is a computer-aided approach that is designed to analyze and solve complex systems through Software (System Dynamics Society). It consists of the cause–effect relationships through stocks, flows, and feedback loops [24]. System dynamics depend heavily upon both quantitative and qualitative data to characterize feedback loops in complex systems. Qualitative analysis is in CLDs part only. Its emphasis on identifying feedback paths that produce either balancing or reinforcing feedback. This provides an overview of the fundamental constructs and qualitative modeling techniques offered by system dynamics [25]. System Dynamic Model (Vensim Software) has a tool namely "Synthesis" that functions to simulate value by just moving the arrow of the parameter. The simulation results will be fast and easy. Besides, the Monte Carlo Simulation tool has already been provided in System Dynamic Model (Vensim Software). The System Dynamic Model is systematic and dynamic. "System" is organized hardware consisting of

variables, whereas “dynamic” refers to the capability of changing problems in dynamic ways to the system easily and efficiently.

Financial Model, on the other hand, is built in Excel Software (Spreadsheets) to forecast a business’ financial performance into the future (Corporate Finance Institute). It deals with the identification of key drivers and variables and a set of logical and quantitative relationships between them [26]. The weaknesses of the Financial Model as compared to the System Dynamic Model are the Synthesis tool and Monte Carlo Simulation not provided in Excel software. It means that the users must download or add it from somewhere. The financial model is a complex system, slow and inflexible especially in determining NPV and IRR [27].

3. METHODOLOGIES

The validation of the System Dynamic Model (SDM) is important. There are three steps to validate the SDM as follows:

A. The structures, variables and flows are checked.

B. The real data of the financial model are compared.

C. The interviews are conducted to validate.

In the context of system dynamics, model validation is a semiformal process consisting of a balanced mix of both quantitative tests and qualitative behavioral criteria targeting the system’s internal structure [25]. In participatory system dynamics modeling, validation can be done throughout model development by a range of experts and stakeholders, which may be much more reliable than an external review of the model at the end of the process. Another research study [8] detailed that technical knowledge, experience, and judgment ability are the major determinants when selecting experts. In addition, bias may arise when experts have direct or indirect interests in influencing the outcomes at hand. Their judgments may be influenced by bias consciously or unconsciously [28].

A. By checking the structures, variables and flows

The System Dynamic Model is checked according to the structures of Financial Model.

B. By comparing real data of financial model

The relation error of model within ±5% [20]. The result showed that the model conforms to the historical behavior and has validation.

In order to verify whether the model is able to provide reliable results, the study compare the modeling results with historical data from 2002 to 2011 [29]. The results indicated that 85% of the relative errors of the model are within -5% to 5%. This indicates that the model is able to provide reliable results.

In this study, the model is validated when the results of output variables show not over than ±5% different with the historical data (financial model). This percentage as a guidance to validate the System Dynamic Model.

C. By Interviewing the Practitioners

In order to validate the secondary data, they interviewed 12 senior managers from the public initiator and the private consortium, as well as representatives of pressure groups, investors and banks, all involved in at least one of the considered cases [30]. At the end of analysis, their findings were presented to in total five consultants and advisors (legal, technical and financial) with cross-case experience for their reaction and response. The semi-structured interviews are used in this research paper. The research targeted practitioners who were expert in financial accounting model of project development, expert in PPP project and experienced in running PPP projects. All the selected practitioners held high positions in their organizations (deputy director level, deputy level and professor level). The interviews are conducted to validate the Causal Loop Diagram and the System Dynamic Model.

Then, the interviews are recorded by using Atlast.ti Software. Further, the interviews are analyzed through “word cruncher” in Atlast.ti Software. The word cruncher is a helpful method for counting words that only keeps track of how often each word would appear. After that, Microsoft Excel is used to export the data for further analysis.

4. DATA ANALYSIS AND FINDINGS

A. Structure Check

By using the "Check Model" tool offered by Vensim software, the SD model structure is examined. With the help of this tool, the users can verify the flows, connections, and parameter equations. It is critical to validate the flows, connections and parameter equations. There are ten (10) dependent variables to verify which is Total Cash Inflow, Total cash Outflow, Cash Flow before Tax, Cash Flow After Tax, Cash Flow after Tax and Dividends, Present Value (PV), Net Present Value (NPV) after Tax, Project Post Tax Internal Rate of Return (IRR), Project Internal Rate of Return (IRR) and Shareholder Equity Internal rate of Return (IRR).

i. Total Cash Inflow

In the financial model shown in Figure 2, the variables, flows, and connections are examined in relation to the results of the overall cash inflow;

Project Cashflow
Cash Inflow:
Availability (Building Lease) charges
Facilities maintenance charges by cost
Facilities maintenance charges for MRF
Other charges / PFI Related cost
Capital
Financing
+
Total Cash Inflow

Figure 2: Total Cash Inflow in Cashflow Statements of Financial Accounting Model

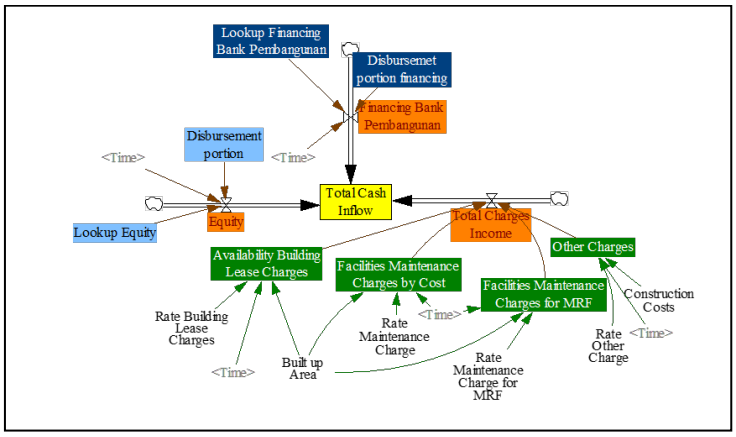

Figure 3: System Dynamic Model for Total Cash Inflow

The similarities of variables, flows and connections for Total Cash Inflow can be seen in Figure 2 and Figure 3. As seen in Figure 3, Total Cash Inflow is influenced by three main variables; they are Equity (Capital), Financing Bank Pembangunan and Total Charges Income. The total charges incomes are obtained from variables Availability Building lease Charges, Facilities Maintenance Charges by cost, Facilities maintenance charges for MRF and other charges. The Equity (Capital) is derived from variables of lookup equity, disbursement portion and time. Whereas, for Financing Bank Pembangunan comes variables of Lookup Financing Bank Pembangunan, Disbursement portion financing and time. Figure 3 indicates System Dynamic Model for Total Cash Inflow that consists of all variables and connects to each other through flows. The calculation has been checked and the similarities are 100% positive.

ii. Total Cash Outflow

Cash Outflow:
Project CAPEX
Payment for construction
Total Capital Expenditure
Operating Expenditure / OPEX
PFI related costs
Facilities maintenance charges by cost
Facilities maintenance charges for MRF
Insurans
Total Operating Expenditure / OPEX
Repayment for Financing / Bank Pembangun
- Principal
- Interest
Total Borrowing
Total Cash Outflow Before Tax

Figure 4: Total Cash Outflow in Cashflow Statements of Financial Accounting Model

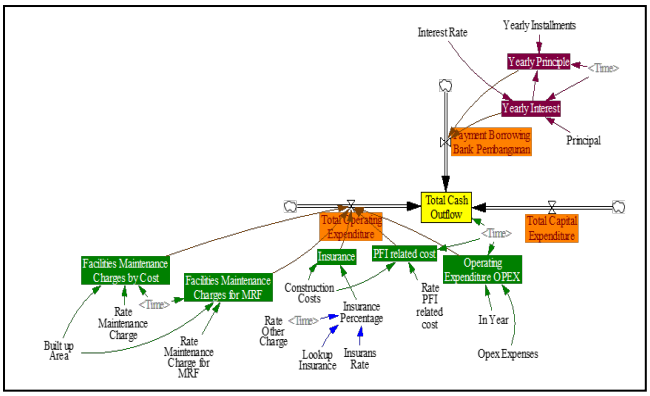

Figure 5: System Dynamic Model for Total Cash Outflow

The similarities of variables, flows and connections for Total Cash Outflow can be seen in Figure 4 and Figure 5. As seen in Figure 5, Total Cash Outflow is derived by three main variables; they are Payment Borrowing Bank Pembangunan, Total Operating expenditure and Total Capital Expenditure. The Total Operating Expenditure is resulted from the variables of Facilities Maintenance Charges by Cost, facilities Maintenance Charges for MRF, PFI related Cost, Insurance and Operating Expenditure. The payment borrowing Bank Pembangunan is derived from the variables of Yearly Principle and Yearly Interest.

Figure 5 indicates System Dynamic Model for Total Cash Inflow that consists of all variables and connects to each other through flows. The calculation has been checked and the similarities are 100% positive.

iii. Cashflow before Tax, Cashflow after Tax, Cashflow after Tax and Dividends, Present Value, and Net Present Value.

Total Cash Inflow
(-) Total Cash Outflow Before Tax
(=) **Cash Flow Before Tax**
(-) **Taxation**
(-) **Dividends**
(=) **Surplus / (Deficit)**
Opening Cashflow
Closing Cashflow

Figure 6: Cashflow before Tax, Tax and Dividends in Cashflow Statements of Financial Model

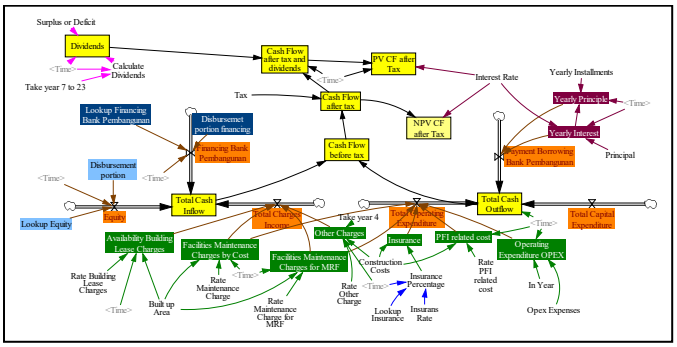

Figure 7: System Dynamic Model for Cashflow before Tax, Cashflow after Tax, Cashflow after Tax and Dividends, Present Value, and Net Present Value

The similarities of variables, flows and connections for Cashflow before Tax, Cashflow after Tax, Cashflow after Tax and Dividends, Present Value, and Net Present Value can be seen in Figure 6 and Figure 7. As seen in Figure 7, The Cash Flow before Tax is resulted by total Cash Inflow and Total Cash Outflow. Whereas, Cash Flow after tax is found after deducting Tax Payable. Cash Flow after Tax and Dividends is existed after deducting Dividends. The Present value is derived from the Cash Flow after Tax times interest rate. The Net Present Value is obtained from the total of PV times interest rate and lastly NPV is calculated from variable of Cashflow after tax and interest rate.

Figure 7 indicates System Dynamic Model consists all variables and connects to each other through flows. The calculation has been checked and the similarities are 100% positive.

iv. Project Post Tax IRR, Project IRR and Shareholder Equity IRR

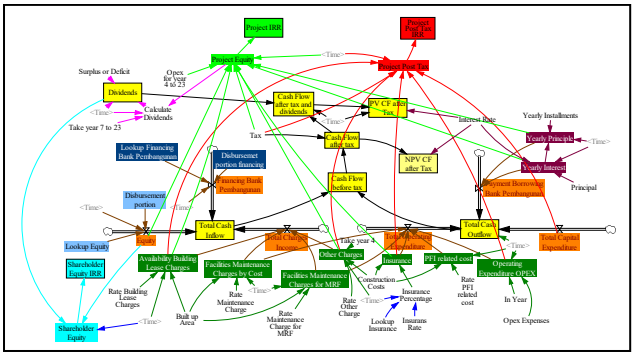

Figure 8: System Dynamic Model for Project Post Tax IRR, Project IRR and Shareholder Equity IRR (After)

The Project Post Tax IRR, Project Equity IRR, and Shareholder Equity IRR are the three criteria variables that PPP project stakeholders are most interested in evaluating. The variables that give impact the Project post-Tax IRR are Availability of Building Lease Charges, Other Charges, Insurance, Operating Expenditure, Total Capital Expenditure, Tax and Equity. While, for the project IRR, it is obtained from the variables of Opex for years 4 to 23, Equity, Availability Building Lease Charges, Tax, Other Charges, Insurance, Yearly Interest and Teary Principal. For Shareholder equity IRR comes from the variables of Equity and Dividends.

Figure 8 indicates System Dynamic Model consists of all mentioned variables and is connected to each other through flows. The similarities are 100% positive.

B. Results Compare

The System Dynamic Model's output outcomes are compared with the financial model's output outcomes. Through the computation of parameters that showed similarities with the actual data of the financial model, the SDM is to be validated. There are a lot of similarities between the output outcomes of Cashflow after before tax, Cashflow after tax and dividends, Profit/Loss before Taxation, Profit/Loss after taxation, NPV, Project Post Tax IRR, Project IRR and Shareholder Equity IRR. The output outcomes are as follows;

Table 1: A Comparison of real data and a system dynamic model for Campus A project

Input Variables/ Parameters	Financial Model	SD Model	Different	%	Different %
Cashflow before Tax	RM5,875,335	RM5,876,000	-RM665	100%	0%
Cashflow after Tax & Dividends	-RM3,063,903	-RM3,064,000	RM97	100%	0%
Profit/Loss before Taxation	RM3,497,485	RM3,498,000	-RM515	100%	0%
Profit/Loss after taxation	RM1,938,651	RM1,939,000	-RM349	100%	0%
NPV	RM16,123,381	RM16,130,000	-RM6,619	100%	0%

Input Variables/ Parameters	Financial Model	SD Model	Different %
Project Post Tax IRR	9.36%	9.12%	0.24%
Project IRR	16.76%	16.29%	0.47%
Shareholder Equity IRR	12.98%	12.79%	0.19%

The comparison between real data of financial model and system dynamic model can be seen in Table 1. For variable Cashflow before tax, Cashflow after tax and dividends, Profit or Loss before taxation, Profit or Loss after taxation and NPV indicate that the percentage difference between the real data of financial model and System Dynamic Model are 0%, 0%, 0%, 0% and 0% respectively. Whereas, for Project Post Tax IRR, Project IRR and Shareholder Equity IRR are 0.24%, 0.47% and 0.19% respectively. The results which do not exceed 5% are considered verified.

The results are interpreted in bar chart and line graph as in Figure 9 and Figure 10 respectively.

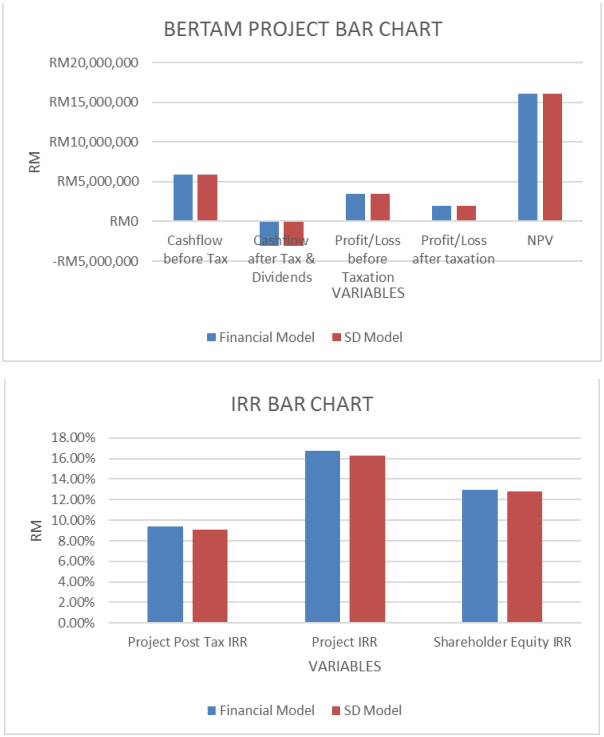

Figure 9: The Bar Chart of real data vs system dynamic model.

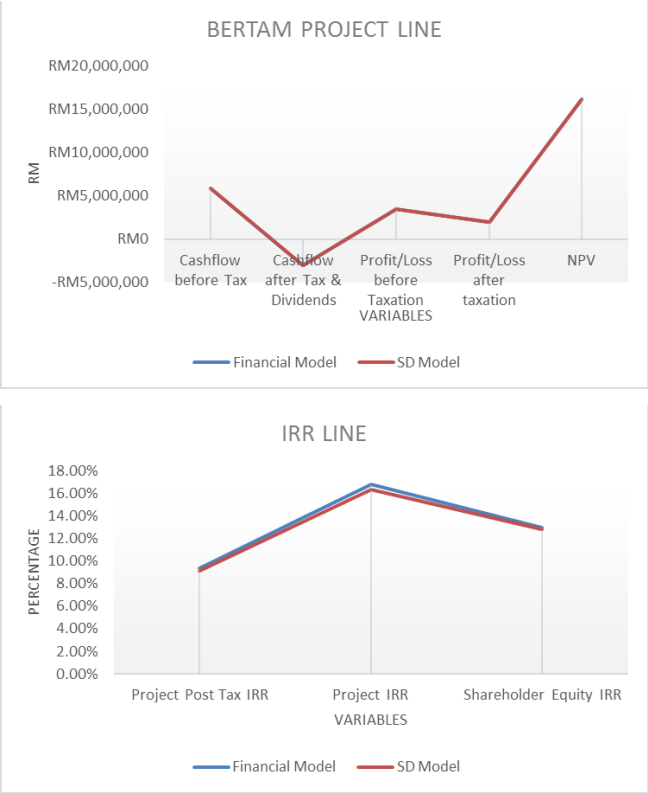

Figure 10: Line of comparison of real data vs system dynamic model

Real data and the system dynamic model are compared using a bar chart and line, which reveals that the values of the two models' bars and lines for each variable are nearly identical and barely different.

C. Interview Results

Several experts have been interviewed. The purpose of this interview is to verify the Causal Loop Diagram model and System Dynamic Model. A total of 6 interviews are conducted with 6 respondents. The interviews are transcripts using Atlast.ti Software. Further, the results of the interviews are analyzed through “word cruncher” in Atlast.ti Software. The "word cruncher" is a helpful tool for counting words that only keeps track of how often each word appears in the interview.

Table 2: Word cruncher for Positive words

POSITIVE WORDS			
WORDS	**Total Count**	**WORDS**	**Total Count**
can	14	**strength**	1
agree	11	**alternative**	1
know	9	**basic**	1
efficient	7	**benefits**	1
solve	6	**not complicated**	1
knowledge	5	**congratulations**	1
understand	5	**easy**	1
new	4	**help**	1
correct	3	**helps**	1
good	3	**learn**	1
fast	2	**nice**	1
faster	2	**okay**	1
simply	2	**simple**	1
solving	2	**useful**	1

They are 28 words that are categorized as “Positive words” as listed in Table 2 from the transcript of the interviews. In the interviews with six respondents, the word "can" appears the most often, followed by "agree," "know," and so forth. Based on this results, the following is a summary;

According to interview comments, in the System Dynamic Model, the users can simulate the variables by inserting any values. It is a simpler and clearer model. The variables are tested and experimented with using a project, and the value outcomes are quite similar to those of the financial model. It is discovered that there are only 5% differences. This indicates that the value outcomes are consistent with the nature of the financial model. The model has been validated and can be used to PPP projects.

In discussing the components of the System Dynamic Model, according to interview comments, the System Dynamic Model is flexible, which means it can modify the variables, flow connections, and computations to suit the needs of different projects and users. Besides, the users can choose and produce the appropriate variables for the project. The users can build the CLDs by adding any variables that fit with the projects. This indicates that the variables are flexible.

In considering the System Dynamic Model, according to interview comments, the System Dynamic Model is organized in a single diagram as opposed to the financial model, which has several divisions. As a result, the users can see that all the variables are shown in a single diagram and are linked to one another. It makes understanding for all users simpler.

The System Dynamic Model can solve the PPP project problems and it really helps in decision making. In considering the disadvantages of the System Dynamic Model, since this research is new, only a few individuals

are experts in Vensim software or System Dynamic Model. However, in terms of the flows, variables, and connections in the SDM perfectly mirror those in the financial accounting model. Therefore, it is expected that users can learn the SDM fast and simply. The System Dynamic Model is more practical and straightforward than the financial model.

The three respondents believed that the System Dynamic Model is a more effective, efficient, and quick method of resolving research issues. Based on the interview comments, the formulas created in SDM to quantify the variables are exactly the same as those in the financial model, but the "project period" is a little different and requires multiplied "time" for lookup variables because the System Dynamic Model does not use spreadsheets as the financial model does. As a consequence, alternative formulas are created to compute Net Present Value and Internal Rate of Return. To conclude, the System Dynamic Model's computations' outcomes resemble those of the financial accounting model identically.

The method of validation has used three different methods: structural assessment, outcomes comparison, and interviews. In order to examine the structure, the variables flows, and connections are analyzed and compared with the financial accounting model's structure. With the exception of formulation and the structural model, they do not vary. Less than 5% is the change in percentage for project, which is not significantly different from the outcomes of the financial accounting model. The transcripts of six respondents' interviews are examined for the interview results utilizing Atlast.ti software's "world cruncher" analysis. The repetitions of words are tallied. The SDM was validated by all six interviewees, who all agreed with it.

CONCLUSION

The method of validation has used three different methods: structural evaluation, outcomes comparison, and interviews. For the first step, the structure of System Dynamic Model is matched with the financial model structure. The structure means the variables and flow of variables. The variables and flows are followed in sequence as in the Financial model and they are connected to each other by arrows.

For the second step, the different outcome results of comparison between the System Dynamic Model (SDM) and the Financial model are less than 5%. The outcome results indicated that the SDM is exactly similar to the financial model. It means the SDM can be used by the user since it is 100% verified.

For the last step of interview results, the System Dynamic Model is a more effective, efficient, and quick method of resolving research issues. The implication of this validation is good to be used by the users or stakeholders of PPP projects. The SDM is an improved technique in the financial evaluation of projects.

Another implication is the pattern of economic activities can be expanded, new funder and private investment/sector in general can be involved. The System Dynamic Model can attract new funders since the SDM has transparent accountability. Thus, it creates trust in the new funders.

Besides, the bankability of the projects is increased where the projects that cannot satisfy the conditions and demand the complementation with public finance resources can be guaranteed if the SDM is applied. Moreover, for the nation, the development of higher education Institutions will be increased since the SDM is easier for stakeholders to control the projects. Thus, it will give an impact on the education industry that aim to produce many graduates.

REFERENCES

1. Avon, Jack (2014), The Basics of Financial Modeling, (book). The expert's voice in financial modeling. Apress.
2. Swan, Jonathan (2015). Practical Ficancial Modelling. The Development and Audit of Cashflow Models. Third Edition. Elsevier Ltd. 2008.
3. Tjia, John. (2004). Building Financial Model. A Guide to Creating and Interpreting Financial Statements. McGraw-Hill.
4. Turhani, A., & Turhani, A. (2012). Financial Model of a PPP Project, 8(7), 975–982.
5. MIA (2012). Accountants. By MIA Professional Standards & Practices. Retrived January 10, 2016, from MIA Professional Standards & Practices.
6. Mechelli, A., Cimini, R., & Mazzocchetti, F. (2015). The usefulness of the business model disclosure for investors' judgements in financial entities. A European study. Revista de Contabilidad, 20(1), 1–12. https://doi.org/10.1016/j.rcsar.2016.03.002
7. System Dynamics Society, (2017). Introduction to System Dynamics. Retrieved February 15, 2013, from http://www.systemdynamics.org/what-is-s/
8. Alasad, R., Motawa, I., & Ogunlana, S. (2012). A System Dynamics-Based Method For Demand Forecasting In Infrastructure Projects - A Case of PPP Projects, (September), 327–336.
9. Xu, Y., Sun, C., Skibniewski, M. J., Chan, A. P. C., Yeung, J. F. Y., & Cheng, H. (2012). System Dynamics (SD) -based concession pricing model for PPP highway projects. International Journal of Project Management, 30(2), 240–251. https://doi.org/10.1016/j.ijproman.2011.06.001
10. de Albornoz, V. A. C., & Soliño, A. S. (2014). Is There Room for a PPP Secondary Market? Financial Analysis of the PPP Transport Sector. Journal of Management in Engineering, 04014084. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000327
11. Jeerangsuwan, T., Said, H., Kandil, A., & Satish Ukkusuri. (2012). Construction Research Congress 2012 © ASCE 2012 2329. In Construction Research Congress 2012 (pp. 2329–2338). ASCE 2012.
12. Dunović, I. B., Radujković, M., & Škreb, K. A. (2014). Towards a New Model of Complexity – The Case of Large Infrastructure Projects. Procedia - Social and Behavioral Sciences, 119, 730–738. https://doi.org/10.1016/j.sbspro.2014.03.082

13. Hu, H., & Zhu, Y. (2012). Social Welfare – Based Concession Model for Build / Operate / Transfer Contracts, 1–5. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000920.
14. Lv, J., Ye, G., Liu, W., Shen, L., Asce, M., & Wang, H. (2013). Alternative Model for Determining the Optimal Concession Period in Managing BOT Transportation Projects, (2005), 1–7. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000291.
15. Yu, C., Lam, K., & Yung, P. (2014). Factors That Influence the Concession Period Length for Tunnel Projects under BOT Contracts, (February), 108–121. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000180.
16. Haldea, G. (2013). Public Private Partnership in National Highways: Indian Perspective. International Transport Forum, OECD.
17. Leviakangas, P., Ojala, L., & T0yli, J. (2016). An integrated ecosystem model for understanding infrastructure PPPs. Utilities Policy, 42, 10–19. https://doi.org/10.1016/j.jup.2016.09.001
18. Nasirzadeh, F., Khanzadi, M., & Rezaie, M. (2014). Dynamic modeling of the quantitative risk allocation in construction projects. International Journal of Project Management, 32(3), 442–451. https://doi.org/10.1016/j.ijproman.2013.06.002
19. Khanzadi, M., Nasirzadeh, F., & Alipour, M. (2012). Integrating system dynamics and fuzzy logic modeling to determine concession period in BOT projects. Automation in Construction, 22, 368–376. https://doi.org/10.1016/j.autcon.2011.09.015
20. Geng, B., Zheng, X., & Fu, M. (2017). Scenario analysis of sustainable intensive land use based on SD model. Sustainable Cities and Society, 29, 193–202. https://doi.org/10.1016/j.scs.2016.12.013
21. Jang, G. W. (2010). The Bids-Evaluation Decision Model Development and Application for (Dissertation). Colorado State University, Fort Collins, Colorado: Copyright by Guan Wei Jang 2010.
22. Marzouk, M., & Azab, S. (2017). Analyzing sustainability in low-income housing projects using system dynamics. Energy and Buildings, 134, 143–153. https://doi.org/10.1016/j.enbuild.2016.10.034
23. Wibowo, M. A., Astana, I. N. Y., & Rusdi, H. A. (2017). Dynamic Modelling of the Relation between Bidding Strategy and Construction Project Performance. Procedia Engineering
24. Ogunlana, S., Li, H., & Sukhera, F. (2003). System dynamics approach to exploring performance enhancement in construction organization. J. Contr. Eng. Manag., 129 (5), 528-536.
25. Mirchi, A. (2013). System Dynamics Modeling as a Quantitative qualitative Framework For Sustainable Water Resources Management: Insights for Water Quality Policy in The Great Lakes Region - A Dissertation, Doctor Of Philosophy In Civil Engineering Michigan Technological University 2013, Department Of Civil And Environmental Engineering.
26. Avon, Jack (2014), The Basics of Financial Modeling, (book). The expert's voice in financial modeling. Apress.
27. Sontamino, P., & Drebenstedt, C. (2013). A Prototype Dynamics Decision Making Model of Mining Feasibility Study on Investment, 76–79.
28. McAndrew, C., Smith, J. L. and Thompson, R. (2009). The Impact of Reservation Prices on the Perceived Bias in Expert Appraisals of Fine Art: Controlling for Latent Censoring of Transaction Prices. Social Science Research Network, Working Paper Series. Available at:

<http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1327026. [Accessed October 10, 2012].

29. Pan, L., Liu, P., & Li, Z. (2017). A system dynamic analysis of China's oil supply chain: Over-capacity and energy security issues. Applied Energy, 188, 508–520. https://doi.org/10.1016/j.apenergy.2016.12.036
30. De Schepper, S., Dooms, M., & Haezendonck, E. (2014). Stakeholder dynamics and responsibilities in Public–Private Partnerships: A mixed experience. International Journal of Project Management, 32(7), 1210-1222.