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A VALIDATION OF A RE-EQUILIBRIUM DECISION SUPPORT SYSTEM FOR PPP CONTRACTS

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A re-equilibrium model was developed which ensures that the rights of the Public Private Partnership (PPP) project stakeholders are preserved during renegotiation and minimizes the chances of disputes. The model develops the typical renegotiation scenarios which include: increasing the service charges, increasing the concession period, or paying a lump sum amount to the party of concern in order to maintain a fixed rate of return and keep the return on equity constant. Moreover, a decision support system was developed with the aid of Microsoft Excel 2013, Visual Basic for Applications (VBA) programming language, and the Precision Tree 5.5 for Excel add-in, in order to facilitate the process of selecting the optimum scenario which maximizes the satisfaction of both parties (the private sector and the public sector). In this paper, data is obtained from a case study of a wastewater treatment plant in Egypt, and applied to the proposed model. The results obtained from the model are close to the ones obtained from the Independent Financial Expert (IFE) of the wastewater treatment plant project. This verifies and validates the objectives of the model.

Keywords: Renegotiation, Scenarios, Model, Microsoft Excel, VBA, Wastewater treatment plant.

1 PUBLIC PRIVATE PARTNERSHIPS

A PPP is a mechanism which allows the private sector to engage in public infrastructure projects. This can be done through different agreements. PPP agreements can include one or more of the following components: Design, Build, Finance, Operate, Maintain, Own, Transfer, Lease, Develop, Buy, and Refurbish. Figure 1 demonstrates the level of involvement of the private sector along different combinations of the above PPP agreement components. The Private Sector is more involved in Build Operate Own (BOO) agreements where the project ownership is transferred to the private sector at the end of the project, (Broadbent and Laughlin, 2004). While on the other hand, the level of the private sector involvement is minimal in case of operate maintain (OM) agreements.

The importance of PPP agreements is that in many of their forms, the private sector becomes the party which finances the PPP project. This allows governments to allocate the funds in their treasuries to other important infrastructure projects and enhance economic growth, (The Construction Management Association of America 2012). Also, the private sector is proven to provide a better value for money (VFM) when achieved properly. This is achieved by providing a balanced allocation of risks and opportunities, (Guan-Wei 2010).

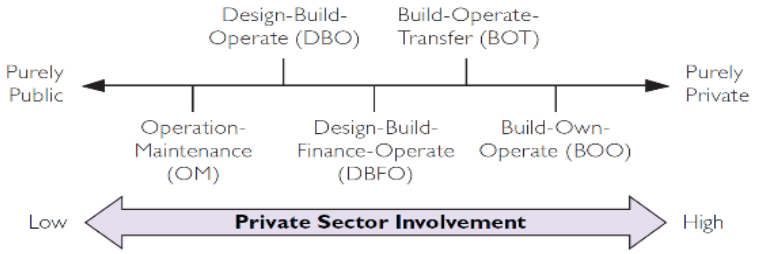

Figure 1. Private sector involvement (Kwak *et al*. 2009).

2 PROBLEM DEFINITION

Despite the above benefits of PPP, contract renegotiation is inevitable in many of the PPP Contracts. Due to the long-term nature of PPP contracts, which usually lasts for decades and in some countries for almost a century, conditions change over time. Assumptions, made at the beginning of the project, become no longer feasible and require alteration and adaptation to the new circumstances. Furthermore, different sets of rules and situations arise which require changes to the original contract. Hence, re-equilibrium of the original contract is required.

3 OBJECTIVE

An ongoing research effort has been conducted to develop a model which produces the re-equilibrium scenarios for the purpose of renegotiating of PPP contracts. The model was developed with the aid of Microsoft Excel 2013, VBA programming language, and the Precision Tree 5.5 for Excel add-in. The aim of this paper is to validate and verify the outputs of the previously mentioned model by applying the mechanism to data obtained from a real-life project located in Egypt. Results obtained from the model are to be compared to the ones developed by the IFE which is a third party who is responsible for any alteration to the Contract financial model.

4 CONTRACT RENEGOTIATION

When an event that was not previously anticipated arises, renegotiation has to take place. At this stage, the comprehensiveness of the PPP contract is tested. Renegotiation usually results in one of the outcomes stated in Table 1.

In his paper entitled “The Dark and Bright Sides of Renegotiation”, De Brux has proven that the longer the duration of the project, the more complex the renegotiation process, (De Brux 2010). On the other hand, Kumaraswamy *et al* claims that the more flexible the PPP contract, the more sustainable the PPP project, (Kumaraswamy *et al*. 2005). Finally, Garvin stressed the importance of mutual trust between the PPP parties and the sharing of risks and benefits which minimize disputes during the renegotiation stage (Garvin 2009).

5 A DECISION SUPPORT SYSTEM

As seen in the previous section, the contract flexibility and the mutual trust between the PPP parties are two important factors in the renegotiation process. The model to be verified is in the format of a decision support system which guides all parties in order to facilitate and increase the flexibility and the satisfaction of all the parties in a PPP project.

The model consists of a five-stage framework. The components of the framework are: the user-interface, risk allocation, PPP valuation, and financial model re-equilibrium and scenario development.

Table 1. Renegotiation Outcomes (Guasch *et al*. 2007).

Renegotiation Outcome	**%Renegotiated Contracts**
Delays on investment obligations targets	69%
Acceleration of investment obligations	18%
Tariff Increases	62%
Tariff Decreases	19%
Extension in the Concession Period	59%
Increase Annual fees paid by the Operator	17%
Decrease Annual fees paid by the Operator	31%

The user interface stage aims to collect all the inputs to the model, including: the risk allocation matrix information, the original financial model of the project, the different interests and concerns of the parties involved and the events that occurred to disturb the project equilibrium. The risk allocation stage processes all the inputs to form the risk allocation matrix. The matrix does not only contain the risk allocation information, but also defines the impact estimated. The impact can be totally allocated to a certain party or shared among the parties with a certain breakdown allocated to each.

The PPP valuation stage aims to fully input the base financial model of the contract which shall be the base for any later change. In PPP contracts, the private sector is required to develop a comprehensive financial model which includes all the expenditures, direct and indirect costs, revenues, debt information, etc. The financial model re-equilibrium stage aims to use the base financial model in order to come up with a new model which incorporates all the changes and events which led to the disturbance of the original contract equilibrium.

Finally, the scenario development stage bridges the gap between the base financial model and the newly formed model in order to come up with different scenarios to suggest during the renegotiation stage in order to minimize disputes and increase all parties' satisfaction. The outputs of the model are the re-equilibrium scenarios which are: increasing the service charges, increasing the concession period, or paying a lump sum amount to the party of concern. The only constraint of the model is to keep the internal rate of return (IRR) of the private sector constant where the IRR is the measure of the profitability of the private sector which needs to remain constant.

6 CASE STUDY

In order to validate the above model, a case study of a wastewater treatment plant in Cairo is used. The PPP mechanism of the project is design, build, finance, operate, maintain, renew and transfer (DBFOMRT) contract. This is a suitable project to use since it has many of the PPP forms within its contract. The project duration is 20 years where two years are allocated to the construction of the project and the rest is for the operation period. The project consists of a wastewater treatment plant with a capacity of 250,000 cubic meters of treated domestic wastewater per day. The government is to pay the private sector an annual fee known in the PPP contract as "availability payment" against the service provided. The location of the wastewater

treatment plant, the private sector special purpose vehicle (SPV) name, the technical consultants' and financial advisors' names are not disclosed for confidentiality purposes.

In Egypt, all PPP projects are administrated by the PPP Central Unit which is part of the Ministry of Finance. Although the owner of the wastewater treatment project is the Ministry of Housing, Utilities and Urban Development (MHUUD), the tender is issued and administered by the New Urban Communities Authorities (NUCA) and the PPP Central Unit. This format changes depending on many factors. For example, depending on the nature of the project, the owner changes to be the line ministry of concern. Moreover, in many countries, each ministry has its own PPP unit rather than having a single central PPP unit.

Beside the public sector and the private sector, the contract stipulated that a third party exists which is called the IFE. The duty of the IFE is to review the base financial model to ensure its integrity and correctness. In addition, the IFE is the party responsible for any modifications that occur to the original financial model. In other words, it is the party which develops the re-equilibrium scenarios.

The project contract stipulates that the IFE is to calculate the re-equilibrium value in a way which always ensures that the internal rate of return of the private sector remains constant. In case of a dispute, the IFE shall hand the issue to the Partnership Committee. According to the project contract, the Partnership Committee consists of five representatives, each belonging to: the New Urban Communities Authority (NUCA), the Construction Authority for Portable Water and Wastewater, the Ministry of Housing, Utilities, and Urban Development (MHUUD), the PPP Central Unit, and the Egyptian Water, Wastewater Regulatory, and Customer Protection Authority (EWRA). To ensure the fairness of the process, another five representatives are assigned from the private sector consortium.

In order to avoid disputes and minimize the need for the IFE and the Partnership Committee and at the same time, enhance robust and transparent re-equilibrium mechanism, the framework proposed is to be validated to ensure that the formulated re-equilibrium scenarios are to achieve the contract requirements of maintaining the private sector internal rate of return constant. This enhances the mutual trust between the project parties as the automated process eliminates bias.

7 VALIDATION OF THE FRAMEWORK

In the above case study, a call for contract renegotiation was raised. The first stage in the framework is the user interface. Inputs required at this stage are: project general information such as project name, contract type, project payment mechanism, payment amount, and payment intervals. As stated above the contract type is DBFOMRT. The payment mechanism is availability payment against the service existence as per the contract specifications. The payment amount is 32 Million Egyptian Pounds paid quarterly for a concession period of 20 years.

The risk allocation matrix was formulated using the contract information. The risk matrix includes the risk description, and allocation and the impact sharing mechanism assigned to each party and the sharing percentage. The risks are categorized into three main categories which are: country-related, sector-related and project-related.

The PPP Valuation stage contains main financial data of the project, the base financial model with their cashflow distribution along the project life-time. The project cashflow components are Capital Fund, Operation Income, Government Subsidy, Loan Principle, Loan Interest, Operation Cost, and Taxes. The model summarizes the financial model submitted to the government to the categories shown in Figure 2 in order to calculate the internal rate of return (IRR). The discount rate is the rate at which the cash flows are to be discounted to obtain the concession value at the project base date. The discount rate is calculated through the bank risk free rate and the producer

price index (PPI) to account for the effect of inflation, and it is fixed to equal 108 percent as per the case study contract.

Payment Distribution

		Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10		Jun-29	Jul-29	Aug-29	Sep-29	Oct-29	Nov-29	Dec-29
Capital Fund at time t (M EGP)	$Capex_t$	124.81	8.07	11.22	14.71	17.80	20.35								
Loan Payments (M EGP)				100.88			37.00								
Operation Income at time t (M EGP)	OI_t								54.66			54.66			54.66
Government Subsidy at time t (M EGP)	GS_t								5.35			5.35			5.35
Loan Principle at time t (M EGP)	LP_t							...							
Loan Interest at time t (M EGP)									0.07						0.07
Loan Interest at time t %	Li_t								10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Operation Cost at time t (M EGP)	$Opex_t$								38.09			38.09			38.09
Taxes at time t (M EGP)	T_t														20.79
Output Quantity at time t (M Unit)	Q_t								7.50	7.50	7.50	7.50	7.50	7.50	7.50

Figure 2. Payment distribution.

The Financial Model Re-equilibrium stage is the stage where the user enters the events which led to the contract renegotiation. In this case study the events were delays in the operation start date, a delay by the New Urban Communities Authority (NUCA) to deliver the influent water (the wastewater to be treated by the plant), and a delay by NUCA to provide the effluent pumping station. The impacts of the events were calculated according to the risk allocation matrix and the base financial model was edited to account for the effect of those events/risks.

The scenario development stage is based on the data obtained in the previous two stages where the project base and modified cashflows are discounted using the above discount rate, which is usually fixed in the contract agreement at an earlier stage, in order to obtain the re-equilibrium amount which is the difference between the net present value of the base and the modified project cashflows.

In the scenario development stage, the re-equilibrium payment is then used in order to develop the different project scenarios using the same discounting factor. The four re-equilibrium scenarios obtained are shown in Figure 3. The scenarios are calculated by transferring the re-equilibrium amount calculated above to the different payment options and extension of time via the time value for money equations.

Re-equilibrium Scenarios

Scenarios	Scenarios Description	Concession Value at time 0 (M EGP)	IRR %	Lump Sum Payment (M EGP)	Payment (M EGP)	Concession Period # of years
Base Scenario	Contract Information	37.52	19.95%	-	32.00	20.00
Updated Scenario	Updated Information	(160.81)	0.00%	-	32.00	20.00
Re-equilibrium Scenario 1	Lump Sum Payment at RD	37.52	19.95%	270.34	32.00	20.00
Re-equilibrium Scenario 2	Adjusted Payment	37.52	19.95%	-	40.36	20.00
Re-equilibrium Scenario 3	Adjusted Concession Period	37.52	19.95%	-	32.00	N/A
Re-equilibrium Scenario 4	Combination of the above	37.52	19.95%	-	34.50	30.00

Figure 3. Re-equilibrium scenarios.

The results obtained from the model is compared to the IFE conclusions and are shown in Table 2. As shown in the table, the percentage variance between the model results and the IFE conclusions varied between zero to almost five percent which is acceptable.

Table 2. Results variance from the real-life case study.

Scenarios	Model Value	Units	%Variance from IFE
Scenario 1	270.34	M EGP	3.1%
Scenario 2	40.36	M EGP/Quarter	0.4%
Scenario 3	N/A	Years	N/A
Scenario 4	34.5	M EGP/Quarter	4.8%
	30	Years	0%

8 CONCLUSION

The validation technique used in this paper is to compare the model results to a real-life case study and observe the deviation or the variance between the calculated results and the actual results obtained from the IFE. The limitation of the research is to use a constant IRR for the private sector when returning the re-equilibrium to the PPP project.

In conclusion, the results obtained from the Decision Support System prototype model were reasonably close to the ones obtained from the IFE of the Egyptian wastewater treatment plant. The percentage variance between the model calculated scenarios and the IFE obtained scenarios varied from almost zero percent in scenario two, which is adjusting the service charges, to a value not exceeding five percent in the other two. This confirms the function ability of the model developed in this research.

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