DEVELOP A STRUCTURED MODEL TO ASSIST THE EVALUATION OF VALUE FOR MONEY ACHIEVED ON PUBLIC PRIVATE PARTNERSHIPS IN LIBYA

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ABSTRACT

Public-private partnerships (PPPs) play an important role in bringing private sector competition to public monopolies in infrastructure development and service provision and in merging the resources of both public and private sectors to better serve the public needs. However, in worldwide practices, there are mixed results, substantial controversy, criticism and conflict over PPPs. The main characteristics of Build-Operate-Transfer "BOT" structure projects are long term contract, Private sector bears a significant share of the risks, and performance based- High level of private investment, it is essential for the public and private partner to extensively evaluate all the potential risks throughout the whole life of the project to decide whether to take up the project or not. This is done through incorporating risk assessment into value for money analysis, which is affected by the amount of risk associated with a project. Therefore, the main objective of this paper is to presents an alternative risk assessment and profit approaches to align benefit both public sector sponsors, by creating value for people, and investor interest, by generating attractive returns in supporting PPP selection.

Keywords: *Public–private partnerships, value for money Infrastructure, Libya*

INTRODUCTION

There is a huge demand on public infrastructure and services worldwide whereas the government budget of any country is always limited. In addition, the public sector often lacks the technologies, skills and expertise required for efficient infrastructure development. Furthermore, civil servants often have less incentive to invest wisely than private project managers [Therefore, the main objective of this paper is to presents an alternative risk assessment and profit approaches to align benefit both public sector sponsors, by creating value for people, and investor interest, by generating attractive returns in supporting PPP selection (World Bank,1998]. Facing these problems, governments worldwide are exploring innovative means for improved infrastructure development, and consequently different types of public–private partnerships (PPPs) have been practiced. PPPs are contractual relationships governing a long-term public sector acquisition and

private sector provision of public works and services [Zhang, 2011]. PPP projects have the following common characteristics [Ministry of Finance of Slovak Republic, 2005]: (i) a private partner provides the design, construction, financing and operation of the infrastructure, in return for payments either from the users of the infrastructure or from the public client itself; (ii) public and private partners share risks and jointly manage them through better utilization of resources and improved project control; and (iii) PPP projects are usually based on a long-term contract to encourage innovations and low life cycle costs. PPPs play an important role in bringing private sector competition to public monopolies in infrastructure development and service provision, and in merging the resources of both public and private sectors to better serve the public needs that otherwise would not be met. A great number of infrastructure projects have been successfully developed through PPPs with significantly increased value and substantial cost savings [Zhang&Kumaraswamy, 2001]. For example, it is reported that U.S. state and local governments have routinely experienced 10-40% cost savings and improvements in service quality and asset management through PPPs [NCPPPs, 2001]. On the other hand, many privatized projects suffered disastrous consequences because of construction cost/duration overruns, changing market demand, depreciation of local currencies and/or reduction in tolls/tariffs by utilities. Some of them had been postponed or abandoned by the sponsors, and others had to be bailed out by host governments [Ogunlana, 1997].

Accompanying the mixed results mentioned above, substantial controversy, criticism and conflict exist over PPPs. The division in thinking over PPPs is as wide as the world itself. Opponents argue that (1) the profit-making objective of the private sector motivates them to seek cost savings at the expense of quality services, and therefore, is antithetical to the public's well-being; and (2) the involvement of private sector in public services results in loss of jobs of public employees and consequently a counterproductive relationship with unions of public employees [9]. In contrast, proponents contend that the profit motive of the private sector does not necessarily comprise service quality or reduce public jobs (Ye& Tiong, 2000). Instead, improved level of service via cost effective solutions are possible as the private sector can become more accountable to the public through well-designed PPPs, which provide the public sector sufficient control over the works and services being provided by the private sector while allowing the management skills, technologies and financial resources of the private sector to come into play. The National Council for Public–Private Partnerships (NCPPP) of the United States provides successful PPP examples in transportation, urban development, schools, water/wastewater and other infrastructure sectors to support these contentions [NCPPPs, 2001].

Research questions are:

How are the risks in PPP that have a bi-lateral effects on key stakeholders of selected BOT projects and the value generation of PPP projects, and how is it to be improved from the point of view of key actors of these projects, illustrates the fundamental players involved in aP3 project and the types of risks they may undertake between various phases of the project as shown in Figure 1, and How

can the probability distribution of project NPVbe estimated with overall risk effects and beneficial effects over project life?

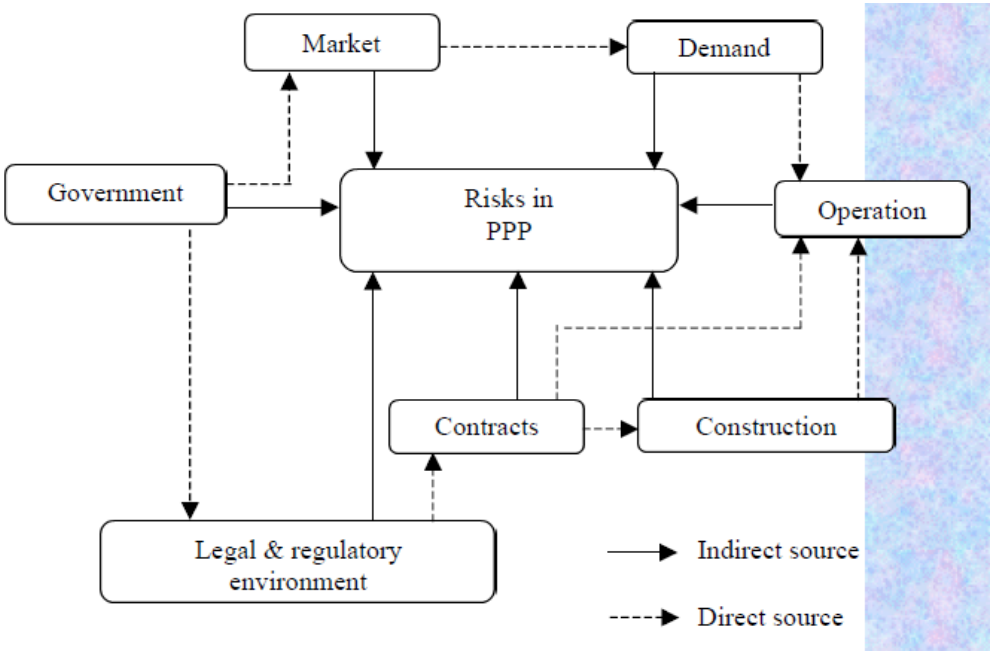

Figure 1. *Structure of a Build-Operation-Transfer (BOT) Contract*

Integrated Decision-Making model with Research Methodology

In order to address the main research question, this research presentedanIntegrated Decision-Making model via methodology that incorporate risk associated with infrastructure projects and financial mechanism in determining procurement strategy, it is able to include the explicit knowledge of the project team members about the political conditions, others project approach, it should allow quick response to changing market /demand factors, and contractual risk allocation. This model has developed using the BOT procedures barriers, and causal risk factors, it established based on a combination of the three models that had been presented. This scheme aims at achieving PPP prerequisites; the model simulates the financial outcomes of the project by demonstrating anticipated cash flow under different risk scenarios. Furthermore, the proposed methodology can be applied by managers of construction projects and practitioners to assess of risk to estimate on a whole-life basis the long-term costs of providing the assets and services involved. The proposed model consists of three parts: Fault and Event Tree Model (FFET), Markov Chain Prediction Model (MCP), and decision (ANP) for each of the (BOCR) Model, as depicted in Figure2.

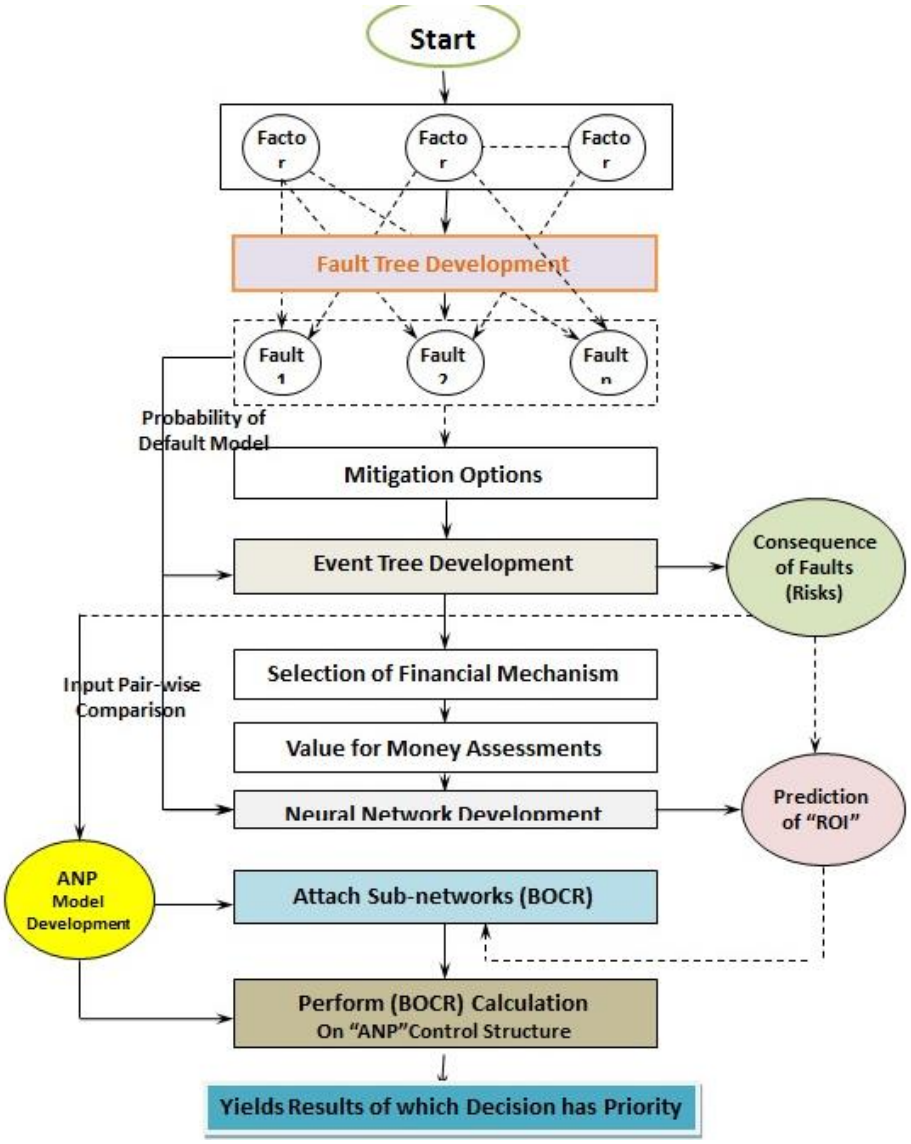

Figure 2. *Flow Diagram of the Proposed Methodology*

Fault and Event Tree Model Development

Firstly, Fuzzy Fault and Event Tree Model; however, probabilistic values are inadequate to use FTA method. Therefore, we employed Fuzzy Fault Tree Analysis (FFTA) approach to analyze root causes of risks and obtain the occurrence probabilities. Firstly, data collection, which is concerned with collecting root causes for each critical risk event and establishing linguistic terms to assess the probability of occurrence of each critical risk event, Probabilities of root causes and their contributions to top event are determined, secondly, assess the fuzzy probability of basic events occurrence and to identify the minimal cut sets (MCS) that defines the most probable path to the top event, FTA is a systematic way to obtain both qualitatively and quantitatively exact values of root causes' occurrence probability, as depicted in Figure3. Dynamic Fault Tree gates support sequences and dynamic probability changes. Dynamic sub-parts of Fault Tree are analyzed by

Markov model. In a dynamic fault tree, the occurrence of a top event depends not only on the combination of component failures, but also on the sequence of occurrences of these events. Thus, the Markov model has been used as a quantitative method to model the failure process and evaluate system reliability. DFT are comprised of various elements1: Basic events, static gates (AND, OR gates), and dynamic gates (functional dependency, priority AND, and spare gates). Each of these elements is viewed as a process moving from one state to another. *Markov-based dynamic fault tree analysis (DFTA) extends the static FTA by introducing additional gates to model such complicated interactions among events*

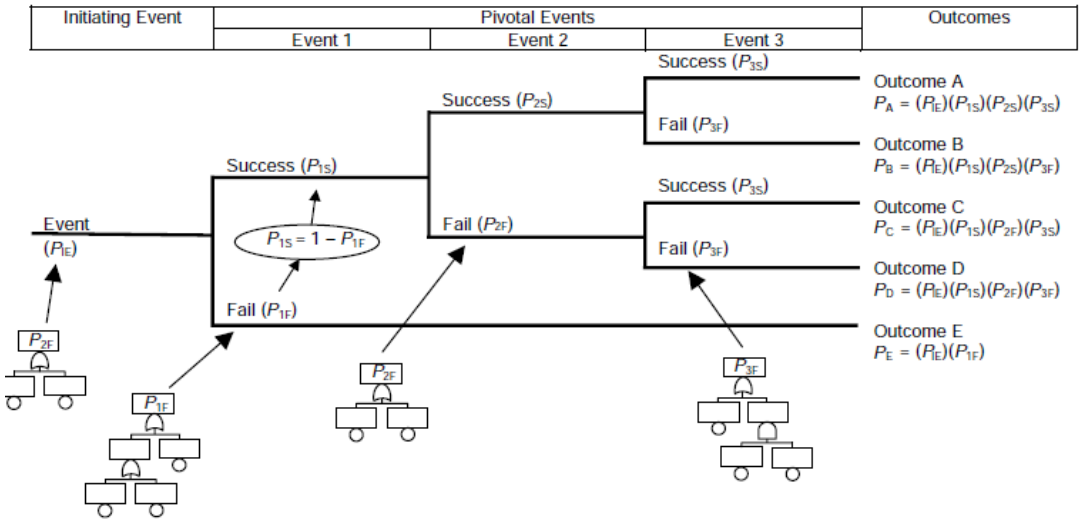

Figure 3.*ETD Development*

Markov Chain Model Development

Secondly, regarding the possibilities of PPP stakeholders to obtain the private financing for these projects is absent, a significant increase in the level of awareness on this matter is becoming an essential factor for the increase of the PPP implementation capacity in Libya. Markov Chain provides Risk analysts with a powerful tool in assessing value for money as well as the expectation of the estimated" NPV" that they can use of selected BOT projects. This type of analysis would quantitative for the retained risk in a monetary term by tying the length of the concession to demand for the project in evaluating value for money (VFM) over time for PPP proposal. If there is high demand, user fee revenue would accumulate quickly and the duration of the PPP would be shorter than if demand is lower. This reduces the risk of the project and the required risk premium for long project lifecycle, as depicted in Figure4. Based on a fuzzy transition rate matrix, a fuzzy Markov model is introduced to capture dynamic behavior of systems.

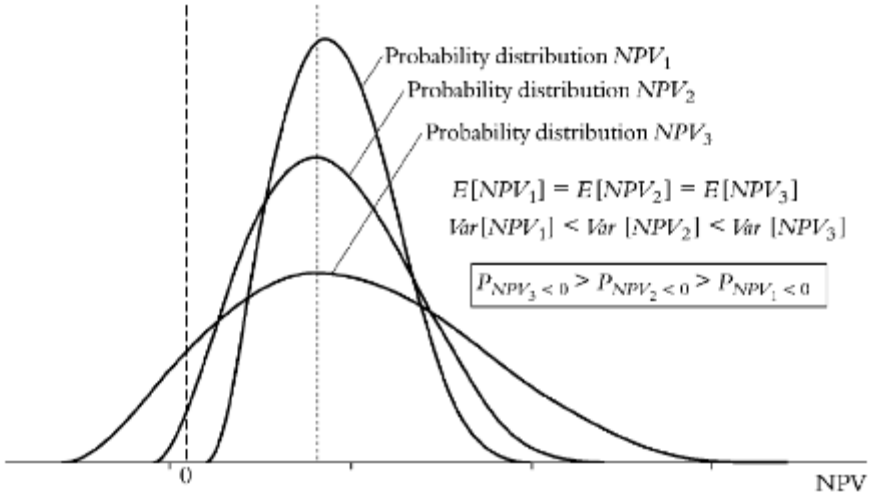

Figure 4. *Prediction of NPV*

The proposed BOCR-ANP model

Finally, BOCR-ANP sub networks models assess the profitability of a project, It is an analytical model based on inputs from two previous models, it detailed economic analysis accountable for benefits, opportunities, risks and costs (BOCR) merits arising from various influencing factors (criteria and sub-criteria…), and evaluates the priorities under benefit; opportunity; cost; and risk models via BOCR-ANP control sub networks individually for each of them and prioritize all factors; and the later to find the alternatives that are (best options & possible outcome), which is the most beneficial and offers best opportunities, and at the same time represents the lowest risk and the lower costs to yield a decision, as depicted in Figure5. Further, BOCR analysis enables a potentially richer analysis than a mere BC analysis, it determines the final possible outcomes (alternatives) through the trade-offs between the BOCR models in order to evaluate the economic feasibility of projects in PPP.

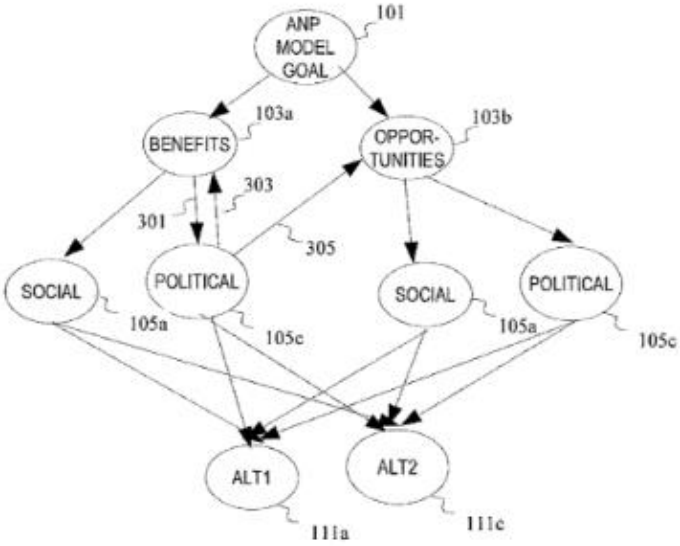

Figure 5. *Procedure to process an ANP control structure with feedback*

Table 1. *Different methods for Public–private partnerships (PPPs)*

Method	Key Note	Author(s)	Perspective	Topic
Dynamic Fault Tree		DEHLINGER et al.	Nuclear engineering and technology, vol.40 no.5 august 2008	Analyzing Dynamic Fault Trees Derived from Model-Based System Architectures
		Joanne Bechta Dugan		Developing a Low-Cost, High-Quality Software ToolFor Dynamic Fault Tree Analysis
		Hichem Boudali et al.	N A	Dynamic Fault Tree analysis using Input/Output Interactive Markov Chains
	Eksploatacja i Niezawodnosc – Mainten ance and Reliability Vol.14, No. 3, 2012	Yan-Feng LI Hong-Zhong HUANG	Applied the fuzzy Markov model to evaluate the reliability Of a complex mechanical system used in CNC machine centre	A new fault tree analysis method: fuzzy dynamic fault tree analysis
	International Journal of Chemical Engineering and Applications, Vol. 4, No. 3, June 2013	Ahmed Ali Baig et al.		DEVELOPMENT OF AN INTUITIVE MODELING METHOD FOR DYNAMIC SYSTEMS
	A Hybrid Bayesian Network (HBN) Framework to analyse dynamic fault trees	David Marquez et al.	Department of Computer Science, Queen Mary, University of London	Solving Dynamic Fault Trees using a New Hybrid Bayesian Network Inference Algorithm
		David Coppit et al.	Computer Science, The College of William and Mary Williamsburg, USA	Sound Methods and Effective Tools for Engineering Modeling and Analysis
BOCR models	Lulea University of Technology, Sweden 2016	K. Krishna Mohan et al.	A holistic model to assess the prototype dependability In software at prototype level in early in the software lifeCycle process.	Prototype dependability model in software: an application using BOCR models
	Mathematical and Computer Modelling 46 (2007) Elsevier	Diederik J.D. Wijnmalen		Analysis of benefits, opportunities, costs, and risks (BOCR) with theAHP–ANP: A critical validation

Markov chain		Yinpeng Zhang,2010	The developing and varying tendency of the forecasting data sequences of traffic volume	Predicting Model of Traffic Volume Based on Grey-Markov
		Michael J Garven,2008		Project financial risk analysis
		148 / JOURNAL OF PERFORMANCE OF CONSTRUCTED FACILITIES © ASCE / MAY 2006 148 / JOURNAL OF PERFORMANCE OF CONSTRUCTED FACILITIES © ASCE / MAY 2006 G. Morcous, A.M.ASCE Morcous A.M., ASCE,2006		Performance Prediction of Bridge Deck Systems Using Markov Chains

CONCLUSIONS

PPPs play an important role in bringing private sector competition to public infrastructure monopolies and in merging the resources of both public and private sectors to better serve the needs of the public that otherwise would not be met. The worldwide interest in PPPs, problems encountered in many countries and the substantial controversy over PPPs calls for an improved methodology for improved infrastructure and service delivery through PPPs. This paper proposes a systematic framework for infrastructure development through PPPs in general, on the realization that although there are many aspects that are project, sector, and/or country-specific, the concept, process and key principles in infrastructure and service delivery through PPPs are essentially identical. This framework integrates four broadly divided stages in the infrastructure and service delivery process, including (1) design of a workable concession, (2) competitive concessionaire selection, (3) financial regulation of the selected concessionaire during the concession period, and (4) periodic concession rebidding to allow new entry for the concession.

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