Developing the Success Index of Public-Private Partnership Transportation Projects in Vietnam

Thac Quang Nguyen, Dinh Thuc Le, and Duy Liem Nguyen

Abstract Like other construction projects, project success has always been the ultimate goal in Public-Private Partnership projects. However, it will be difficult for private and public sectors to define whether their projects have been successful or not if the success index is not considered. Thus, this study aims to construct a success indicator for Public-Private Partnership transportation projects in Vietnam via a case study. 15 success criteria were identified from a literature review and expert interview. Using factor analysis, four principal factors were grouped based on 15 identified success criteria, namely project objectives, reliable and quality service, effective output, and project management. Finally, the fuzzy synthetic evaluation (FSE) method computed the success index for Rach Mieu Bridge project is 4.15 which is considered as highly successful. This study might provide decision-makers with a quantitative tool to make the decision for implementing PPP projects effectively and assuring sustainable infrastructure development in Vietnam.

Keywords Success index · Public-Private partnership · Brigde project · Vietnam · Fuzzy synthetic evaluation

1 Introduction

Public-Private Partnership (PPP) emerged as an effective procurement in delivering infrastructure and public service. PPP schemes brought benefits in procurement for the parties. Nevertheless, not all PPP transportation projects are successful. The

T. Q. Nguyen (✉)
University of Transport and Communications, Campus in Ho Chi Minh City, Ho Chi Minh City, Vietnam
e-mail: ntquang@utc.edu.vn

D. T. Le
Department of Construction Management, Pukyong National University, Busan, South Korea

D. L. Nguyen
Ho Chi Minh City University of Technology and Education, Ho Chi Minh City, Vietnam

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Sydney Cross City Tunnel were examples of the failure of PPP procurement [1]. In fact, it will be difficult for private and public sectors to define whether their projects have been successful or not if the success index is not considered [2]. Therefore, this study aims to assess the success of PPP transportation projects in Vietnam by evaluating a success index for Rach Mieu Bridge project as a case study. This result will help both practitioners and researchers to be more depth understanding of the success model in PPP transportation projects in Vietnam for good investment decision making.

2 Literature Review

PPP nature is complex due to the huge amount of investment and long-term contractual periods [3]. Determining whether a PPP project is successful or not has still remained an ambiguous perception [4]. To select criteria for evaluating the PPP project success, it is essential to satisfy the general criteria of project success in the construction industry. Therefore, many authors have sought different ways to gain success for PPP projects, such as Tam [5], Yuan et al. [6], Kusljic and Marenjak [7], Villalba-Romero and Liyanage [8], Osei-Kyei and Chan [2]. Whereby, fifteen success criteria were identified from prior related studies.

3 Research Methodology

The process of research methodology is presented in Fig. 1.

4 Data Analysis and Result

A questionnaire survey is constructed based on fifteen success criteria for PPP transportation projects. The pre-test of the questionnaire was carried out with five experts who had many experiences regarding PPP transportation projects in Vietnam. As a result, fifteen success criteria were agreed upon by the consensus of five experts, and no criteria were suggested to add to the list. 21 valid questionnaires have received for one month. The obtained sample size is small. The low number could be explained as (1) PPP model in Vietnam is still a new model and (2) respondents who are working in PPP projects hold a conservative perspective towards sharing information leading to fewer practitioners are willing for participating in this investigation. However, the reliability of investigation is high because 42.9% of respondents had at least 10 years of experience regarding PPP transportation projects, 47.6% of the respondents had more than 5 years of experience and the remaining percentage had less than 5 years. Apart from this, the number of

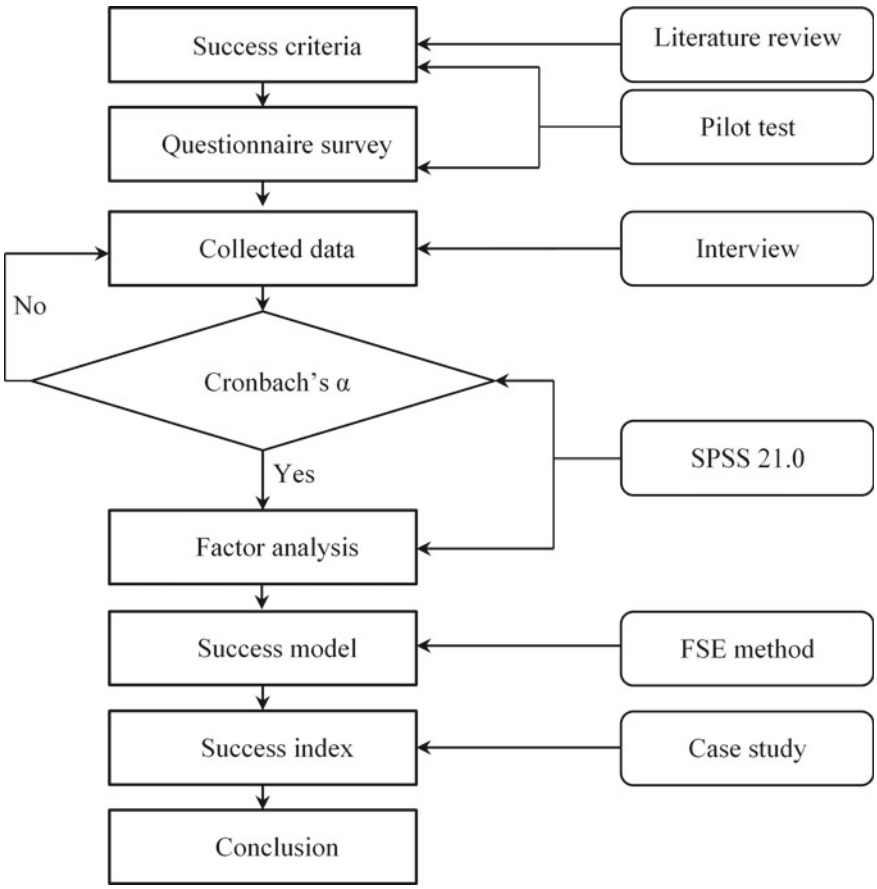

Fig. 1 Research methodology framework

respondents from the public sector accounts for 52.4% and the private sector of 47.6%. Majority of respondents is engineering with 38.1%, team leader of 33.3% and director accounts for 28.6%.

Cronbach's Alpha was utilized to consider the reliability and internal consistency of the obtained data. Cronbach's α value of the present study is 0.896 which greater than 0.70 [9]. Hence, the data of this investigation ensures for further analysis.

The factor analysis method is employed to group interrelated sub-variables into small groupings from a large number of factors. The value of Bartlett's test of sphericity is significant with the Chi-Square value of 218.647 and the associated significant level (p) is 0.000. In addition, the obtained KMO value is 0.610 which greater than 0.50 [10]. Therefore, the collected data is suitable for factor analysis. The principal component analysis using varimax rotation was adopted to extract the

principal factors. Four principal factors were established with eigenvalues greater than 1.0, explaining 78.756% of the total variance with factor loadings of success criteria exceed 0.50. Four principal groups are presented in Table 1.

FSE method is then used to establish a project success index from identified success criteria. FSE was a developed method from fuzzy set theory (FST). As a branch of FST, FSE is considered as a prominent method for multi-criteria synthetic evaluation in complex and uncertain environment [11]. The process of the FSE

Table 1 Weight (W) and membership function of success criteria and success groups

Factor groupings	W	MF of level 2	MF of level 1
G1. Project objectives	*0.405*		[0.00, 0.04, 0.18, 0.44, 0.35]
Local development	0.167	[0.00, 0.05, 0.14, 0.48, 0.33]	
Long-term partnership	0.165	[0.00, 0.05, 0.14, 0.52, 0.29]	
Contract disputes	0.161	[0.00, 0.00, 0.33, 0.38, 0.29]	
Equitable legal system	0.189	[0.00, 0.00, 0.05, 0.29, 0.67]	
Stakeholder satisfaction	0.167	[0.00, 0.00, 0.14, 0.62, 0.24]	
Environment impact	0.150	[0.00, 0.14, 0.29, 0.33, 0.24]	
G2. Reliable service	*0.191*		[0.00, 0.09, 0.22, 0.43, 0.26]
Service quality	0.335	[0.00, 0.10, 0.24, 0.38, 0.29]	
Productivity	0.318	[0.00, 0.14, 0.19, 0.52, 0.14]	
Technology transfer	0.347	[0.00, 0.05, 0.24, 0.38, 0.33]	
G3. Product output	*0.259*		[0.00, 0.03, 0.24, 0.42, 0.31]
Health and safety	0.216	[0.00, 0.10, 0.52, 0.29, 0.10]	
Profitability	0.246	[0.00, 0.05, 0.14, 0.48, 0.33]	
Achieving VfM	0.280	[0.00, 0.00, 0.10, 0.43, 0.48]	
Risk management	0.258	[0.00, 0.00, 0.24, 0.48, 0.29]	
G4. Project management	*0.145*		[0.00, 0.00, 0.17, 0.29, 0.55]
Completion in budget	0.494	[0.00, 0.00, 0.19, 0.29, 0.52]	
Completion on time	0.506	[0.00, 0.00, 0.14, 0.29, 0.57]	

Table 2 Coefficient of success index for PPP bridge and tunnel projects

Factor grouping	Index	Ranking	Coefficient*	Linguistic
Project objectives	4.10	2	0.251	Very important
Reliable service	3.85	4	0.235	Important
Product output	4.01	3	0.245	Very important
Project management	4.38	1	0.268	Very important
Total	16.34			

*Coefficient = DI of each group/ΣDI of all groups

method is described as detail in research of Osei-Kyei and Chan [12]. Using FSE method and mean score, the weight and membership function (MF) of each success criterion (level 2) and success criteria groups (level 1) is presented in Table 1.

Then, the success index of each group is computed by normalizing the MF of level 1 with a set of corresponding grade E = (1, 2, 3, 4, 5). For example, the group of project objective is calculated as follows:

Index of project objectives = [0.00, 0.04, 0.18, 0.44, 0.35] × (1, 2, 3, 4, 5) = 0.00 × 1 + 0.04 × 2 + … + 0.35 × 5 = 4.10.

Similarly, the remaining groups and the coefficients of factor groupings are summarized in Table 2.

Finally, success index is expressed as follows [12]:

$$\begin{aligned}\text{Success index} = {} & (0.268 \times \text{Project management}) + (0.251 \times \text{Project objectives}) \\ & + (0.245 \times \text{Product output}) + (0.235 \times \text{Reliable service})\end{aligned} \quad (1)$$

4.1 Calculating the Success Index for Rach Mieu Bridge Project

In order to illustrate the suitability of the above mentioned model, this section investigated and assessed the success of the Rach Mieu Bridge project which has implemented by the BOT model. This investigation relies on the information of the government's website, investor's website and the respondents who have involved in the Rach Mieu Bridge project. The average score of each criterion is computed according to the judgment of 16 respondents. The respondents were requested to rate based on a five-point Likert scale: 1—not reached; 2—fairly reached; 3—moderately reached; 4—highly reached; 5—extremely reached [12]. The result of the investigation is shown in Table 3.

Finally, by calculating the average score of each success criteria group, the success index for Rach Mieu Bridge project is defined by Eq. (1):

Success index of Rach Mieu Bridge project = (0.268 × 4.50) + (0.251 × 4.04) + (0.245 × 3.89) + (0.235 × 4.17) = 4.15.

Table 3 Average score of each success group in Rach Mieu Brige project

Code	Success criteria	Average score
G1.	Project objectives	4.04
G2.	Reliable service	4.17
G3.	Product output	3.89
G4.	Project management	4.50

Using the success evaluation model, the success index of Rach Mieu Bridge project is 4.15, mean that it is assessed as highly successful. Basically, this project has satisfied the expectations of stakeholder as well as selected criteria.

5 Conclusions

The previous studies noticed that there is no consensus in the perception of project success in the construction industry. In order to enrich refer to this knowledge, this study attempted to develop a success index for PPP transportation projects in Vietnam by a case study with the support of 15 identified success criteria and 4 success criteria groupings. This finding will help the government and private sector more depth understand in the success of PPP model in Vietnam, whereby the decision-makers might assess the success of other PPP projects in specific circumstances via the proposed model.

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