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IMPACTS OF RISK FACTORS ON THE PERFORMANCE OF PUBLIC-PRIVATE PARTNERSHIP TRANSPORTATION PROJECTS IN VIETNAM

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Abstract

The rapidly increasing demand and the inefficacy of financing transportation infrastructure project investments have contributed to various challenges for Vietnam in recent decades. Since the country's budget is inadequate for investing in all necessary infrastructure projects, the Vietnam government has been inviting other economic sectors, especially the private sector, to participate in infrastructure development. The cooperation between the government agencies and the private entities, called Public-Private Partnership (PPP), must encounter various challenges leading to difficulties in attracting private investors. A main reason is that private investors must deal with critical risks concerning PPP investment environment. It is a challenging task for the government to optimally manage such risks to enhance the attractiveness of PPP projects for private investors. This paper examines the critical risk factors that influence the private sector's investment decisions on PPP transportation projects in Vietnam. Risk factors inherent in typical PPP projects were compiled by comprehensive literature review. To reflect unique characteristics of PPP projects in Vietnam, the compiled risk factors were reviewed by a group of PPP experts from both the public and private sectors in Vietnam through in-depth interviews and questionnaire surveys. In addition, ten PPP project case studies in Vietnam were analyzed to derive the risk profile of PPP transportation projects of the nation. These risk factors were quantitatively assessed based on their probabilities and impact levels. We found that the critical risk factors of PPP infrastructure projects in Vietnam are acquisition/compensation problems, approvals and permits, inadequate feasibility studies, finance market issues, subjective evaluation methods, and change in laws and regulations. By performing factor analysis, these critical risk factors were grouped into four categories: (1) bidding process, (2) finance issues, (3) laws and regulations, and (4) project evaluation issues. These critical risk factors represent the obstacles that repel private investors from PPP transportation projects in Vietnam. Thus, the Vietnam government agencies should meticulously address these issues to attract both domestic and foreign private investors in PPP projects.

Keywords: Critical risk factors, Infrastructure, Public-Private Partnership, Risk management, Transportation projects, Vietnam

Introduction

In recent years, the Vietnam construction industry has encountered various challenges resulting from the rapidly increasing demand for infrastructure, the financial investment of which cannot be met. Infrastructure projects have mainly been funded by the government budget and bonds, the official development assistance (ODA) fund, and private investment capital. The government budget is however limited, and national and state-owned enterprise debt loads cannot continue increasing. Attracting investment through the government bonds is also ineffective due to low rates of return and illiquidity. Since Vietnam was excluded from the list of underdeveloped countries, the ODA fund has been limited. Thus, the private capital plays a more important role in infrastructure development. To attract more private investors, the government has been cooperating with the private sector in various forms of Public-Private Partnership (PPP).

Since 1993, a number of infrastructure projects, especially transportation infrastructure, in Vietnam have been developed in different forms of PPP such as Build-Operate-Transfer (BOT), Build-Transfer-Operate (BTO), Build-Transfer (BT), pilot PPP (issued in 2010), and new PPP (issued in 2015). The legislations regarding BOT, BTO, and BT projects issued at the end of 2009 [1] and revised in early 2011 have put the issues of capital owned by the private sector in the center. The government also introduced the pilot PPP regulation [2] for the implementation of a number of projects in which the public and private sectors collaborate and share the capitals. This pilot regulation assists as a basis for improving mechanisms, policies, and regulations in order to improve the performance of PPP investment. Later, a PPP legal framework has been added with a view to draw more investment from the capital, thus filling the existing financial gap. Moreover, it helps facilitate the implementation of feasibility studies, which forms a basis for determining the amount and the form of government support as well as a risk sharing mechanism among the relevant parties prior to the selection of project investors. Pilot PPP was implemented in parallel with BOT/BT/BTO legislation from 2010 to 2015. The legal framework for the pilot PPP projects is expected to form a basis for a more comprehensive PPP model [3]. More than 20 pilot PPP public services and infrastructure projects have been implemented very slowly, and many projects have stalled. The Dau Giay-Phan Thiet Expressway, 100 km expressway from Ho Chi Minh City to Phan Thiet coastal, was the first pilot PPP project in Vietnam. Since 2007, the Bitexco Group has been assigned as the first investor without tendering process, but since then has not been able to find other investors for this project. The latest regulation about consolidated PPP has just been issued and took effect from 10 April 2015 [4]. The new PPP regulations, which replaced the previously issued BOT/BT/BTO regulations [1] and pilot PPP regulations [2], are quite new for both the public and private sectors.

It is evident that the PPP transportation projects in Vietnam have encountered with various problems such as lack of transparency in the business environment, inadequate legal framework, and complex procurement procedure. Since the number of research works on this issue is extremely limited, this paper aims to identify, assess, and rank the critical risk factors affecting the performance of PPP transportation projects in Vietnam as well as uncovering critical risk groups based on factor analysis. Understanding the impacts of risk factors on transportation infrastructure performances would maximize the benefits of both Vietnam government and private investors in implementing this cooperative form of business.

Previous research

PPP infrastructure projects always encounter with challenges and critical risks that affect projects at various aspects, including project performance, organization, and environment. Moreover, risks in the PPP infrastructure development can be analyzed by risks related to investment associated with investment in new infrastructure, such as expanding the existing networks, building new facilities or renovating existing facilities; and operation-related risks regarding the operation and maintenance services.

Several research works have investigated different issues concerning the implementation of PPP projects and the performance of project participants. A primary step of risk management is to identify and categorize risk factors. Merna and Smith [5] divided risks in PPP projects into two key groups: systematic and unsystematic risk groups. The former includes political risk, legal, commercial, and environmental risk, whereas the latter consists of factors related to PPP project phases such as construction, design, operation, finance, and revenue risks. According to Toan and Ozawa [6], risk factors can be grouped into two main categories: general and project-specific. General risk was subdivided into political, commercial, and legal risks. Project-specific risk, which can be controlled by the stakeholders, was identified and analyzed based on the phases in project life cycle, namely, development, construction, and operation. Toan and Ozawa [6] made a verdict of more risks in the BOT projects in Vietnam according to the private partner. Besides, foreign investors concentrated on critical risks as many risks in a general risk group due to nine out of top ten critical risks of foreign private partner are general risk. By considering the top 20 critical risks of foreign private partner, there were 17 risks as the general risk. It may be interpreted that BOT infrastructure projects in Vietnam were less attractive to foreign investors.

For PPP construction projects in China, Xu et al. [7] identified 17 critical risk factors, which were classified into six groups: (1) macroeconomic, (2) construction and operation, (3) government maturity, (4) market environment, (5) economic viability, and (6) government intervention. Among these risks, the most critical ones were government intervention, poor public decision-making process, government corruption, financing risk, inadequate law, and supervision system. The study pointed out that government intervention and corruption be the major hurdles to the success of PPP highway projects in China. These may result from inadequate law and supervision system, and poor decision-making process of the public sector. In addition, Ongipattanakul [8] investigated critical risks in the operation phase of PPP projects in Thailand. Unsolvable dispute over user fees was the major cause for the main stakeholders' withdrawal from the project. The government's disapproval of a raise in toll fee, which resulted in poor revenue from the insufficient cash flow, led to late payment of the debt.

Regarding the underlying relationships, risk factors can be classified into groups of risk related to investment environment and project execution, such as politics, law, commerce, design and procurement, construction, and operation. The risk factors are listed in the respective groups as follows:

Category 1 – Politics

Threatening political risk governs the risk of actions at the central, provincial and local levels by governmental agencies [9]. More specifically, primary politics risks include government's intervention, delay in project approvals and permits, corruption, expropriation and nationalization, and political instability. A PPP scheme, if any contains politically sensitive content, should be turned down [10]. From the investors' perspective, carefully considering a

PPP project's political feasibility prior to submitting a concession proposal is essential since any political changes can increase the risk of failure in the project [11]. To mitigate this type of risks, the government should create an encouraging investment environment, catching the attention of potential investors for the PPP projects [12]. However, it should be noted that the experience of the public sector has not always been positive with PPP forms [13], so it might have a major impact on the implementation of the PPP projects.

Category 2 – Law

Law risks concern problems or adverse factors caused by deficiencies in the legal and institutional framework. Inadequate law and supervision system [7], change in laws and regulations [6,14], change in tax regulation [6,7] are common law risks that investors might face when investing in PPP projects. The complicated approval process which runs through different levels of administration also adds barriers to large PPP projects [15]. Bureaucratic administration systems, poor law implementation, and the incompetence of government staff are the main reasons leading to the failure of PPP projects.

Category 3 – Commerce

Commerce risks are risks related to finance and commerce of PPP projects. Finance is indispensable in any large construction project, especially PPP transportation projects. Indeed, evaluating the project's financial viability is the most common method to measure the capability of achieving its financial targets set by the stakeholders [16]. Whether the PPP project is a potential depends on the attractiveness of its financial market [17]. Financial market risk [14,18] and foreign exchange fluctuations [6,7,14] are adverse factors identified in previous works. Furthermore, inflation and interest rate are other common risks attributed to commerce risks. Indeed, the fluctuation of inflation and interest rate also led to the crisis in the construction industry. Unfortunately, these risk factors are of macroeconomic concerns and thus are inevitable. A volatile interest rate is undesirable for all sectors who participate in the project as it leads to worries about profits and/or return on equity. Another barrier is that the private investors are unable to assess the project capital via loans from financial institutions [19]; and the private sector would also have to pay additional interest in case they are incapable of paying the loads on time [20].

Category 4 – Design and procurement

Design and procurement risks display problems occurred into design and procurement phases of PPP projects. They include lack of transparency in the bidding, inefficient feasibility study, poor or incomplete project evaluations, poor decision-making process, conflicting or imperfect contract, breach of contract by government, unfair process of selection of the private sector, inadequate allocation of responsibility and risk, and low capacity of concession company [6,7,14,21] that related to bidding process and project evaluation issues. PPP contracts should be strictly applied the competitive bidding procedures. Bidding evaluation methods should also be transparent to ensure fair competition and to avoid inefficient investors [12,22]. Moreover, in order to attract investors in PPP projects, the issues related to the supporting incentive policies and state participation portion [9,22,23]must be main concerns of private investors.

Category 5 – Construction

Construction risks concern adverse factors related to construction phase of PPP projects. They include scope change of projects, land acquisition and compensation [6,7,14,24], problems due to partner's different practice[6,13], lack of supporting infrastructure [7,25] environmental protection risk [14], force majeure risk [6,7,14], and material/labor non-a vailability [7].

Category 6 – Operation

The operation risks are the major risks that would affect the future cash flows generated in the operation period. Payment risk, completion risk [7,14], early termination of concession by concession company [6], toll fee issues, demand risk, operator inability, cost escalation risks, and supply risks [21] are common factors for which project companies or investors held responsible in literature.

Investment in the PPP transportation projects is subject to high risk since there is high uncertainty in these types of transportation projects. Economic, political, social, construction, operational and other related risks issues have been recognized as crucial criteria for investment decision-making [6,26,27]. Risk assessment has been widely used to make investment decisions by the private sector [28]. Risk in investment environment under PPP projects was also found to profound influence the private sector's investment willingness.

Research Methodology

The research framework (see Figure 1) presents the process and techniques used in this research. Major steps consist of (1) identification risk factors in PPP transportation projects; (2) assessment the critical risk factors through Probability-Impact method; and (3) capturing multivariate interrelationships by factor analysis.

The identification of risks in PPP projects in Vietnam was made through literature as well as review on real practices. First, relevant literature helps produce a list of risks that facilitates the implementation of a pilot test, where data from experienced professionals were collected in order to finalize a questionnaire survey. The revised questionnaire was then distributed in a larger scale to respondents in PPP transportation projects in Vietnam. Probability and impact (*PI*) method (stated by Cooper et al. [29]) was applied to assess the combined risk level based on probability and impact of each risk factor. In this research, the professionals were asked to specify probability (rating 1 to 5) and impact (rating A to E), based on the five-point Likert scale. The respondents' opinions were then converted into numerical scales (from 0 to 1) [30,31] and analyzed. The combined risk level (*RL*) of such certain risk factors can be calculated based on *PI* method in the following:

$$RL = P + I - P \times I \tag{1}$$

where P = risk probability measured on a scale of 0 to 1

I = impact measured on a scale of 0 to 1

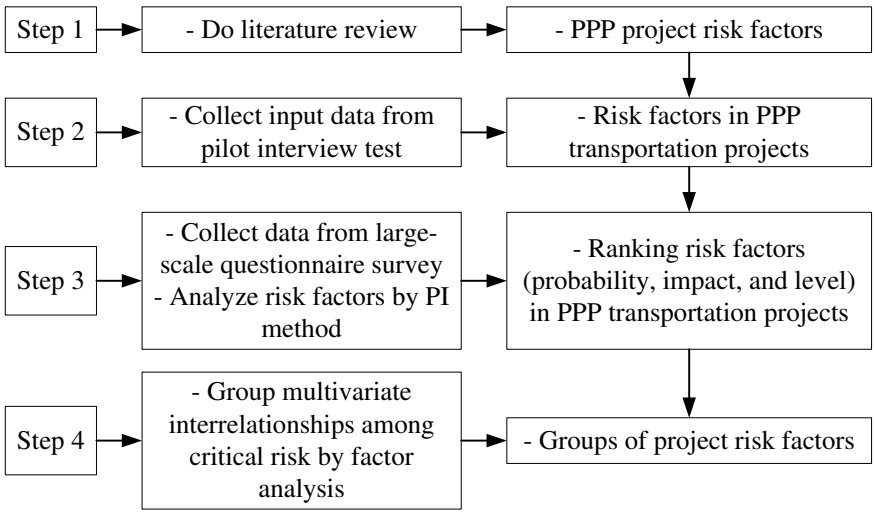

Figure 1. Research framework

All the risks are then classified into three levels, namely, high, medium, and low. Based on the research of Sy [30], the cut-off points between the high-risk and the medium-risk levels, and between the medium-risk and the low-risk levels were defined at $RL = 0.80$ and $RL = 0.45$, respectively (see Figure 2). These levels of 0.45 and 0.8 are validated by in-depth interviews with experience professionals in a pilot test.

The level of agreement as perceived between two survey groups, such as the public and private partners on their rankings of the critical risk factors (CRFs) is measured by the Spearman's rank correlation coefficient (r_s) as shown in Equation (2). The correlation coefficient, r_s, can take on values from -1 to +1. A perfect correlation of +1 or -1 indicates that the value of one variable can be determined exactly by knowing the value on the other variable [32]. If the correlation is near to 0, then it indicates that no linear relationship exists between the two groups of the variable. If r_s is significant under correlation test, the null hypothesis that no significant correlation between two groups on the rankings can be rejected. The Spearman's rank correlation coefficients are calculated by the following equation [33]:

$$r_s = 1 - \frac{6\sum d^2}{N(N^2-1)} \quad (2)$$

Where d = the difference in rank of the two groups for the same risk factors

N = the number of pairs of the risk factors being ranked.

This study employed factor analysis to capture multivariate interrelationships existing among the critical risk factors in terms of level of risk. Factor analysis addresses the problem of analyzing the structure of correlations among a large number of variables by defining a set of common underlying dimensions, known as factors or components [34]. Several tests are required to determine the appropriateness of factor analysis for factor extraction. They include Bartlett test of sphericity - a statistical test for the presence of correlations among the variables, the Kaiser-Meyer-Olkin (KMO) - the measure of sampling adequacy (MSA). Details of the factor analysis process and these tests can be found in Hair et al. [34].

Respondent's Characteristics

Literature review was conducted to establish a list of 38 project risk factors. The list was then reviewed by seven experienced professionals. Their feedback after the semi-structured interviews and group discussion serves to produce a revised list of risk factors that fit with the research context. Seven experienced professionals participated in the pilot test entailed two officers from the Ministry of Planning and Investment, a PPP investor, a consultant, a contractor, and two university lecturers. All professionals had at least ten years of experience in transportation projects in Vietnam. Each professional was provided list of risk factors and was asked to specify which factors affecting the performance of PPP projects, based on his/her experience. From this process, while easily agreed by seven professionals to keep the list of project risk factors, eight factors were removed, and three new factors were additionally suggested by them. Three new factors were added to the list, including "unclear about state participant potion", "breach of contract by government", and "inefficient feasibility study". Finally, 33 risk factors were collectively chosen by seven professionals. The questionnaire was then finalized and distributed to Vietnam experienced professionals related to PPP transportation projects in the large-scale survey. Face-to-face interview was selected so as to improve the rate as well as accuracy of the respondents' feedback. The respondents were divided into two groups: 1) the public sector and 2) the private sector. The private sector includes private investors, consultants, contractors, financiers and designers who are experienced in PPP schemes, while officers in relevant government department were targeted in the public sector. The questionnaire survey was conducted in Vietnam from August to October 2014, within which a total of 320 questionnaires was disseminated in Vietnam. The result was 123 valid responses received representing a response rate of more than 38 percent.

The proportions in response received from the different groups (Table 1) are 20.3% (25 out of 123) for the public sector, and 79.7% (98 out of 123) for the private sector. The total response rate for this research is 38.4% (123 out of 320 respondents). More than half (57.7%) of the respondents are line directors and project managers, followed by directors/deputy directors (23.6%) and project managers (34.1%). The proportions of the respondents in terms of number of experience years involved in construction are 43.1% (between 5 and 10 years) and 56.9% (10 years or more). More than 99% of respondents are mostly experienced in equal or more than one PPP projects. This implies that the research results can represent the opinions of a large group of PPP experts in Vietnam.

Table 1. Questionnaire Return Rate

Stakeholder	Questionnaire distributed	Response received	Response rate	Proportion (%)
Private sector*	277	98	35.4%	79.67%
Public sector**	43	25	58.1%	20.33%
Total	**320**	**123**	**38.4%**	**100.00%**

**The private sector includes private investors, consultants, contractors, financiers and designers.*

***The public sector includes the officers in relevant government departments.*

Results and Discussions

Ranking the Probability and Impact of Risks

By reviewing some research works of Toan and Ozawa [6], Xu et al. [7], Karim [35], Ke et al. [36], Hwang et al. [37], PPP case studies, and in-depth interviews with experienced professionals in Vietnam PPP market, 33 risk factors were identified as indicated in Table 2. General risks are subdivided into politics, law, and commerce categories. Project-specific risks are divided further into design and procurement, construction and operation categories. In order to check the internal consistency reliability of data, Cronbach's alpha coefficient has been conducted in this study. The reliability test returned a Cronbach's alpha coefficient of internal consistency value of 0.906 (>0.600), which is considered reliable.

Table 2. Risk Factors and Risk Categories

	Categories	No.	Code	Risk factors
General risks	**Politics**	1	P1	Government's intervention
		2	P2	Delay in project approvals and permits
		3	P3	Corruption
	Law	4	L1	Inadequate law and supervision system
		5	L2	Change in laws and regulations
		6	L3	Change in tax regulation
	Commerce	7	C1	Financial market risk
		8	C2	Interest rate fluctuations
		9	C3	Foreign exchange fluctuations
		10	C4	Inflation
Project-specific risks	**Design and procurement**	11	D1	Poor public decision-making process
		12	D2	Lack of transparency in the bidding
		13	D3	Subjective project evaluation method
		14	D4	Supporting incentive of government risk
		15	D5	Unclear about state participant portion
		16	D6	Conflicting or imperfect contract
		17	D7	Breach of contract by government
		18	D8	Inefficient feasibility study
		19	D9	Unfair process of selection of the private sector
		20	D10	Inadequate allocation of responsibility and risk
		21	D11	Low capacity of SPV
	Construction	22	Co1	Scope change of projects
		23	Co2	Land acquisition and compensation
		24	Co3	Problems due to partner's different practice
		25	Co4	Lack of supporting infrastructure
		26	Co5	Environmental protection risk
		27	Co6	Force majeure risk

Categories	No.	Code	Risk factors
Operation	28	O1	Completion risk
	29	O2	Early termination of concession by concession company
	30	O3	Toll fee issues
	31	O4	Payment risk
	32	O5	Demand risk
	33	O6	Operator inability

SPV: special purpose vehicle – project enterprise

The full ranking of the degree of Probability (P) and Impact (I) of 33 risk factors rated by different respondents are available from the authors on request. Table 3 shows the top 20 risks perceived as having high level of probability (P) and great impact (I). From these rankings, many risks have high rankings for both their degree of probability and impact. Examples are *land acquisition and compensation* (Co2), *delay in project approvals and permits* (P2), *inefficient feasibility study* (D8), *subjective project evaluation method* (D3), and *financial market risk* (C1). It can be said that these problems occurred under a wide range of causes, such as financial market conditions, project evaluation problems, land issues, as well as approvals and permits problems.

Table 3. Risk Factors with High Probability or High Impact

Rank	Risks as high probability	Mean	SD	Rank	Risks as high impact	Mean	SD
1	Land acquisition and compensation	0.718	0.149	1	Land acquisition and compensation	0.767	0.151
2	Delay in project approvals and permits	0.671	0.153	2	Delay in project approvals and permits	0.750	0.144
3	Corruption	0.586	0.214	3	Inefficient feasibility study	0.744	0.144
4	Inefficient feasibility study	0.581	0.175	4	Financial market risk	0.693	0.151
5	Lack of supporting infrastructure	0.568	0.175	5	Change in laws and regulations	0.689	0.136
6	Payment risk	0.567	0.155	6	Subjective project evaluation method	0.687	0.142
7	Inadequate allocation of responsibility and risk	0.565	0.134	7	Scope change of projects	0.661	0.153
8	Subjective project evaluation method	0.555	0.161	8	Interest rate fluctuations	0.654	0.140
9	Completion risk	0.552	0.166	9	Poor public decision-making process	0.654	0.175
10	Interest rate fluctuations	0.550	0.132	10	Demand risk	0.651	0.167
11	Financial market risk	0.549	0.161	11	Supporting incentive of government risk	0.646	0.147
12	Poor public decision-making process	0.547	0.179	12	Inadequate law and supervision system	0.645	0.136
13	Scope change of projects	0.546	0.184	13	Early termination of concession by concession	0.641	0.200

Rank	Risks as high probability	Mean	SD	Rank	Risks as high impact	Mean	SD
					company		
14	Unfair process of selection of the private sector	0.546	0.209	14	Toll fee issues	0.635	0.159
15	Change in laws and regulations	0.536	0.193	15	Lack of transparency in the bidding	0.633	0.18
16	Lack of transparency in the bidding	0.536	0.197	16	Corruption	0.633	0.177
17	Supporting incentive of government risk	0.536	0.172	17	Unfair process of selection of the private sector	0.622	0.182
18	Problems due to partner's different practice	0.534	0.142	18	Inadequate allocation of responsibility and risk	0.619	0.120
19	Demand risk	0.533	0.141	19	Low capacity of SPV	0.617	0.145
20	Inadequate law and supervision system	0.533	0.187	20	Inflation	0.615	0.156

Several risk factors, however, entailed high levels of probability but low levels of impact and vice versa. Although *change in laws and regulations* (L2) and *inadequate law and supervision system* (L1) were rated with medium levels of probability, their impacts were very high. In contrast, *corruption* (P3), *lack of supporting infrastructure* (Co4), and *inadequate allocation of responsibility and risk* (D10) were rated with great levels of probability and low levels of impact. These results correspond with those by Xu et al. [7], and Toan and Ozawa [6], which also investigated PPP in developing countries.

To carefully investigate which sectors and groups are responsible for these risk factors, risk categories were ranked in terms of their degree of probability and impact as shown in Table 4 and Table 5, respectively.

Regarding the degree of probability, both the public and private sectors agreed about the probability of risks related to “design and procurement”, “construction”, “law”, and “operation”. On the other hand, differences between the two sectors are found in the categories of “politics” and “commerce”. The public sector was of the view that “commerce” risks are most likely to happen, and the probability of “politics” risks is least likely. Meanwhile, the pattern of risk possibility was the reverse according to the private sector as they ranked “politics” first and “commerce” fourth.

As for the degree of impact of risks, the private sector considered “politics” and “commerce”, which ranked first and second respectively, to have profound impact on their execution in PPP projects. The public sector did not share these opinions with their private counterparts as these two risk categories were in turn assigned to fourth and fifth positions by the public sector. This ranking reflects concern of the private sector is political stability. Indeed, political stability as well as a transparent legal mechanism would more likely result in investors’ willingness to proceed with their works. At the present, the public sector has realized the importance of stable legal regulation and framework that support PPP. Therefore, they considered “law” related risks to have a massive impact on the execution of PPP projects in Vietnam. Evidently, the current Vietnam legal regulation and framework that serve PPP projects need revising soon.

Table 4. Ranking Degree of Probability of Risk Categories

Risk categories	Overall		Public sector		Private sector	
	Mean	Rank	Mean	Rank	Mean	Rank
Politics	0.558	1	0.442	6	0.587	1
Law	0.494	5	0.456	4	0.504	5
Commerce	0.532	3	0.508	1	0.538	4
Design and Procurement	0.524	4	0.467	3	0.538	3
Construction	0.537	2	0.486	2	0.550	2
Operation	0.493	6	0.449	5	0.504	6

Table 5. Ranking Degree of Impact of Risk Categories

Risk categories	Overall		Public sector		Private sector	
	Mean	Rank	Mean	Rank	Mean	Rank
Politics	0.664	1	0.586	4	0.684	1
Law	0.635	4	0.600	1	0.645	4
Commerce	0.642	2	0.577	5	0.658	2
Design and Procurement	0.636	3	0.595	3	0.647	3
Construction	0.598	6	0.538	6	0.614	6
Operation	0.616	5	0.597	2	0.620	5

Risk assessment

To deeply investigate the effect of critical risk factors on the performance of PPP transportation projects in Vietnam, combined risk levels (RL) were used to rank all the risk factors, as shown in Table 6. Figure 2 displays a risk contour diagram of all 33 risk factors. The diagram is divided into three zones, namely, low-risk level (no risk factor), medium-risk level (10 risks), and high-risk level (23 risks). The two factors that were ranked as least affecting PPP projects are force majeure, and environmental protection risk. Among 23 high-risk level factors (see Table 6), ten most critical risk factors (CRFs) were identified including(1) *land acquisition and compensation* (*Co2*), (2) *delay in project approvals and permits* (*P2*), (3) *inefficient feasibility study* (*D8*), (4) *financial market risk* (*C1*), (5) *subjective project evaluation method* (*D3*), (6) *change in laws and regulations* (*L2*); (7) *interest rate fluctuations* (*C2*); (8) *corruption* (*P3*); (9) *scope change of projects* (*Co1*); and (10) *supporting incentive of government risk* (*D4*). Most of the CRFs are risks related to pre-feasibility studies or feasibility studies phases of the PPP projects, such as the issues related to land acquisition/compensation, approvals and permits, feasibility study, financial market, change in laws/regulations, and corruption. It implies that Vietnam government might be facing great difficulties in attracting the participation of private investors during the initial phases of PPP transportation projects. Thus, a large number of current issues in PPP transportation projects in Vietnam must be addressed to attract the private sector. Top ten critical risks are analyzed as followings.

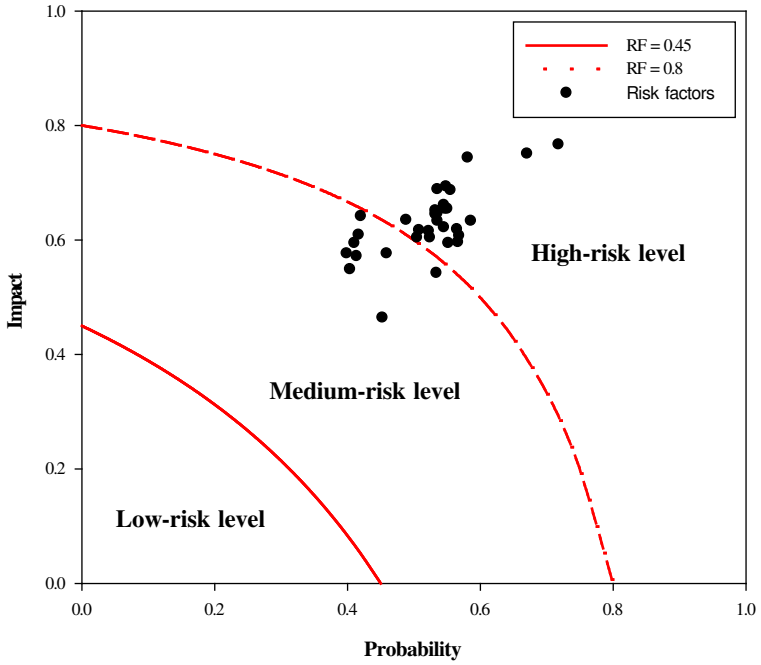

Figure 2. Risk contours diagram of the results

Table 6. Ranking Risk Factors Level

Code	Risk factors	Probability		Impact		Risk level		
		P	Rank	I	Rank	RL	Rank	Remark
Co2	Land acquisition and compensation	0.718	1	0.767	1	0.924	1	High
P2	Delay in project approvals and permits	0.671	2	0.750	2	0.912	2	High
D8	Inefficient feasibility study	0.581	4	0.744	3	0.878	3	High
C1	Financial market risk	0.549	11	0.693	4	0.852	4	High
D3	Subjective project evaluation method	0.555	8	0.687	6	0.851	5	High
L2	Change in laws and regulations	0.536	15	0.689	5	0.847	6	High
C2	Interest rate fluctuations	0.550	10	0.654	8	0.837	7	High
P3	Corruption	0.586	3	0.633	16	0.835	8	High
Co1	Scope change of projects	0.546	13	0.661	7	0.834	9	High
D4	Supporting incentive of government risk	0.536	16	0.646	11	0.829	10	High
D1	Poor public decision-making process	0.547	12	0.654	8	0.829	11	High
D10	Inadequate allocation of responsibility and risk	0.565	7	0.619	18	0.829	12	High
O5	Demand risk	0.533	19	0.651	10	0.828	13	High
L1	Inadequate law and supervision system	0.533	20	0.645	12	0.823	14	High
Co4	Lack of supporting infrastructure	0.568	5	0.607	22	0.813	15	High
O1	Completion risk	0.552	9	0.594	26	0.812	16	High
O4	Payment risk	0.567	6	0.596	25	0.811	17	High
D2	Lack of transparency in the bidding	0.536	16	0.633	15	0.811	18	High
C4	Inflation	0.523	22	0.615	20	0.809	19	High

Code	Risk factors	Probability		Impact		Risk level		
		P	Rank	I	Rank	RL	Rank	Remark
O3	Toll fee issues	0.489	25	0.635	14	0.808	20	High
D9	Unfair process of selection of the private sector	0.546	14	0.622	17	0.804	21	High
D6	Conflicting or imperfect contract	0.524	21	0.604	23	0.802	22	High
D11	Low capacity of SPV	0.508	23	0.617	19	0.801	23	High
C3	Foreign exchange fluctuations	0.505	24	0.604	24	0.790	24	Medium
O2	Early termination of concession by concession company	0.420	28	0.641	13	0.780	25	Medium
Co3	Problems due to partner's different practice	0.534	18	0.542	32	0.779	26	Medium
P1	Government's intervention	0.417	29	0.609	21	0.761	27	Medium
D5	Unclear about state participant portion	0.459	26	0.576	28	0.757	28	Medium
D7	Breach of contract by Government	0.411	31	0.594	27	0.752	29	Medium
L3	Change in tax regulation	0.414	30	0.572	30	0.740	30	Medium
O6	Operator inability	0.399	33	0.576	28	0.739	31	Medium
Co6	Force majeure risk	0.404	32	0.549	31	0.719	32	Medium
Co5	Environmental protection risk	0.453	27	0.464	33	0.691	33	Medium

Land acquisition and compensation (Co2)

Land acquisition and compensation risk was the most critical risk with a probability of 0.718, an impact of 0.767 (highest), and an *RL* of 0.924 (1st rank). In the case of Vietnam, land acquisition and compensation had to cope with a number of issues. For example, the government's proposed compensation price for land is lower than its actual market price. The situation is even more complicated when the compensation rates are different from one province to another. Other problems include corruption that happens in the compensation process [38,39], litigation, administrative delay, and non-availability of land on time for construction [40]. Moreover, under the pilot PPP regulations [2], the provincial people's committees are responsible for site clearance while the Authorized State is the entity party to the project contract. This separation of roles and responsibilities may lead to delays in land acquisition in practice if there is no timely and effective coordination [3]. *Corruption* (P3) issue was ranked 8th as a high critical risk factors in PPP projects. It may cause the delay of compensation process and lead to failures of PPP projects.

In addition, although the difficulties of land acquisition and compensation have been recognized and evaluated huge impact for PPP projects, analyzing and mitigation strategies for this issue were still not sufficient in Vietnam. Site clearance and compensation processes encountered several difficulties. These problems could affect the entire schedule and viability of the project. Therefore, the government must launch new appropriate policies to address these problems.

Delay in project approvals and permits (P2)

In most cases, the Vietnam government does not grant an approval on project-related issues on time, and sometimes they even cancel those approved previously [38]. The prolonged approval process is mostly due to a number causes such as incompetence and unprofessional of government officials, complex approval procedures, and change in laws and regulations. Some of the current laws and regulations have been amended many times in short periods, thus making them difficult to be applied practically. According to a study by Li et al. [41], the project approval and permit risk is difficult to be classified clearly into the public sector, the private sector, or shared allocation. It is logical that *delay in project approvals and permits (P2)* was ranked 2nd as very high critical risk factors. This implies that the legal and regulations for the PPP projects is currently problematic in Vietnam.

Inefficient feasibility study (D8)

In Vietnam, project proposals will be assessed and, if successful, be developed into a PPP potential project list. Based on the PPP project list, an Authorized State Body in Vietnam will conduct bidding documents in order to select a consultant to formulate the feasibility study (FS) report. In addition to the contents in the project proposal, the FS report must include an analysis of risks, rights and obligations of the parties [3]. Thus, it plays a leading role in the success of PPP infrastructure projects, especially PPP transportation projects. According to the in-depth interviews, FSs of PPP transportation projects in Vietnam were less efficient, ranking the 3rd in this study. It probably comes from the weak capacity of FS consultants and different viewpoints or disputes between the public and private sectors [42]. Feasibility study inefficiency, in many cases, is also caused by deliberately falsified FS data with a view to speed up the tendering process [43]. Consequently, FS report regularly requires adjustments several times, even changes. This may lead to the *scope change of projects* (Co1) which are also critical risk factors, ranking 9th. Therefore, in order to ensure the highest level of objectively possible feasibility studies, it is necessary to utilize the selective third-party consultants [44].

Financial market risk (C1)

Evaluating the project's financial viability is the most common method to measure the capability of achieving its financial targets set by the stakeholders [16]. Risk level of financial market in Vietnam is so critical (4th rank), thus making it difficult for private investors to draw investment into PPP transportation projects. Indeed, *high inflation* (C4-19th rank) and *fluctuation of interest rate* (C2-7th rank) led to the crisis in the construction industry. Unfortunately, these risk factors are of macroeconomic concerns and thus are inevitable. A volatile interest rate is undesirable for all sectors who participate in the project as it leads to worries about potential profits and/or return on equity. Furthermore, accessing to capital through loans from financial institutions by the private sector is also very difficult.

Subjective project evaluation method (D3)

Project evaluation process consists of many activities, such as design of the concession period, tariff structure, and market demand. The risk level of *subjective project evaluation method* in PPP transportation projects is so critical (5thrank). This result accords with previous research of Ke et al. [14], as well as Kert and Izaguirre [42]. Most of prior BOT/BT/BTO projects in

Vietnam have faced many complications with the concession period and market demand. For instance, Phu My Bridge BOT project has terminated by Phu My Corporation (PMC) during operating stage and return this project to Ho Chi Minh City People's Committee. The main reasons led to failure of Phu My Bridge are low traffic flow, low revenues, incomplete of link connection road to Phu My Bridge, and especially big problems with project evaluation issue. Therefore, it is necessary for the public and private sectors to produce comprehensive project evaluation method.

Change in laws and regulations (L2)

Laws and regulations in Vietnam are very complicated, and some of them contradict with each other. Transportation projects are required to be approved by several administration levels and various laws, decrees, decisions, circulars, and dispatches. The level of changes of laws and regulations risk (*L2*) is so critical. It received a critical value of 0.847, and which was ranked 6th. It led to unattractive of the investment environment in Vietnam to potential private investors. Although the public sector has improved many incentive policies for private investors, investment environment in Vietnam still did not attractive enough to increase capitals from the private sector. This is clearly reflected by the outcomes of this research, respondents evaluated the *supporting incentive of government risk (D4)* factor received a critical value of 0.829, which was ranked 10th on total 23 critical risk factors.

Factor analysis of risk levels

Concerning the attitudes of different sectors towards these risk factors, there were strong agreements on ranking based on the combined risk level (*RL*). These relations between rankings of two sectors are verified by hypothesis testing at the 1% significant level. The Spearman's correlation coefficients for ranking of the Probability and Impact of the risk factors between the public and private sectors are 0.500, and 0.673, respectively. Similarly, the Spearman's correlation coefficient for ranking of risk levels between the public and private sectors is 0.711. Table 7 summaries the Spearman's rank correlation coefficients and corresponding significant levels. It suggests that all the null hypotheses, which no significant correlation between the public sector and private sectors, can be rejected. It also implies a high degree of agreement (i.e, r_s from 0.5 to 1.0) between two groups on the level of probability, impact, as well as the level of risk factors [45]. Therefore, factor analysis in the further research can use the collection data from the public and private sectors without any matters.

Table 7. Spearman's Rank Correlation Coefficient Test between Groups for Risk Factors of PPP

Comparison		r_s	Sig.	Conclusion
Public sector ranking vs. Private sector ranking	Probability	.500	.010	Reject H_o at 1% sig. level, and thus accept the H_a
	Impact	.673	.000	Reject H_o at 1% sig. level, and thus accept the H_a
	Risk level	.711	.000	Reject H_o at 1% sig. level, and thus accept the H_a

H_o = No significant correlation on the ranking of PPP's risk factors between two groups.
H_a = Significant correlation on the ranking of PPP's risk factors between two groups.
Reject H_o if the significant level (p-value) is less than the allowance value of 5%, 1% (one-tailed).

The 23 risk factors in the high-risk level factors were then selected for factor analysis. That is, their means of risk level are approximate to or greater than 0.8 (Table 6). The various tests for the appropriateness of factor analysis were performed. As a result, 11 risk factors were ignored because they did not pass such tests. That is, if either communalities or their factor loadings in, at least a component is not greater than certain values, the variables should be ignored and factor analysis should be repeated from the first step. Each variable's communality, representing the amount of variance accounted for the factor solution for the variable, should be equal to, or greater than, 0.5 to have sufficient explanation [34]. As recommended in Hair et al. [34], with a sample size of this research around 123 - factor loading for each factor should exceed 0.495. Moreover, items had to display a 0.3 loading difference with any other factor to ensure discriminant validity [46].

The remaining 12 risk factors were appropriate for factor analysis. The value of Bartlett test of sphericity is 535.415 and associated significance level is small (p=0.000). These suggest that the population correlation matrix is not an identity matrix [34]. The correlation matrix shows that all variables have significant correlation at the 5% level. It implies that the deletion of any other problems is unnecessary. The value of the KMO MSA is 0.762, which is satisfactory for factor analysis [34].

The principle component analysis carried out produced a four-factor solution with eigenvalues greater than one. The varimax orthogonal rotation of principal component analysis was used to interpret these factors. The factor grouping based on varimax is displayed in Table 8. Four groups retained represent 69.8 percent of the variance of the 12 risk factors, deemed sufficient in terms of total variance explained. The groups and associated variables are explainable as: group 1 concerns bidding process issues, group 2 concerns finance issues, group 3 is laws and regulations issues, and group 4 concerns project evaluation related issues. The factor groups are elaborated further in the following section.

Discussion of factor analysis results

Bidding process problems

This factor group consists of *lack of transparency in the bidding* (*D2*), *unfair process of selection of the private sector* (*D9*), and *corruption* (*P3*). These issues were clearly caused by activities of stakeholders throughout tenderingprocess of PPP projects. Open competitive bidding is widely required in the regulations of PPP. Based on approved feasibility study reports, the government agencies will issue bidding documents and organize international tendering process for selection of project investors [2,4].

Table 8. Results of the Factor Analysis Using Varimax Orthogonal Rotation

Groups	Group labels	Eigenvalue	Percentage of variance	Risk factors	Factor loading
1	Bidding process problems	4.155	34.622	Lack of transparency in the bidding	0.862
				Unfair process of selection of the private sector	0.846
				Corruption	0.766
2	Finance issues	1.851	15.427	Interest rate fluctuations	0.837
				Inflation	0.758
				Financial market risk	0.671
3	Laws and regulations issues	1.235	10.290	Inadequate law and supervision system	0.880
				Change in laws and regulations	0.854
				Supporting incentive of government risk	0.615

Groups	Group labels	Eigenvalue	Percentage of variance	Risk factors	Factor loading
4	Project evaluation issues	1.139	9.493	Subjective project evaluation method	0.787
				Inefficient feasibility study	0.757
				Lack of supporting infrastructure	0.698

Lack of transparency in the bidding [47] and lack of competitive procurement [48] were very common complaints of the private sector. Since inequity and fraud in the bidding process were common in Vietnam [39], this has led to contracts being often awarded to incapable investors or contractors. Indeed, regarding to Dau Giay-Phan Thiet Expressway, the first pilot PPP project in Vietnam, there was no tender or bidding process even though the government had committed a fair playground in the PPP projects. As a result, Bitexco Group, a firm short on capital with a background in textiles, property and bottling water, was nominated as the first investor of this project (60% total investment capitals). Obviously, Bitexco Group was not a best choice to build a $757 million highway supported by World Bank in the first pilot PPP in Vietnam. Since 2007, the government has still been unable to find a second investor for this project through competitive tender. It had set a bad example for a country trying to get rid of a notorious reputation for corruption, bureaucracy and vested interests. Therefore, calling for investors to participate in PPP projects in Vietnam are currently facing several difficulties and challenges. Two root causes, including visible evaluation system have not been carried out properly and lack of ability of consultants/ investors for undertaking PPP projects, are common phenomena in Vietnam.

Moreover, the absence of transparent procurement processes can readily result in substantial corruption. The anti-corruption legal framework in Vietnam is considered the best legal framework for anti-corruption in Asia [49]. However, its implementation is facing with many problems such as lack of transparency, accountability, as well as low pay for government officials and inadequate system for holding officials accountable for their actions. Although corruption may cause quite significant loss, however, it is considered to have less severe impact in the Vietnam construction industry (ranking 16th in this research). The main reason could be because the majority of businessmen and entrepreneurs in Vietnam have become accustomed to corruption [38,50], thus making it as a common and acceptable practice. Corruption, however needs to be excreted out by suitable policies of the public sector to ensure fair competition and transparency in the future [50].

Finance issues

The factor grouping is made up of *interest rate fluctuations* (C2)*, inflation* (C4)*, and financial market risk* (C1). Finance is indispensable in any large construction project, especially PPP transportation projects. Indeed, evaluating the project's financial viability is the most common method to measure the capability of achieving its financial targets set by the stakeholders [16].

Funding for transportation projects in Vietnam over the recent years mainly came from the state budget, government bonds, official development assistance (ODA), and private capital (domestic and international). Funds from state budget, government bonds, and ODA cannot be expanded or still very ineffectively. Domestic private capital participation was very low because the government's attitude about private investment was inconsistent. In addition, the government did not expect efficiency from the domestic private capital and still did not carry out enough guarantees. Besides, stock market in Vietnam is still undeveloped, so to get long-term capital, investors could only rely on loans from commercial banks. However, since

mobilized capital from domestic commercial banks is mostly short-term, it should not be able to meet the needs of private investors.

The fluctuation of inflation and interest rate are considered macroeconomic conditions and are impossible to avoid. A volatile interest rate is undesirable for all sectors who participate in the project as it leads to worries about profits and/or return on equity. Furthermore, it makes private investors access to capital through loans from financial institutions very difficult [19]; and the private sector would also have to pay additional interest in case they are incapable of paying the loads on time [20].

Therefore, the government should use a combination of concessional resources and appropriate support policies to enhance the viability of PPP projects [11]. For instance, Vietnam government was constructing project development facility (PDF) (signed a loan agreement with the Asian Development Bank and Agence Française de Développement) and viability gap fund (VGF) to support viability of PPP projects which can attract the participation of both domestic and foreign investors.

Laws and regulations matters

This group consists of *inadequate law and supervision system* (*L1*)*, change in laws and regulations* (*L2*)*, and supporting incentive of government risk* (*D4*). These issues were clearly caused by deficiencies in the legal and institutional framework. Indeed, the Vietnamese laws and regulations system are very complicated, and some of them contradict with each other [39,51]. Besides, projects are required to be approved by several administration levels, from local to central [15]. Bureaucratic administration systems, poor implementation of the laws and the incompetence of government staff were considered the major causes of the failure of PPP projects.

Regarding the recent legislation related to PPP regulations [4], a lot of investors expressed their desire to invest. However, they are still afraid to face many legal issues related to private investment, unstable legal framework, as well as regulations about the incentive policies. In addition, the public sector and private investors in Vietnam mostly have little experience in implementation and management of PPP transportation projects. It is therefore very difficult for the private sector to deal and comply throughout regulations, especially new PPP laws in Vietnam.

As mentioned by Toan and Ozawa [6], a high risk in a developing country as Vietnam in the private sector's perception and the government's inappropriate policies caused the private sector to be less interested in the project. Moreover, in case of Vietnam, the respondents confirmed that current supports from the government for private investors are not attractive enough. Therefore, a solid legal framework and suitable supporting policies are needed to specify for the private sector and then could reduce the project risk, thus improving the success rate of PPP projects in Vietnam [48]. The government's regulatory policies are also required to increase the availability of private investment [23].

Project evaluation issues

Included in this factor are *subjective project evaluation method* (*D3*)*, inefficient feasibility study* (*D8*)*, and lack of supporting infrastructure* (*Co4*). These issues were clearly caused by the inadequate project evaluation method. Indeed, project evaluation and feasibility study assessment are crucial for any PPP transportation projects. For the public sector, competent state agencies shall organize bidding under regulations to select professional consultants to

assess the feasibility of PPP projects [2]. For the private sector, assessing the viability of PPP projects could enable them to make decisions to invest [20]. The private sector then defines the risk sharing scenarios under which a project becomes viable, incorporates risks, and expresses effective risk mitigation strategies. However, assessing the feasibility of the project in Vietnam experienced a lot of problems such as immature legal basis for PPP model [3], instability politics, lack of experience of the public sector [20], unrealistic forecast on future economic development and demand, low actual traffic revenues [38] and undefined public contributions of funds [48]. This has led to the difficulties in evaluating viability of PPP projects. In addition, the failure to appreciate fully the provision of infrastructure support is currently one of the most concerning issues in Vietnam [52]. For instance, PPP transportation projects in Vietnam, such as Binh Trieu II Road Bridge and Phu My Bridge, have gone to the operation stage, while their ring roads or connecting roads have not been completed as pre-construction obligations by the government in contractual commitments. It has led to low traffic volume and the actual flow of revenue lower than estimated. These factors present major implications for PPP prospects in terms of the clear need for improving infrastructure coupled with the associated challenge of evaluating viability of PPP projects.

Conclusions

The PPP form has been proclaimed as bringing a new age to infrastructure development in Vietnam. New PPP regulation and list of pilot PPP projects were expected to open up opportunities for foreign and domestic investors to penetrate into new markets in Vietnam. However, the risky environment of the PPP transportation projects in Vietnam are extremely critical and thus considered major barriers for further investment from private investors. The primary objectives of the paper are to investigate project critical risk factors and examine their underlying interrelationships. The respondents from the public and private sectors were asked to specify the risk factors affecting PPP project implementation. We found that there is no risk factor in the low-risk level, ten risk factors in the medium-risk level, and 23 risk factors in the high-risk level. The ten most critical risk factors in descending order of importance are (1) Land acquisition and compensation; (2) Delay in project approvals and permits; (3) Inefficient feasibility study; (4) Financial market risk; (5) Subjective project evaluation method; (6) Change in laws and regulations; (7) Interest rate fluctuations; (8) Corruption; (9) Scope change of projects; and (10) Supporting incentive of government risk. Clearly, these issues are directly associated with the entrance of private investors to capitalize in PPP transportation projects in Vietnam. It also decreases the investment willingness of private investors in PPP market in Vietnam. The acquisition and compensation problems, approvals and permits issues, and financial market matters are the critical factors that have an enormous impact on the success and/or failure of PPP projects. Hence, project evaluation issues (i.e., inefficient feasibility studies, subjective evaluation method) should be considered and assessed carefully by both the public and private sectors. For example, the feasibility study of PPP projects should be evaluated by independent consultants. Moreover, the new legal framework for PPP in Vietnam is quite new for both the public and the private sectors. Thus, it should be examined thoroughly, especially foreign investors.

Additionally, factor analysis was applied to deeper analyze the interrelationships existing among critical risk factors. Critical risk factors have been gathered into four main groups:(1) Bidding process problems, (2) Finance issues, (3) Laws and regulations matters, and (4) Project evaluation issues. “Bidding process” problems require the transparency, fairness, and

in-corruption in tendering process. Thus, the bidding process must be constructed carefully. Government should establish clear statements of evaluation criteria in bidding documents. "Finance" issues such as interest rate, inflation, especially financial market should be concerned by the government to ensure stability. The government can perform some support policies such as guarantees/insurances, or increasing the toll levels in accordance with inflation. On the other hand, private investors must construct financial risk profile in order to illustrate the impact of the financial price risk on the project value. This enables investors to be assured when participating in PPP projects. "Laws and regulations" matters help clarify and disseminate all necessary PPP regulations and supporting incentive policies of government in any PPP form. The state agencies should establish stable legal framework and appropriate policies for PPP, such as suitable guarantees, insurance for politics risk, and supporting incentives. Investors for PPP projects would like to obtain tariff adjusting or concession period extension guarantees. Furthermore, maintaining good relationship with government authorities is very necessary for the success of the private sector. "Project evaluation" is beneficial as it validates the economic feasibility of the project to both the public and private sectors. The public sector should select appropriately third-party consultants to ensure the highest possible level of PPP projects.

The results presented in this paper are very important for the Vietnam government to understand the current implementation situation of PPP transportation projects and to improve the policies for attracting both domestic and foreign private investors. Besides, private investors, who would like to invest in Vietnam, can realize current situations of previous PPP transportation projects to make their investment decisions. Moreover, the private investors would prepare suitable strategies to response to such risk factors that may occur during their investment process.

Further research should analyze the stakeholder's risk allocation for such critical risk factors in Vietnam's PPP transportation projects. The risk mitigation strategies of the public and private sectors should be also identified and analysed. These further research would be helpful for government and private investors to consider in the negotiation or feasibility stage, a significant stage of PPP transportation projects that could reduce the time and cost for negotiation stage.

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