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Risk Management in the Malaysian Public Private Partnership Projects

(*Pengurusan Risiko di dalam Projek Perkongsian Persendirian Awam Malaysia*)

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ABSTRACT

The Malaysian government has been implementing Public Private Partnership (PPP) program since 1980s for infrastructure development. The literature shows that quite a number of PPP projects failed to achieve their objectives due to lack of risk management. Nonetheless, literature on risk management process for different type of PPP projects is lacking. In addition, the literature does not provide the robust measurements to study PPP risk management as a variable in the field of risk management. Therefore, this study aims to describe risk management practices for PPP projects in Malaysia. To facilitate the empirical research, the current study develops a set of items for describing PPP risk management processes by employing exploratory sequential research design. The findings show existence of some forms of risk management in PPP projects where the agreement and design concept form a vital role in risk management.

Keywords: Public private partnerships; agreement; design concept; risk management

ABSTRAK

Kerajaan Malaysia telah melaksanakan Perkongsian Persendirian Awam (PPA) sejak tahun 1980 untuk pembangunan infrastruktur di negara ini. Kajian terdahulu menunjukkan beberapa projek PPA telah gagal mencapai objektif kerana ketiadaan pengurusan risiko. Walau bagaimanapun terdapat sangat sedikit karya mengenai proses pengurusan risiko untuk setiap jenis projek PPA. Tambahan pula, kajian terdahulu tidak menyediakan alat pengukuran yang mantap untuk mengkaji proses pengurusan risiko PPA sebagai pemboleh ubah dalam bidang sains sosial. Untuk membolehkan perlaksanaan kajian empirikal ini, satu set item pengurusan risiko telah dibangunkan melalui kaedah penyelidikan secara jujukan penerokaan. Penemuan kajian menunjukkan kewujudan amalan pengurusan risiko dalam projek-projek PPA, di mana konsep perjanjian dan konsep kaedah memainkan peranan penting.

Kata kunci: Perkongsian persendirian awam; perjanjian; konsep kaedah; pengurusan risiko

INTRODUCTION

The Malaysian government aims to promote the involvement of private sector for the provision of public services by using Public Private Partnership (PPP) (Ismail 2013a). Various factors such as increased innovation, reduction of public money tied up in capital investment, reduction of the total project cost, and local economic development, attract the Malaysian government to apply PPP as a tool for provision of infrastructure and public services (Ismail 2013b). In PPP projects a private concessioner designs, constructs and maintains the facility, and after the concession period, the ownership is transferred to government except in a few models of PPP (Ahmad, Ibrahim & Abu Bakar 2018a, 2018b).

Despite the benefits of PPP, quite a few numbers of PPP projects in Malaysia failed to achieve the desired objectives (Mohamad, Ismail & Said 2018). The National Audit Report ("Auditor General's Report" 2012, 2015 & 2016) highlights the issues of delay in constructions, lack of monitoring and risk management in the Malaysian PPP projects. Similarly, for Malaysian e-government PPP projects, Khadaroo, Wong and Abdullah (2013) reported the barriers that hinder the project objectives such as lack of clarity in contract, relationship risks and inaccurate costs assessment. All these issues are extreme risks for Malaysian PPP projects (Ahmad, Ibrahim & Minai 2017). Several studies have identified that organizations that are involved in PPP have not adopted proper risk management (Keers & Van Fenema 2018; Markom 2012). Likewise, for Malaysian Light Rail Transit (LRT) PPP project, Markom (2012) and Mottain (2017) reported the lack of risk management in handling demand risk, design risks and risk of technical feasibility.

Keers and Van Fenema (2018) claims that recent literature on risk management of PPP mostly emphasizes on risk identification and allocation as the strategy to manage the risks while few studies consider only risk identification (Ahmad et al. 2018; Hwang, Zhao & Gay 2013). Moreover, studies on PPP around the globe focused on risk ranking or risk allocation only (Li et al. 2005; Ahmad et al. 2017). Apart from Fischer et al. (2010), the discussion on risk management in PPP projects is scant. Some researchers have suggested that a better understanding of risk management in PPP projects may lead to achieving the desired objectives (Fischer et al.

2010, Grimsey & Lewis 2004; Nguyen, Imamura & Iuchi 2017).

Prior literature indicates that many types of PPP projects implemented around the globe (Ahmad et al. 2018a; Li 2003), therefore, the Malaysian government has also adopted various types of PPP projects (Ahmad et al. 2018a). As the nature of PPP project is distinct from a normal project due to the involvement of public and private sector, the definition of PPP project success and risk management may differ from that of other projects (Ahmad, Ibrahim & Minai 2018; Osei-Kyei & Chan 2018). In addition, the scale and measurement for risk management as a variable for PPP studies are not well defined in the existing literature. Therefore, the empirical studies on PPP risk management are scant.

In order to enable empirical studies to be undertaken on PPP risk management it is vital to first develop the measurement of the risk management variable. Thus, this study aims to develop the measurement for PPP risk management and to describe the risk management process implemented in PPP projects. The findings from this study may contribute to the better understanding on managing risks in PPP projects. Moreover, the development of robust measurement may guide researchers to explore factors that affect the risk management. Furthermore, explanation of risk management process may help practitioners to better assess, treat and monitor the risks in PPP projects.

PPP PROJECTS

Public Private Partnership (PPP) has been employed as a tool for the provision of infrastructure and public service (Yescombe 2011). The increase significance of PPP in infrastructure development is reflected in the establishment of a specialized department/unit that initiates and monitors PPP projects. Table 1 depicts the number of specialized PPP units in different region of the globe.

TABLE 1. PPP units in different regions

Sr.	Regions	Number of PPP Units
1	Sub-Saharan Africa	9
2	Middle East and North Africa	3
3	East Asia and the Pacific	18
4	South Asia	18
5	Europe and Central Asia	48
6	Latin America and the Caribbean	14
7	North America	9
	Total	119

Source: World Bank

Malaysian government has employed various types of PPP for the development of infrastructure since the year 1980s (Ismail 2013a). In Malaysia, Unit Kerjasama Awam Swasta (UKAS) was established in April 2009 as a separate department under the direct supervision of the Prime Minister of Malaysia to improve PPP activities (Official Portal UKAS n.d). UKAS does not represent a party in the contract/PPP agreement however it facilitates the respective government ministry to establish PPP agreement and monitors all PPP projects. Moreover, UKAS also evaluates the feasibility of project under PPP and finds private partner for the project through bidding.

The Malaysian PPP project starts when a specific ministry initiates the project and develops the need statement with UKAS. Ahmad et al. (2018a) explained that a Special Purpose Vehicle (SPV) is created after a systematic procedure and granted a contract to build and maintain the facility for certain concession period. After the concession period, the ownership is transferred to government. In some type of PPP projects, the SPV collects revenue/unitary charges directly from users and in few cases, government directly pays rentals to SPV (Ahmad et al. 2018a).

There is a wide variation of definitions for PPP (Kostyak et al. 2017). The Prime Minister's PPP department in Malaysia defines PPP as "[a] form of cooperation between the public-private partnership in which a standalone business created, funded and managed by the private sector as a package which includes the construction, management, maintenance, repair and replacement of public sector assets include buildings, infrastructure, equipment and facility" (Official Portal UKAS" n.d).

Although consensus on one definition of PPP does not exist in the literature, however, it reveals the agreement on some common characteristics of PPP (Peters 1998; Li 2003; Akintoye, Beck & Hardcastle 2008). First, PPP comprises of two or more players; a public organization and a private entity. Second, the partners act individually as a principal. Third, PPP is a continuous long-term partnership that creates long-term relationship, whereas, the relationship is one-off transaction. Fourth, each player/partner must have some form of contribution in terms of resources such as capital or land to create the partnership. Lastly, each player/partner share responsibilities, risks and outcomes. These characteristics are different than conventional partnerships and leads to the distinct nature of PPP.

The involvement of both public and private sectors makes PPP project a complex arrangement as they possess different requirements and objectives throughout the PPP project life cycle (Fischer et al. 2010; Nederhand & Klijn 2018). Table 2 list the different objectives of the various stakeholders in PPP projects.

Due to differences in objectives, both public and private partners have difference in perception about the critical issues. For instance, Ahmad et al. (2017) described the difference of perception between public and private partners about critical risks. Similarly, Mohamad et al. (2018) highlighted the difference in perception between SPV and government about performance indicators. Moreover, Nederhand and Klijn (2018) found that stakeholder involvement does not lead to a better project performance as the difference in perception about critical

TABLE 2. Objectives of different stakeholders in PPP

Stakeholders	Objectives
Government	Efficiency benefits PSC
	Leveraging of public funds PPP
	Early and rapid project implementation
	Good service quality
	Adherence to statutory requirements and provisions
SPV	Adequate profit margins
	Adequate return and strategic potential for business activities IRR
	Maximisation of returns and high long-term current income
Debt provider	Full repayment and interest payments at scheduled time
	Promotion of development objectives (development banks)
	Conservative financial analysis and modelling assumptions

Source: Fischer et al. (2010)

issues that leads to conflict in objectives. The distinct nature of PPP project therefore, creates the need to define and develop the construct for PPP risk management.

RISK MANAGEMENT

Risk management can broadly be defined as a systematic process in managing an organization's risks to achieve objectives. Fischer et al. 2010 and Li (2003) explained PPP risk management process that includes risk identification, risk analysis, risk allocation, risk mitigation and, risk monitoring. Xia et al. (2018) explained the risk management process as collection documents and making plans, identification and classification, analyzing and assessing, responding, and controlling project risk.

Similarly, ISO 31000 (2009), a globally accepted risk management standard, elucidates that a risk management process involves risk assessment, risk treatment and risk monitoring. Risk assessment includes the process of risk identification, risk analysis and risk evaluation Risk treatment covers formulation of risk mitigation policies including risk allocation. Risk monitoring refers to continuous review of strategies to assess and treat the risk.

METHODOLOGY

This study adopts exploratory sequential research design (Cresswell 2013) to describe the risk management process for PPP projects and to develop the measurement items for PPP risk management. The method is carried out in three phases.

In the first phase, interviews were conducted to understand the risk management process for PPP. Interviews were conducted based on the guidelines of Groenewald (2004). In the interviews, the respondents were asked to share the experience about managing risks in PPP projects. The interviewees have been selected from both the public and private sectors as both contracting parties are likely to have different perception about the risks (Ahmad et al. 2017). All the twenty-eight interviewees have experience of at least 5 years in the field of PPP and are currently engaged in PPP projects. Atlas ti8.0 is used to arrange the interview data and to generate some themes. Based on the themes and important quotations of interviews, this study describes the risk management process for PPP projects, and the operational definition of PPP risk management and derive a large pool of items to measure risk management in PPP projects.

In the second phase, the large pool of items was presented to the risk management faculty members at Universiti Utara Malaysia. Based on suggestions and brainstorming, the pool was shriveled to 44 items. For content validity of 44 selected items, the study selected 10 experts from the field of risk management and public-private partnership to validate.

In the third phase, after the validation of items a survey was conducted to assess reliability and dimensionality. The study applied Exploratory Factor Analysis (EFA) to extract the factor/dimensions and to validate the construct. The main limitations for EFA are large sample size and selection of extraction and rotation method. In order to get the overall perspective of both public and private partners, the study selected two respondents from one project (i.e. one from public and other from SPV). The study received 152 forms out of 200.

INTERVIEW FINDINGS

The Atlas ti 8.0 generates the report of interview quotations for theme/codes. These reports help to elucidate the phenomena in the form of diagram (Appendix A). The detail of risk management process as follows:

a. Risk Management IN PPP Projects

In Malaysian PPP projects, risk management process is not carried out separately, however it is a continuous process that starts at the planning stage. In this process, risk assessment is conducted at the planning stage and risk

treatment is carried out at the planning, construction and operation stage. In addition, risks are properly monitored at all stages. The figure (Appendix A) represents the risk management process. The density and groundedness explain the importance of code. The density refers to the attachment of code to other codes and groundedness refers to number of important quotations attached to each code. The detailed risk management process is as follows:

b. Risk Assessment

Risk assessment process includes risk identification, risk analysis and evaluation.

Risk Identification Based on findings of interviews, the risk identification process is conducted at the planning stage after the selection of SPV. This risk identification process is separated into technical risk identification, financial risk identification and legal risk identification.

In the technical risk identification process, a committee of experts comprising of experts from both the public and private partners is formed. Based on the requirements of respective ministry, the SPV presents the "Design Concept". After the discussion of officials (UKAS official, Ministry officials and SPV) on design concept, SPV prepares the detailed design concept. The technical experts highlight all potential technical risks such as the risks of project selection, design, construction and operation. Moreover, technical experts enlist all critical risks in design concept. A clear and detailed design concept depicts the better risk identification. After the technical risk identification, a committee of financial experts is formed. Finally, a committee of legal experts is formed to highlight the legal risks. Financial risk identification process focuses on macroeconomic and financial risks while the legal risk identification process discusses and records different issues of permits, tax rules and political hostility.

Risk Analysis and Evaluation For Malaysian PPP projects the risk analysis and evaluation are based on experts' judgment. The process of risk analysis and evaluation measures the risks in terms of frequency of occurrence and the severity of loss. The detailed design concept explains the possible impact of the identified risks. Moreover, in risks analysis and evaluation the risks are ranked based on criticality and documented in the agreement. This analysis plays a crucial role in agreement development as all risks are mentioned in different clauses.

In risk assessment the design concept plays a vital role as it depicts project design and assessment of SPV about the critical risks and the budgeted statements.

Design Concept: The design concept is detailed document that explains all critical aspects of the PPP project. SPV presents the detailed design concept and government approves the design concept. A detailed design concept many aspects and some are listed below;

1. All critical risks and their categories.
2. Possible impact of the risk and expected severity of the risks.
3. Budgeted cost statements such as budgeted financial costs, budgeted construction costs and budgeted operational costs.
4. Budgeted cash flows based on expected demand.
5. List of guarantees required from government. The guarantees of the government help the SPV to get loan on favourable terms, however, lack of government guarantees increase the cost of finance.
6. Construction design that contains; detailed schedule of construction, technology requirement, material specifications, workforce requirements and imported material (if any).
7. Operational design that includes; expected date of commencement of operation, required frequency of maintenance, schedule of maintenance, case of expected disruption in operation, measurement of service quality. Although, finalized KPIs are stated in agreement but design concept state the procedure of measurement of service quality.
8. Design concept states the recommended risk treatment plans for all mutual risks and for the risks that belongs to SPV.

The approval of a design concept is a lengthy process. First, SPV presents the initial design concept then experts from UKAS, government and SPV discuss the design concept and finalize after thorough meetings. The final design concept is submitted to ministry for approval. The respective ministry consults experts for evaluation of design concept and approves after consultation. The ministry may suggest revisions based on consultations.

c. Risk Treatment

In PPP projects, risk treatment includes risk allocation and risk mitigation.

Risk Allocation The risk allocation is carried out with mutual consent of all parties involved in project. The risk allocation of each type of PPP project is different. Though UKAS database has the risk allocation chart/formula for each type of PPP project actual risk allocation may differ from the chart. Furthermore, not all risks are transferred to SPV or government, some risks are shared as well. All allocations of important risks are part of the agreement.

Risk Mitigation Strategies Risk mitigation strategies are carried out at all stages: planning, construction and operation. Although, respective partners develop risk mitigation strategies for their respective risks, however, both government and SPV jointly develop relevant strategies at the planning stage.

For risk mitigation, the agreement is a vital document because it states risk allocations and most of mitigation strategies. A clear agreement is a tool for effective risk mitigation particularly, relationship risks. It defines contracting parties' roles, responsibilities, ownership, duties and span of control. The actual agreement includes many other important aspects such as definition of key terms, effective date of commencement and unitary charges.

d. Risk Monitoring

Risk monitoring is a continuous process to evaluate the occurrence of any risk at any stage of PPP projects. Project Monitoring Committee (PMC) and Dispute Resolution Committee (DRC) are formed to monitor the project and meetings are often held on a quarterly basis. Conventionally, each committee contains equal number of representatives from both government ministry and SPV. Sometimes, UKAS members are also part of PMC. The monitoring includes Key Performance Indicators (KPIs) and rules of arbitration which are derived at the planning stage. Generally, based on project type and sector of economy UKAS database keeps the KPIs however, experts formulate some specific KPIs at planning stage related to the project. Moreover, KPIs of all projects includes the general KPIs of safety, environment, water and sanitation. Based on KPIs, PMC assesses the performance of SPV.

OPERATIONAL DEFINITION

The findings from the interview revealed that all the steps in risk management process stated in ISO 31000:2009 Risk Management Guidelines are undertaken by PPP projects in Malaysia. Thus, PPP risk management can be defined as a continuous process that comprises of risk assessment, risk treatment and risk monitoring. Risk assessment includes risk identification and risk analysis. Risk assessment mainly consists of listing the risks, evaluation of risk and assessment of risk in design concept. Risk treatment comprises of risk allocation and development of risk mitigation strategies. The parties responsible to manage identified risks and most of the risk mitigation strategies are stated in agreement. Risk monitoring process comprises of development of KPIs, formation of PMC and DRC, and review of risks.

DEVELOPMENT OF MEASUREMENTS

Based on themes extracted from interview, the study derives the pool of 44 measurement items for PPP risk management construct. Lynn's (1986) method of content analysis was conducted. In this method, a form was prepared that states the definition/domain of variable. Research experts are approached to rate the items based on the stated domain. Based on the ratings, the results of content validity (Appendix B) are presented in the form of item-content validity index (I-CVI), construct validity index (C-CVI) and ratio of agreed expert to all experts. The threshold value for this study for each item (I-CVI) is 0.6 (Lynn 1986; Devillis 2012). All items have values more than threshold value.

SELECTION OF SCALE

To conduct the EFA and reliability of the measurement items, the study needs numeric values for each measurement item. Devillis (2012) and Sekaran and Bougie (2016) suggested to use 5-points Likert scale if measurement items are worded as declarative sentences and phenomena needs agreement or disagreement of the respondents. Therefore, this study adopts 5-points Likert scales to measure the agreement of the respondent based on their experience.

EXPLORATORY FACTOR ANALYSIS

EFA divides the pool of items in small groups that are named as factors/dimension. Each factor contains few items out of the pool of items. Yong and Pearce (2013) explain the fundamental steps of EFA; patterned relationship, sampling adequacy and extraction of factors.

PATTERNED RELATIONSHIP

The most important statistical bias for EFA is dataset and to ensure the suitability of the dataset for EFA, the patterned relationship through correlation matrix is examined. The patterned relationship reveals the possibility of extraction of factors from pool of items through correlation matrix and Bartlett's Test of Sphericity. In addition, confirmation of patterned relationship authenticates the absence of multicollinearity amongst the items. Furthermore, Yong and Pearce (2013) asserted that determinant score of the correlation matrix should be higher than 0.00001 and correlation among variables should be less than 0.9. In addition, the Bartlett's Test of Sphericity determines the significant level of patterned relationship. The Bartlett's Test of Sphericity ensures that p-value should be less than 0.05.

In order to adjust the determinant score for patterned relationship, a few items; RA3, RA5, RA6, RA7, RA11, RT3, RT4, RT4, RT5, RT9, RT10, RT11, RT13, RT15, RT16, RM4, RM5, RM6, RM7 and RM8 have been deleted to achieve determinant score 1.53E-005. In addition, the p-value of Bartlett's Test of Sphericity is less than 0.05 (Table 3) and correlation values of all items is less than 0.9 (Appendix C) that authenticate the patterned relationship.

TABLE 3. Kaiser-Meyer-Olkin test

KMO Measure of Sampling Adequacy.		0.780
Bartlett's Test of Sphericity	Approx. Chi-square	1.572e3
	Df	300
	Sig.	0.000

Moreover, for the sample adequacy, the value of KMO value should be higher than 0.5 and diagonals values should also be more than 0.5 (Field 2013; Yong & Pearce 2013). The Table 1 shows 0.780 KMO value that is acceptable. In addition, the diagonal values of anti-image matrix are greater than 0.5. Thus, sample size for this study is adequate.

FACTOR EXTRACTION AND ROTATION

For extraction of factors, the decision of extraction method and rotation is crucial. This study selects the Principle Axis method and varimax as rotation as the study intends to find dimensions (latent structure) (Conway & Huffcutt 2003). Furthermore, this study adopts the Kaiser criterion and scree plot method to decide the number of factors retained (Conway & Huffcutt 2003; Costello & Osborne 2005; Yong & Pearce 2013). In Kaiser criterion, the rotated sum of extracted eigenvalues should be more than one and the scree test involves the graph of the eigenvalues to decide about number of factors by observing the bend/break in the data curve. The number of data points above the break are the number of factors to retain. Table 4 clearly depicts that Rotated Sums of Squared Loadings for first 3 factors is greater than 1. Moreover, scree plot also shows the bend at factor 4. Thus, all items of risk management are divided in three factors. The factor matrix and rotated factors illustrate the items in each factor. The details of three factors are:

FACTOR 1

Factor 1 (Table 5 & 6) consists of 10 items. The factor loadings of all items are more than 0.5 that is acceptable except RA1, however it is included due to content analysis and its importance. Furthermore, the main reason of inclusion of RA1 is the importance of listing risks at planning stage that is the main function of risk identification (ISO 31000 2009). All the items in this factor belong to risk assessment; therefore, the first factor is named as "Risk Assessment".

FACTOR 2

Factor 2 (Table 5 & 6) contains 10 items of "Risk Treatment" which have factor loadings more than 0.5 that is acceptable criterion.

FACTOR 3

Factor 3 includes five items (Table 5 & 6) which measure the risk monitoring; therefore, this factor is named as "Risk Monitoring". Table 3 depicts that all the items of risk monitoring have factor loadings more than 0.5.

TABLE 4. Total variance explained for risk management items

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.096	20.383	20.383	4.541	18.163	18.163	4.272	17.087	17.087
2	4.22	16.878	37.261	3.637	14.549	32.712	3.849	15.395	32.482
3	2.717	10.866	48.127	2.137	8.548	41.26	2.195	8.778	41.26
4	1.403	5.61	53.738						

Extraction Method: Principal Axis Factoring

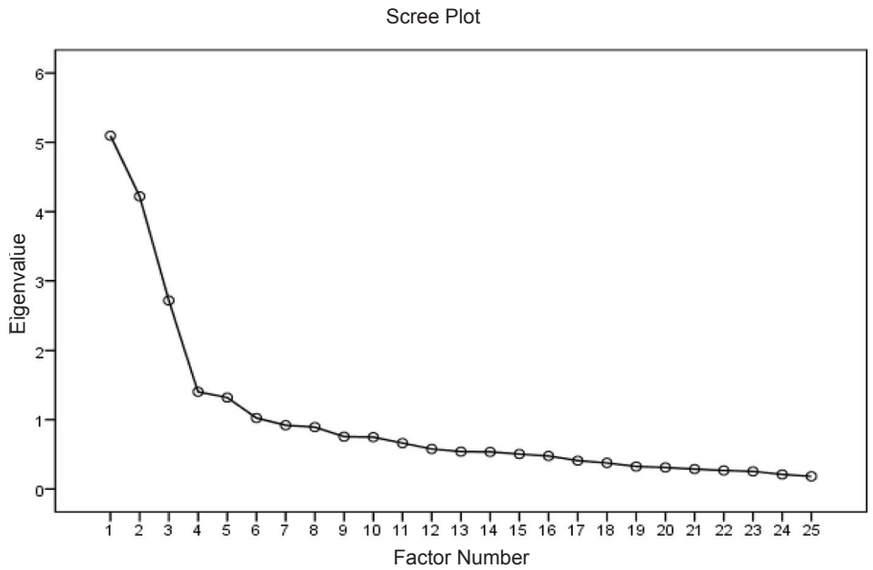

FIGURE 1. Scree plot

TABLE 5. Factor matrix

	Factors		
Items	1	2	3
RA12	0.703		
RA2	0.690		
RA13	0.594		
RA10	0.591		
RA4	0.546		
RA14	0.530		
RA15	0.530		
RA9	0.508		
RA8	0.489		
RT2	-0.488		
RA1	0.439		
RT1		0.577	
RT6		0.567	
RT18		0.561	
RT17		0.561	
RT19		0.522	
RT14		0.515	
RT12		0.432	
RT7		0.423	
RT8		0.414	
RM2			0.693
RM1			0.665
RM9			0.662
RM3			0.57
RM10			0.504

Extraction Method: Principal Axis Factoring.

TABLE 6. Rotated factor matrix

	Factor		
Items	1	2	3
RA12	0.801		
RA2	0.723		
RA10	0.692		
RA13	0.676		
RA9	0.658		
RA4	0.645		
RA14	0.607		
RA15	0.590		
RA8	0.581		
RA1	0.444		
RT6		0.689	
RT18		0.689	
RT1		0.664	
RT2		0.656	
RT19		0.654	
RT17		0.633	
RT14		0.556	
RT8		0.547	
RT7		0.532	
RT12		0.499	
RM2			0.710
RM9			0.679
RM1			0.668
RM3			0.586
RM10			0.521

Extraction Method: Principal Axis Factoring.

RELIABILITY

Finally, this study computes the Cronbach's alpha, a coefficient to test the reliability of the PPP risk management construct. In general, the agreed lower limit for Cronbach's alpha is 0.70 (Cronbach 1951). This study calculates the Cronbach's alpha for each factor separately. For risk assessment, the overall Cronbach's alpha is 0.872 (Table 7). Moreover, the individual item's total correlation is above the acceptable criterion of 0.33 (Ho 2006). In addition, the value of Cronbach's alpha if item is deleted, for each item is below the overall Cronbach's alpha that is satisfactory except RA1. This study keeps this item because RA1 investigates the listing of risks.

TABLE 7. Risk assessment

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
RA1	0.410	0.877	0.872
RA2	0.675	0.853	
RA4	0.601	0.859	
RA8	0.551	0.863	
RA9	0.601	0.859	
RA10	0.631	0.857	
RA12	0.741	0.848	
RA13	0.632	0.857	
RA14	0.558	0.862	
RA15	0.558	0.862	

Table 8 depicts the overall Cronbach's alpha 0.857 for risk treatment and the corrected correlation for all items is more than 0.838 which is acceptable (Ho 2006).

TABLE 8. Reliability of risk treatment items

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
RT1	0.604	0.840	0.857
RT2	0.605	0.840	
RT6	0.635	0.838	
RT7	0.500	0.849	
RT8	0.503	0.849	
RT12	0.460	0.852	
RT14	0.513	0.848	
RT17	0.582	0.842	
RT18	0.631	0.838	
RT19	0.599	0.841	

The overall Cronbach's alpha is 0.765 for risk monitoring and the corrected correlation for all items is more than 0.694 (Table 9). However, the item RM10 with a value of 0.769 is retained as the content validity score is 1. In addition, RM10 is the only item that investigate the function and jurisdiction of the DRC.

TABLE 9. Reliability of risk monitoring items

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
RM1	0.582	0.706	0.765
RM2	0.617	0.694	
RM3	0.493	0.737	
RM9	0.591	0.705	
RM10	0.413	0.769	

DISCUSSION

The study described PPP risk management process and developed the construct. The results of EFA divides the risk management construct into three factors which confirms to ISO 31000 (2009) description that PPP risk management comprises of risk assessment, risk treatment and risk monitoring. Moreover, the description of risk management process confirms the argument of Steyn (2002) that risk management is consistent with theory of constraints because it identifies, analyze, counter and monitor the risks which might be the constraints for the projects. In addition, the vital role of design concept in PPP risk management is coherent with the findings of Mohammad et al. (2018). Similarly, the study findings about the clarity of agreement is also consistent with the prior literature (Ahmad et al. 2018a). Thus, PPP risk management process comprises of risk assessment, treatment and monitoring, moreover, design concept and agreement are crucial aspects of PPP risk management.

LIMITATIONS

The study has few limitations, first, the study includes the respondents from the private partners and public ministry, whereas, due to limited information the debt provider is not included. However, the debt provider is an important stakeholder. Second, cross-sectional survey was adopted for this study in which data was collected in limited time of eight months. The problem of using the cross-sectional survey is that the studied variables might change over time.

CONCLUSION AND FUTURE RESEARCH

The study concludes that PPP risk management process is continuous process of risk assessment, treatment and monitoring. Moreover, the design concept and agreement play a vital role in PPP risk management. The study contributes to the existing knowledge by developing the construct for PPP risk management based on the unique nature of the PPP project. Thus, the findings of this study can be generalized to all PPP projects around the globe whereas, the risk management in other project may differ from PPP risk management. The findings from this study help stakeholders to better understand the risk management process in PPP project. Moreover, practitioners should incorporate the role of design concept and agreement for better risk management process.

Future research may focus on confirming the presented construct and empirical relationship between the risk management and other variables such as; project success and project performance. To examine any empirical relationship of PPP risk management, Confirmatory Factor Analysis (CFA) should be carried out. In addition, further research may add more measurements in the construct. However, certain factors likely to be considered during confirmation or empirical research of presented construct. First, the dataset must be large for confirmatory factor analysis or hypothesis testing. Secondly, future research must consider at least two stakeholders; government and SPV, because of the difference in perception of these partners. Thirdly, the future studies should consider the different types of PPP project while conducting the survey.

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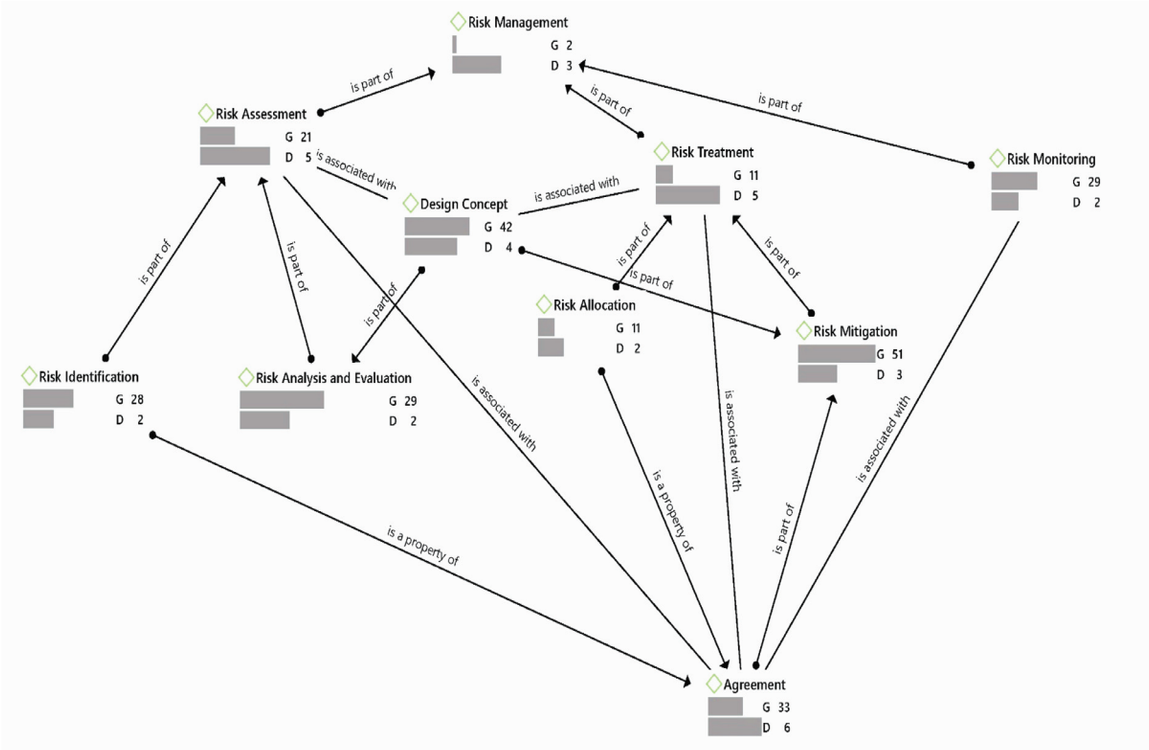
APPENDIX A. RISK MANAGEMENT



APPENDIX B. CONTENT VALIDITY ASSESSMENT

Codes	Items	Experts										Number of Experts agree	I-CVI
		1	2	3	4	5	6	7	8	9	10		
	Risk Assessments												
RA1	At the planning stage, experts have listed all possible risks	4	4	4	4	4	4	4	4	4	4	10	1.00
RA2	Experts have identified causes and sources of volatility of macroeconomic and natural variables (e.g. inflation, interest rate, weather, geological condition)	4	4	3	4	3	2	3	3	4	3	9	0.90
RA3	Experts have prepared the list of all "laws and regulations" and 'permits/approvals" which are mandatory to comply	4	4	4	3	3	4	3	4	4	4	10	1.00
RA4	Experts have documented the time required for each phase of PPP project	4	4	3	4	4	3	4	4	3	4	10	1.00
RA5	Experts have defined the terms "Working Condition of Assets" and "Corruption" in the agreement	4	4	3	4	3	2	3	3	4	3	9	0.90
RA6	Experts have defined the terms "Nationalization" and "Force majeure" in the agreement	4	4	3	4	4	3	4	4	3	4	10	1.00
RA7	SPV officials have listed the required material, labour, staff and engineering skills in the design concept	4	4	3	4	3	2	3	3	4	3	9	0.90
RA8	SPV officials have prepared the budgeted cost statements (i.e. cost of finance, construction and operations)	4	4	3	3	4	3	3	4	4	4	10	1.00
RA9	SPV has prepared the list of required guarantees from the government	4	4	4	4	4	4	3	4	4	4	10	1.00
RA10	SPV officials have listed the available financial instruments for debt	4	4	3	4	4	3	4	4	3	4	10	1.00

Codes	Items	Experts										Number of Experts agree	I-CVI
		1	2	3	4	5	6	7	8	9	10		
RA11	At the planning stage, the government has clearly explained project objectives, and requirements to SPV	4	4	4	4	3	4	4	4	4	4	10	1.00
RA12	Experts have defined the terms "Major Defect", "Minor defect", "breech of agreement", "associated penalties" in the agreement	4	4	4	4	3	3	2	3	4	3	9	0.90
RA13	Experts have assessed the impact of penalties on unitary charge of SPV	4	3	4	4	4	4	4	4	4	4	10	1.00
RA14	Experts have assessed the probability and impact of volatility of economic, financial, construction and operational variables	4	4	4	3	4	4	4	4	4	3	10	1.00
RA15	Experts have ranked the risks	4	4	4	4	4	4	4	4	4	4	10	1.00
	Risk Treatment												
RT1	The agreement states the risk allocations (i.e. risks belong to the SPV, government and shared risks)	4	4	4	4	3	4	4	4	4	4	10	1.00
RT2	The agreement states the "roles/responsibilities of SPV & government" and "conditions of arbitration"	4	4	3	4	3	2	4	3	4	3	9	0.90
RT3	The Agreement states the formula for SPV compensation in case of Nationalization/expropriation	4	4	3	4	3	3	2	3	4	3	9	0.90
RT4	The Agreement states the formula for compensation of SPV in case of default of government	4	3	4	4	4	3	4	4	3	4	10	1.00
RT5	The Agreement states the depreciation method and dispose-off method for assets	4	4	3	4	3	4	3	3	4	3	10	1.00
RT6	In the operation stage, the SPV preserves the right to request for increment in "Unitary Charge" in the case of any sudden increase in cost	4	4	3	4	2	3	3	3	4	3	9	0.90
RT7	The design concept states the risk treatment plan	4	4	4	4	4	4	4	4	4	4	10	1.00
RT8	The risk treatment plan includes the risk mitigation policies	4	4	4	4	4	4	4	4	4	4	10	1.00
RT9	The design concept includes the policies of hiring competent staff for operation and construction stage	4	4	3	4	2	2	3	3	3	3	8	0.80
RT10	The design concept includes the procedure and required time to attain the mandatory permits	4	4	3	4	3	2	3	3	4	3	9	0.90
RT11	The Design concept includes the schedule of "construction phases" and "Maintenance in Operation"	3	4	3	4	3	2	3	3	4	3	9	0.90
RT12	The SPV officials have presented the design concept within the specified time	4	4	3	4	2	3	2	4	3	3	8	0.80
RT13	The Design Concept includes feasible technological method to build and operate the project	2	4	3	4	3	3	3	3	2	3	8	0.80
RT14	The SPV officials have prepared the financial viability report for investors	4	4	3	2	3	4	3	3	4	3	9	0.90
RT15	The SPV has contracted with material and labour suppliers for continued supply	4	4	3	4	3	3	3	3	4	3	10	1.00
RT16	The SPV takes guarantees from material and labour suppliers	4	4	3	4	3	2	3	3	4	3	9	0.90
RT17	The government has published the project feasibility report	4	4	4	4	4	3	3	4	4	3	10	1.00
RT18	The government has provided sufficient guarantees to the SPV	4	4	3	4	3	4	4	3	4	3	10	1.00
RT19	The UKAS keeps record of the risks that are not mentioned in the agreement	4	4	3	4	3	3	3	3	3	3	10	1.00
	Risk Monitoring												
RM1	The agreement states the Key performance indicators (KPIs) for construction and operations	4	4	4	4	4	4	4	4	4	4	10	1.00
RM2	The agreement defines the role and responsibility of Project Monitoring Committee (PMC)	4	4	3	4	3	3	3	3	4	3	10	1.00

Codes	Items	Experts										Number of Experts agree	I-CVI
		1	2	3	4	5	6	7	8	9	10		
RM3	PMC has the full access to all records/files/drawings and other project related documents	4	4	4	4	4	3	4	4	4	4	10	1.00
RM4	The PMC has authority to halt the project at any time in case of any discrepancy	4	4	3	4	3	4	3	3	4	3	10	1.00
RM5	PMC conducts regular inspections and review-meetings at construction and operational stage	4	4	3	4	3	4	3	3	4	3	10	1.00
RM6	PMC records of actual values of macroeconomic variables (e.g. inflation, interest rate)	4	3	4	4	4	4	4	3	4	4	10	1.00
RM7	PMC compares the actual values of operational variables (e.g. productivity, service quality, cost of operations) with KPIs	4	4	3	4	3	4	3	3	4	3	10	1.00
RM8	PMC has formulated the review strategies for the variables which are not in accordance with KPIs	4	4	3	4	4	3	4	4	3	4	10	1.00
RM9	PMC settles the SPV unitary charge in the case of any inflationary/deflationary trend	4	4	3	4	3	4	3	4	4	4	10	1.00
RM10	The agreement states the functions and jurisdiction of Dispute Resolution Committee (DRC)	4	4	3	4	4	3	4	4	4	3	10	1.00
	I-CV I= Number of Experts Agree/Total Number of Experts												
	S-CVI = Sum of all I-CVI Values/Total Number of Items											S-CVI	0.84
	S-CVI/UA = Total items for which all experts agrees/ Total Number of items											UA	0.73

APPENDIX C. CORRELATION TABLE

	RA1	RA2	RA4	RA8	RA9	RA10	RA12	RA13	RA14	RA15	RT1	RT2	RT6	RT7	RT8	RT12	RT14	RT17	RT18	RT19	RM1	RM2	RM3	RM9	RM10
RA1	1	0.413	0.309	0.374	0.225	0.254	0.393	0.288	0.147	0.22	-0.11	-0.118	-0.033	-0.115	0.012	-0.096	0.168	0.146	-0.086	-0.167	0.074	0.146	0.239	0.179	0.392
RA2	0.413	1	0.469	0.341	0.499	0.549	0.565	0.464	0.46	0.377	-0.047	-0.24	-0.135	-0.12	-0.2	-0.085	-0.04	-0.031	-0.121	-0.119	-0.035	0.016	-0.057	0.014	0.175
RA4	0.309	0.469	1	0.5	0.387	0.462	0.531	0.419	0.382	0.281	0.021	-0.09	-0.048	-0.074	-0.031	-0.007	0.082	0.05	0.034	-0.017	0.04	0.135	0.016	0.015	0.11
RA8	0.374	0.341	0.5	1	0.443	0.303	0.496	0.334	0.334	0.316	0.063	-0.104	-0.034	0.033	0.095	-0.079	0.108	-0.014	-0.025	-0.14	0.039	0.054	-0.013	-0.064	0.144
RA9	0.225	0.499	0.387	0.443	1	0.559	0.501	0.345	0.387	0.402	0.062	-0.046	-0.063	0.054	-0.064	0.123	0.043	0.056	0.098	0.045	0.016	-0.054	-0.093	0.006	-0.003
RA10	0.254	0.549	0.462	0.303	0.559	1	0.591	0.44	0.352	0.401	0.07	-0.121	0.037	-0.133	-0.174	-0.083	0.032	-0.012	-0.012	-0.026	-0.021	-0.03	-0.021	-0.008	-0.044
RA12	0.393	0.565	0.531	0.496	0.501	0.591	1	0.58	0.434	0.422	-0.057	-0.188	0.016	-0.127	-0.073	0.018	0.081	0.064	-0.094	-0.081	0.019	0.144	-0.002	0.021	0.06
RA13	0.288	0.464	0.419	0.334	0.345	0.44	0.58	1	0.496	0.551	0.04	-0.13	-0.007	-0.068	-0.073	0.044	-0.012	-0.023	-0.105	-0.085	0.08	0.078	-0.011	-0.016	-0.033
RA14	0.147	0.46	0.382	0.334	0.387	0.352	0.434	0.496	1	0.521	0.048	-0.163	-0.059	-0.069	-0.123	0.059	-0.085	0.012	-0.073	0	0.038	0.019	0.007	-0.092	-0.042
RA15	0.22	0.377	0.281	0.316	0.402	0.401	0.422	0.551	0.521	1	-0.096	-0.068	-0.045	-0.012	-0.047	-0.028	-0.044	-0.026	-0.133	-0.104	-0.017	-0.065	0.003	-0.018	0.013
RT1	-0.11	-0.047	0.021	0.063	0.062	0.07	-0.057	0.04	0.048	-0.096	1	0.468	0.52	0.422	0.339	0.399	0.27	0.308	0.514	0.379	0.077	0.001	-0.017	-0.122	-0.06
RT2	-0.118	-0.24	-0.09	-0.104	-0.046	-0.121	-0.188	-0.13	-0.163	-0.068	0.468	1	0.549	0.392	0.521	0.245	0.237	0.421	0.368	0.406	0.036	-0.094	-0.031	-0.015	-0.042
RT6	-0.033	-0.135	-0.048	-0.034	-0.063	0.037	0.016	-0.007	-0.059	-0.045	0.52	0.549	1	0.328	0.429	0.256	0.398	0.421	0.387	0.475	0.009	-0.019	-0.006	-0.07	-0.042
RT7	-0.115	-0.12	-0.074	0.033	0.054	-0.133	-0.127	-0.068	-0.069	-0.012	0.422	0.392	0.328	1	0.535	0.292	0.266	0.223	0.305	0.28	-0.066	-0.095	-0.177	-0.187	-0.03
RT8	0.012	-0.2	-0.031	0.095	-0.064	-0.174	-0.073	-0.073	-0.123	-0.047	0.339	0.521	0.429	0.535	1	0.157	0.339	0.221	0.281	0.254	0.098	-0.063	-0.09	-0.118	-0.04
RT12	-0.096	-0.085	-0.007	-0.079	0.123	-0.083	0.018	0.044	0.059	-0.028	0.399	0.245	0.256	0.292	0.157	1	0.281	0.344	0.434	0.384	0.045	-0.042	-0.005	-0.087	-0.122
RT14	0.168	-0.04	0.082	0.108	0.043	0.032	0.081	-0.012	-0.085	-0.044	0.27	0.237	0.398	0.266	0.339	0.281	1	0.612	0.361	0.317	-0.102	-0.073	-0.048	-0.109	-0.019
RT17	0.146	-0.031	0.05	-0.014	0.056	-0.012	0.064	-0.023	0.012	-0.026	0.308	0.421	0.421	0.223	0.221	0.344	0.612	1	0.456	0.455	-0.022	-0.038	0.014	0.092	0.024
RT18	-0.086	-0.121	0.034	-0.025	0.098	-0.012	-0.094	-0.105	-0.073	-0.133	0.514	0.368	0.387	0.305	0.281	0.434	0.361	0.456	1	0.621	0.007	-0.082	-0.13	0.02	0.057
RT19	-0.167	-0.119	-0.017	-0.14	0.045	-0.026	-0.081	-0.085	0	-0.104	0.379	0.406	0.475	0.28	0.254	0.384	0.317	0.455	0.621	1	-0.024	0.025	-0.139	-0.071	-0.032
RM1	0.074	-0.035	0.04	0.039	0.016	-0.021	0.019	0.08	0.038	-0.017	0.077	0.036	0.009	-0.066	0.098	0.045	-0.102	-0.022	0.007	-0.024	1	0.612	0.402	0.492	0.221
RM2	0.146	0.016	0.135	0.054	-0.054	-0.03	0.144	0.078	0.019	-0.065	0.001	-0.094	-0.019	-0.095	-0.063	-0.042	-0.073	-0.038	-0.082	0.025	0.612	1	0.433	0.411	0.335
RM3	0.239	-0.057	0.016	-0.013	-0.093	-0.021	-0.002	-0.011	0.007	0.003	-0.017	-0.031	-0.006	-0.177	-0.09	-0.005	-0.048	0.014	-0.13	-0.139	0.402	0.433	1	0.371	0.279
RM9	0.179	0.014	0.015	-0.064	0.006	-0.008	0.021	-0.016	-0.092	-0.018	-0.122	-0.015	-0.07	-0.187	-0.118	-0.087	-0.109	0.092	0.02	-0.071	0.492	0.411	0.371	1	0.447
RM10	0.392	0.175	0.11	0.144	-0.003	-0.044	0.06	-0.033	-0.042	0.013	-0.06	-0.042	-0.042	-0.03	-0.04	-0.122	-0.019	0.024	0.057	-0.032	0.221	0.335	0.279	0.447	1

a. Determinant = 1.53E-005