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## The Review on Risk Identification and Risk Allocation in PPP Model

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### **Abstract:**

*Public private partnership (PPP) is the important and effective mechanism to introduce a big project for one country. Because PPP project is a large project, generally it consumes high amount of financial investment and involves with various risks. Risk management in PPP is one of the keys to project success as it needs the most suitable sector to handle every specific kind of risk that may happen through the whole project life. This paper conducts a summary and resume of two significant risk processes, risk identification and risk allocation on PPP infrastructure project. Risk identification part includes the mechanism, procedure and the principle risks that may appear on each PPP project from many countries. Moreover, preferred risk allocation from three different countries, the UK, Nigeria and China, will be summarized and compared whether they should be retained by public sector, allocated to private sector or both of them share it together.*

**Keywords:** *Public-private partnership, risk identification, risk allocation*

### **1. Introduction**

Infrastructure such as transportation, information and communication technology (ICT), energy, electricity, the management of water sewerage and waste disposal are significant for country's development. Basic structure and facilities developments like airports, roads, railways, water supplies, bridges, telecommunications or any utility services have an important role in every country in all perspective especially in economy (Joseph, 2011). Apart from increasing the quality of life, it also facilitates the investment by attracting the investors, including foreign investors when it was planned to construct by using PPP model.

Nowadays, Public Private Partnership (PPP) plays an important role of project development no matter in developed countries or developing countries. It was used in several infrastructure projects (Josef, 2014). PPP has been accepted as an effective method to bring a value of money for the above-mentioned public infrastructure and services. This model was used over past 30 years worldwide (Wang, 2019). This also includes that PPP is searching for the combination from benefit of competitive bidding and the negotiation and to have risk allocation on the contract between government or public sectors and business unit or private sectors (Ke, 2010). It is the practical funding way for management to develop infrastructure in country (Nguyen, 2018). In risk management, it is suggested that when public sectors and private sectors share risks together, it will affect PPP projects' success because both sides consider more about each other opinions (Joseph, 2011). They work and collaborate more efficient to bring better outcomes services. PPP model was promoted in the beginning of 90s by the government of many countries due to its effectiveness of funding and running the large-scale project. PPP is a model in many types of project such as transportation, power infrastructure, telecommunications, education, etc. Globally, PPP are applied for different kind of infrastructure construction with many successful projects (Lina, 2016).

### **2. PPP Model**

The National Council for Public-Private Partnership, USA (2009) defined a public-private partnership (PPP) as "a contractual agreement between a public agency (federal, state, or local) and a private sector entity." (Ke, 2010). The definition of PPP described by World Bank is a long-term agreement or contract between public sector and private partner in order to provide services, which are in charge of the government but manage by private sector (Lina, 2016). Another definition of PPP given by Akintoye cited by Ibrahim (2006) is a "contractual agreement of shared ownership between a public agency and a private company, whereby they pool resources together and share risks and rewards to create efficiency in the production and provision of public or private goods". Moreover, the relationship of public and private sector can be realized based on the risk and benefit they share together. Public sector needs efficiency of investment and services while private sector get advantages from social and economy (Pu Ming Shu, cited by Nguyen, 2018). The contract usually lasts 25-30 years or longer covering both construction and maintenance of infrastructures in the country. This also

includes management of government’s property for example schools and hospitals (Nguyen, 2018). Therefore, it is unavoidable to apply public private partnership for infrastructure project (Martinus, 2006). PPP model has a complex relationship because it associates with many stakeholders so this complex relationship between stakeholders can be recognized by the contracts. Moreover, this kind of relationship can also give a long period of sustainable approach to improve the country’s capacity in a perspective of public asset value and to have more worth and advantageous of tax money (Martinus, 2006).

PPP has the origin from past 30 years to encourage the cooperation of government together with private sector to provide the services. It is the alternative procedure to the conventional system for the purpose of dealing with higher demand of public services and also the alternative form for government when making a decision to have a lower cost in project including the chance to cooperate with expertise from private sector or international investor for more efficient work. PPP projects are expected to bring good services with a fair cost to one social.

Since 1990, the number of PPP projects from all around the world has reached more than 7,000 projects with more than 1,800 billion us dollar investment (figure 1). East Asia and Pacific got the first rank by number with about 300 projects more than the number of Latin America and the Caribbean but the rank by investment money is inverse, Latin America and the Caribbean reached more than 670,000 million which is about 200,000 million higher than those from East Asia.

Moreover, for the information of PPP project by sectors, the data from World Bank indicated that electricity sectors are the first one which had the biggest amount of investment and the number of projects. This number is greater than the second rank, road projects, about 3 times.

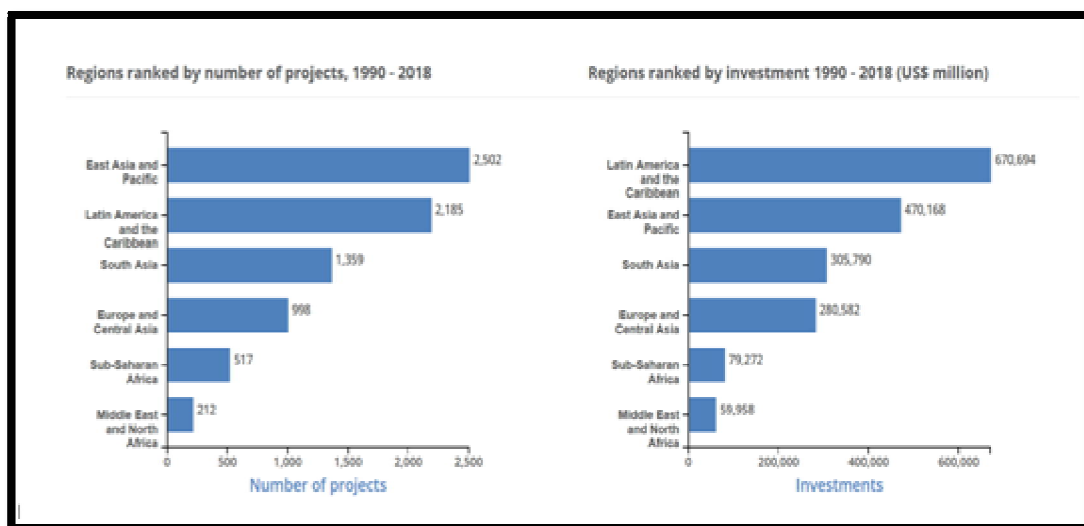


Figure 1: PPP Projects Ranked by Regions from 1990-2018  
Source from PPI Database, World Bank

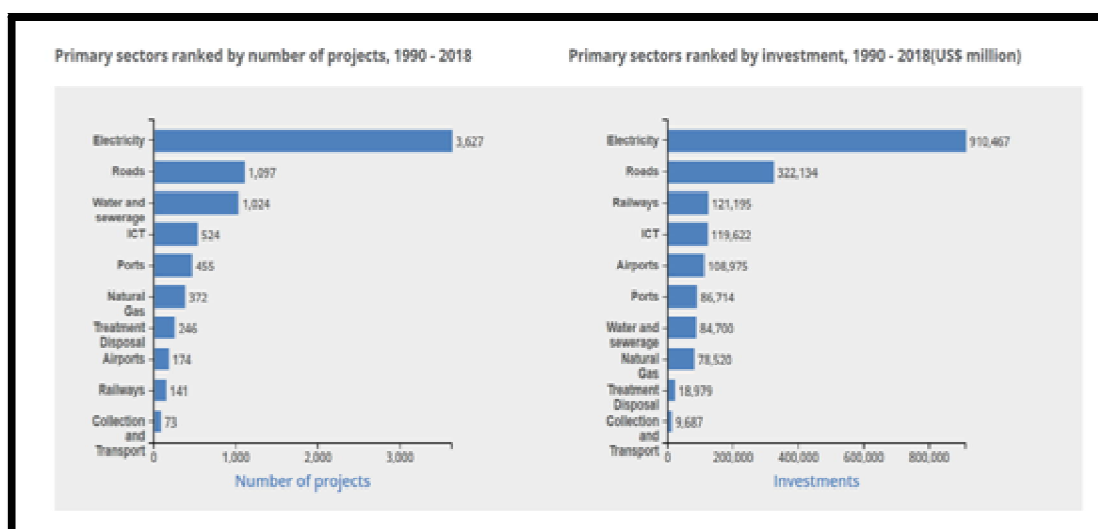


Figure 2: PPP Project Ranked By Project Types from 1990-2018  
Source from PPI Database, World Bank

### 3. Risk Identification in PPP model

Risk is one of the important keys to project success due to its complication and difficulty to manage. It demands high level of understanding and appropriate risk management system in all perspective. Therefore, it is significant for both

sides, the public sectors and the private sectors, to have all risks that might occur through the whole project cycle identified and evaluated (Ke, 2010). One of the important features of PPP is that the public sectors and the private sector share their risk together. The percentage of shared risks will be identified in the contract. These risks can be different in term of types and amount that each section should bare due to the characteristic of project. So, it is important for both sectors to know and be aware of each types of risk associated throughout the whole life-cycle of project as each risk will have a positive or negative impact to the project.

The risks can be managed but cannot be ignored (Lam, 2007). Although PPP project can be achieved if the project has a good strategy, but the risks has an uncertain possibility to overcome. Risk management in PPP has 4 stages: identification of risk, analysis of risk, choosing the technique of management and follow up the risk result (Aurelija, 2013). To have a good outcome of project, risk identification and analysis are needed to be done before the allocation. The important process is to do risk evaluation in every kind of risks identified in the project. The risk evaluation includes the decision of what are the level of the probability of occurrence and how much it will impact on the project. While 4 ways to respond the risk are elimination, transfer, retention and reduction (Raftery, 1994 cited in Ibrahim, 2006). Practically, risk cannot be completely removed, so they are just only transferred from one to another party within the project so after 4 stages of risk mentioned above, there is another step called risk allocation that public and private sector need to consider before signing the contract (Aurelija, 2013). Risk allocation or risk sharing is also one of the important process of PPP project because public sector and private sector need to make a decision about the amount of risk they are going to take. In the negotiation, the contract normally created by the owner tends to allocate more risk to the contractor and they accept as less risk as possible.

### 3.1. Type of Risk

Risk identification is one of the most important process in risk management of PPP. Normally the risks appear in PPP derived from a complicated contract like documentation, tax term, financial particular (Lina, 2006). One way of identifying risk is to create the checklists of the risks that may occur during the whole project life-cycle. All risks needed to be identified in this process before allocating them (Nur, 2011). To have an effective analysis process, to evaluate the effect of each risk, to have a better way to prioritize the risk during risk management process, it is essential to divide risks by level. Dividing all the risk of PPP project into categories also require the excellent comprehending about risk allocation among stakeholders in the project. According to Hastak and Shaked, the types of risk identification was classified into three levels national level, market level and project level (Wei, 2015). The state level risk or national level risk is the risks that is potential and specific in one country. This is the uncertainty factors that derived from social, economic, political issues, etc. such as political stability. The risk in market level is also special in one country that they appeared only particular area or particular market economy. The example of market level risk on PPP project for construction market is to competition among local market for the company (Wei, 2015). Risks in project level are the risks that occur and have influence in a specific PPP project for example, PPP can face the risk about construction cost overrun or quality of workmanship. Moreover, according to Li, risks in PPP project can be classified into 3 basic levels. These 3 levels of risks include macro level, meso level and micro level. First, the macro risk level composes of the risk that have the 'exogenous' origin which means the risk that have external origin from the project. Macro level emphasizes the risks in country and one industry level. These risks mostly concerned with the political situation, economic situation, social situation and weather situation. In brief, the origin of these macro risks is not inside the project system but these risks may have impact and influence over the project and its outcome. Secondly, the risks of meso level have 'endogenous' origin which mean the risks that have origin appear within the project system itself. The risks associated in this level usually concern with project construction, project operation, technology, project finance and selection etc. Lastly, micro risk level also has 'endogenous' origin but these risks are different from meso level in the perspective of relationship. The meso risks focus on the risk that related to the project but micro risks focus on the relationship between stakeholders which is public sector and private sector. The reason to classified this risk level is based on the fact that public and private sector are different in some vision, public sector carried social responsibility but private sector emphasizes on the profit of the whole project.

### 3.2 Risk Factor

Risks can be divided into more specific category like political risk, financial risk, legal risk, construction risk, weather condition and natural disaster, etc. In each category, various risk factors will be combined in the group that is related to them. For example, construction cost overrun and completion risk belong to construction risk, legislation change and change in tax regulation belong to legal risk, land acquisition and poor public decision making belong to political and government policies. Many researches in the past decade has studies about risk in PPP projects in several dimensions such as how risk factors impact to project success, the possibility of appearance, how degree of its effect, preferred allocation. Each research paper mentions different risk factors as each type of PPP project may have specific risk factors. However, some risk factors often appear in research paper as it may happen in PPP project. The information in table 1 is collected from several research paper around the world.

Table1: risk identification several research papers. 1=Li, 2=Wei, 3=Andres, 4=Ibrahim, 5=Robert, 6=Ke, 7=Atena, 8=Joseph, 9=Svetlana, 10=Lina, 11=Ernest, 12=Hwang

Risk Group	Risk Classification	Risk Factor	1	2	3	4	5	6	7	8	9	10	11	12
Macro	Political and Government Policies	Unstable government	√			√		√					√	√
		Strong political opposition	√			√	√	√				√		
		Poor public decision making	√			√	√		√		√			√
		Land acquisition	√			√		√						
	Legal	Legislation change	√			√			√			√		
		Change in tax regulation	√			√	√	√	√	√		√		√
		Industrial regulatory change	√			√		√				√		
	Economic	Poor financial market	√	√		√			√	√				√
		Inflation rate volatility	√	√	√	√	√	√	√	√	√	√	√	√
		Interest rate volatility	√	√	√	√	√	√	√		√	√	√	√
	Natural	Weather	√	√		√		√					√	√
		Environmental		√		√	√			√	√			√
		Force majeure	√		√	√	√	√	√	√	√	√	√	√
Meso	Construction	Labour/ material availability	√	√		√	√	√				√		√
		Late design change	√			√	√	√	√					
		Construction cost overrun	√		√	√	√	√	√			√	√	√
		Completion risk	√	√		√	√	√		√	√	√	√	
		Poor quality workmanship	√			√	√	√		√				√
	Operation	Operation cost overrun	√	√	√	√	√	√				√	√	√
		Low operation productivity	√			√		√		√				√
		High maintenance cost	√			√	√	√	√					
	Project Finance	Attraction of finance to investor	√			√			√					√
		High finance cost	√			√	√	√	√					√
		Available of finance	√			√			√			√		√
	Project selection	Change in market demand		√	√	√	√	√				√		√
	Micro	Relationship	Inadequate experience of PPP	√			√	√		√	√			√
Difference in working method between partner			√			√			√					√
Lack of commitment from either partner			√			√	√		√			√		√
Organisation risk			√	√		√								√
Third Party		Third party liability	√	√		√	√		√					
		Staff Crisis	√			√			√					

#### 4. Risk Allocation

Risk allocation is a main is a main topic and specific characteristic of PPP project, the risks to be allocated are the risk that had been identified and evaluated through the project cycle such as market risk, political risk, legal risk, financial risk, etc. The relationship between stakeholders is recognized under the contract based on risks and benefits they have, which is risk allocation. Both will gain their advantages during the project which economics benefits belong to private sectors meanwhile the public sector will achieve their goal by improve a more effective services and better social infrastructure for its citizens (Nguyen, 2018). Allocating the risks requires a good understanding of risk event consequences and management ability (Garshashb, 2011). The main reason and goal for risk allocation is to transfer the risk to the sector that is the most appropriate to deal and manage it for the best outcome (Nguyen, 2018). It is obvious that bad circumstance appears in the project because the risks are wrongly allocated between sectors (Solomon, 2019). When risks are improperly allocated to party, it demands the responsible sector to have more attempt to control and solve the problem than necessary. In the other way, when risks are appropriately allocated, the responsible sector will have more

potential to bear and manage the risks. So, risk allocation must be given or shared to the sector that possess the high control of the risks and also need to be suitable with the return benefits (Wei, 2015).

#### 4.1. Risk Allocation Mechanism

Public sector and Private sector must pay attention particularly on the negotiating process for PPP contracts. Normally, contract negotiation will emphasize on risk allocation topic. This is to assure that the risks for both sides would be equitably allocated in the contract. During the preparation of PPP project, public sector will mention their preferred risks allocation of the project while private sectors need to estimate their efficacy of taking those risks and then offer the bidding price (Ke, 2010). Analyzing risk allocation has many methods but according to the research of Li, the most universal technique in the research is to use questionnaire survey. The previous research of Ward and Flanagan cited by Martinus, 2006, to measure whether the risks are appropriately allocated need to measure the satisfaction on various conditions. These conditions include 4 main points which is 1.the risks need to be given to the sector that most suitable and have the great ability to control the situation that might be the origin of risks, 2.risks need to be correctly identified, well understood and assessed by all sectors, 3.The financial of the sector that responsible for risks need to be stable in order to deal with the result of risks or to prevent them, 4.Sectors must be willing to carry the risks. So, it is important for all public partner and private investor to assess the risk including the possibility to appear, the effect to the project and how possible they can deal when the risks appear. However, these details are the basic process of PPP that they must evaluate every sectors capability before transferring the risks to a specific sector (Ke, 2010). Moreover, the strategy for risk allocation is not only about stating which sector should bear the risks, it should be more than these processes. Throughout the process of reasonable risk allocation between public and private sectors, the risks from the project can be reduced and they can bring the success to overall project performance with the lowest risks (Wei, 2015).

In PPP framework, public sector will list the identified risk that may occur in each stage during the project life, and then forecast the financial amount. This process helps and points out the public sector how to manage the risk in the first step such as types of the risks and how to allocate or transfer to the private sector. When document about the whole detail of the risks were given to private bidders, they will have their own risk assessment and analysis and finally they will estimate about those risks and cost to manage them. When the bid price proposed by private sectors is acceptable then the public sector will make a contract with that private bidder but when the bid price is higher than public sector expect, public sector will do negotiation with the bidder they choose. They either consider accepting the bid or reconsider bearing more of the risk (Li, 2005).

PPP risk allocation in every project have different public or private proportion of risk bearing due to the contract and negotiation. So, a number of researches in about PPP preferred risk allocation have been studied through many countries (Li, 2005). The researchers measured risk perception of each risk by the respondents and the result indicated the percentage of how that risk should be shared. For instance, the researches of Ke applied Delphi survey to conducted PPP preferred risk allocation in China. The researches of Ibrahim, 2006 investigated preferred risk allocation in Nigeria by questionnaire survey. The result pointed out that public sector should bear the political risk, private sector should bear endogenous risk while relationship risks should be shared between both of them. The researches of Li 2005 divided risks into 3 levels which are macro level, meso level, and micro level. The research was investigated PPP construction project in the UK and found that mainly of the risks in Macro level and micro level should be borne by public sector or shared with private sector while most of the risks from meso level should allocate to private sector. The research of Bon-gang studied the risks preference from the contractors' perspective in Singapore. Apart from divided which risks should allocated to whom, also indicated which should be depended on each project circumstance.

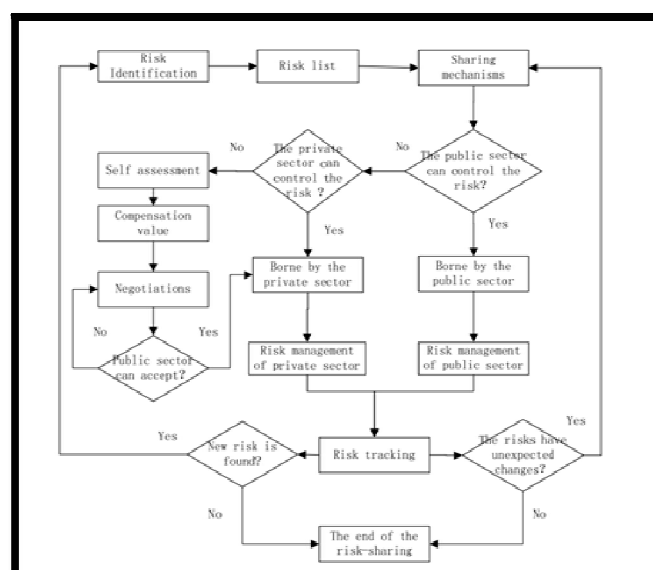


Figure 3: The Reasonable Risk-Sharing Process of PPP Project Risk  
Source: Wei, 2015

#### 4.2 Preferred Risk Allocation

Risk allocation in each country and in specific type of PPP project is different. Many researches found how risk preference in one country is by using questionnaire. The risk sharing table below is combined of preferred risk allocation from three different researches in three different countries in the world which are the UK, Nigeria and China.

##### 4.2.1. Same Preference in Risk Allocation Public Sector

According to the research of Ke, Li, Ibrahim the risk that should be borne by public sector is political and government policies which are unstable government, strong political opposition and poor public decision making. These risks belong to macro level. It is obvious that the respondents preferred these risks to be retain by public sector as the government is directly responsible for these tasks (Ke, 2010).

Risk Group	Risk Classification	Risk Factor	Li	Ibrahim	Ke
			UK	Nigeria	China
macro	Political and government policies	Unstable government	public	public	public
		Strong political opposition	public	public	public
		Land acquisition	public	public	depend
		Poor public decision making	public	public	public
	Legal	Legislation change	shared	shared	public
		Change in tax regulation	private	shared	depend
		Industrial regulatory change	private	depend	private
	Economic	Poor financial market	private	private	shared
		Inflation rate volatility	private	private	depend
		Interest rate volatility	private	private	private
	Natural	Weather	private	private	private
		Environmental		private	private
		Force majeure	shared	shared	shared
meso	Construction	Labour/ material availability	private	private	private
		Late design change	private	private	depend
		Construction cost overrun	private	private	private
		Completion risk	private	private	private
		Poor quality workmanship	private	private	private
	Operation	Operation cost overrun	private	private	private
		Low operation productivity	private	private	private
		High maintenance cost	private	private	private
	Project Finance	Attraction of finance to investor	private	private	private
		High finance cost	private	private	private
		Available of finance	private	private	private
Project Selection	Change in market demand	private	private		
micro	Relationship	Inadequate experience of PPP	depend	depend	shared
		Difference in working method between partner	private	private	shared
		Lack of commitment from either partner	shared	shared	shared
		Organization risk	private	depend	shared
	Third party	Third party liability	private	private	shared
		Staff Crisis	private	depend	private

Table2: Comparison of Risk Allocation from the UK, Nigeria and China

##### 4.2.1.1. Private Sector

13 out of 31 risks from three different countries survey mentioned that the risks that should be allocated to private sector are construction risk, operation risk, project finance risk and project selection risk which are interest rate volatility, weather, environment, labour/ material availability, construction cost overrun, completion risk, poor quality workmanship, operation cost overrun, low operation productivity, high maintenance cost, attraction of finance to investor, high finance cost, available of finance and change in market demand. The majority of these risks belong to meso level.

#### 4.2.1.2. Sharing

The risk that should be shared between public and private sector from three different researches have only two risks in common which are lack of commitment from either partner and force majeure. The probability of force majeure to be appeared is low but it was known to have a great severity when occur. Therefore the best way is to share it together (Li, 2005).

#### 4.2.2. Different Preference in Risk Allocation

Among three different countries the UK and Nigeria has the most in common result by their respondents than from China. The risks that have different preferred allocation are majority from five types which are political and government policies, legal risk, economic risk, relationship risk and third-party risk.

##### 4.2.2.1. Macro Level

For political and government policies the only risk that has different preference is land acquisition. The UK and Nigeria prefer public sector to have responsibility for this risk while the result from China is almost the same between public sector and shared which public sector received slightly higher percentage than sharing it. So, this cannot address that public sector should bare this risk.

Legislation change should be shared between both partner In UK and Nigeria while China preferred public sector to assign for this risk. Change in tax regulation is the one that three countries have totally different preference, allocate to private in UK, share together in Nigeria and no preference in China. Industrial regulatory change has the same preference between UK and China which is to allocate to private sector but Nigeria need to see the specific situation by project.

Poor financial market and inflation rate volatility tended to allocate to private sector in UK and Nigeria while china prefer share and no specific preference respectively.

##### 4.2.2.2. Meso Level

According to table 2 the majority of risk in meso level preferred to be transfer to private sector. Only 'late design change' that has different result. The respondents from UK and Nigeria preferred to allocate this risk to private partner while China's respondent has no clear preference on this. In other word, this needs to be seen whether public or private sector have responsibility of this risk's appearance (Ke, 2010)

##### 4.2.2.3. Micro Level

Micro level risk is the one that have the number of disagreement most between three countries. For relationship risk, the respondents from UK and Nigeria preferred inadequate experience of PPP to be depended to each specific project and different in working method between partner to be allocated to private sector. The only one that UK and Nigeria had different opinion is organization risk, UK assign to private sector while Nigeria would like to share it together. For China three of these risks would be shared together.

Third party liabilities will be allocated to private sector due to the result from UK and Nigeria while China prefer to share it. Staff crisis will be allocated to private in UK and China. This is the only risk in micro level group that China allocate to private sector. The result showed that the project could not be conducted well without assistance from the government (Ke, 2010)

## 5. Conclusion

In conclusion, PPP brought a practical way of collaboration between public sector and private sector. As it a large-scale project and involves with many stakeholders, it is inevitable to relate with several risks so risk management in PPP is important and has influence to the project success. Each PPP project may have different risk factor depended on project type and specific but also, they have some risk that may occur in every kind of project either. The allocation of risks is also particular in one country and even particular for project. So, the survey result reflects risk sharing from respondents' perspective. The resume and comparison of three different countries also represent each countries preference.

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