

# Risk Mapping in Public Private Partnership Projects

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## **Abstract**

The vast majority of Public Private Partnership (PPP) are developed based on the rationale that the public authority commissions the design, construction, operation, maintenance, and financing of a public infrastructure project from a private consortium within a single contractual framework. PPP project risks typically include the development and construction of a new asset as well as its operation for several decades. Probably the most serious consequences of risks during the construction period are cost and time overruns. These events are among the most widely used scenarios in value for money analysis risks. The sources of risk change over the life cycle of a PPP project. Construction and development risks in infrastructure projects are, in some cases, very significant. Projects that are related to IT, rehabilitation/refurbishments and complex agencies' interaction are thought to carry more substantial risks than other assets. Work by Standard & Poor's has classified PPP construction risks according to asset types, which suggests at least that funding bodies recognise the existence of an association between construction risks and PPP asset types. In traditional procurement, the public sector normally has to cover all cost distress from these risks. At least there is ample evidence to suggest that cost distress is a norm in some of the projects that are delivered under the public procurement systems. This paper examines the main reasons behind development and construction period risk manifestation and distress. The paper will demonstrate how to map out risks into PPP projects construction cost units.

**Keywords— Mapping Risk, Public Private Partnership (PPP), Risk, Cost Overrun.**

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## **Introduction**

The involvement of the private sector in the delivery of public infrastructure projects is not a new phenomenon, but one that has developed significantly in both scope and extent over the past thirty years. These developments have taken many forms in different countries and regions, under different legal systems and conditions of economic development, but the fundamental rationale for a wide array of these public private contracts has been to transfer the long-term risks associated with the delivery of public infrastructure assets and services from the public to the private sector. In traditional procurement, the arrangement has transferred less risk to the contractor while in PPP projects the studies have proved that PPP have greater cost and time certainty. However, achieving value for money will not transfer all risk to the private sector but will transfer it to whoever is able to bear it [2]. The most essential issues that are considered in PPP projects are value for money and risk transfer. These two concepts are interconnected [3]. Proper risk allocation among the contracting parties in construction projects is regarded as an important decision leading to project success [9]. Based on the theory that the party in the greater position of control over the event has the best opportunities to reduce the likelihood of the risk and to control the risk if it occurs, the essential aim of risk allocation is to minimise the project cost and risk, by allocating the risk to party best able to control it. Therefore if there is any risk and no party is able to bear it and manage it on their own, then the best way is to share the risk between the public sector and private sector [8].

The vast majority of PPPs are developed based on the rationale that the public authority commissions the design, construction, operation, maintenance, and financing of a public infrastructure project from a private consortium within a single contractual framework. PPP project risks typically include the development and construction of a new asset, as well as its operation for several decades.

Probably the most serious consequences of risks during the construction period are cost and time overruns. According to [12] a successful risk transfer to the party

most suited to manage it is evidence enough to execute a construction project within budget estimate which achieves value for money. These events are among the most widely used scenarios in value for money analysis risks. The sources of risk change over the life cycle of a PPP project. Construction and development risks in infrastructure projects are, in some cases, very significant. Projects that are related to IT, rehabilitation/refurbishments and complex agencies' interaction are thought to carry more substantial risks than other assets. Work by Standard & Poor's has classified PPP construction risks according to asset types, which suggests at least that funding bodies recognize the existence of an association between construction risks and PPP asset types. In traditional procurement, the public sector normally has to cover all cost distress from these risks. At least there is ample evidence to suggest that cost distress is a norm in some of the projects that are delivered under the public procurement systems. Thus the aim of this paper is to map the relationship between PPP projects risks and the construction cost in these projects. The remainder of the paper is organized as follows. An overview of risk classification is presented, and then the method set by the research is briefly explained. This will be followed the risk mapping results presentation. The paper concludes with discussion and conclusion.

## Risk Classification

One of the more significant vital factors for a PPP project is risk management. PPP projects are influenced by several risks but not all of them influence every project, and not to the same extent. Particular risks are specific to certain sectors; some may be country-specific, and others are general [1]. The authors proposed a risk classification based on the impact of risks on the construction cost outcomes. Figure 1 illustrates the classification adopted by this work. This classification divides risk factors into two groups: exogenous risks that include political risks, legal risks, economic risks, natural risks and market risks, and endogenous risks that include Project selection risks, project finance risks, construction risks, relationship risks and operation risks. This technique has also been utilized by other authors such as [6], [10], [4], [5], [7].

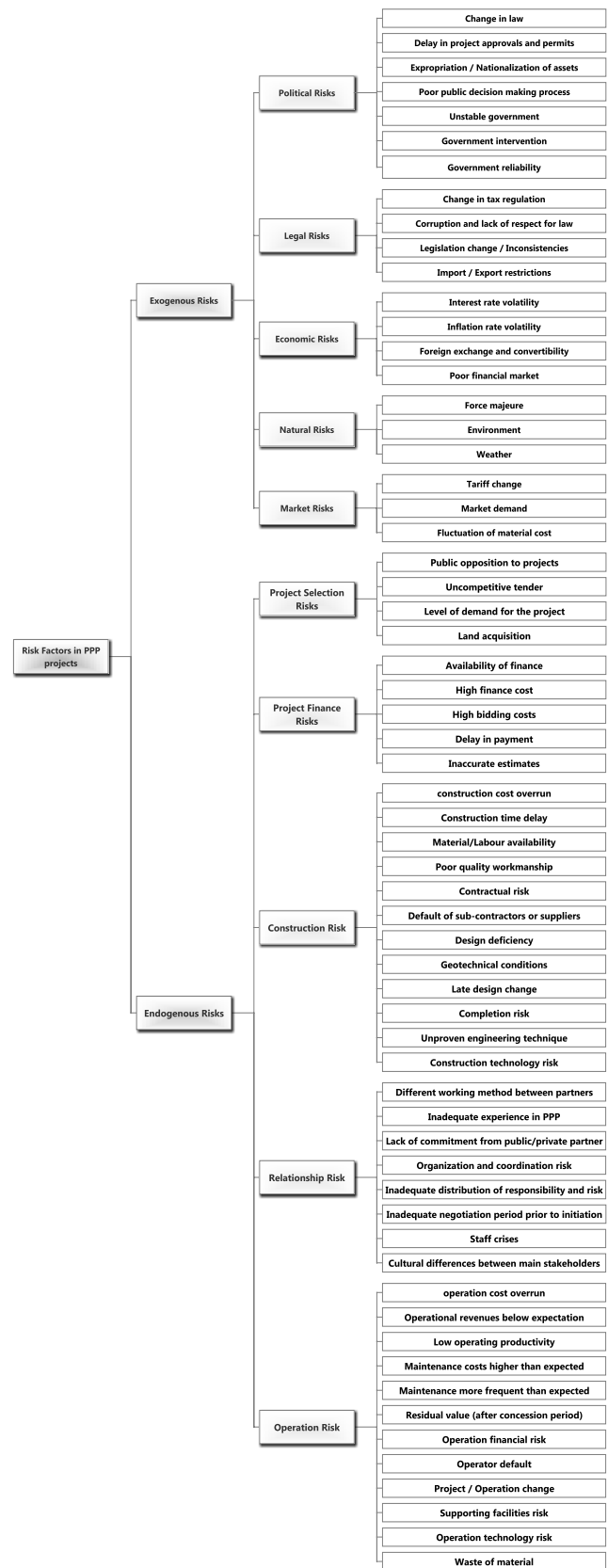


Figure 1: Risk classification in PPP projects

## Methodology

Mapping processes are considered as a qualitative research method. Risk mapping is considered as an interactive approach that draws on existing knowledge to create visual and non-visual risk maps and data to explore project risk scenarios. The mapping research method helps us to show how project costs or other features are affected by specific risk determinates, and how these maps change over time through the dynamism of risks' interaction with the internal and external project environment. Following this research process sometimes leads to rich and surprising risk interaction results. The process used in this paper to evoke the relationships between construction costs and their associated risk determinateness is shown in Figure 2. The first step is knowledge-gathering about the risks and their interaction. An extensive literature review was carried out in order to develop in-depth understandings about a proper risk factors classification in order to get greater capacity for more accurate risk control to achieve VfM. The second step is to form a matrix of the influencing of risk factors on each other and on construction cost unit. The third step is to draw the risk maps. At the alter stage the risk maps are used for simulating project risk outcomes.

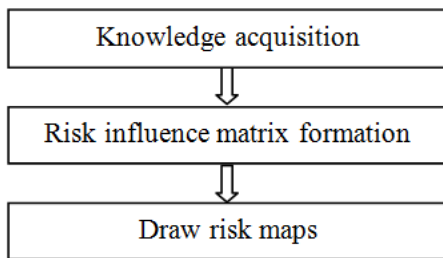


Figure 2: Research Methodology

## Mapping Risks into Construction Cost

Most of the risk in a PPP project results from the intricacy of the arrangement regarding technical details, financing, documenting, taxation and sub-agreements that form part of a PPP project, whereas the character of the risk changes during the project period. For instance, the construction stage of a project will entail risks that vary from those found in the operating stage [4].

The sources of risk change over the life cycle of a PPP project. Construction and development risks in infrastructure projects are in some cases very significant. Projects that are related to IT, rehabilitation/refurbishments and complex agencies interaction are thought to carry more substantial risks than other assets. The vast majority of PPPs are developed based on the rationale that the public authority commissions the design, construction, operation, maintenance, and financing of a public infrastructure project from a private consortium within a single contractual framework. PPP project risks typically include the development and construction of a new asset as well as its operation for several decades. Probably the most serious consequences of risks during the construction period are cost and time overruns. These consequences in many projects are caused by not dealing properly with risks. All parties must understand risk responsibilities, risk event condition, risk preferences and risk management capabilities. This section examines and maps construction risks into time and cost delays as illustrated in figure 3.

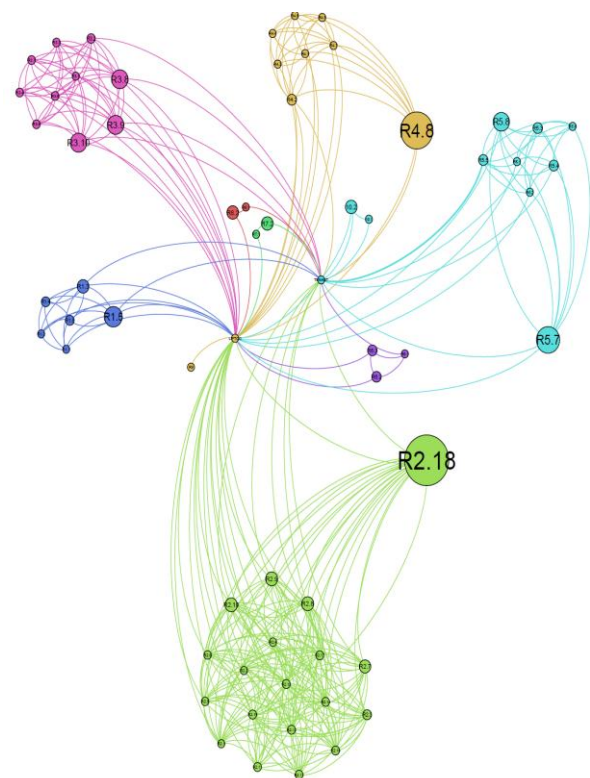


Figure 3: Mapping risk into construction cost

## Discussion

PPP projects provide a broad spectrum of opportunities to both the private and public sectors for the purpose of improving service delivery. Nonetheless, there exist numerous risks that may result in the emergence of problems and probable failures if they are not accurately identified. In fact, there are many projects unable to meet their required targets. This is not shocking if it is taken into account that there are no faultless engineers, or faultless designers, and nature cannot be expected to conduct itself perfectly. In reality the changes cannot be removed, but the risk can be managed [7]. Work by Standard & Poor's has classified PPP construction risks according to asset types, which suggests at least that funding bodies recognize the existence of an association between construction risks and PPP asset types. In traditional procurement, the public sector normally has to cover all cost distress from these risks. At least there is ample evidence to suggest that cost distress is a norm in some of the projects that are delivered under the public procurement systems. Therefore, establishing an association between project outcomes and risk factors is an essential process in enhancing value for money to all PPP partners. Failure to understand this association appropriately would result in unfair risk pricing and allocation. Thus, adequate risk analysis processes have to be implemented to assist in ensuring that project costs and risk prices are analytically robust, not assertively analyzing risks for the sake of winning the bid, thus conceding extended value for money to the state [11].

## Conclusion

This work has tried to show how some of the risks that are associated with PPP projects can be mapped into construction costs. For the purpose of risk mapping, risks are categorized into exogenous and endogenous construction risks. Exogenous construction risks are uncontrollable and emanate from external factors such as weather events, natural disasters, market risk, interest-rate risk, etc., whereas endogenous risks are learnable risks and originate from PPP projects' specific contractual factors. These two forms of risk are fundamental in defining and pricing risk obligations of the PPP contractors. As shown in the risk mapping provided in this work, there are multi-links between risks on one hand and construction costs on the other hand. This intertwining creates a form of risk complexity that could lead to amplification of risk consequences.

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