NATIONAL CONCESSION COUNCIL

RISK ANALYSIS GUIDE FOR PRIVATE INITIATIVE PROJECTS

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PRIVATE INITIATIVE PROGRAM

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INDEX

Guide Purpose

This guide is meant to provide a methodological basis to use to prepare the risk study for private initiative projects. It is not meant to delve into how each of the different types of risk to which a public work concession project may be exposed should be analyzed. Instead it is meant to establish the structure and minimum processes needed so the risk study is appropriate and complete. Nor does it discuss the tools or considerations to be used to define a more appropriate strategy to deal with each risk and is limited to discussing the typically available options: elimination, mitigation, transfer, and acceptance.

Development of private initiative projects, the same as for any other public work concession project, requires a risk management plan to be prepared that makes it possible to determine the following and other things:

- Risk distribution among the parties
- Contingency reserve allowance
- Analysis of activities to mitigate, transfer, or eliminate risks
- Alternative assessment based on the accepted risk level
- Preparation of anti-risk response plan
- Determination of the project's general risk level
- Project scope uncertainty allowance (time, cost, and quality)

This guide was prepared by following the standard PMI[1] guidelines for project management. According to the PMI guidelines, the management plan is developed as part of the planning process group. For private initiative projects, this planning process is split into two stages: the Bid and the Proposal. This guide describes processes related to developing project risk management. Is made up of processes related to risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, and risk follow-up and control.

[1] Project Management Institute. Pennsylvania, USA

Methodological Framework

The risk management plan and the general project plan is prepared in a progressive fashion, often called "gradual planning," which indicates that planning is a repetitive, ongoing process. This is congruent with the private initiative study preparation stages wherein a "preliminary" plan is prepared with limited information during the Bid that must later be complemented and broadened during the Proposal until there is sufficient information to prepare the request for proposals.

Each of the processes needed to prepare a project plan requires a series of input and generates outcomes by using certain tools. Chart 1 shows the characteristics of the processes related to the "knowledge area" for risk management to be able to understand how the different processes involved in preparing a risk management plan are related. This chart was prepared based on the PMI standards. However, it only shows the risk management area, the input, and outcomes that are related to this area.[2]

One of the more important tools is the Job Breakdown Structure[3] (WBS). The WBS is a hierarchical decomposition oriented toward the deliverable product and the work that will be executed by the project team to achieve the project objectives and create required deliverable products. This structure is usually developed as part of the project scope definition and is updated throughout preparation of the general project plan, including the risk management plan.

The WBS organizes and defines the total project scope. The WBS subdivides the project work into smaller work portions that are easier to manage where each descending level of the WBS represents a definition that is even more detailed about the project work. The planned work that is part of the lowest level WBS components, called the work packages, may have their costs[4] scheduled, supervised, controlled, and estimated. This is the level where the WBS must be added to or complemented by all the activities involving elimination, mitigation or transferrable

[2] The other knowledge areas defined by the PMI are: Scope, Time, Cost, Quality, Acquisitions, Integration and Documentation. To study other knowledge areas, you may turn to the *Project Management Body of Knowledge (PMBOK)*, edited by the PMI.

[3] In the bibliography in English it is found as *Work Breakdown Structure (WBS).*

[4] For more details about preparing and applying the WBS, turn to the guide called *Practice Standard for Work Breakdown Structures*, prepared by the PMI.

that may be obtained as a result of the project risk management plan, to thus appropriately modify the project scope in relation to its main dimensions: cost, time, and quality.

Another important tool during risk management plan development is the existence of an appropriate identification tool for the project stakeholders so the risks may be distributed more appropriately for everybody affected.

Chart 1. Risk Management Plan Development Methodology

Knowledge Area	Process	Required Input	Techniques and Tools Used	Outcomes Obtained
Risk management	Risk Management Planning	Scope statement General project management plan	Planning meetings	Risk management plan
	Risk Identification	Project scope statement Risk management plan Project management plan	Information compilation techniques Checklists Risk identification forms	Risk record
	Qualitative Risk Analysis	Risk record Risk management plan	Probability and impact evaluation matrix	Risk record (updates)
	Quantitative Risk Analysis	Scope statement Risk management plan Risk record Timeline management plan Cost management plan	Simulacrum, PERT, etc.	Risk record (updates) Timeline management plan Cost management plan (update)
	Risk response planning	Risk management plan Risk record	Avoidance Transferal Mitigation Acceptance	Risk record (updates) Project management plan (updates)

Risk Management Plan

The Risk Management Plan intends to establish how to identify and analyze the risks that may affect developing the project stages. This plan should be prepared as part of the project Bid and uses the information available during this stage. Then it will be executed and updated during the different proposal, request for proposal preparation, and project execution stages

Management planning is the first task to be performed and is included in the Bid risk study because it is the place that defines how to carry out the following processes and which assumptions will be used while the plan is being developed. When preparing the Bid, the risks associated with the proposal stage must be clearly identified, rated, and quantified because their analysis will be considered when sending the Initial Acceptance Ruling.[5] However, any risk that may affect the later project stages (request for proposals, construction, and operation) may be preliminarily analyzed to broaden and complement the study during the proposal stage.

The information shown below may be used as the basis for preparing private initiative project risk management planning.

Risk Management Planning

Risk Identification

Risk identification determines any risk that may affect the project and identifies its characteristics. Information from previous experiences during preparation may be incorporated while risks are being identified.

Risk identification must be done for all project phases and not during the execution phase itself. This way, risks should be identified that affect the project during the Bid, Proposal, preparation of the request for proposals, construction, and operation.

While risks are being identified, it is important to remember that risks may be positive or negative and both may be equally important when performing the analysis.

To perform the identification, a tool should be used to identify project risks, which must make it possible to identify them in an organized and systematic fashion all the while that it allows

[5] One of the main considerations when issuing the Initial Acceptance Ruling would be risk distribution among the parties.

for creation of a risk database for future use.

The most basic tool that may be used is form preparation. The information that this tool usually requires for each identified risk is the following:

- Event (risk condition)

State the event that causes the risk. It is also called *risk condition* because this event is what unleashes impact on the project. Generally, events are beyond the control of project execution. Event examples are: earthquakes, supply price changes, contractor breach, and equipment failure.

- Impact Description

Describes the consequences of the event on the project objectives should there be any impact. An event must unleash an impact on the project objectives for it to be considered to be a risk. A single event may unleash several types of impact on the project. Each of the risks should be identified separately to make analysis easier because each type of impact implies different costs and delays and possibly different ways of facing them. This way, an earthquake (event) will have different types of impact on the project, especially as a function of when it occurs (during the studies, during construction, or during operations).

- Category

Characterizes the type of risk according to the type of event that generates it. For concession projects, the following risk categories are considered to be typical:[6]

  - Construction Risk
  - Design Risk
  - Work Finalization Risk (implementation)
  - Operating Risk
  - Financial Risk

[6] This list is neither exhaustive nor definitive so different projects may involve risk categories in addition to the categories shown in this guide.

- Planning Risk
- Market Risk (includes size, capacity, and revenue)
- Legal, Legislative, and Political Risk
- Risk of Force Majeure
- Risk of Insolvency or Bankruptcy
- Tax Risk
- Technological and Obsolescence Risk
- Residual Value Risk
- Environmental and Social Risk

- Reference to WBS

Identifies the WBS work packages that will be directly affected by the described types of impact. Facilitates risk monitoring during execution, making it possible to associate risks with the active project stages every time an analysis is performed

- Probability

Describes probability that the event will occur and that it will unleash the described types of impact. The value is assigned based on a pre-established chart and the following is recommended:

Chart 2: Risk Probability Scale

Very Probable	90%
Fairly Probable	70%
Probable	50%
Not Very Probable	30%
Improbable	10%

- Impact

Describes the magnitude exercised by the impact on the project objectives. It is a qualitative way of defining how important the risk is to the project. The value is assigned based on a pre-established chart and the following is recommended:

Chart 3: Risk Impact Scale

Very High	80%
High	40%
Moderate	20%
Low	10%
Very Low	5%

- Affected Objectives

States which project objectives would be affected by the previously described types of impact. The options are: time, cost, scope, and quality.[7] Several options may be selected depending on the case.

- Response Type

Suggests the best type of response for the risk in question. In some preliminary cases, this value deepens and modifies the chosen response throughout the project risk study.

- Elimination: Actions may be taken to eliminate the risk.

- Mitigation: Actions may be taken to make it possible to decrease the likelihood that the event will occur or to decrease magnitude of its impact on the project.

- Transfer: The types of impact generated by the event may be transferred through contracts, insurance, etc. They may also be transferred to another party involved in the project with greater response capacity (Risk transfer between the Awarding Administration, State Institutions, and the Proposal Concessionaire).

- Accept: No mitigation or transfer actions may be taken or such actions do not improve the project risk position.

- Loss and Delay Allowance

An allowance is created for the losses or delays that the project could suffer if the analyzed risk occurs. Remembering that the risks may also affect the project positively. This point may

[7] In PMI nomenclature, scope refers to the amount of work needed to develop the project. This way, a risk may have an impact on a project that only causes delays in execution or only increases the cost of carrying out the works and activities. Another type of risk may involve executing activities or works that were not considered initially which affects the time, cost, or scope.

include earnings or advances in the timeline that would be received should the risk occur. This point should be updated every time the risk response type and the elimination, mitigation, or transfer plan is modified.

- Elimination/Mitigation/Transfer Plan

Describes the activities that may be performed to eliminate or decrease the probability that the event will occur or decrease the magnitude of the impact should it occur. For risk transfer, the form of transparency may be described (contract clauses, insurance, transfer to a third-party, etc.). This point may be congruent with the risk response type.

- Emergency Plan

Describes the activities that may occur after the event occurs. These activities will have an impact on the time, cost, and execution scope for the project if they are executed so these types of impact should be added to the loss and delay allowance.

- Status

Describes the current status of the risk in question. It is used only for control purposes during the identification process.

  - Passive: The risk is not expected to occur in the current project stage.
  - Active: The risk is expected to occur during the stages that are currently being executed.
  - Disregarded: The conclusion was reached that this should not be taken into account for the project risk analysis.[8]

- Related Events

Should this apply, another previously identified event is indicated that may be related to the risk in question. When an event brings about different types of impact (and they are independently identified), they must be linked to each other.

[8] The risk type should not be completely eliminated because later analyses may suggest that it should be incorporated into the project study. In addition, for documentation purposes, it is appropriate to demonstrate all the risks that were identified including even those that were disregarded for some reason.

Recording Identified Risks

Once the identification tool has been defined, work sessions are held to create a record of the identified risks. After a risk is first identified, it is submitted to a purging and selection process. In this process, the analysis team members complement the information for each risk and decide which types of risk will be included in the analysis and which will not. At the end of this analysis phase, there should be a list with all the types of risks identified along with all the relevant information associated with each of them as was defined during risk management planning.

The scope of this record will depend on the project stage. During the Bid stage, the greatest detail possible is needed for the risks associated with the Proposal stage, with the possibility of fewer details for risk that affect the request for proposal, construction, and execution stages. During the Proposal, this information needs to be completed and broadened to have the greatest detail possible for all the types of risk when the request for proposals is prepared.

Qualitative Analysis

After the risks have been identified and selected, they need to be sorted according to priority so it is possible to focus on the most important risks. The criterion recommended to be used is range or rating. Therefore, the values for Probability (P) and Impact (I) defined during risk identification will be used. This range is evaluated as P x I, to allow us to rate the risks based on a pre-established scale, so the following chart is recommended:

Chart 4: Risk Rating Ranges

High	0.99 - 0.18
Medium	0.17 - 0.05
Low	0.04 - 0.01

This range makes it possible for us to have a descending list of prioritized risks. In addition, we are able to estimate the general project risk rating by using the average of all the values of P x I for risks.

At that time, the risk list will be able to be updated including the range or rating for each of them so they may be presented in descending order in relation to the importance of the identified risks. A pre-established criterion is needed to define which risks will be analyzed in depth and which will be analyze more briefly and it is possible to have a different criterion for the Bid and Proposal stage.

Is usually recommended to simply accept all the risks that are considered to be low based on the previous rating so it does not make sense to engage in activities to eliminate, mitigate, or transfer such events. On the other hand, for risks that are rated as being high, the best strategy to face these risks should be identified, updating the loss and delay allowances when convenient. An analysis policy should be generated in each case for risks that are considered to be "medium."

Quantitative Analysis

Quantitative analysis includes two phases: determination of the risks' influence on the project scope and a quantitative determination of the general uncertainty for the project time and cost allowances.

To perform the first phase, first of all it will be necessary to modify the WBS and the project timeline to add all the elimination, mitigation, and transfer activities that are associated with each one of the risks that have been identified. Each one of these activities should have time and cost allowances that will affect the timeline and the project budget. For example, if a decision is made to eliminate a landslide risk by building containment walls, that construction activity will have to be included in project planning, which will make it possible to decrease the probability or the impact of the risk. In a similar fashion, to transfer risks through insurance, all the costs and periods of time needed to obtain the insurance will have to be added to the timeline and to the budget (perhaps including consultants, premium costs, etc.).

The next step for determining the risk's influence on the project scope consists of an estimate of the *contingency reserve* to deal with the risks. This reserve consists of an allowance for time and cost that will need to be added to the project timeline and budget to prevent any possible cost overrun and delay due to the risk occurring. To define this point, allowances for loss and delay (A) and the probability of occurrence (P) that were obtained while the risks were being identified are used. Although there may be different methodologies for estimating the contingency reserve, the most simple to use is the following ratio:

$$RC = \sum_i E(i) \cdot P(i)$$

where *RC* is the contingency reserve, *E(i)* is the loss or delay allowance associated with risk *i* and *P(i)* is the probability that risk *i* will occur. Although the preceding formula is sufficient to estimate this reserve during the Bid stage, in some cases there will be a need to use more advanced techniques to estimate this amount during the Proposal stage. Nevertheless, the result will always be the same: include it

a reserve in the project time and cost allowance to prevent the occurrence of risks.[9]

To perform the second quantitative analysis phase, the effects of uncertainty on the cost and time allowances must be included. This may be done using a PERT analysis or a Monte Carlo simulation.[10] For a PERT analysis, the optimistic, expected, and pessimistic values will be specified for each of the project activities for the activities' time and cost allowances. These values are obtained from the project development team members' experience and are based on the information available in each stage. This way, the allowances may change as greater information is procured during the study development stages so the risk analysis must be updated at all times.

Unlike the PERT analysis, a Monte Carlo simulation requires associating a probability distribution with the cost and time allowances to achieve an effect that is similar to the PERT analysis but with a greater amount of information.

It is even possible to mix the two techniques, e.g., using PERT during the Bid and running a Monte Carlo simulation during the Proposal.

What should be had at the end of the quantitative analysis is a project time and cost variance allowance based on the variances in the activities that contain it in addition to the previously discussed *contingency reserve*. This will make it possible to have more information for making financial decisions for the project, which are especially useful for defining the deadlines and concession tariffs as well as for many other considerations.

During the Bid, for the types of risk identified for the Proposal stage, the contingency reserve and the budget variances due to the uncertainty of the allowances will be associated with the development costs solicited by the Bidder so a good risk analysis may help justify the allowance to the Administration.

[9] This contingency reserve is different than the reserve labeled as "incidentals." Incidentals pertain to events that were not identified during planning whose probability of occurrence or magnitude of impact is unknown.

[10] The literature contains other methodologies that may be applied to some projects as a replacement for the methodologies presented in this text.

Risk Follow-up

The main reason for identifying project risks is to prepare the project development and analysis team for any possible events that may affect project stage execution. Therefore, it is mandatory for the risk factors identified during project development to be constantly monitored. During the project follow-up process, the status of each of the identified risks should be analyzed to be able to update them when necessary in each case.

One of the other important reasons for risk management is to have more information for preparing the request for proposals. Therefore, the process must be monitored to be able to have the most information possible to be included in the request for proposal documentation to guarantee that the bidders in the process are as transparent as possible and to decrease the possibility of renegotiating the contract during execution.