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Expenditure Efficiency & Projects Authority

# EXPRO National Manual for Projects Management

# Volume 13, Chapter 2

# Project Risk Management Procedure

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## 1.0 PURPOSE

The purpose of project risk management is to decrease the likelihood and minimize the potential impact of events or uncertainties (threats) that could adversely impact upon the successful achievement of project objectives. This procedure applies to all projects and details underpinning principles, identifies key roles and responsibilities, and describes the overall process for application of project risk management on a project.

Project risk management is fundamental to project delivery and the management of project uncertainty. It applies to all stages of project execution and is an intrinsic part of project management.

> ***The benefit of having a defined project risk management process is to give assurance to management and other appropriate stakeholders that risks which could adversely impact on successful realization of a project's objectives, have been properly identified, assessed, prioritized, treated, and managed.***

The project risk management process described here establishes common requirements for **Project-Specific Risk Management Plans** that reflect best practices and ensures seamless integration with other project procedures. A **Project Risk Management Plan Template (EPM-EM0-TP-000002)** has been developed for this purpose. Risk management plans provide the benefits of:

- Assigning clear responsibilities with regards to project risk management within the project team
- Establishing common risk language, which enhances team communication, and commonality of approach
- Ensuring that the project risk profile is developed in a consistent and clear format to support common understanding of the key risks
- Providing risk based information to the Project Manager in a form that supports development of prioritized risk treatment plans, informs the development of realistic project targets, and ensures that any risk contingencies are informed rather than based on 'rules of thumb'
- Ensuring that a more holistic view of risk is taken, that extends beyond cost and time risks to include: safety; quality; environment; community; reputation; and security
- Helping to reduce the likelihood of poor project performance.

The concepts defined in this procedure are consistent with ISO 31000: 2009 Risk Management - Principles and guidelines.

This procedure has been designed to be flexible and to allow for alignment with any pre-existing risk frameworks and risk programs - where appropriate. This flexibility in design and execution allows for the unique context, circumstances, structures, and other Entity needs to be included, as appropriate, in each project's risk management plan.

(Note: In this procedure ***'threats'*** are considered as the key dimension of interest for risk management. More information on this is provided in the **EXPRO Projects White Book: Volume 13 - Introduction to Risk Management (EPM-EM0-GL-000001)**.

## 2.0 SCOPE

This procedure applies to all **Projects** that are defined and managed by an Entity Project Management Organization (EPMO) and should be implemented and executed as described in the **EXPRO Projects White Book: Volume 13 - Introduction to Risk Management**.

This procedure applies to all stages of the project life cycle which have been defined in the EXPRO project life cycle Stage Gate Process (see **Attachment 1**) as follows:

1. Registration
2. Initial Planning
3. Tender for Design
4. Design
5. Tender for Construction
6. Construction
7. Test and Commission
8. Handover & Closeout.

Additionally, in recognition that each project is unique, and that there are a multitude of contract types that exist, and that any project adopting this procedure will have specific contextual challenges, this procedure is designed to be inherently flexible and can be tailored to allow for these variances.

## 3.0 DEFINITIONS

A full glossary of risk management terms and definitions is provided in **Attachment 2**.

## 4.0 REFERENCES

The following documents are referred to in this procedure.

- EPM-EM0-TP-000002 - Project Risk Management Plan Template
- EPM-EM0-TP-000001 - Project Risk Register Template
- EPM-EM0-GL-000001 - Introduction to Risk Management
- EPM-S00-GL-000002 - Project Delivery Strategy
- EPM-EQ0-PR-000001 - Project Stage Gate Procedure
- EPM-KPC-PR-000007 - Project Trend Program Procedure
- EPM-KPR-PR-000005 - Project Critical Items Action Report Procedure.

The following documents are useful references. The procedure developed here has been informed by them and the reader is referred to them for additional background reading.

- Project Management Institute (PMI) Practice Standard for Project Risk Management, 2009
- Association for Project Management (APM) Project Risk Analysis and Management (PRAM) Guide, 2004
- IEC/ISO 31010:2009 Risk Management - Risk Assessment Techniques
- ISO 31000:2009 Risk Management - Principles and Guidelines
- ISO Guide 73:2009 Risk Management - Vocabulary.

## 5.0 RESPONSIBILITIES

For the application of project risk management to be effective on a project, adequate resources must be allocated, individual roles identified, and their responsibilities clearly defined. The project risk management plan will define all the key roles and responsibilities and, where appropriate, will name the individuals who will hold the key posts. A **Project Risk Management Plan Template (EPM-EM0-TP-000002)** has been developed and can be used to inform development of the project risk management plan and ensure alignment with the requirements of this procedure.

For any project, it will be important that their customer (i.e. the EPMO) is involved in the project risk management process. The extent of this involvement will be detailed in the project risk management plan.

## 5.1 Project Manager

The Project Manager has overall responsibility for the successful implementation and execution of the project risk management program of activities on a project. As part of this duty, the Project Manager can

delegate individuals to oversee and manage aspects of the project risk management process and a Risk Manager should be appointed to this role. Some projects may also appoint risk management steering groups or committees to oversee or provide governance for the risk management process. The risk management plan will define these groups and the constituent members of each group. Whatever delegation or governance arrangements are implemented, the Project Manager will always retain overall responsibility for the risk management program.

Specifically, the Project Manager is responsible for:

- Providing high-level direction for the project's risk management activities, while considering external and internal stakeholder interface requirements, and ensuring adequate resources are assigned and available for the execution of the project risk management program and supporting activities
- Approving and implementing the risk management plan and the project risk management program based on the defined project objectives, while ensuring that customer requirements are considered and factored in
- Communicating with the customer in relation to the coordination and execution of the project risk management program
- Providing clear instructions, to include roles and responsibilities, to the project team on the management of the project risk management program; typically detailed in the project's risk management plan
- Specifying the governance arrangements that will be employed for the project in the risk management plan
- Reviewing and approving risks on the risk register, to include Risk Owner, treatment activities, treatment plans, and the priority in which they are executed
- To be the approval authority for any risk management interventions (risk treatments) and their implementation
- Reviewing the effectiveness of risk treatments and the project risk management program on a regular basis
- Approval of transfer of risks that have become Trends to the project controls function
- Escalating risks to the EPMO that are beyond the project's scope and/or ability to manage.

## 5.2 Risk Manager

Every major project has unique challenges. Consequently, the project risk management requirements for different projects can be different and the Risk Manager's responsibilities can vary accordingly. Project risk management personnel may be assigned full-time with no other duties or responsibilities, part-time; perhaps acting as the Risk Manager for several projects, or have a dual role in another function in addition to the Risk Manager role on the same project. For major projects, there may be a need for a full-time team of assigned project risk management personnel. The makeup and design of the project risk management program and supporting personnel will be detailed in the project's risk management plan and according to direction from the Project Manager. Regardless of who or how many personnel are involved in executing the project risk management program, the Risk Manager will have the following minimum responsibilities:

- Manage the project risk management process and all supporting activities, in accordance with the requirements described in the risk management plan, and under direction from the Project Manager
- Support the Project Manager in the development and execution of the project risk management plan – which will include advice on an appropriate risk assessment methodology and the associated project risk tolerance criteria that should be employed
- Ensure active engagement and participation by the project team in the risk management process

- Engage and work with: project functions; project team members; customer representatives; contractors; sub-contractors; suppliers; and other stakeholders, in a collaborative execution of the project risk management process
- Plan and facilitate project risk identification and review workshops and conduct follow-up discussions with appropriate personnel as necessary
- Manage, and act as custodian of, the project risk register; ensuring the quality, timeliness, and completeness of the information captured in the project risk register
- Support Risk Owners and Risk Treatment Owners through on-going engagement, communication and facilitation activities to ensure that all risk-based information held in the project risk register around: risk identification, risk description, risk treatment options, risk response plans, and the status of any risk management interventions, is maintained, kept up-to-date and communicated to all relevant stakeholders in a timely manner
- Prepare and issue reports concerning project risk management health, the project risk profile, and the status of any project management interventions in accordance with the periodic project risk reporting requirements described in the risk management plan, as well as on an ad-hoc basis.

## 5.3 Project Team Members

The project team comprises everyone on the project, including consultants, joint venture partners, sub-contractors, and the customer. Project team members are integral to the success of the project risk management program and will specifically:

- Follow the risk management plan and associated risk management procedure by carrying out the risk management roles and responsibilities assigned to them and to review, actively manage, and take actions against those assigned risk activities
- Monitor their work areas and the project in general for information or indications which could serve to identify new risks or changes to existing risks, to include treatment activities
- Participate in the project risk management process on an ongoing basis by communicating any new risk information; participation may also include attending risk workshops, owning risks and/or risk treatment activities, reviewing and providing information concerning risk status, and/or supporting risk reporting.

## 5.4 Risk Owner

Risk owners are fully responsible and have the authority for the management of any risks assigned to them as approved by the PM. This includes clarifying and defining risks, developing treatment activities and their associated treatment plans, ensuring the information contained in the project's risk register is accurate, timely, and complete, and keeping the Risk Manager appraised of the status to enable risk register updates. Additionally, Risk Owners will:

- Participate in risk identification and review workshops
- Participate in project risk reviews and other project risk status / health meetings to provide status updates of their assigned risks to project leadership and other stakeholders
- Manage assigned risks and their treatment plans; be responsible for the timely reporting of risk status, progress, and effectiveness of treatment activities undertaken
- Assign treatment activities and requirements to applicable risk treatment activity owners
- Update the Risk Manager of the risk management status to meet project reporting requirements
- Monitor and review project activities and hold discussions with risk treatment activity owners and other relevant personnel on the status of assigned risks.

## 5.5 Risk Treatment Activity Owner

Risk treatment activity owners are responsible for the management and reporting of the treatment activities assigned to them by the Risk Owner. The treatment activity owner will:

- Execute the treatment activities in a timely manner in accordance with dates stated in the risk treatment plan
- Monitor the progress and effectiveness of the treatment activities in relation to the projected / desired results
- Report to the Risk Owner on the treatment activity status so the risk register can be updated in accordance with the project's reporting requirements.

# 6.0 PROCESS

The risk management process should be an integral part of day to day project management. It should be embedded in the culture, the people and practiced throughout all project activities.

In line with the principles and guidance provided in **ISO 31000: 2009 Risk Management - Principles and Guidance**, a five-step project risk management process will be adopted.

To initiate this process effectively, it is vitally important that the context surrounding project initiation, delivery and execution is established, understood, and communicated.

## 6.1 Establishing the Project's Risk Management Context

Establishing a project's risk management context involves gathering the relevant facts, defining the scope and objectives of the risk process, and establishing risk tolerance criteria. This can be informed by consideration and clarification of the following aspects:

- External influences and concerns
- Internal influences and concerns
- Project objectives
- The expected project risk profile.

### External Influences and Concerns

The external context, or external environment, will have an influence over how a project seeks to achieve its objectives. External impacts on the project can include: regulatory; financial; economic; technological; cultural; social; political; legal; competitive; and the natural environment at the local, regional, national, and international levels. External stakeholder values, relationships, and perceptions will also impact on a project achieving its objectives, e.g. local communities or stakeholders may need to be consulted for planning approval purposes. All of these need to be considered in establishing, monitoring, and updating a project's risk management objectives over the duration of a project.

### Internal Influences and Concerns

The internal context, or internal environment, will also impact on how a project seeks to deliver and realize its objectives. A project's risk management program must be aligned with and work within the project's culture, processes, structure, and strategy. Anything within a project organization that could influence how risk is managed is considered within this internal context. The list of internal influences to consider when developing a project's risk management program includes but is not limited to: established roles and responsibilities; governance arrangements; contract structure; policies; capabilities; resources; technology and information systems; reporting requirements; standards, and relationships with internal stakeholders (both established and perceived).

### Project Objectives

The project's objectives must be clearly defined, understood, and communicated before the risk management process can be applied. These objectives will have differing levels of detail associated with them - depending on which stage in the Stage Gate Process the project has reached. For example, in the very early stages of the project the risks are likely to be focused around aspects such as: project needs or justification; the robustness of the business case (which should consider finance availability and affordability); planning (including environmental approvals); and constructability issues. As the project concept develops further, with a more refined understanding of what it looks like and how it will be delivered,

then the project objectives will become more focused on: cost; schedule; safety; environmental; quality; operational delivery; reputational; and community benefit/improvement requirements.

**Risk Tolerance Criteria**

As indicated in the risk management plan a set of risk tolerance criteria will be established that define the risk tolerability limits that will be employed for risk management purposes.

The risk tolerance criteria will be established following an assessment and consideration of relevant factors which should include the following:

- Cost
- Schedule
- The political, legal and regulatory constraints
- Safety considerations
- Environmental obligations
- Customer expectations
- Other factors as appropriate.

The project will define the risk tolerance criteria in the risk management plan.

**Attachment 3** describes risk impact categories that can be used in this determination. The impact categories described are: cost; time; safety; quality; environmental; community; reputation and security. **Attachment 4** provides an illustration of how risk tolerance criteria can be defined using these impact categories.

## 6.2 Five-Step Project Risk Management Process

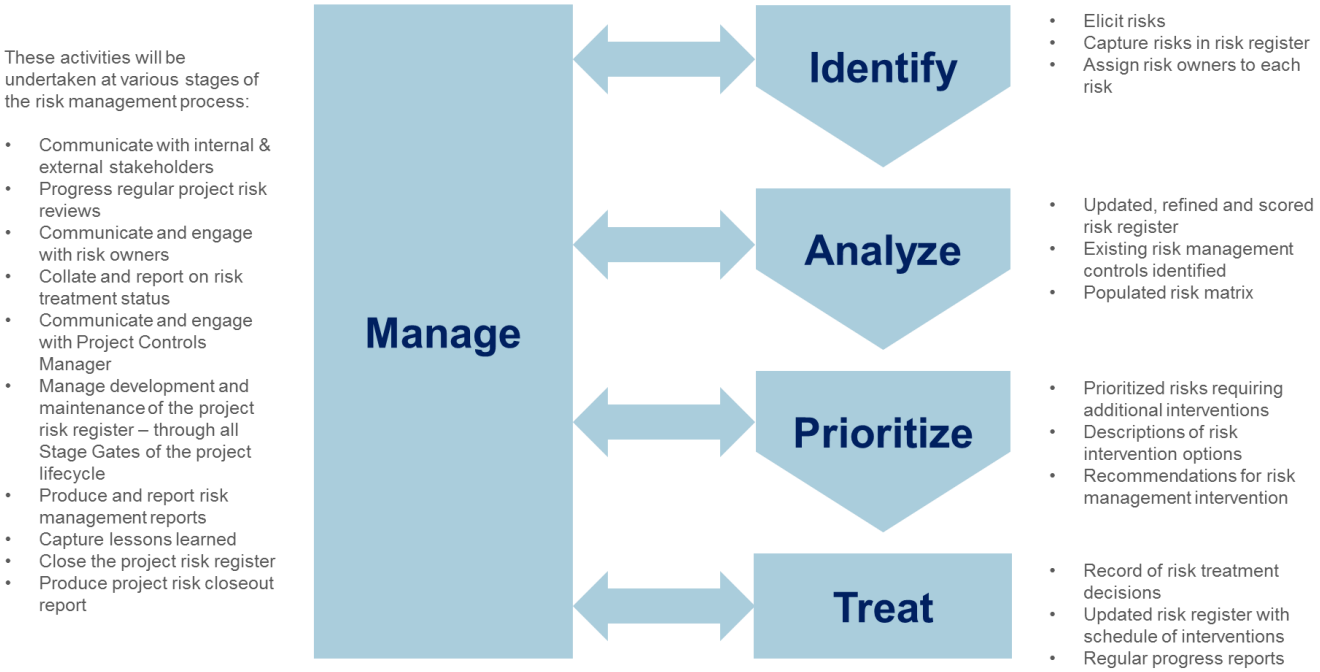
Once the previous contextual items have been identified and understood, the project risk management process is then developed. The five-step project risk management process, outlined below, can be tailored to a project's specific needs but should always follow these five basic steps.

The project risk management process is incorporated into the project's risk management plan. The risk management plan defines a project's risk management philosophy, details, and communicates how the project will execute the project risk management process and integrate it into the overarching **Project Delivery Strategy (EPM-S00-GL-000002)**.

A visual representation outlining the five-basic project risk management process steps (or stages): *Identify*, *Analyze*, *Prioritize*, *Treat*, and *Manage* along with their associated activities is shown in **Figure 1**.

The subsequent sections describe the activities associated with each step or stage, in more detail.

**Figure 1 - Project Risk Management Process Outline**




### 6.2.1 Identify

Risk identification is a project activity that is undertaken at all stages in the project life cycle. The purpose of this activity is to identify events or uncertainties that may or may not happen, but which could have an adverse impact on the achievement of a project's objectives.

In the ***Identify*** stage the risk events and uncertainties are identified and examined.

From these considerations, a comprehensive list of risks that could have an adverse impact on realizing the project objectives will be generated and descriptions of their sources, root causes, and the impacts if the risks materialize. It is important to ensure that a thorough risk identification is undertaken at the beginning of each project phase, and reviewed regularly (especially when a change to the project is being considered), so that any new or emerging risks can be identified for subsequent analysis in a timely manner.

In the ***Identify*** stage, risk descriptions will need to be sufficiently clear so that there is complete understanding as to what the risk includes and does not include, even if the risk cause or source is not readily evident. The following should be included in the risk identification examination effort:

- Whether the risk source is within or outside the project's control
- Consideration of all significant relevant potential impacts
- Any knock-on, cumulative, or cascading effects of the identified impacts.

Identified risks will be documented in a risk register which will include, as a minimum, the following:

- A risk title
- A description of the risk sources
- A description of the risk causes
- A description of the potential risk impacts if the risk materializes (for all relevant risk impact categories)
- Identification of a named Risk Owner.

A spreadsheet based risk register tool has been provided for this purpose (see the template in the EXPRO Projects White Book: Volume 13 - Introduction to Risk Management), and it is recommended that in the absence of any other tool, then this should be used. The spreadsheet template provides detailed guidance on the type of information that should be recorded.

To provide some guidance on the nature and source of project risk that can be expected during different stages in the project life cycle a hierarchy of risk sources is detailed in **Attachment 5**. The content of this hierarchy has been developed over many thousands of man years of collective experience in delivering major projects. It can never be 100% complete as engineering methods and technologies are continually changing and emerging and many of the items listed in this hierarchical list will not apply to every project. However, in its current form it provides project teams with a set of prompts that they should review and reflect upon their relevance when considering the sources of project risk.

**Outputs from Identify Stage**

1. A list of project risks that have been identified with initial impact and likelihood scores.
2. The risks will be captured in a Risk Register.
3. All risks will have a named Risk Owner assigned to them.

### 6.2.2 Analyze

Once a risk has been identified and recorded in the Risk Register, it must then be analyzed to determine whether it requires additional risk management interventions such as controls, actions or mitigation measures.

**Risk analysis** involves a more refined **assessment of the risk impacts and associated likelihoods** of being realized, than will have been developed in the ***Identity*** stage.

During this stage the risk understanding should be more thoroughly developed, risk levels determined, and risk statements developed. The need for risk management interventions (treatments) will be assessed, potential interventions evaluated, and strategies for employment explored.

During the ***Analyze*** stage, risk causes and sources will be fully identified, their potential impacts and associated likelihood of occurrence are estimated, and a risk statement is synthesized. The risk statement should provide a summary overview of the risk event or issue, its root causes and resulting impacts.

Risks can have interdependencies, multiple consequences, and can impact multiple project objectives. All these factors, including any pre-existing or potential controls and mitigation measures, should be carefully considered. Risk analysis results can be expressed in qualitative, semi-quantitative, or quantitative format, or a combination thereof. The type of analytical approach that should be adopted will depend on the situation and will consider things such as: available information, data quality, and the resources available to undertake any analysis.

Risk impacts and their associated likelihoods can be determined in a variety of ways. Events and scenarios can be modelled, results can be extrapolated from historical experience and available data, and expert judgement can be employed.

**Attachment 3** presents eight **impact categories** that can be used to characterize a risk. The definitions of the impact ratings A to E are also presented in Attachment 3 so that the risk impacts can be assessed consistently. There are two exceptions to this. For the cost and schedule impact categories, the user should define project specific impact ratings that are related to the project budget and plan and Attachment 4 provides an illustrative example of this.

A set of **likelihood rating** definitions are also presented in Attachment 3. Both qualitative and quantitative descriptions are provided for likelihood ratings ‘Rare’ to ‘Almost Certain’. The quantitative scale is expressed in probabilities in the range 0% - 100% (which is the preferred form) but it can also be expressed in terms of frequency (e.g. number of events per year) - if the situation being assessed is more conducive to this.

***Analyze*** efforts should consider the confidence level of determining the risk, sensitivity to input variables, information and data limitations, availability, quality, quantity, and timeliness, as well as conflicts or divergence of subject matter and expert opinions. These all need to be communicated to project decision makers when results are presented so that the best-informed decisions can be made.

Risks should always be assessed by consideration of their impacts and likelihoods in combination and for a given risk impact, the risk likelihood is the assessed likelihood that the specified risk impact will be realized. For sophisticated Monte Carlo analysis of risks, then the impact **or** the likelihood (note - only one or the other, never both at the same time) may have a range associated with them for risk quantification purposes, but this is beyond the scope of this procedure.

All risks should be mapped onto the **Risk Matrix** which will have been defined in the risk management plan and which will also define the risk tolerance criteria that will be employed for the project. This, in turn, will define the need for any additional risk management interventions such as controls, actions or mitigation measures. **Attachment 4** provides an example of a risk matrix as well as an illustrative example.

Note that the residual risks that are mapped onto the risk matrix provide a visual illustration of the **project risk profile**.

Once the risk analysis has been completed, risks can then be evaluated for treatment prioritization.

**Outputs from Analyze Stage**

4. A revised and updated risk register that contains more information about the nature and scale of the risk as well as any risk management controls that are employed.
5. A populated risk matrix.

### 6.2.3 Prioritize

***Prioritize*** uses the outputs from the ***Analyze*** stage to inform decisions about which risks require risk management interventions (treatment) and the priority order in which they will be treated. The risk level outcomes from the *Analyze* stage will be compared with the risk tolerance criteria defined in the risk management plan and priorities established according to the scheme described in **Attachment 4**.

During this stage, decision makers will ensure that all relevant factors are considered, including:

- Comparison of the analyzed risk levels with the risk tolerance criteria
- Ensuring that any residual risks are compliant with all legal and regulatory obligations
- An assessment of the residual risk levels against Ministry, customer and other stakeholder expectations
- Confirmation that existing controls are implemented effectively
- An assessment of the feasibility and practicability of any additional risk management interventions (treatments) that are required
- Determination of the need for any additional analysis before a decision can be made.

If a risk has been determined to require treatment, then the project team will develop risk management intervention or treatment options. These will be evaluated to identify the most practicable interventions (i.e. considering both effectiveness and costs) for the specific project risk. This evaluation will involve one or a combination of any of the following strategies:

- Avoiding the risk to eliminate a threat
- Removing the risk cause
- Reducing the likelihood
- Reducing the impact
- Transferring or sharing the risk (e.g. by insuring against the risk).

Risk management interventions or treatments can take the form of different types of activity. These are: controls; actions; contingency plans; and/or fallback plans.

**Risk treatment controls** are any ongoing system, procedure, process, device, or other means of treating risk. A key characteristic of risk controls is that they are routine and typically a normal part of day to day operations. Controls can take many forms, including physical equipment, process control systems, management processes, operating or maintenance procedures, emergency response plans, and staff competences. Note that 'audit' is not a control. It is a mechanism for providing assurance that controls are being employed correctly and effectively.

**Risk treatment actions** are normally one-time or limited duration risk management interventions, that are undertaken to reduce the risk impact and/or its likelihood of occurrence. A risk treatment action can convert to a risk treatment control if a decision is made to operationalize the action and adopt it as 'business as usual' going forward.

For example, consider the following scenario. During the design stage for a particularly complex and constrained construction site with lots of moving vehicles, the residual safety risk to construction workers has been judged to be unacceptable. As a result, the designers revise the construction site operating configuration so that moving vehicles and construction site workers are segregated and the residual risk is judged to be tolerable. When this configuration and the associated operating logistics are adopted during the construction stage of the project, then the segregation of the vehicles and the workers becomes a risk treatment control.

A **contingency plan** is the management response that will be undertaken if a risk is realized, as determined by a pre-defined trigger agreed by the project team.

A **fallback plan** is executed only in the case where a contingency plan proves to be ineffective or fails.

Both contingency plans and fallback plans will be developed, costed and assessed for practicability in exactly the same way as for all other risk treatment options. This will be done to ensure that the project team is fully informed when they consider risk treatment options and priorities.

The treatment options will contain fully developed and defined individual activity items with supporting facts and rationale, required resources, identified owners, and timelines for implementation. Draft risk treatment plans providing recommendations as to which risks to treat, treatment options to pursue, and the order in which to pursue those options will be prepared for consideration by the project team. Which treatment option or combination of options selected for implementation will be determined by the project team in the next project risk management stage - ***Treat***.

**Outputs from Prioritize Stage**

6. A list of prioritized risks which have been judged to require additional risk management intervention or treatment.
7. A description of the risk treatment options that could be considered for implementation to address each of these prioritized risks.
8. A description of any contingency plans and fallback plans that could be considered for employment for risks that might merit them.
9. A recommended plan of action that considers all the above for consideration by the project team.

### 6.2.4 Treat

From the ***Prioritize*** stage the risks prioritized for treatment will have been identified, optional risk treatment options will have been evaluated, and recommendations made as to which risk treatment options should be implemented. The project team (under the guidance of the Project Manager) will then review these recommendations and make decisions about which risk management interventions or treatment activities will be implemented. Following these decisions, the **risk treatment plans** will be finalized.

At a minimum, the **risk treatment plans** will contain:

- The justification and rationale for selecting the treatment activities
- The treatment activity implementation resource requirements (i.e. cost, time, manpower and materials)
- Timing for implementation of the treatment activities and evaluation
- The named individuals who will be accountable for the treatment activities
- The expected outcomes in terms of risk benefits.

The risk treatment process is cyclical and its activities will consist of:

- Implementing the selected risk treatment plan
- Evaluating the risk treatment plan effectiveness
- Continuous assessment of the results against the pre-defined risk tolerance criteria to assess whether the residual risks are tolerable.

If the post risk treatment residual risk is not tolerable then the risk treatment approach will need to be modified and revised risk treatment plans developed. This cycle is repeated until the residual risk reaches a tolerable level. If any residual risk is not tolerable then other risk management intervention options must be explored.

The risk management plan will provide detailed guidance on how the practicability of risk management interventions will be assessed for this project. In broad terms the practicability tests will include the following:

- Are all legal and regulatory requirements being complied with?
- Are there any standards or Approved Codes of Practice (ACoPs) that are applicable? If so, are they being employed?
- Have all customer specific requirements been addressed (e.g. related to environmental or societal concerns)?
- What are the costs of additional risk management interventions?
- What are the associated risk benefits?
- Are the costs grossly disproportionate for the benefits that are expected to accrue?

Risk treatment activities will be recorded, tracked, and monitored in the Risk Register. Particular attention will be paid to ensuring that the risk treatment activity owners are aware of their responsibilities. The Risk Manager will ensure that the status and effectiveness of the timed risk management intervention (whether it is an action, contingency plan of fallback plan), is monitored and reported to the project team.

**Outputs from Treat Stage**

10. A record of the project team decisions about which risk treatment options will be implemented (note - these may take the form of actions agreed at project team meeting minutes), and who has been assigned as the risk treatment activity owners.
11. An updated Risk Register that captures the agreed risk treatment plans, owners and timings for implementation.
12. Regular updates to the project team on the status of the risk treatment activities.

### 6.2.5 Manage

The final element of the risk management process is not a separate step as it is a continuous activity that weaves throughout all of the steps that have been described above.

The Risk Manager will be responsible for all activities undertaken to support ***Manage***. These can be summarized as ensuring that the right risk-based information is communicated effectively and in a timely

manner to the right people so that risk-based decision making and associated risk management interventions are executed in compliance with the requirements of the risk management plan and this procedure. The Risk Manager's communication activities will include providing feedback to project leadership as to the effectiveness and efficiency of the risk management program.
Managing the project risk management process relies on contributions from all project team members. Some of the applicable key ***Manage*** activities are detailed below.

**Consultation and Communication**

The key for efficient management is consultation and communication - continual, consistent, timely, and relevant consultation and communication with all relevant stakeholders, internal and external to the project. This type of interaction will ensure that the interests and potentially divergent views of the customer and other stakeholders, are fully understood and considered as appropriate when project risk tolerance criteria are determined. Continuous communication will ensure that a consistent understanding and appreciation of the scale, nature and source of project risks is shared by all project stakeholders. This consistency will ensure that any decisions around the need for additional risk management interventions, for example, are based on a common and collective understanding.

All risk management interventions (controls, actions, contingency plan and fallback plans) have individuals allocated who 'own' the risk treatment activities. These Risk Owners will be responsible for implementing the risk treatments, and reporting on the associated costs, benefits and overall effectiveness. The Risk Manager will be responsible for collating this information and disseminating it to the rest of the project team.

When a risk event or issue is realized - or there is good evidence that it will be realized - then it will be recorded as a ***trend*** and transferred to the Project Controls Manager who will be part of the project team. The Risk Manager is responsible for ensuring that this line of communication is maintained and that trends are identified and communicated to the Project Controls Manager as early as possible. The Project Controls Manager is responsible for addressing the trend in accordance with the project controls procedures described in the EXPRO Projects White Book (EPWB).

**Monitoring and Review**

Regular monitoring and review of all aspects of the risk management process are necessary components of the *Manage* element, and is key to tracking performance management. It is the mechanism by which the effectiveness of risk treatment activities is evaluated, while ensuring that any changes to the overall project risk profile is continually assessed. Continuous monitoring and review of these aspects means that the need for any additional risk management interventions can be anticipated and acted upon in a timely and effective manner.

The **project risk management plan** will define the nature and frequency of all project risk management monitoring and review activities. This will address the following activities:

- The frequency with which the project team will consider project risk (for example this may be a standing item on monthly project team review meetings)
- The frequency with which project Risk Treatment Owners will report progress on the status of their risk treatment activities to the Risk Manager
- The frequency and format of risk management reports and metrics (e.g. there may be a monthly 'dashboard' report, as well as an annual risk review report)
- The nature of project changes that will trigger a review and reassessment of the project risks
- The project life cycle stages when a thorough review and update of the project risk register will be undertaken (e.g. there will be a link to the stage gates process)
- How risk related lessons will be captured and who they will be communicated to
- How the customer will be involved in risk reviews.

Occasionally, ad hoc meetings will be needed to focus on evaluation of treatment activities or to perform further analysis and quantification. If necessary, smaller group meetings may be able to handle detailed evaluations better than the project team. The risk management plan will describe how the outputs and findings from these reactive activities will be fed back into the project team reviews.

Lessons learned will be documented as they arise through the monitoring and review process. Lessons learned provide invaluable insight for future analysis and project activities. At a minimum, the lessons learned documentation will include an overview of the item, the challenge presented, the solution employed, and the resulting outcome. Lessons learned collected throughout the project's life cycle will be included in the project risk closeout report.

### Reports and Metrics

The risk management plan will define metrics and reports, including level of reporting and reports to Customers, that indicate the status of the project's prioritized risks and the status of the risk program's effectiveness, concerns, and process improvement activities. The metrics will be reviewed and acted upon at planned intervals during the monthly risk review cycle.

A trigger risk level threshold and communication protocol will be developed and documented in the risk management plan. Protocols for escalating risks that are judged to be intolerable, after all risk treatment options have been exhausted, will also be described.

### Closing Risks and the Risk Program

The risk management plan will define the conditions or circumstances under which a risk can be closed. These will include:

- Project scope change resulting in the risk being no longer relevant
- The project phase associated with the risk exposure having passed
- The risk event or issue is realized (or is judged to be realized imminently) in which case it is passed to the Trend program under control of the Project Controls Manager.

In all cases when a risk is closed the circumstances around the closure must be evaluated to ensure any residual or emerging risks are properly captured, recorded, and included in the project risk register. When a risk is closed, the information contained within the project risk register will be updated to reflect:

- The fact that the risk was closed
- Date when the risk was closed
- Why the risk was closed
- If any residual or emerging risks were identified, and what those risks were.

If the project is moving on to another stage in the Stage Gate Process (e.g. from 'design' to 'tender for construction'), any risk information relevant to the next stage will be retained in the risk register - and will be shared with the relevant stakeholder at the subsequent stage. In the case of transition from 'design' to 'tender for construction', the risk register will be passed from the designer to the contractor (in this case it may even be made available as part of the request for proposal (RFP) package to all potential construction bidders). In the case of the transition from stages 'test and commissioning' to 'handover and closeout' the risk register will pass from the contractor to the operational entity, which could be the Customer.

It will the responsibility of the Risk Manager to manage the process of passing the risk register between the relevant stakeholders at each Stage Gate.

When a project's risk program is being closed, every risk contained within the risk register will be reviewed and, where appropriate, individually closed. Once all risks within a project's risk register have been reviewed and properly closed the Risk Manager will:

- Close the project risk register
- Generate a project risk closeout report which will contain, as a minimum:
    - Summary of the project objectives, risk management plan, risk tolerance criteria, and closed risk register; redact any Customer sensitive and/or project identifying information from the risk register file contained in the report
    - Historical overview of the execution of the risk program, to include any significant challenges and successes
    - Lessons learned
- Provide a copy of the risk closeout report to the Project Manager and project team.

## 6.3 Tools & Techniques

There is a wide range of techniques that can be employed at different steps in the risk management process. For example, qualitative and quantitative methods can be used to identify and assess project risks. **Attachment 6** presents a selection of these, indicates some of the strengths and weaknesses of different techniques, and provides some guidance on the circumstances, project life cycle stages and risk management process steps, when different techniques may be more applicable.

The risk register is a critical tool for successful project risk management. To encourage a standard and consistent approach to project risk management, it is recommended that a simple format for recording project risks is adopted. It is therefore recommended that a risk register based on a Microsoft Excel based spreadsheet is used to capture project risks, and to record how they are being managed. An Excel based spreadsheet template has been provided for this purpose (Project Risk Register Template (EPM-EM0-TP-000001)) and a sample of this is presented in **Attachment 7**.

As the risk management maturity level within an Entity develops, then it may well look to employ a more sophisticated web-based and commercial off the shelf software package such as Active Risk Manager (http://www.sword-activerisk.com/products/active-risk-manager-arm/) on its projects.

Regardless of the tools used to support development and management of the risk register, and of the techniques used to identify and assess project risks, projects will follow this procedure.

## 6.4 Interfaces

Project risk management is integral to every project system and process, and all benefit from a risk-based approach. Interfaces between project risk management and other project management functions will be formally defined in the risk management plan. Over the project life cycle, the Risk Manager will interact regularly with other project management functions to ensure that the project risk register reflects any changes or emerging issues in a timely manner. The risk management plan will describe the nature and frequency of these interactions which will depend on the project needs, and which stage in the project life cycle, the project has reached.

For example, as events or issues crystalize or are realized during the course of project development or execution, then they will be identified as ‘Trends’ and passed over to the Project Controls Manager to manage. The type of event or issue that typically falls into this category would include: scope changes; material quantities; prices; productivity levels; and activity durations.

Guidance on project controls management, and supporting templates, is provided in the EXPRO Projects White Book.

Another critical interface will be with the project Stage Gate Process reviews. At these reviews, all project products that should have been delivered up to that point in the project life cycle will be reviewed for acceptance before transition to the next stage in the Stage Gate Process. As part of this review, the Project Manager, with advice from the Risk Manager, will indicate whether they consider the residual risks captured in the risk register to be tolerable, thereby allowing the project to pass through to the next stage in the project life cycle. **Attachment 1** provides guidance on how this will be implemented.

As a project definition matures and moves through the relevant Stage Gate Reviews, then it will be moving into project phases such as design and build where there are well known project risks and for which a suite of project risk control procedures (e.g. design or construction procedures) have been developed. At these stages the designers or contractors will be required to follow and comply with these procedural requirements. In these circumstances, the role of the Risk Manager evolves towards an assurance function by ensuring that these project risk control procedures are being followed, that any outputs (e.g. design or construction risk assessments) are being developed to the standard required, and that there are not any residual risks that are intolerable.

Guidance on how these engineering procedures should be developed and implemented, along with supporting templates, are described in the EXPRO Projects White Book.

The project's risk management plan will define the handoff, interfaces, and ongoing interaction with other project management processes such as Project Controls. The risk management plan will also describe the triggers that will be used to initiate transfer of risks from project risk register to the Project Controls Trend program. These triggers can include items such as risks that have been realized, risks with high impact likelihoods, risks with approaching impact dates, risks with high risk treatment costs, etc. Any risks that transfer to the Trend program may have residual risks or new risks may emerge so the Risk Manager will review all activities associated with the risk transfer to ensure that any new or emergent risks are captured and recorded in the project's risk register.

## 7.0 ATTACHMENTS

1. Guide to Risk Management and the Stage Gates Process
2. Risk Management Terms and Definitions
3. Guide to Risk Impact and Likelihood Categories
4. Guide to Risk Matrix and Risk Tolerance Levels
5. Guide to Hierarchical Sources of Risk
6. Examples of Risk Management Tools and Techniques
7. EPM-EM0-TP-000001 - Project Risk Register Template

## Attachment 1 - Guide to Risk Management and the Stage Gates Process

The **EXPRO Stage Gate Process** is a key lynchpin in the project management suite of tools. It describes the 'gates' that need to be passed through successfully at various stages in the project life cycle. The Stage Gate Process provides assurance that the project is on track, is meeting its original objectives, and is being delivered effectively.

Risk management is a continuous activity that will be undertaken throughout the project life cycle and will provide a critical checkpoint at each stage gate. The level of detail that will be considered during the risk management activities, and the sources of critical risk related inputs, will vary at each stage gate and the following table provides a guide to the type of things that the Risk Manager will review at each stage.

The Risk Manager (recognizing that the person may change during an extended project duration) will provide continuity across the Stage Gate Process. It is the responsibility of the Risk Manager to advise the Project Manager on whether there are any residual risks associated with the project that should prevent the project passing through to the next stage (i.e. whether there are any intolerable residual risks).

The Risk Manager's findings and recommendations will be communicated to the Entity Gate Committee.

**Note** - the Risk Manager will provide advice. It will be up to the Project Manager, in consultation with the Entity Gate Committee to take decisions.

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 1 | Registration | • Has a project risk register been developed (from the Entity Risk Potential Assessment)?<br>• Is the need for the project clearly defined?<br>• Is the need aligned with the strategic plan?<br>• Is the strategic outline case robust?<br>• Have all key assumptions been clearly identified?<br>• Are the residual uncertainties around any of the key assumptions tolerable?<br>• Has budget for the project been approved?<br>• Have all significant stakeholders been identified?<br>• Have approvals processes / regulatory hurdles been considered?<br>• Have all potential interdependencies with other Ministries / Entities / Projects been considered?<br>• Has the feasibility of the project been considered (e.g. constructability, access to transport and utilities, availability of critical resources)?<br>• Have all potentially high risk factors been considered and assessed (e.g. introduction of new technologies, employment of innovative methods, supply chain vulnerabilities)?<br>• Are the residual risks associated with the project tolerable? |

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 2 | Initial Planning | • Has the project risk register been updated?<br>• Is the need for the project still clearly defined?<br>• Is the project still aligned to the strategic plan (i.e. has there been any change in strategic imperatives)?<br>• Has the scope of the project been refined and more clearly defined?<br>• Is the project scope understood and agreed by all significant stakeholders?<br>• Is there any residual uncertainty around project scope?<br>• Has an outline business case been prepared and reviewed by the relevant authority?<br>• Are the key assumptions still valid?<br>• Have residual uncertainties associated with the key assumptions from Stage 1 been addressed and reduced?<br>• Are the residual uncertainties tolerable?<br>• Is budget still available?<br>• Have all the approvals, permissions and feasibility activities been developed to a level sufficient to provide assurance that there are no project showstoppers?<br>• Are the residual risks associated with the project tolerable? |
| 3 | Tender for Design | • Has the project risk register been updated?<br>• Is the project scope clear with no ambiguities?<br>• Is there confidence that there is sufficient design capacity in the market (i.e. how much other work is being tendered / undertaken at the time)?<br>• Did the designer pre-qualification exercise generate a good response?<br>• Did we have at least four reputable designers pre-qualified?<br>• Was the bid evaluation process straightforward?<br>• Was there a large divergence in scores between the bid evaluators?<br>• Are there any residual concerns about the winning bid (e.g. are we confident that they have sufficient capacity, depth and competence)<br>• Does the winning bid include any qualifications in their bid or have they accepted all the contractual requirements?<br>• Is it clear how scope changes will be accommodated contractually?<br>• Has funding been committed by the Ministry of Finance to progress the project?<br>• Are the residual risks associated with the project tolerable? |

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 4 | Design | • Has the project risk register been updated?<br>• Has a design risk assessment been undertaken (by the designer)?<br>• Does the design risk assessment account for constructability, operations, and maintenance issues?<br>• Has the design risk assessment been independently reviewed?<br>• Has the designer shared the risk register with the Risk Manager?<br>• Have communications between the designer and the Risk Manager been constructive?<br>• Has the project scope changed?<br>• If there has been scope change, has this been accommodated easily or has it resulted in contractual disputes?<br>• Have all design elements gone through 30%, 60%, 90% and Final?<br>• How have design stage approvals been assured?<br>• Has there been any disputes associated with design stage approvals?<br>• Are there any outstanding or unresolved design issues?<br>• Has the design been sub-packaged?<br>• If there has been design sub-packaging, have all interdependencies and systems engineering issues been addressed at Final design stages, and how has this been assured?<br>• Has the outline business case been updated and reviewed by the relevant authority?<br>• Are the residual risks associated with the project tolerable? |

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 5 | Tender for Construction | • Has the project risk register been updated?<br>• Is the project scope clear with no ambiguities?<br>• Is there confidence that there is sufficient construction capacity in the market (i.e. how much other work is being tendered / undertaken at the time)?<br>• Did the constructor pre-qualification exercise generate a good response?<br>• Did we include safety performance record in the pre-qualification criteria?<br>• Did we include contractual dispute record in the pre-qualification criteria?<br>• Did we have at least four reputable construction firms pre-qualified?<br>• Was the bid evaluation process straightforward?<br>• Was there a large divergence in scores between the bid evaluators?<br>• Are there any residual concerns about the winning bid (e.g. are we confident that they have sufficient capacity, depth and competence)<br>• Does the winning bid include any qualifications in their bid or have they accepted all the contractual requirements?<br>• Is it clear how scope changes will be accommodated contractually?<br>• Has a final business case been prepared and reviewed by the relevant authority?<br>• Has funding been committed by the Ministry of Finance to progress the project?<br>• Are the residual risks associated with the project tolerable? |

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 6 | Construction | • Has the project risk register been updated?<br>• Has a construction risk assessment been undertaken (by the constructor)?<br>• Does the construction risk assessment account for operational and maintenance risks?<br>• Has the construction risk assessment been independently reviewed?<br>• Has the constructor operated a robust risk management process?<br>• Has the constructor openly shared the risk register with the Risk Manager?<br>• Have communications between the constructor and the Risk Manager been constructive?<br>• Have there been any difficulties or issues during construction?<br>• If there were difficulties, what were the main reasons for these?<br>• Has there been any changes to scope / design during construction?<br>• If there have been changes, how easily have these been accommodated, or has it resulted in contractual dispute?<br>• How much rework has had to be undertaken?<br>• What confidence do we have in the inspection reports?<br>• What confidence do we have in the accuracy of as-built drawings?<br>• What level of assurance has been provided to support certification of all works?<br>• Do we have any residual concerns about quality of build?<br>• Are the residual risks associated with the project tolerable? |
| 7 | Test and Commission | • Has the project risk register been updated?<br>• Has a test and commissioning plan been developed?<br>• Has the testing and commissioning plan been independently reviewed and agreed with the customer?<br>• Has a comprehensive and complete set of approved test and inspection records been provided?<br>• Did execution of the testing and commissioning plan uncover any operational issues?<br>• Have all defects and operational issues been identified?<br>• Are there any outstanding defects and operational issues?<br>• Has a schedule for addressing any defects and operational issues been developed?<br>• Has the defect and operational issues correction schedule been accepted by the customer?<br>• What confidence do we have in the accuracy and completeness of the as-built drawings?<br>• Has a handover plan been developed?<br>• Has the customer reviewed and accepted the handover plan?<br>• Are the residual risks associated with the project tolerable? |

| Stage # | Stage Gate Description | Risk Management Considerations at Stage Gate |
|---|---|---|
| 8 | Handover and Closeout | • Has the project risk register been updated?<br>• Has the defects and operational issues correction schedule been executed?<br>• Have all final test and inspection activities been completed?<br>• Are there any residual defects and operational issues?<br>• Are there any residual commercial issues (e.g. unpaid invoices, contract change disputes)?<br>• Have all project records been disposed of or handed over as appropriate?<br>• Has the customer formally accepted the project (e.g. via a handover certificate)?<br>• Are the residual risks associated with the project tolerable? |

## Attachment 2 - Risk Management Terms and Definitions

| Term | Definition |
|---|---|
| **Action** | A one-time measure to avoid, reduce, transfer or accept a threat. |
| **Consequence** | A potential risk outcome that could affect the attainment of a project's objectives. The Risk Consequence can have several impact categories such as cost, time and safety.<br>Refer to **Attachment 3** for full details of a set of rating schemes for eight consequence categories. |
| **Control** | A repeated intervention that modifies a risk. This can include execution of any process, procedure, physical device, operational practice or worker competence, that has a modifying effect.<br>Controls may not achieve the desired results so they need to be monitored for effectiveness. |
| **Contingency Plan** | An action (or set of actions) that will be executed after a risk event has occurred. |
| **Event** | In the project risk management context, an event is something which might or might not happen, but which if it does happen has the potential to adversely impact upon successful attainment of a project's objectives. |
| **Fallback Plan** | A recovery plan of action (or set of actions) that will be executed if the **contingency plan**, employed after a risk has occurred, fails. |
| **Impact** | See **consequence** above. These terms are used interchangeably in the risk management discipline. Impact is the preferred term.<br>**Impact Factors** are facts or factors that inform the project team's belief about the potential **risk impact**, if the risk is realized. |
| **Likelihood** | The chance that a risk event might happen. Likelihood is often expressed as a probability (the preferred approach) or frequency.<br>See **Attachment 3** for full details of a standard likelihood rating scheme. |
| **Monte Carlo Analysis** | A mathematical modelling technique that through repeated random sampling simulates the interaction of multiple risks to model the statistical distribution of different project outcomes (e.g. cost, schedule). This technique enables sensitivity as well as 'what if' scenario analysis.<br>There are a range of commercially available tools that are available to undertake such analyses. |
| **Residual Risk** | The risk that remains after implementation of all existing and/or planned **risk management interventions** (**risk treatments**).<br>It is the residual risk which is considered when determining whether or not the project risk profile is tolerable or not. |
| **Risk** | A risk is an uncertain event or condition that, if it occurs, can adversely affect successful achievement of project objectives.<br>Best practice risk management considers risk as either an opportunity or a threat. However, for the purposes of this risk management procedure, and in accordance with the approach described in the risk management plan, we only consider threats.<br>Risk is usually characterized as a potential event with a specific impact than can be realized by a specific cause with a specific likelihood. |
| **Risk Analysis** | Risk analysis is the process used to understand the nature, impact and associated likelihood of a risk on the project's objectives and then the use of that information to make decisions on which risks should be treated and the appropriate treatment options to pursue. Risk analysis can be |

| Term | Definition |
|---|---|
| | conducted and expressed in **qualitative**, **semi-quantitative**, or **quantitative** terms, or a combination thereof.<br>**Qualitative risk analysis** is a technique concerned with subjectively describing a risk and estimating and expressing the risk impact and associated likelihood in a textual format.<br>**Semi-quantitative risk analysis** is a risk assessment technique that provides an intermediary level of effort between the textual evaluation of qualitative risk assessments and the technical numerical evaluation of quantitative risk assessments. Typically, this is accomplished by evaluating and expanding on the textual information obtained in a qualitative risk analysis and providing a score that can allow risks to be ranked against one another. To allow this, risk scoring categories are used – as defined in the project risk management plan.<br>**Quantitative risk analysis** is the process of numerically quantifying the impact on overall project objectivities of identified risks. The power of quantitative risk analysis is it allows multiple risks to be considered and compared at once, instead of individually as with qualitative and semi-quantitative techniques. It is typically undertaken using Monte Carlo simulation and conducted to quantify project cost and schedule risks. It usually includes sensitivity analysis to identify key drivers of overall risk and risk uncertainty. |
| **Risk Cause** | Causes are events or circumstances which currently exist and might give rise to risks. |
| **Risk Driver** | This is a fact or project related factor that informs the project team's belief about how likely a risk is. **Risk drivers** are the basis for estimating the **risk likelihood** which can be expressed as a Probability or Frequency (although probability is preferred over frequency).<br>The **cause** field in the **risk register** is where Risk Drivers should be recorded. |
| **Risk Management Intervention** | These are activities (**risk treatments**) that could alter the likelihood of a risk being realized, or the impact if it is realized.<br>Risk Management Interventions can take the form of one of the following: **control**; **action**; **contingency plan**; **fallback plan**. |
| **Risk Management Plan** | Document defining the project-specific risk management scope, roles and responsibilities, risk tolerance criteria, the application of the project risk management process, communication strategy (e.g. meetings, reports to be generated, minimum reporting cycle), and the sequence and timing of the project risk related meetings and reports. |
| **Risk Matrix** | A two dimensional 5 × 5 matrix representation of **likelihood** and **impact** used for visual representation of risks. It is used to inform decisions about priorities for **risk management intervention (treatment)**.<br>The **risk matrix** maps each individual risk from the **risk register** onto one of the matrix cells defined by its likelihood and impact risk scoring categories. If the risk has impacts in several categories, ***the highest Impact level is used***.<br>The individual cells of the risk matrix have a priority sequence ranging from 1 to 25 to provide a **risk ranking** (see the risk management plan and **Attachment 4**). Risks are prioritized for the attention of the project team according to the colored priority bands to which they belong and are sequenced in reports according to this priority sequence. |
| **Risk Register** | The repository for all the project's identified risks, information about the nature and scale of the risk, who is responsible for managing the risk and |

| Term | Definition |
|---|---|
| | the nature of any risk management interventions employed to maintain the risk at a tolerable level.<br>Risk registers are typically held in spreadsheets although there are commercially available products that can be employed. |
| **Risk Score** | Risks are scored against a project **risk scoring scheme** which is defined in the **risk management plan**.<br>The risk scoring scheme has two component parts: likelihood and impact. Five categories of impact and likelihood are defined. |
| **Risk Source** | Where the risk originated. A risk can have more than one source.<br>**Attachment 5** provides a three-level hierarchy of risk sources. |
| **Risk Statement** | A concise statement that describes the uncertain risk event and its major causes along with impact levels. The risk statement is typically not fully refined and defined until after the risk has been fully analyzed. |
| **Risk Tolerance Criteria** | The risk tolerance criteria are the combinations of risk impact and likelihood that are defined in the risk management plan as falling into one of the following categories: **unacceptable**; **tolerable**; **broadly acceptable**.<br>This is usually presented as colored cells on the risk matrix with guidance as to the risk management response that will be employed for risks assessed as being in each color. |
| **Risk Treatment** | See **risk management intervention**. Modifying the likelihood or consequences (or both) of a risk. This is achieved through a treatment plan composed of treatment activities which can consist of controls, actions, contingency plans, and/or fallback plans. |
| **Risk Treatment Plan** | Also known as the **risk response plan**. Establishes how the project will alter the likelihood of a specific risk and the scale of its impacts by detailing the risk treatments that will be implemented. |
| **Stakeholder** | Person, group, or organization which can affect or be affected by the project's objectives, policies, and execution. Some examples of stakeholders include the customer, project team, sub-contractors, local communities, regulators, other government departments and local communities. |
| **Threat** | A Threat is a risk with a potential adverse effect on at least one of the project's objectives. |
| **Uncertainty** | The situation which involves imperfect and / or unknown information and applies to predictions of future events, to physical measurements that are already made, or to the unknown. Uncertainty is not knowing exactly what is going to happen next, nor what the distribution of possible outcomes looks like. |

# Attachment 3 - Guide to Risk Impact and Likelihood Categories

## Project Risk Impact Rating Scheme

| Impact Category | A<br>Very Low | B<br>Low | C<br>Medium | D<br>High | E<br>Very High |
|---|---|---|---|---|---|
| **Cost** | *Project Specific*<br>*e.g. < 1% of budget* | *Project Specific*<br>*e.g. 1-5% of budget* | *Project Specific*<br>*e.g. 5-10% of budget* | *Project Specific*<br>*e.g. 10-25% of budget* | *Project Specific*<br>*e.g. > 25% of budget* |
| **Time** | *Project Specific*<br>*e.g. < 1 month delay* | *Project Specific*<br>*e.g. 1-3 months delay* | *Project Specific*<br>*e.g. 3-6 months delay* | *Project Specific*<br>*e.g. 6-12 months delay* | *Project Specific*<br>*e.g. > 12 months delay* |
| **Safety** | First aid or slight injury/illness with no treatment. | Recordable, medical treatment, restricted work, temporary effect. | Lost time injury/illness or permanent disability. | Single fatality or permanent disability of 3 or more persons. | Multiple fatalities. |
| **Quality** | Defects in work identified. Minor corrective action contained within operational role in that shift. Insignificant impact, fully contained. Minor productivity impact. | Defective work identified. Corrective action spanning multiple shifts required. Minor schedule and cost impact. Schedule recoverable. | Systemic defective work produced & identified prior to operational testing. Multiple corrective actions required over many days. Moderate schedule impact or knock on effect on delaying subsequent work activity by a number of days & up to $50k cost impact to business. | Defective work not identified until operational testing. Single corrective actions spanning multiple weeks. Significant impact. Risk of lost time incident in operational testing. Multiple weeks delay to schedule and up to $1M cost impact to business. | Systemic defective work produced & not identified until operational testing. Multiple corrective actions required spanning months. Catastrophic impact, risk of employee fatality in operational testing, Multiple months impact on schedule & multi-$M cost impact to business. |
| **Environmental** | Insignificant impact. fully contained. | Negligible short-term impact, confined on site, no regulatory exceedance. | Moderate to significant impact confined on site, regulatory exceedance, or any off-site impact. | Significant impact on or off site, or potential enforcement action. | Catastrophic impact, long-term liability, or irreversible damage. |
| **Community** | Little or no complaint(s) to site and/or regulator from abutters, local stakeholder groups or local government. | Minor complaint(s) from abutters, local stakeholder groups or local government. | Significant complaint(s) from abutters, local stakeholder groups or local government. Isolated, small-scale protest. | Persistent complaints from community and national stakeholder groups or national government. Large-scale protests. Threat of legal action. | Community/NGO legal action. Significant concerns expressed by key international stakeholder groups or from more than one national government. Sustained large-scale protests with injury or damages. |

| Impact Category | A Very Low | B Low | C Medium | D High | E Very High |
|---|---|---|---|---|---|
| **Reputation** | No negative media coverage. No disruptions in current operations. | Local negative media coverage. Some limits on current operations. | Regional negative media coverage. Disruptive impact on current operations. Issue creates complications with customer relationship. | Sustained negative regional or national media coverage. Significant and/or sustained impact on project progress/current operations. Issue creates significant customer conflict. | Influential national or international negative media coverage. Significant impact on project delivery for months. Customer publicly states dissatisfaction with EPMO. Significant legal action. |
| **Security** | A threat exists against the asset or a person. A willful criminal act or condition resulting in a Category I impact. Normal management action required. | A threat exists against the asset or a person. A willful criminal act or condition resulting in a Category II impact. Normal management action required. Low level of external emergency service assistance may be required. | A threat exists against the asset or a person. A willful criminal act or condition resulting in one or more Category III impacts. External emergency service assistance may be required. | A threat exists against the asset or persons. A willful criminal act or condition resulting in one or more Category IV impacts. External emergency service assistance is required. | A threat exists against the asset or persons. A willful criminal act or condition resulting in one or more Category V impacts. Multiple external emergency services assistance is required. |

**Project Risk Likelihood (Probability) Rating Scheme**

| Category | A Rare | B Unlikely | C Possible | D Likely | E Almost Certain |
|---|---|---|---|---|---|
| **Likelihood** | Risk has an occurrence of less than 1% in the relevant industry. | Risk is unlikely to occur on this project with current processes and procedures in place. | Risk occurs often within the industry or Company. | Risk has recently occurred on a similar project within the industry or Company. | Risk is highly likely to occur on this project, potentially multiple times. |
| **Probability** | < 10% | 10% to 30% | 30% to 70% | 70% to 90% | > 90% |

(**Note** - only likelihood OR probability will be used, never both at the same time.)

## Attachment 4 - Guide to Risk Matrix and Risk Tolerance Levels

The risk management plan will define the risk dimensions (impact and likelihood) that will be adopted to assess project risks, and it will define the risk matrix categories (red, amber, yellow, green) that will be used to prioritize risk management interventions.

Within each risk category, a scoring mechanism will be adopted to enable prioritization within each category. Note the numbers are assigned for prioritization purposes only. They are not derived from any numerical calculation.

The following example illustrates this concept.

**RISK MATRIX**

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | 10 | 15 | 20 | 25 | Almost certain | Likelihood |
| 4 | 9 | 14 | 19 | 24 | Likely | |
| 3 | 8 | 13 | 18 | 23 | Possible | |
| 2 | 7 | 12 | 17 | 22 | Unlikely | |
| 1 | 6 | 11 | 16 | 21 | Rare | |
| A | B | C | D | E | | |
| Impact | | | | | | |

The risk management plan will define how priorities will be established based on the risk categories defined, and it will define the level of risk management intervention that will be required for risks in different priority categories.

This is illustrated in the following example:

| | **Level of Risk Exposure** | | | |
|---|---|---|---|---|
| | **Red Priority 1** | **Amber Priority 2** | **Yellow Priority 3** | **Green Priority 4** |
| **Risk Tolerance** | Risks that significantly exceed the risk tolerance threshold | Risks that exceed the risk tolerance threshold | Risks that lie on the risk tolerability threshold | Risks that are below the risk tolerability threshold |
| **Risk Response** | Requires urgent and immediate attention | Requires proactive management | Requires active monitoring | Do not require active management |

The following example provides an illustration of how the risk cost and schedule impacts can be defined and combined in a form aligned with the risk matrix requirements described above.

| | | | | | |
|---|---|---|---|---|---|
| **Almost certain** | **5** | **10** | **15** | **20** | **25** |
| **Likely** | **4** | **9** | **14** | **19** | **24** |
| **Possible** | **3** | **8** | **13** | **18** | **23** |
| **Unlikely** | **2** | **7** | **12** | **17** | **22** |
| **Rare** | **1** | **6** | **11** | **16** | **21** |
| **Cost Impact (*)** | **< SAR 1M** | **SAR 1-2.5M** | **SAR 2.5-5M** | **SAR 5–10M** | **> SAR 10M** |
| **Schedule Impact (*)** | **< 1 week** | **1- 2 weeks** | **2-4 weeks** | **1– 2 months** | **> 2 months** |
| **Impact Category** | **A** | **B** | **C** | **D** | **E** |

*(*) **Note** – these impact scales are illustrative only. Each project should define its own impact scales to reflect the overall budget and schedule for project delivery.*

## Attachment 5 - Guide to Hierarchical Sources of Risk

Figure 5-1 illustrates how the risk assessment process can be informed by a tiered or layered approach that forms a hierarchy of risk sources. In general, the level of detail or resolution of the risk source increases as we move from Level 1 out to Level 3 and this is illustrated in Figure 5-2. Also, in general, the level of resolution of the risk sources should increase as the project becomes more well defined.

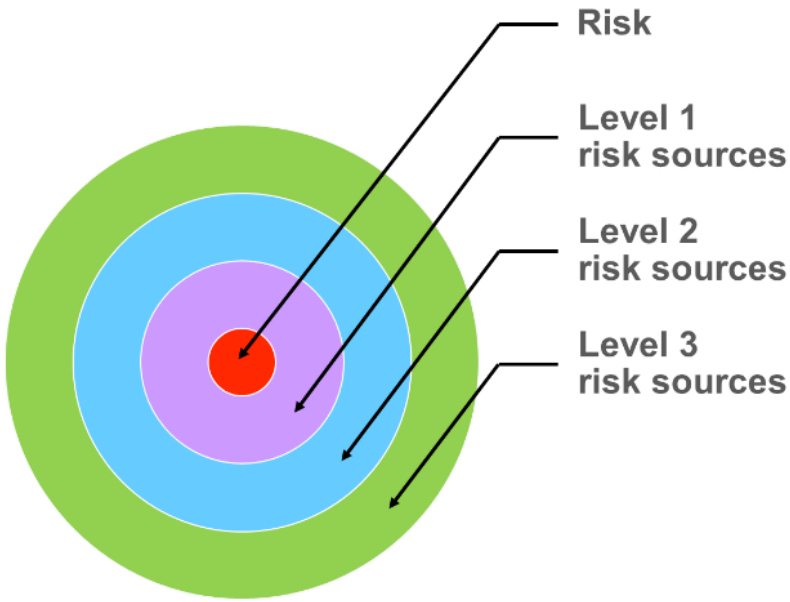



**Figure 5-1: Layered approach to identifying risk sources**

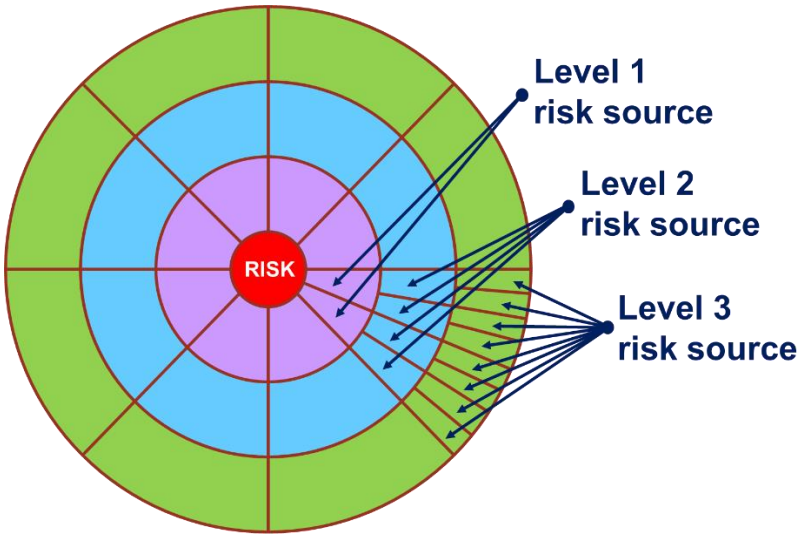



**Figure 5-2: Risk source hierarchy**

The following table presents examples of Level 1 risk sources that can be considered when undertaking a project risk assessment.

| Level 1 Risk Sources | | |
|---|---|---|
| • Project<br>• Site<br>• Technical | • Resources: non-manual craft and labor<br>• Resources: subcontractors<br>• Resources: vendors of permanent equipment / materials<br>• Resources: construction equipment / non-permanent equipment | • Natural hazards<br>• Human-caused hazards<br>• Government<br>• Customer<br>• Partnership |

Each Level 1 risk source is further broken down into sub-levels (Level 2 and Level 3) which are detailed on the following pages. This structure allows projects to more accurately pinpoint the actual source of a risk.

For example, the human-caused hazards risks could break down into community risks which could further break down into a risk of a local protest at the project site, e.g.:

human-caused hazards ➔ communities ➔ local protests.

Or, natural-hazards risks could break down into climatic event risks, which could further breakdown into a risk of extreme rainfall at the project site, e.g.:

natural hazards ➔ climatic events ➔ extreme precipitation.

## Level 1 - Project

| Level 2 | Level 3 | |
|---|---|---|
| • Scope | • Inadequate or inaccurate information from a third party<br>• Unknown and undefined scope<br>• Division of responsibility<br>• Ownership of scope | • Ambiguity of scope<br>• Inconsistent scope interpretation<br>• Changes to scope<br>• Conflict of information<br>• Requirements & specification |
| • Duty of care | | |
| • Enterprise risk (equity owners) | | |
| • Contracts | • Unclear, misunderstood contract<br>• Missing contractual requirements<br>• Terms and conditions | • Interfaces between work packages<br>• Contractual allocation of project risk to parties<br>• Claims procedure |
| • Estimation & schedule | • Incorrect estimation<br>• Missing elements of scope | • Long term currency fluctuation and trends<br>• Contingency |
| • Stakeholders | • Ineffective management<br>• Ownership of scope<br>• Impact on stakeholders | • Communication channels<br>• Changes in requirements |
| • Execution strategy | • Change of execution strategy<br>• Joint venture or partner commercial framework<br>• Change management and review processes<br>• Partner company's business strategy alignment | • Partner company's profit center strategy<br>• Changes to key staff, resources, and partner companies<br>• Commitment of the partner company's senior directors to the partnership<br>• Availability of procedures / processes. |
| • Coordination & interfaces | • Undefined interfaces<br>• Lack of coordination at key stages<br>• Alignment between internal and external functions | • Interdisciplinary coordination (internal & external)<br>• Multiple execution units / locations |
| • Joint project team | • Cultural differences<br>• Availability & recruitment<br>• Skills and qualifications<br>• Training | • Locations & time zones<br>• Staff retention & incentivization<br>• Visas, permits, administration, and employment terms |
| • Approvals | • Approvals process | • Delays in approval by consultants, contractors, sub-contractors, vendors, local government, land owners, etc. |
| • Assurance | • Quality assurance<br>• Design assurance<br>• Traceability of design | • Parallel working agreements<br>• Testing criteria<br>• Certification |
| • Unrecorded assumptions | • Assumptions on behalf of other parties / partners | • No record of assumptions |

## Level 1 - Site

| Level 2 | Level 3 | |
|---|---|---|
| • Project facility | • Restrictions and easements<br>• Working environment | • Working conditions |
| • Storage / laydown | • Restrictions and easements | |
| • On-site fabrication | • Restrictions and easements | |
| • Availability | • Restrictions and easements<br>• Real estate acquisitions<br>• Delay (ownership, permits, etc.) | • Adequacy of permits<br>• Regulatory agency requirements<br>• Seashore use rights<br>• Air use rights |
| • Suitability | • Size and shape<br>• Site layout for construction operations<br>• Surface conditions<br>• Sub-surface conditions<br>• Geological<br>• Geotechnical<br>• Hydrological<br>• Geography (including remoteness or elevation)<br>• Climate and weather conditions<br>• Sea conditions | • Security and evacuation<br>• Environmental sensitivity<br>• Health, disease, & local medical / emergency care<br>• Local material for backfill, aggregates, etc.<br>• Waste handling (hazardous & non-hazardous)<br>• Pre-existing hazardous material requiring special handling<br>• Site of historical / cultural/ archeological interest |
| • Transportation & logistics | • Accessibility<br>• Local roads & infrastructure<br>• Local transport (availability, reliability)<br>• Navigation channels<br>• Key overpass or underpass bridges<br>• Local port facilities | • Local airport facilities<br>• Local accommodation<br>• Ambulance and emergency response<br>• Transportation safety & security<br>• Right of way |
| • Utilities on site | • Electricity (available, reliable & repairable)<br>• Water (available, reliable, & repairable) | • HVAC (available, reliable, & repairable)<br>• Gas (available, reliable, & repairable) |
| • Telecommunications on site | • Wireless (available, reliable & repairable) | • Wired (available, reliable & repairable) |
| • Surrounding infrastructure | | |
| • Other construction works | • Interfaces with surrounding construction works | |

## Level 1 - Technical

| Level 2 | Level 3 | |
|---|---|---|
| • Technology | • Deployment of unproven technology<br>• Deployment of proven technology in new / unproven application | • Deployment of technology unfamiliar to the contractor<br>• Level of design detail |
| • Process / system | • Familiarity with process / system<br>• Reliance on third party process / system provider | • Risk of changes to process / system design |
| • Local codes and standards | • Consistency with known international standards<br>• Implementation of new work processes / tools<br>• Codes, standards, units and languages | • Culture specific design requirements<br>• Changes to codes and standards during project execution. |
| • Scope definition | • Requirements<br>• Specifications | • Completeness & consistency<br>• Changes |
| • Technical interfaces | • Interdisciplinary coordination<br>• Engineering / procurement / construction interface | • Multiple execution locations |
| • Fabrication and construction | • Design error or interpretation<br>• Design compatibility with local construction practices<br>• Construction feasibility<br>• Complexity<br>• Construction performance requirements | • Construction method<br>• Construction operations, workmanship, quality control, testing<br>• Construction method or sequence changes<br>• Records and as-built drawings |
| • Tunneling, mining and deep excavations | • Geological name plate capacity<br>• Geotechnical suitability, capacity, features, & quality<br>• Metal concentration or recovery<br>• Metal deleterious elements<br>• Ore recovery<br>• Mining dilution and prediction<br>• Impact on other ores<br>• Impact on geo-metallurgical environment | • Ventilation<br>• De-watering and water ingress<br>• Ground conditions and hazards<br>• Backfill and hauling<br>• Condition of excavated areas<br>• Hydro-geological environment<br>• Groundwater levels and seasonal fluctuations<br>• Settlement<br>• Existing utilities |
| • Environmental restoration / sustainability | • Environmental permits (LEED, BREEAM etc.) | • Changes to legislation during project execution |
| • Governmental services | | |
| • Design of hazardous aspects | • Pressure<br>• Temperature<br>• Altitude<br>• Chemical | • Biological<br>• Radiological<br>• Flammable<br>• Toxic |
| • Data collection | • Incomplete or inadequate surveys | • Unrepresentative or misleading information |
| • Modelling (physical, numerical, & VPD) | • Calibration<br>• Data collection<br>• Modelling conditions | • Verification (accuracy)<br>• Validation (fit for purpose)<br>• Impacts on design |
| • Utilities design | • Existing<br>• Interfaces | • Unforeseen |

## Level 1 - Resources: Non-Manual Craft & Labor

| Level 2 | Level 3 | |
|---|---|---|
| • Availability | • General<br>• Specific groups / disciplines | • Key personnel |
| • Capability / competency | • Skills<br>• General experience<br>• Relevant experience (e.g. type of project, location) | • Foreign language communication<br>• Inadequate on-boarding |
| • Management | • Adequacy of interfaces / DOR<br>• Adequacy of policies / procedures<br>• Adequacy of communication protocols | • Adequacy of supervision<br>• Effectiveness of quality controls |
| • Low morale / motivation | • Employment terms<br>• Working conditions | • Work ethics |
| • Legal compliance issues (including ethics / corruption) | • Adequacy of compliance training<br>• Adequacy of ethics culture | • Familiarity with applicable laws / requirements<br>• Control effectiveness (including supervision / audit) |
| • Local issues | • Requirements for use of local / national labor<br>• Restrictions on use of foreign personnel / labor<br>• Requirements for local qualifications / licenses (company & individual) | • Familiarity with local labor laws<br>• Substandard local practices |
| • Labor relations | • Local labor laws<br>• Industrial relations including craft jurisdiction<br>• Unions / non-union<br>• Labor agreements | • Wage scales<br>• Crew ratios<br>• Labor hiring requirements<br>• Grievance handling |
| • Environmental, safety & health (ES&H) culture | • Local ES&H laws<br>• Local ES&H practices | • ES&H training |

## Level 1 - Resources: Subcontractors

| Level 2 | Level 3 | |
|---|---|---|
| • Availability | • Significant / specialist subcontractors | • |
| • Capability / competency | • Adequacy of skills / qualifications (including management skills)<br>• Adequacy of general experience | • Relevant experience (e.g. type of project, location)<br>• Adequacy of resources (workforce, equipment)<br>• Effectiveness of quality controls |
| • Legal compliance issues (including ethics / corruption) | • Adequacy of compliance training<br>• Adequacy of ethics culture<br>• Familiarity with applicable laws / requirements | • Adequacy of past practices checks (pre-contract)<br>• Control effectiveness (including supervision / audit) |
| • Local issues | • Requirements for use of local / national subcontractors | • Foreign language communication |
| • Environmental, safety & health (ES&H) culture | • Local ES&H laws<br>• Local ES&H practices | • ES&H training |
| • Contracting issues | • Inadequate scope definition | • Inadequate DOR |
| • Financial capability | • Low net worth<br>• Cash flow constraints | • Losses on other contracts |
| • Customer requirements | • Customer preferences / requirements (e.g. MBE) | • Customer approval delays / qualifications |

## Level 1 - Resources: Vendors of Permanent Equipment / Materials

| Level 2 | Level 3 | |
|---|---|---|
| • Availability of equipment | • Of specific equipment / materials / commodities | • |
| • Capability / competency of vendors | • Adequacy of qualifications<br>• Adequacy of general experience<br>• Relevant experience (e.g. type of project) | • Adequacy of resources (e.g. manufacturing, storage)<br>• Effectiveness of quality controls |
| • Legal compliance issues (including ethics / corruption) | • Adequacy of compliance training<br>• Adequacy of ethics culture<br>• Familiarity with applicable laws / requirements | • Adequacy of past practices checks (pre-contract)<br>• Control effectiveness (including supervision / audit) |
| • Local issues | • Requirements for items purchased locally / nationally | • Foreign language communication |
| • Specification | • Type or kind<br>• Placement<br>• Use conditions | • Quality<br>• Quantity |
| • Procurement | • Type or kind<br>• Delay | • Quality<br>• Quantity |
| • Fabrication | • Incorrect fabrication<br>• Out of specification | • Damaged<br>• Defective |
| • Delivery and handling | • Timeliness of delivery<br>• Packing<br>• Loading | • Unpacking<br>• Offloading |
| • Transportation & logistics | • Transit<br>• Storage<br>• Verification, tracking & record keeping<br>• Security / piracy | • Import / export restrictions<br>• Customs clearance<br>• Competency of transporter<br>• Duties, taxes and local dealers |
| • Testing | • Quality assurance testing | • Accept / reject decision |
| • Contracting issues | • Adequacy of scope definition / specification | • Adequacy of DOR |
| • Financial capability | • Low net worth<br>• Cash flow constraints | • Losses on other contracts |
| • Customer requirements | • Customer preferences / requirements (e.g. MBE) | • Customer approval delays / qualifications |
| • Spare parts | • Availability of spare parts | • Special tools / personnel required |

## Level 1 - Resources: Construction Equipment / Non-Permanent Equipment

| Level 2 | Level 3 | |
|---|---|---|
| • Availability | • Specific equipment<br>• Spare parts | • Fuel types and quantities |
| • Condition | • Reliability<br>• Maintenance skills | • Age: performance for project period |
| • Operation | • Trained operators<br>• Storage of equipment | • Language (e.g. translation of documents) |
| • Legal compliance issues (including ethics / corruption) | • Adequacy of compliance training<br>• Adequacy of ethics culture<br>• Familiarity with applicable laws / requirements | • Adequacy of past practices checks (pre-contract)<br>• Control effectiveness (including supervision / audit) |
| • Local issues | • Requirements to use local / national companies | • Foreign language communication |
| • Transportation & logistics | • Transit<br>• Storage<br>• Verification, tracking & record keeping<br>• Security / piracy | • Import / export restrictions<br>• Customs clearance<br>• Competency of transporter<br>• Duties, taxes and local dealers |
| • Environmental, safety & health (ES&H) culture | • Local ES&H laws<br>• Local ES&H practices | • ES&H training |
| • Contracting issues | • Adequacy of scope definition | • Adequacy of interfaces / DOR |
| • Financial capability | • Low net worth<br>• Cash flow constraints | • Losses on other contracts |

## Level 1 - Natural Hazards

| Level 2 | Level 3 | |
|---|---|---|
| • Climatic events | • Hurricane / cyclone / typhoon<br>• Tornado<br>• Drought<br>• Extreme heat<br>• Extreme wind | • Extreme cold<br>• Extreme storm (including winds, snow, hail & ice)<br>• Extreme precipitation and monsoons |
| • Natural disasters | • Volcanic<br>• Earthquake / earth tremor | • Tsunami |
| • Other natural events | • Flooding<br>• Coastal / shoreline erosion<br>• Dam / levee failures<br>• Sea-level rise<br>• Landslides | • Mudslides<br>• Subsidence<br>• Natural fires (including bushfires and forest fires) |

## Level 1 - Human-Caused Hazards

| Level 2 | Level 3 | |
|---|---|---|
| • Security-related events | • War (including similar state-to-state hostilities)<br>• Civil unrest / hostilities (including revolution & riot) | • Sabotage<br>• Theft<br>• Terrorism or similar security risks |
| • Medical | • Disease (including epidemic and pandemic) | • Lack of facilities for treatment of disease |
| • Environmental | • Pollution (including spills & releases) | • Nuclear incident |
| • Safety | • Lifting, dropping and falling<br>• Confined space access<br>• Noise or vibration<br>• Fire | • Collision<br>• Collapse<br>• Explosion<br>• Site visitors |
| • Industrial action (external cause) | • Labor disturbance (including industry & regional strike) | |
| • Communities | • Relocation of local communities<br>• Dislocation of local businesses<br>• Other impacts on local communities | • Local critics / protesters<br>• Local / provincial politicians<br>• Fairness and accuracy of media coverage<br>• Local unions |

## Level 1 - Government

| Level 2 | Level 3 | |
|---|---|---|
| • Licenses / registrations | • Secure required licenses / registration for state / country<br>• Conditions on licenses / registrations | • Revocation of licenses / registrations |
| • Project permits (including approvals) | • Requirements to secure / maintain permits<br>• Delay in securing required permits<br>• Conditions on permits | • Revocation of permits<br>• Changes in terms of permits |
| • Permits for individuals | • Issue of visas | • Issue of work permits |
| • Laws (including regulations / sanctions & embargo) | • Legal uncertainty as to current law<br>• Current law restrictions on project activities<br>• Change in published law | • Change in application of published law<br>• Change in interpretation of published law |
| • Discretionary government action | • Expropriation / confiscation<br>• Nationalization<br>• Restrictions on movement of equipment / personnel<br>• Martial law | • Contract repudiation / frustration<br>• Loan default<br>• Currency transfer / conversion restrictions<br>• Imposition of taxes |

## Level 1 - Customer

| Level 2 | Level 3 | |
|---|---|---|
| • Capability | • Experience / capability of customer personnel<br>• Experience / capability of advisers to customer | • Complexity / speed of decision making |
| • Scope definition | • Awareness of / alignment on customer expectations<br>• Adequacy of / errors in customer-provided information | • Clarity of interfaces / DOR |
| • Project funding | • Available funds for project development / commencement | • Withdrawal of project funding |
| • Customer default | • Payment delay / default | • Other default |
| • Legal compliance issues (including ethics / corruption) | • History of past ethical practices<br>• Adequacy of customer ethics culture | • Customer familiarity – applicable laws / requirements<br>• Commitment to compliance plan |
| • Discretionary customer action | • Customer interference | • Wrongful call on security instruments |
| • Change of control of customer | • Uncertainty as to company assuming control | • |
| • Financial capability | • Low net worth<br>• Cash flow constraints | • Losses on other contracts |

## Level 1 - Partnership

| Level 2 | Level 3 | |
|---|---|---|
| • Requirements for local partner | • | • |
| • Capability / competency | • Skills<br>• General experience<br>• Relevant experience (e.g. type of project, location) | • Resources<br>• Foreign language communication |
| • Work management | • Clarity of interfaces (DOR)<br>• Adequacy of policies / procedures<br>• Adequacy of communication protocols | • Adequacy of supervision<br>• Effectiveness of quality controls |
| • Governance | • Complexity / speed of decision making process<br>• Experience of managers | • Effectiveness of delegation of authority |
| • Legal compliance issues (including ethics / corruption) | • Adequacy of compliance training<br>• Inadequate ethics culture<br>• Familiarity with applicable laws / requirements | • Adequacy of past practices checks (pre-contract)<br>• Control effectiveness (including supervision / audit) |
| • Change of control of partner | • Uncertainty as to company assuming control | • |
| • Financial capability | • Low net worth<br>• Cash flow constraints | • Losses on other contracts |

## Attachment 6 - Examples of Risk Management Tools and Techniques

Tried and tested structured techniques should be applied to derive the outputs of a step of the project risk management process. Guidance from organizations such as ISO and PMI gives more than 80 common techniques which can be used in risk management. For brevity, this attachment only reviews a selection of these, and provides a brief introduction to each, with cross references to further reading.

The techniques are introduced here in alphabetical order. The following table shows which steps of the project risk management (PRM) process they are applicable to and the following text gives a brief description of each, with cross-references to further information in the identified sections of the following documents:

- APM Project Risk Analysis and Management (PRAM) Guide 2004
- IEC/ISO 31010:2009 Risk Management – Risk Assessment Techniques
- PMI Practice Standard for Project Risk Management 2009

Guidance and descriptions on other valid common structured techniques can also be found in these referenced external documents.

These external documents use the words 'tool,' 'technique,' 'method,' and 'methodology,' often interchangeably. This procedure uses 'tool' to mean a software tool (e.g. a spreadsheet based risk register template), and 'technique' for a pre-defined, structured way of working.

**Technique Applicability in the PRM Process**

| Techniques that can be used to comply with this procedure | Identify | Analyze | Prioritize | Treat |
|---|---|---|---|---|
| Bow Tie Analysis | | Y | Y | |
| Controls Effectiveness | | | | Y |
| Dashboards | | | | Y |
| Delphi | | Y | | |
| Documentation Reviews | Y | | | |
| EMV Comparison | | | Y | |
| Fishbone Analysis | | Y | | |
| Individual Team Member Reporting | Y | | | |
| Quantitative Risk Analysis | | Y | Y | Y |
| Risk Identification Workshops | Y | | | |
| Root Cause Analysis | | Y | Y | Y |
| Structured Team Member Interviews | Y | | | |

## Descriptions and Cross References

| **Technique** | **Bow Tie Analysis** |
|---|---|
| **Recommended for** | PRM's *Analyze* and *Prioritize* Steps |
| **Description** | This diagramming technique is helpful for clarity in risk analysis, and for rigor and completeness in identifying risk treatment options.<br><br>On the left of the diagram the causes of the risk event are listed, structured by risk source. Lines from the list of causes converge on a description of the risk event in the center of the diagram, and diverge to a list of consequences on the right, resulting in a bow tie shape, hence the name of the technique.<br><br>Drawing the bow tie of causes and consequences is an aid to risk analysis in PRM's Analyze step. During the *Prioritize* step barriers which could prevent the causes and consequences are added to the diagram. These imply treatment activities (normally controls). The technique helps team members methodically identify controls for all the causes and consequences of a risk, rather than brainstorming an ad hoc subset. |
| **Further Information** | ISO "Bow Tie Analysis" |

| **Technique** | **Controls Effectiveness** |
|---|---|
| **Recommended for** | PRM's *Treat* Step |
| **Description** | When a risk treatment activity is an ongoing control, it is essential to monitor its effectiveness in achieving the stated treatment objectives. If the control proves not to be fully effective or to generate unintended results, it will be necessary to improve its design or even change the treatment option.<br><br>There are regulatory requirements in some industrial sectors concerning controls effectiveness. For example, there may be a requirement for a critical control monitoring program, verifying that all causes and consequences of top priority risks have controls in place, and that the performance standard for each control has been specified along with the test frequency. Similarly, there can be required checklists for control design effectiveness. |

| Technique | Dashboards |
|---|---|
| **Recommended for** | PRM's *Treat* Step |
| **Description** | During PRM's *Treat* step, visualization of status data via dashboards is essential to keep on top of the detail. Pie charts, bar charts, 'speedometers' and similar representations help those responsible understand key measures such as: number of priority 1 risks without treatment plans; number of risks with no next review date; number of risks overdue for review; number of overdue risk treatment activities. |

| Technique | Delphi |
|---|---|
| **Recommended for** | PRM's *Analyze* Step |
| **Description** | The Delphi technique is applicable whenever consensus is sought from a group of subject matter experts. This PRM Procedure particularly recommends it when seeking consensus on the estimated likelihood and consequences of a risk.<br><br>A questionnaire is sent to the chosen subject matter experts, in this case asking for their estimated likelihood and consequences for the risk. The results are collated and distributed to the experts without saying who made which estimate. If an individual finds his or her estimates are significantly different from most, this will prompt them to check and if necessary reconsider. A second round of submissions is made, and the process repeated until consensus is reached or, if necessary, consensus but with some dissenting views.<br><br>Delphi achieves consensus from a starting point which encourages divergence, avoiding the problem of the instant group-think which can occur when a dominant or persuasive individual contributes to a group discussion. |
| **Further Information** | APM: "Delphi Technique"<br><br>ISO: "Delphi"<br><br>PMI: "Delphi Technique" |

| | |
|---|---|
| **Technique** | **Documentation Reviews**, including:<br>• Review of project constraints and assumptions<br>• Review of customer and industry risk databases<br>• Review of published checklists |
| **Recommended for** | PRM's *Identify* Step |
| **Description** | It is tempting to focus solely on group brainstorming sessions to identify risks, but there is a wealth of evidence-based risk intelligence documented by the customer and industry sources. Also, each constraint or assumption in the project's baseline, documented in the contract or project execution plan, may imply risks to the project if it proves to be infeasible or invalid or changes over time.<br><br>This review of documentation is most valuable as a completeness check after more creative techniques have been used with the project team. |
| **Further Information** | APM: "Assumptions & Constraints Analysis," "Checklists," "Knowledge-Based Risk Assessment," and "Prompt Lists"<br><br>ISO: "Checklists"<br><br>PMI: "Assumptions & Constraints Analysis," "Checklists," "Document Review," "Industry Knowledge Base," "Post-Project Reviews / Lessons Learned / Historical Information," and "Prompt Lists" |

| | |
|---|---|
| **Technique** | **EMV Comparison** |
| **Recommended for** | PRM's *Prioritize* Step |
| **Description** | The Expected Monetary Value (EMV) of a risk with a single-point cost consequence estimate is the estimate multiplied by the probability of the risk event (or derived using frequency and time interval, if likelihood was specified using frequency rather than probability). In the case of a three-point estimate of cost consequence, the EMV is the average expected value of cost (as implied by the probability distribution and the three estimates) multiplied by the probability or derived from the frequency.<br><br>EMV provides a simple semi-quantitative way of comparing the cost consequences of a risk after applying different treatment options, supporting a cost-benefit based choice between options. |
| **Further Information** | APM: "Expected Value"<br><br>PMI: "Expected Monetary Value" |

| Technique | **Fishbone Analysis** |
|---|---|
| **Recommended for** | PRM's *Analyze* Step |
| **Description** | Fishbone Analysis is a technique to facilitate a group discussion of the possible causes of an effect (impact) and help the group identify which are most likely. It uses a horizontally oriented diagram with the effect in question in a box at the right-hand side, categories of contributing causes in boxes to the left, above and below a backbone-like line coming out of the effect box, with branches and sub-branches of causes drawn between the backbone and the cause category boxes. It is easy to read and aids group participation.<br><br>It should be contrasted with other cause and effect (impact) diagramming techniques which focus on logic, showing AND / OR gates or Yes / No / Condition nodes, or focus on the probabilities of the various branches and the resulting combined probability. |
| **Further Information** | ISO: "Cause-Consequence Analysis." Two techniques are given the same name in this ISO document - refer to the second, B.17, not the first, B.16<br><br>PMI: "Cause and Effect (Ishikawa) Diagrams" |

| Technique | **Individual Team Member Reporting** |
|---|---|
| **Recommended for** | PRM's *Identify* Step |
| **Description** | In addition to the scheduled activities of the Identification step of the PRM Process, the Project Manager and Risk Manager function should promote a culture of risk-based thinking where individual team members are encouraged to report potential risks at any time. |
| **Further Information** | APM: "Reporting by Team Members" |

| Technique | Quantitative Risk Analysis |
|---|---|
| **Recommended for** | PRM's *Analyze*, *Prioritize*, and *Treat* Steps |
| **Description** | Quantitative Risk Analysis (QRA) can first be used in PRM's *Analyze* step, producing three-point estimates for the cost and time consequences of a risk, but this Procedure particularly highlights its use in the *Prioritize* and *Treat* steps. In *Prioritize*, the three-point estimates are used to compare a risk with the project's risk criteria as specified in its consequence and likelihood rating schemes, placing it in the appropriate cell of the project's risk matrix for prioritization for treatment.<br><br>The exact interface between risk and the project's cost estimating and scheduling functions is not detailed in this Procedure, but the three-point estimates of the cost and time consequences of risks can be included in their Monte Carlo simulations, both at the current consequence levels and after the application of various treatment options. From the PRM perspective, this is particularly useful for understanding how event-based risks affect the project's critical path. A tornado diagram will highlight those most in need of treatment. Comparison of the critical path before and after various treatment options may help understand their relative cost-benefit positions, enabling a well-informed recommendation of treatment options as input to the PRM *Treat* step.<br><br>See also EMV Comparison, above, for a simple approach to comparing the effect on cost consequences of different treatment options. |
| **Further Information** | APM: "Monte Carlo Analysis," "Probability Assessment," "Probability Distribution Functions and Three-Point Estimates," "Probability-Impact (P-I) Matrices," and "Sensitivity Analysis"<br><br>ISO: "Consequence/Likelihood Matrix" and "Monte Carlo Simulation"<br><br>PMI: "Estimating Techniques," "Monte Carlo Simulation," "Probability and Impact Matrix," and "Quantitative Analysis" |

| | |
|---|---|
| **Technique** | **Risk Identification Workshops**, including the use of:<br>• Brainstorming<br>• Scenario reviews<br>• PESTLE<br>• Risk source hierarchical checklists |
| **Recommended for** | PRM's *Identify* Step |
| **Description** | In the *Identify* step of the PRM Process, it is common to break down the full scope of the project, for example by team, by work or risk breakdown structure components, or by areas of the risk sources hierarchy, and to hold a series of risk identification workshops scoped accordingly.<br><br>There are several ways of structuring each Risk Identification Workshop. A brainstorming session needs careful facilitation to set the scope, pose thought-provoking questions, and then allow free-flowing suggestions to be made without discussion or evaluation, because that would inhibit lateral thinking and off-the-wall ideas. Common methods that are typically used in support of gathering individual contributor's inputs in brainstorming sessions include Crawford's Slip Writing Method (using post-it notes) and Affinity Diagrams to then organize those individual inputs.<br><br>Brainstorming is often immediately followed by an evaluation session to filter the brainstormed ideas and assign Risk Owners. In contrast, in scenario reviews, first the changes which could affect the project are identified, then corresponding scenarios are drawn up, usually covering worst case, best case, and expected case. The implied risks are then identified. This approach is often a rich source of opportunities as well as prompting risks from situations people are reluctant to contemplate.<br><br>In contrast to these creative, team-oriented approaches which start from a 'blank sheet of paper,' tried-and-tested prompt lists can be used to facilitate a risk identification workshop. One widely used in risk management across all sectors is PESTLE: Political, Economic, Social, Technological, Legal, and Environmental. The hierarchy of risk sources provided in **Attachment 5**, which was drawn up from an extensive review of risks and issues on past and current projects, provides a very relevant and broad prompt list for risk identification workshops. |
| **Further Information** | APM: "Brainstorming," "Nominal Group Technique," "Political, Sociological, Technological, Legislation and Environment (PESTLE) Analysis," "Prompt Lists," and "Source-Oriented Risk Breakdown Structures"<br><br>ISO: "Brainstorming" and "Scenario Analysis"<br><br>PMI: "Brainstorming," "Nominal Group Technique," "Prompt Lists (includes PESTLE)," "Risk Breakdown Structure," and "Scenario Analysis" |

| Technique | Root Cause Analysis |
|---|---|
| **Recommended for** | PRM's *Analyze*, *Prioritize*, and *Treat* Steps |
| **Description** | Classic "Root Cause Analysis" is about learning from an asset loss due to a failure, or a financial loss due to an external factor or catastrophe. Evidence is gathered about the failure or loss, and a structured analysis technique is applied in the *Analyze* PRM step to uncover the root cause, so that treatments options identified in the *Prioritize* PRM step and selected in the PRM *Treat* step will address that root cause and not superficial symptoms. The structured analysis techniques used to get to the root cause include 5 Whys, Failure Mode and Effects Analysis (FMEA), Fault Tree Analysis, Fishbone (Ishikawa) Diagrams, Pareto Analysis, and Root Cause Mapping.<br><br>More informally, for any type of identified risk, a diagram can be drawn showing the causal chain between an immediate cause of the risk and its underlying causes, or showing a chain of risks triggering each other. As any node on the diagram will have multiple causes, the diagram will actually show a network, not a linear chain. |
| **Further Information** | ISO: "Cause-Consequence Analysis," "Failure Mode Effect Analysis," "Fault Tree Analysis," and "Root Cause Analysis"<br><br>PMI: "Cause and Effect (Ishikawa) Diagrams," "Failure Mode Effect Analysis," "Fault Tree Analysis," and "Root Cause Analysis" |

| Technique | Structured Team Member Interviews |
|---|---|
| **Recommended for** | PRM's *Identify* Step |
| **Description** | In this approach, individual team members are asked pre-prepared questions which help them examine the project from a number of angles and identify risks accordingly. It is a valuable technique when divergent thought is needed, to avoid group-think or undue influence by the stronger personalities in a team. |
| **Further Information** | APM: "Interviews"<br><br>ISO: "Structured or Semi-Structured Interviews"<br><br>PMI: "Interviews" |

# Attachment 7 - EPM-EM0-TP-000001 - Project Risk Register Template

| ITEM | RISK TITLE | RISK OWNER | OWNING FUNCTION | RISK STATUS | CAUSE(S) | CONSEQUENCE(S) | RISK SOURCE(S) | RISK STATEMENT | CURRENT | | | | TREATMENT PLAN TITLE | TREATMENT PLAN OWNER | | ACTIVITY TITLE | ACTIVITY OWNER | ACTIVITY TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | RISK TYPE | RISK RANKING | | RISK LEVEL | | | | | | |
| 1 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | Nil | | | 2 | | | |
| | | | | | | | | | | | Time | Nil | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |
| 2 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | NIL | | | 2 | | | |
| | | | | | | | | | | | Time | NIL | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |
| 3 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | NIL | | | 2 | | | |
| | | | | | | | | | | | Time | NIL | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |
| 5 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | NIL | | | 2 | | | |
| | | | | | | | | | | | Time | NIL | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |
| 6 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | NIL | | | 2 | | | |
| | | | | | | | | | | | Time | NIL | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |
| 7 | | | | | | | | | Threat | Probability/ Likelihood | Select | NIL | | | 1 | | | |
| | | | | | | | | | | CONSEQUENCES | Cost | NIL | | | 2 | | | |
| | | | | | | | | | | | Time | NIL | | | 3 | | | |
| | | | | | | | | | | | Safety | NIL | | | 4 | | | |
| | | | | | | | | | | | Quality | NIL | | | 5 | | | |
| | | | | | | | | | | | Environmental | NIL | | | 6 | | | |
| | | | | | | | | | | | Community | NIL | | | 7 | | | |
| | | | | | | | | | | | Reputation | NIL | | | 8 | | | |
| | | | | | | | | | | | Security | NIL | | | 9 | | | |