Risk and Financial Management in Construction

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Risk Response Planning

Having undertaken the risk analysis and evaluation described in the previous chapter this leads the project or risk manager to now look at risk mitigation by taking appropriate actions to achieve the project’s objectives through revision to the project’s schedule, budget, scope or quality. Risk management should therefore be regarded as an integral part of project management and not as an additional extra. These final phases of risk management involve establishing specific action plans to manage the risks and, more importantly, the identification of fall-back plans to drive, inform and support risk response planning.

Effective risk management demands an active process of regular risk reviews and the commitment to:

- anticipate and influence events before they happen by taking a proactive approach;
- provide knowledge and information about predicted events;
- inform and, where possible, improve the quality of decision making;
- avoid covert assumptions and false definition of risks;
- make the project management process clear and transparent;
- assist in the delivery of project objectives in terms of benchmarked quality, time and cost thresholds;
- allow the development of scenario planning in the event of the identification of a high-impact risk;
- provide improved contingency planning;
- provide verifiable records of risk planning and risk control.
To achieve risk management which is not only effective but efficient requires risk response planning. The commonest form of risk response planning is the Risk action plan where the inputs to this include:

- the risk management plan;
- a list of prioritized risks;
- a risk ranking of the project;
- a prioritized list of quantified risks;
- a probability analysis of the project;
- a list of potential responses as the risk identification process can help suggest a response to individual risks or categories of risks;
- the level of risk that the project stakeholders are able to own. As risk owners they should be involved in developing the risk response;
- any trends from the qualitative and quantitative risk analysis results. Trends in the results can make the risk response, or further analysis, more or less urgent and important.

There are a number of tools and techniques which can be employed in the risk response planning phase and as discussed in Chapter 1 the options available as actions to risk are based on one or more of the ‘4Ts’ risk response actions, namely to Terminate, Treat, Tolerate and Transfer risks (see Figure 4.1).

Where it is not possible to reduce the risk probability, a mitigation response (that is, ‘treat’ on the 4Ts) might address the risk impact by targeting linkages that determine the severity. The outputs of risk response planning include the following:

<table>
<thead>
<tr>
<th>Identification of residual risks</th>
<th>Residual risks are those that remain after the 4T’s actions have been taken. These may also include minor risks that have been accepted and addressed, for example, by adding contingency amounts to the costs or the project time allowed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of secondary risks</td>
<td>Risks that arise as a direct result of implementing a 4T risk response are termed as secondary risks. Having identified these then suitable responses need to be planned and managed.</td>
</tr>
<tr>
<td>Detail contractual agreements</td>
<td>Contractual agreements may be entered into to specify each party’s responsibility for specific risks should they occur. These will also include insurance and other items as appropriate to avoid or mitigate threats.</td>
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</tbody>
</table>
Several risk response strategies are often available for consideration by the project team and the strategy that is most likely to be effective should be selected for each risk. Specific actions can then be developed to implement each strategy. However, it is advisable to have both primary and back-up secondary strategies selected.

**Figure 4.1 Risk response actions**

Action plans are needed for all significant risks identified and in particular those with a high criticality from the impact matrices. The action plans must be cost effective and are likely to use the technique of three point estimates as covered at the end of Chapter 3. The contents of a typical action plan cover:

- description of the planned activities;
- ownership;
- start date and any identified risk trigger conditions;
- the cost and resource requirements;
- secondary risks;
- comments and the action status, employing the widely used ‘BRAG’ coding (where blue means completed action, green means on plan, amber indicates that it may not be achieved and red that it is unlikely to be achieved).

For whatever reason, if the mitigation action is not proving successful and the risks become a problem then a Fallback Plan will need to be initiated. Although some consider this an unnecessary luxury there is a great benefit to having fallback plans already developed with time to then quickly put them into service. The contents of a fallback plan are similar to the mitigation action plan, namely:

- description of the plan for recovery and clear ownership;
- start date/trigger condition;
- the costs and resource requirements;
- secondary risks as a consequence of the fallback plan’s actions;
- comments and action status, using the BRAG coding when implemented.

It has to be recognized that on some occasions there can be no effective, or cost-effective, fallback recovery plan. Residual risks may also be present and rarely is it cost-effective to seek to remove risks entirely; therefore even after action plans have been initiated some small level of risk is likely to remain. It is common that action plans or fallback plans introduce risks of their own; these secondary risks also need to be documented and accounted for in assessing the cost-benefit of their response.
Despite all this risk identification and planning of actions, no industrial activity is entirely free from risk and so many organizations and regulators around the world require that safety risks are reduced to levels that are ‘As Low As Reasonably Practicable’, (ALARP). The ‘ALARP region’ lies between unacceptably high and negligible risk levels. Even if a level of risk has been judged to be in this ALARP region it is still necessary to consider introducing further risk reduction measures to address the remaining, or residual, risk. The ALARP level is reached when the time, effort and the cost of further risk reduction measures become unreasonably disproportionate to the additional risk reduction obtained.

Project risks can be reduced by employing the 4T strategies already discussed or increasing the number and effectiveness of controls. The concept stage of a new project offers the greatest opportunity to achieve the lowest residual risk by considering alternative options. This is a standard approach in offshore oilfield development and once the concept is selected and the design progresses, the attention moves to considering alternative layout and system options to maintain risk reduction and optimize safety. In this industry example, the attention of the safety management culture is on collecting feedback, improving procedures and managing change to maintain the residual risk at its ALARP level. However, with advances in technology, what is accepted as ALARP at the design stage may not be regarded as such when the plant becomes operational, warranting necessary periodic risk reviews.

Working to the ALARP principle means that risks are reduced to a level that is ‘as low as reasonably practicable’ and which can be considered to have been achieved when:

- legislation, established standards and good design practice have been complied with; and
- that the resources (in terms of cost, time, difficulty and risk) required for the implementation of additional measures which may further reduce the risk are disproportionately large when compared to the potential benefit to be gained. This will naturally suggest when resources would be better applied to then reduce risks in another area of the business.

For those high-risk industries where ALARP is a major feature of the risk management process the first stage will be to demonstrate that the risks are within established acceptance criteria for risk tolerability (that is, they are not inside the intolerable zone shown in Figure 4.2)
These criteria may be legislative, industry or company standards and the risks can be demonstrated to be tolerable by reference to relevant industry best practice, professional and, where necessary, suitable quantitative assessment. Once it has been determined that the risks are in the tolerable region, the next stage of the ALARP demonstration will be to determine if there are any additional, practicable risk reduction measures which are reasonable to implement. All risk reduction measures will be assessed to determine whether they are technically viable and offer a significant benefit.

In many situations, such assessments can be based simply on professional judgement, experience and recognized best practice. In other situations, the effort required to implement a risk reducing measure, in terms of cost, time, difficulty, resources required and so on, needs to be formally evaluated against the risk benefit likely to be achieved. Where the effort is shown to be grossly disproportionate to the benefit, the measure can then be rejected. Where the effort is not disproportionate, the measure should be implemented immediately or at the most convenient point in time especially where the risk impacts of health and safety.

During design development, demonstration of ALARP is inherent throughout the process and relies on the assessment and conclusions reached by the project team. By asking the questions: ‘Are the proposed control arrangements good enough?’ and ‘Can we do anything better?’ the team uses its experience and expertise to verify that the residual risk associated with the design is managed to ALARP levels.

**Figure 4.2 ALARP risk zones**

![ALARP Risk Zones Diagram](image_url)
Moving to the operations stage, ALARP can be achieved by reviewing the existing control measures and questioning if anymore can be done. In this case, improvements may involve redesign or modification, but also changes to procedures, processes and even established ways of working.

Figure 4.3 illustrates the relationship between risk and the resources required to reduce its occurrence and how the ALARP position segregates the costs of mitigation from the residual hazard.

ALARP may be assessed in several ways, varying from documenting the purely subjective evaluation based on engineering judgement to taking a fully quantitative approach where risk reduction is expressed as a measurable parameter and formally evaluated against cost.

**Risk Monitoring and Control during the Project**

During the project, risk monitoring and control is the processes of keeping track of the identified risks, monitoring the residual risks and identifying new risks. This process should also ensure the execution of the risk plan and continually evaluate the plan’s effectiveness in reducing risk. Resource allocations can also be monitored as these too will have been pre-planned and, where appropriate, allocated to the agreed actions. Immediate risk actions should be built in with the other project activities as an integral part of the overall project management plan. Other actions will be dependent upon the risk materializing and will be triggered by the occurrence of risk metrics and milestone events.
Risk monitoring and control also records risk metrics associated with implementing contingency plans and needs to be, of course, an ongoing process for the duration of the project. Naturally the risks change as the project matures; new risks may develop or the anticipated risks disappear.

The elements of the process of risk monitoring and control are shown in Figure 4.4.

Attention to the risk monitoring and control processes will provide information that can assist with making effective decisions in advance of the risks occurring. Communication with all project stakeholders is needed to periodically assess the acceptability of the level of risk on the project. The purpose of risk monitoring is to determine:

- that risk responses have been implemented as planned;
- that the risk response actions are as effective as expected, or if new responses should be developed;
- that the project assumptions are still valid;
- if the risk exposure has changed from its prior state with additional analysis or trends;
- if a risk trigger has occurred;
- if the correct policies and procedures are followed;
- if any previously identified risks have occurred.

**Considerations**
- Project risk response audits
- Periodic risk reviews
- Earned value analysis
- Critical design features management
- Design reviews
- Additional risk response planning

**Inputs**
- Risk management plan
- Risk action plan
- Project communication
- Additional risk identification and analysis
- Scope changes

**Outputs**
- Fallback plan
- Corrective actions
- Project change requests
- Updates to the risk action plan
- Risk database
- Updates to risk identification checklists

*Figure 4.4 Elements of the risk monitoring and control process*
Risk control may involve choosing alternative strategies, implementing a contingency plan, taking corrective action(s), or even the re-planning of the project. It is important for the risk response owner to report periodically to both the project manager and the risk team leader on the effectiveness of the plan, any unanticipated unwanted effects and any mid-project programme correction needed to mitigate the risk occurrence.

Some activities of risk monitoring and control use triggers to indicate that a risk is occurring as defined during the risk response planning stage. This is one of the outputs of the action plan and as such triggers are events or consequences that cause activation of the corrective actions: a fallback plan, updating of the risk plan and use of the risk identification checklists. The concept of monitoring and feedback of risk information is a standard systems approach as shown in Figure 4.5.

The final stage of risk control is to:

- monitor risk metrics and milestones so that, if required, contingent actions can be implemented;
- monitor the effectiveness of risk management actions to ensure that they are having the predicted effect;
- feedback lessons about which actions are the most effective.

There are a number of project control tools which are very effective as indicators in managing project risks. In looking at the closed loop feedback system (Figure 4.5) it is noted that this is applicable in a range of project control areas.

Figure 4.5 Risk monitoring and control: the use of a closed loop feedback system

When choosing the object of this control loop application, the project manager must consider the value of the control provided and judge this against the cost of obtaining it. The factors that need to be considered are:

- the degree of detail needed to provide the desired status or performance information;
- the frequency of the feedback needed about the project status or its performance;
- the accuracy of the feedback of the measurement required to provide the desired status or performance information;
- the timeliness of the feedback including how soon the data is required to support decision making on the project;
- the level of management attention required to obtain the information, the type of records that must be maintained and the format in which information must be provided;
- the cost of producing and using the data. Generally the greater the frequency, the level of detail, accuracy and timeliness all serve to increase the cost of the process.

As new risks are identified throughout the project it is possible that the increased project exposure will exceed its available contingency. However, risks can be ‘retired’ when they occur and these become business issues to be addressed by the fallback plan or when the risk window date has passed without the risk occurring due to either good management, a change of circumstances or simply the passage of time. On the basis of the retired risks, the contingency set aside for them should be released at that point and made available as contingency for any new risk which may immerge. On this basis for the risk management plan to be of maximum benefit, the project must be monitored against it and this should typically involve:

- coordinating the risk activities alongside the other project work;
- monitoring resource usage against limits and resolving any conflicts;
- monitoring risks to ensure that they remain within the agreed project limits;
- monitoring risks to ensure that they do not become too large to manage effectively;
monitoring risks to ensure that they do not threaten the viability of the project objectives;

- re-evaluating the risks to the project as outlined in the risk strategy;

- implementing an agreed problem resolution process for any risks or issues that fall outside the authority of the project team. For example, an environmental risk which may impact on more than one of the project’s stakeholders;

- implementing an agreed problem resolution process for any risks or issues that are not being effectively managed by the risk owner, and as a consequence, other stakeholders who may be adversely affected. Such problem-solving escalation demonstrates good project management; it should not be viewed as an admission of failure.

**Risk Monitoring and Control at Project Closure**

Having looked at risk monitoring and control during the project it has to be said that project closure is also an integral part of the construction process lifecycle; although in practice its importance is often underestimated, or even ignored. Formal closing of a construction project warrants its completion in an organized and controlled manner. This phase usually includes the following four activities:

1. obtaining acceptance of the project results from the client;
2. balancing the project budget;
3. closing of the final account and invoice payments, warranties and as-built details;
4. conducting of a project closure meeting.

Importantly, project closure also presents the opportunity to learn from the project experience for the benefit of both the individuals and the companies involved with respect to any future similar projects. As such a fifth activity is suggested as:

5. documenting the experience gathered.

As part of the post-project review process, a questionnaire can be distributed among all project participants (for instance, the members of the design
and supervision teams, client representatives, suppliers and other project participants) aimed at gaining a number of individual assessments of the specific aspects of design planning and implementation of the project. The information obtained using questionnaires can be compiled and summarized in a final project report and then distributed among the members of the project team and discussed during the project closure meeting. A report from the post-project study can facilitate discussion on the project experience – what has gone right, what went contrary to the plan and what should be improved. This may also be known as Learning from Experience (LfE), and should be documented and stored in an accessible repository of the organization's project knowledge. It may then serve as a basis for assessment of processes, implementation of improvements and modified cost and risk allocation contingencies for other potential projects.

Project closure, where used, may follow company or industry processes such as:

a) The set of ‘good practices’, for example the document issued by PMI (Project Management Institute) or the Association of Project Management’s ‘Body of Knowledge’.

b) The PRINCE 2 Project Management methodology.

Both of these processes are discussed below.

Project closure in accordance with the APMs ‘Body of Knowledge’ consists of two main processes:

1. Closing the project. This is a process necessary to finalize the activities in all groups of project management processes. It allows the project or a project stage to be formally closed and includes an opportunity for the completion acceptance of all works and the gathering of project documentation. Subject to assessment are also the problems of failure on the project (or its stage), an opportunity to review the areas of success on the project and produce some conclusions applicable to further work.

2. Contract closure. This is a process necessary to finalize the contractual requirements covering the provision of goods or professional services pertaining to the whole project or a particular contraction phase or activity. This procedure is associated with the
actual checking of the project result as well as financial settlement of the project (or its stage).

Project closure in accordance with the PRINCE 2 methodology calls for an assessment of the project effectiveness (and its profitability) and uses the ‘business case’ term. Specification of the business case is to answer how the project assists the development of the company and questions if the expected results are worth the dedicated time and money invested – not just the profit generated. The document describing the original business objective will serve as a basis for comparison with the actual situation, and thus aid the final financial settlement of the project. The methodology establishes, among other things, the following three key criteria necessary for closing projects:

1. Has the project been constructed as required and have all of the products specified in the project plan and the WBS been delivered, installed and shown to be functional?

2. Are the project resources and support finished functions now and no longer needed?

3. Are there any contractual consequences on closure of the project?

Answers to the above three questions will be contained in the project completion report prepared by the project manager and aimed at summarizing the project’s performance by comparison with the documents prepared earlier; in particular these documents will include the project plan and the risk plan as discussed in Chapter 2, together with the cost plan and project programme.

Whilst the above suggestions, in the main, refer to the risk management at project end, the opportunity also exists to review the lessons, knowledge and experiential learning about the effectiveness of the project’s wider actions. For example, a preventative action may have been put in place to reduce the likelihood of a risk from high to medium and the project closure review presents an ideal opportunity to question:

• if this was effective?
• did the risks materialize?
• if so, was this because the action was ineffective or for some other reason?
• in retrospect, might a different action have been more effective?
Such lessons can be used to:

- improve ongoing risk planning for the organization's future projects;
- share good practice with other current projects: for example through project archives, project evaluation reviews or post implementation reviews;
- monitor risk metrics and milestones.

Project closure will therefore involve both checking whether risk metrics or milestones have been reached, whether any contingent management actions are required, and ensuring that indicators continue to give a clear picture of the status of project risks until those too are closed off. The roles and responsibilities in the post-project process are presented in Figure 4.6.
<table>
<thead>
<tr>
<th>Role</th>
<th>Obligations</th>
<th>Responsibility</th>
<th>Rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management Office</td>
<td>Prepares, analyzes, interprets and distributes results of post-project study in form of a report. Updates the project knowledge database by adding new, unique knowledge.</td>
<td>Organizes the post-project review and present the report on experience gathered.</td>
<td>Present an objective assessment of the project on the basis of the post-project study results.</td>
</tr>
<tr>
<td>Project Team Members</td>
<td>Fill out post-project questionnaires and participate in meetings.</td>
<td>Fill out the post-project questionnaires on time, providing honest answers. Participate in discussion on experience gathered.</td>
<td></td>
</tr>
<tr>
<td>Supervising Team Members</td>
<td>Fill out post-project questionnaires and participate in meetings.</td>
<td>Fill out the post-project questionnaires on time, providing honest answers. Participate in discussion on experience gathered.</td>
<td></td>
</tr>
<tr>
<td>Project Parties</td>
<td>Fill out post-project questionnaires and participate in meetings.</td>
<td>Fill out the post-project questionnaires on time, providing honest answers. Participate in discussion on experience gathered.</td>
<td></td>
</tr>
<tr>
<td>Suppliers</td>
<td>Fill out post-project questionnaires.</td>
<td>Fill out the post-project questionnaires on time, providing honest answers.</td>
<td>Formulate, from the perspective of the suppliers, their own process improvement recommendations.</td>
</tr>
</tbody>
</table>

Figure 4.6  Responsibility matrix: post-project review process