



Managing Risk in Large Complex Programs

Key Points

- Importance of risk management in project execution is laid out in a ten-step process.
- Risk management is a continuous process.
- Importance of assumptions and optimism bias are addressed.
- Alternative risk responses are defined.
- Relationship among risk management stages is shown.
- Use of contingency is discussed.
- Traditional risk management tools are described.
- Risk management is a core management process and an integrated risk assessment program is described.
- The benefits of the risk management process include:
 - Identifying and managing risk that may not otherwise be considered.
 - Avoiding/reducing large losses as well as reducing the frequency of smaller losses.
 - Improving decision making by clarifying responsibilities and authorities.
 - Increased program confidence and improved allocation of resources.

Managing Risk

Risk is inherent to major capital construction programs. Although many risk events are unpredictable, many risks can exist in response to the actions and decisions that are made when planning the implementation of the program.

Risk management begins with a focus on planning for the mitigation of risk consequences. These consequences can be defined as potential losses, damages, or any other undesirable events, including the loss of opportunities.

Capital construction programs have a history of disappointment and failure because of risk consequences.

Comprehensive program management and focused attention to risk is critical in achieving capital program success.

Change is inevitable. The best planned and managed capital construction programs experience change as the work progresses, potentially creating deviations or significant impact on the initial estimates of time and cost.

A ten-step process can be defined to guide in the consideration of program risks. Collectively, these interrelated processes contribute to successful strategic risk management. The ten-step process is:

1. **Plan for risk** – Recognize the need to apply risk management processes during the preconstruction phase or initiation phase of the program.
2. **Make realistic assumptions** – Do not allow the program assumptions to be optimistic. Such an approach leads to believing that everything will go to plan.
3. **Utilize outside expertise** – A range of expert judgments helps ensure unbiased assessments and analysis.
4. **Understand risk elements and their impacts** – Clearly understand the elements of risks and their potential impacts in the early phases of program planning and development.
5. **Assess and analyze risks** – Complete the evaluation and analysis of particular risks to the point of determining the impacts they can have on the program goals and strategic business objectives.

Top Reasons for Program Failure

- Strategic business objectives not clearly articulated, agreed to, and continuously communicated
- Poor scope definition
- Inefficient organization/decisions structure
- Inadequate risk management and risk reserves
- Unrealistic cost estimates and schedules
- Inadequate execution plan
- Shortage of resources
- Delays in engineering, procurement, and construction
- Absence of a “no change” culture
- Poorly developed goals and expectations
- Misalignment between stakeholders
- Impacts of change and underestimating length and cost of delays
- Geological risks or natural elements not clearly defined
- Environmental, safety, and existing conditions unclear

6. **Develop mitigation and contingency plans** – Fully develop mitigation and contingency plans sufficient for the degree of impact associated with the risks identified. Recognize the difference between each of these two types of plans.
7. **Synthesize the risks** – Synthesize all programmatic, construction, and other risks and determine the cumulative effects.
8. **Integrate the risk management process** – Integrate the risk management process with the day-to-day program management framework processes.
9. **Establish clear metrics** – Establish a clear and reliable definition of program performance. It is essential to understand risks common across multiple projects within the program.
10. **Manage risk continuously** – Evaluate the effects of risks through the progress of the program and intervene as required to mitigate.

These ten points are derived from comments and observations from program and project directors and executives involved with more than 40 major programs and projects collectively totaling approximately \$300 billion.

Plan for Risk

Let's look at the risk management process from the planning that expectedly occurs during the pre-program phase. All program plans are based on estimates that contain uncertainty. The bigger or more complex the program, the more uncertainty exists and the more severe the consequences can be. One of the problems with planning major capital construction programs is the magnitude of these uncertainties.

Where there is uncertainty, there are also potential unfavorable consequences. The best method for dealing with these uncertainties and the associated consequences is to develop and implement a risk management process as part of the program management effort. A structured risk management methodology should be one of the key management processes integrated with the other program management framework processes. It must receive the same level of attention as budget control and scheduling, decision making, and other framework processes.

Controlling risks should not be an arbitrary function separate or apart from these other program management applications. Rather, it is an integral part of the total program that in some way touches each and every one of the other framework processes.

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The first step in risk management strategy is acknowledging that the potential for risk consequences cannot be completely eliminated, but can be mitigated. Major capital construction programs are commonly faced with all types of risk events, such as adverse weather, differing site conditions, unavailability of specific types of resources, unanticipated environmental factors, or community pressures. In addition, strategic business objectives may evolve through the program implementation process. The adverse effects associated with these events are normally manifested in the form of increased cost, re-sequencing of project and construction activities, and delays that have the potential to interfere with successful program delivery.

The risk management process should start at the very beginning of the program with the development of a Program Risk Management Plan. This plan should contain a statement of purpose for the risk management process and the objectives of the overall program performance. It also should detail the processes planned for assessing, mitigating, and managing the potential risks.

Continuous Risk Strategy and Management



An iterative and continuous process for managing risk as it changes and shifts.

Overall Strategy of the Risk Management Program



Employing risk management processes to help attain success and meet expectations.

The Program Risk Management Plan should summarize key definitions of risk terminology, establish program and process policies, and identify each stage of the process. Specifically, the plan should document the risk identification and mitigation methods to be used. This

plan should help guide the program and project teams' overall understanding of the risk management processes and help create personal connection and commitment for using the risk management methodology.

Make Realistic Assumptions

Program and project assumptions are to be viewed in a realistic manner—not in the most optimistic (or idealistic) manner. An optimistic approach would influence the thinking that everything will go according to plan.

Interpreting the program and project assumptions in the most optimistic manner can be fatal to the implementation of a successful program. Because of an optimistic interpretation, there are many cases where teams take risk without ever constructively thinking about the ramifications of their actions. The optimistic view can often be the result of extreme political pressures, monetary and time frame pressures, and even inexperience of the team.

This overzealous expectation is sometimes referred to as the “EGAP-principal” (everything goes according to plan), which characteristically means:

- No changes in performance specs
- No management problems
- No contract problems
- No geological, environmental, or technology problems
- No political, administrative, or commitment promises compromised

For an effective risk management strategy, the expected results in terms of cost and schedule must be objective and realistic.

Utilize Outside Expertise

Effective identification and prioritization of risks can be achieved through interviews, brainstorming sessions, workshops, and joint risk review meetings. Many different agendas are apparent when all the groups come together. In order to ensure group focus and discipline, the risk work sessions should be under the guidance of a professional program manager who has skill sets in organizational planning and strategy.

During the planning and early development phase, the full spectrum of requisite specialists should participate in the information gathering process by identifying the risks that are particular to the program. At this early stage of program development, when scopes of work, cost estimates, and schedules are preliminary at best, no other resource can provide the kind of specific knowledge of key program issues. Not only will their participation be invaluable to the total program team, these specialists and experts can incorporate findings from risk assessments into their designs, work plans and processes, and management systems, thus helping to mitigate potential risk impacts at the grass roots level.

Although risk sessions and workshops are held during the planning and early program execution phase, additional risks are continually identified. As the program development progresses, it is beneficial that key specialists continue to participate in the risk process.

Gathering risk information from key experienced people and reviewing relevant past project risk experiences can be invaluable. These information-gathering sessions should take place during or at the end of each major phase of the program and respective project milestone schedules. The continuing risk reviews and evaluation will help increase the confidence that the program budget and overall program objectives will be ultimately achieved.

At an appropriate point, these risk reviews should be complemented by reference class forecasting.

Assess and Analyze Risks

Failing to assess and analyze the particular risks and determining the impacts they will have on program goals and objectives can be avoided by extending the risk reviews and workshops just discussed. This part of the risk management process includes the assessment of the probabilities of occurrence and potential impacts to cost and schedule of individual project risks.

Risk response planning includes allocation of risks by avoiding, mitigating, transferring, or accepting. For example, risk response strategies can include management actions, contractual arrangements with third parties such as contractors/subcontractors and insurance companies, and the use of contingencies and reserves.

While every effort must be made to develop and implement cost-effective mitigation measures and management actions, it is important to realize that some risks cannot be cost-effectively transferred to other parties, which is why adequate contingencies and reserves must be determined and kept in the project budget. Additionally, the program manager should develop and implement new risk mitigation strategies while monitoring the performance of mitigation strategies for risks already assessed.

Contingency is characteristically an integral part of the budget estimating process. It is typically added to a base estimate of cost to cover unknowns. This contingency assignment is intended to increase the confidence level in the capability of the project being delivered within the cost budget. Likewise, schedule contingency is intended to cover the uncertainty and risk associated with the schedule for the program.

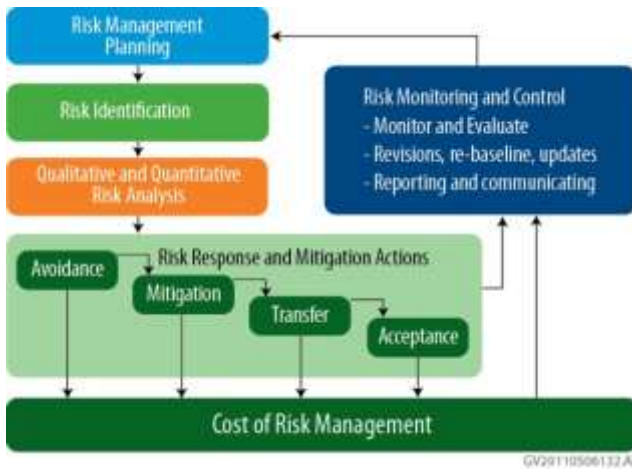
While some program management practitioners do not necessarily perform rigorous risk analysis, many program management teams will respond to program and project risk by addressing them in a way to mitigate the most serious of impacts. The mitigation factor that is frequently used is assigning an arbitrary contingency and then drawing down funds as needed.

Develop Mitigation and Contingency Plans

In today's highly competitive program environments, owners and program managers must continually seek new methods to reduce program costs and improve performance. In addition, project management teams must be prepared with mitigation strategies that can be implemented when the program or discrete projects do not run according to plan.

One of the key objectives of the risk management effort is to measure the adequacy of the allocated budget for executing the program's scope of work. One accepted way to do this is by evaluating whether the program's contingency sufficiently compensates for program risk as measured by the mitigated probabilities and impacts.

Relationship Among Program Risk Management Stages



Mitigated probabilities and impacts should be by consensus of the program team on recognizing the nature of the risk as well as the program manager's and owner's ability and willingness to pursue mitigation measures.

In a disciplined risk management process, the step in determining the adequacy of a program's budget estimate and schedule is the development

of a cost contingency model. This model can be developed in a spreadsheet format and can include separate sections for budget, event, and scope elements.

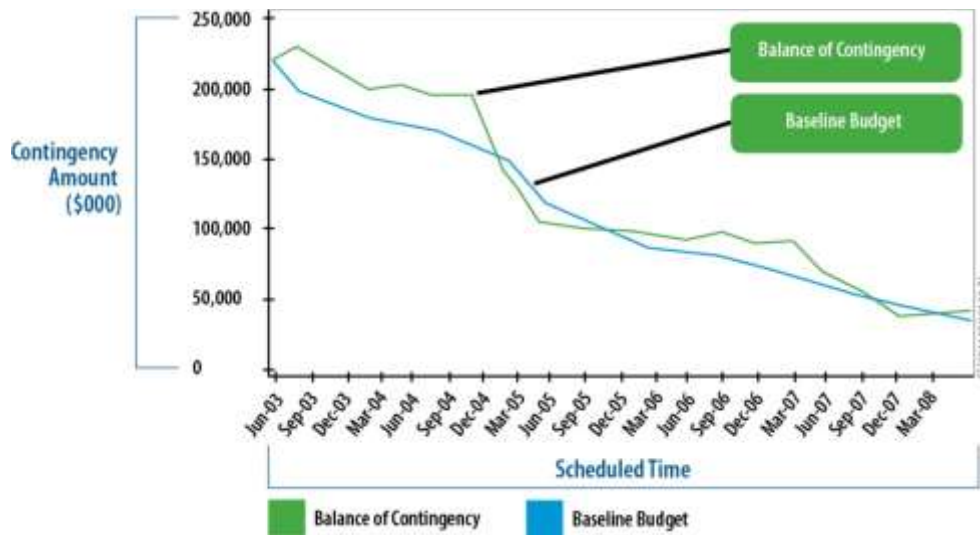
- **Budget elements** – Modeled by including the program cost estimate at a level of detail that line items with similar risk profiles and behaviors are grouped. Each line item is assigned a triangular probability curve that is defined by expected, minimum, and maximum parameters.
- **Event and scope elements** – Modeled by including all the event and scope risk items that have been identified. The probability curves that best match the expected behavior of risks and their descriptive parameters are chosen in consultation with expert resources.

Once the contingency models are developed and updated, a probabilistic analysis is run for the entire project. This provides information related to:

- The probability that the program will meet its established budget.
- The probability that the contingency in the total budget would be adequate to meet the program objectives.

Unmitigated risks can also exist because the assessment finds that there is no alternative project management action or alternative whatsoever. It is important to note that extreme caution should be taken when dealing with unmitigated risks because contingencies can be grossly underestimated or overestimated.

Program Contingency Drawdown as Compared to the Baseline

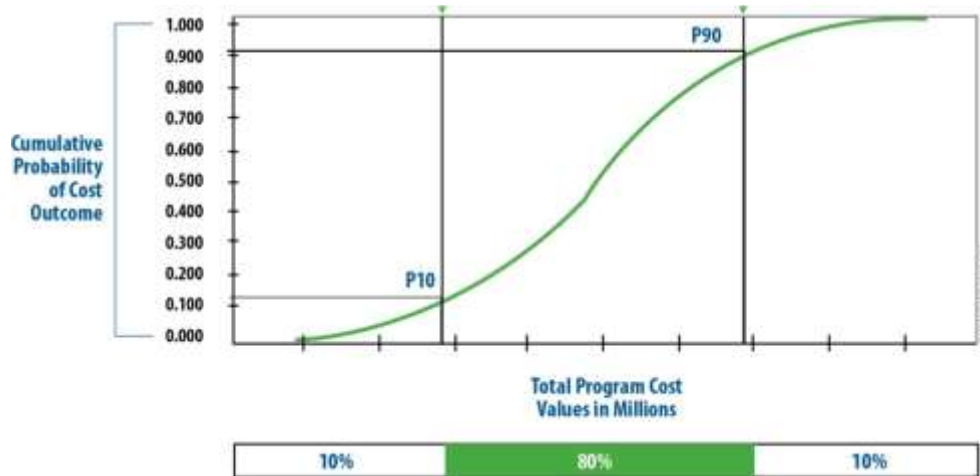


Synthesize the Risks

Risk measurement and analysis, at least in the context of this discussion, include using an analysis vehicle for predicting the extent of possible variations and forecasting worst-case and best-case scenarios for the program budget and schedule. The most unpopular element of employing risk analysis techniques is using the worst-case scenario. By using probabilistic methods in risk analysis, the program manager will have much more information when compared to other methods, and this helps in making more informed decisions.

Technology tools are widely available to help in managing risk information when evaluating and quantifying multiple risk scenarios. The use of these tools allows program managers to create reasonable and often realistic forecasts and assign the needed resources such as time and money with confidence. It is important to note that risk management software such as @Risk™, Monte Carlo™, and PertMaster™ have become widely used in the construction industry and are thought to provide the most scientific results available. These tools cover statistical risk management techniques and probabilistic calculation methods used in business planning and cost estimation applications. Several references have been included that provide in-depth discussion and examples of modeling, simulation, and analysis techniques. Limitations of these risk modeling tools are discussed in the NAC Executive Insight on Fat Tail.

Cumulative Probability Distribution Curve



Risk analysis uses statistical methods in order to arrive at a set of confidence limits determined for the program objectives of cost and schedule. By using a simulation risk analysis technique, a cumulative probability distribution curve can be constructed to provide the probability of not exceeding a specified cost or schedule duration. The @Risk™ simulation calculates numerous scenarios by repeatedly picking random values from the input variable distributions and calculating a risk adjusted estimate.

The risk analysis process integrated with program management applications helps to discipline the continuous collection and evaluation of the multiple factors that have an influence to negatively affect the program. It is imperative a continuous risk analysis methodology become integrated with the day-to-day program management application. The major objectives of an integrated risk management approach are:

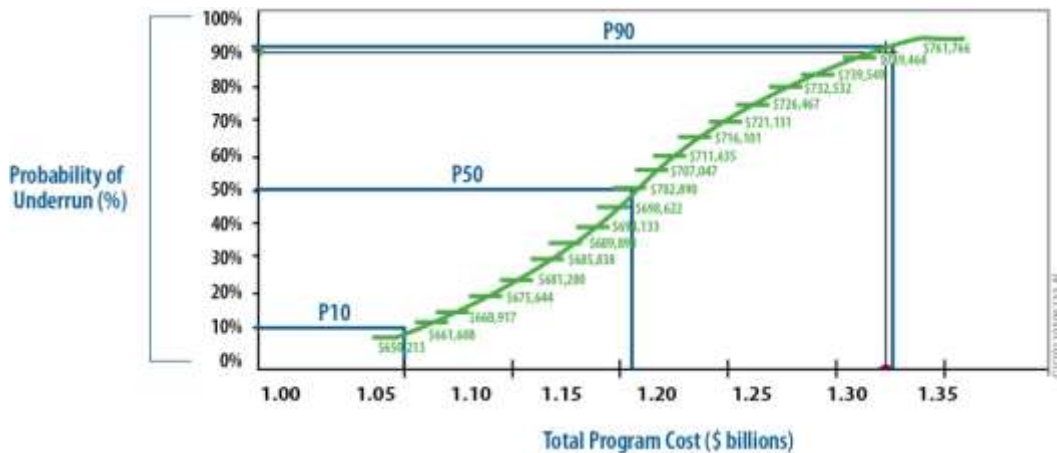
- Collaborative mitigation planning for risks before they introduce impact.
- Sharpening the program management foresight of potential risk issues.
- Enhancing the identification of resources or technical assistance that would benefit the risk mitigation planning.
- Facilitating continuous monitoring, analysis, and communication of risk issues.

Integrate Risk Management Process

The risk management process should be implemented to do more than just identify the risk and present a mitigation plan. The risk management process should become a definitive and integrative process to ensure program objectives are achieved.

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Program Cost Contingency Analysis



Many appraisals of programs assume, or pretend, that programs exist in a predictable world of cause and effect, where things always go according to plan. In reality, major capital construction programs are highly risky undertakings, where things happen with certain probability and rarely turn out as originally intended. Major capital construction program executives have found that a number of risks are commonly embedded in the program environment and are frequently the major cause of variances. The common risks include:

- Lack of realism in initial cost estimates.
- Length and cost of delays underestimated.
- Contingencies too low.
- Geological risks or natural elements not clearly defined.
- Environmental, safety, and existing conditions unclear.

The primary reason for these common risks is that no one wants to be the messenger of bad news, and information is filtered as it goes up the hierarchy. Furthermore, because those intimately involved with a program are not likely to distribute unflattering and less-than-optimistic forecasts, information is also biased at the source.

Establish Clear Metrics



Manage Risk Continuously

Any program can expect to face numerous potential impacts that, in turn, compound already identified risks. As the capital program transitions into the execution phase, the risks can change. Therefore, risk management cannot be looked upon as an independent function, but rather should be planned from the beginning as an integrated part of program management. The absence of the continuous evaluation of the effects of risk throughout the progress of the program, and intervention when necessary to ensure risk mitigation and resolution, is cause for the risk management process to break down. Many risks outside of the control of the program team have the potential to cause impacts if not continually monitored. Fundamental principles of a sound, integrated risk management process require the ongoing evaluation and re-evaluation of risks as conditions change as well as a process in place for implementing new mitigation strategies and options.

A continuous integrated risk management process will help reduce the potential for unidentified negative impacts, improve program management's continuous efforts of obtaining consensus, continue coalition building, and maintain a steady focus on the program's constraints and objectives. Integrating risk analysis methodologies into the program management applications helps keep program teams from making avoidable catastrophic mistakes.

Recap

It is not reasonable to think that risk can be eliminated from major programs. Risk events can be acknowledged much more explicitly and managed a great deal better, however, with more accountability than is typically the case. As program managers, we must embrace risk. We know it is going to happen. The challenge is to recognize risk, decide what to do about it, and manage it. To enhance program delivery and performance, an integrated risk management process should be one of the strategic tools used with the program management applications.

The benefits of the risk management process are expected to include:

- A disciplined framework for systematically guiding the process of identifying and managing risk that may not otherwise be considered.
- Help in avoiding/reducing large losses, as well as lessen the frequency of smaller losses.
- Improved decision making through clarification of responsibilities and authorities.
- A better understanding for managing risks, which leads to increased program confidence and improved allocation of resources.



Most program managers recognize the importance of risk management processes and use some method for program and project analysis. What is needed now are program management teams redefining their risk management processes in terms of another program management tool: to make iterative risk assessments that quantify the potential risks and build a program organizational culture that focuses on potential risk impacts and the associated mitigation and contingency planning.

Reference:

The GIGA Factor; Program Management in the Engineering & Construction Industry; CMAA; ISBN 978-1-938014-99-4; 2011

About the Author

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