

Managing Project Risks

Dr. Eldon R. Larsen, Marshall University

Mr. Ryland W. Musick, West Virginia Division of Highways

Abstract

Nearly all projects have risks, both known and unknown. Appropriately managing these risks in a well-thought-out, planned, methodical way can very often make the difference between project success and failure. This paper discusses some common ways to manage project risks, based on good project management concepts.

Introduction

Project managers need to pay constant attention to project-associated risks. Project risks are uncertain events or conditions which could impact that project. These uncertain events or conditions can be categorized as either *known unknowns* or *unknown unknowns*. Some risks we can foresee, while others we cannot. Some risks we can control, while others we cannot. In any case, there will always be project risks.

Known unknowns are the uncertainties about which we know we should be concerned, but we might not know enough about their impact on cost, schedule, and scope, their likelihood of occurrence, how to prevent them, how to make the desirable ones more likely to happen, and so forth. But we know we don't yet know these characteristics, and we can now plan to do something about these unknowns.

Unknown unknowns, by contrast, are events or conditions that we have no realistic way of expecting that they might occur—we don't even know enough realistically to ask any specific questions about them because they are completely unexpected to have an impact on the project and we don't even know what they are—they are unknown unknowns.

Risks can be good or bad, opportunities or threats, positive or negative. These risks can impact project scope, duration, costs, stakeholder relations, quality, and so forth. We want to maximize the likelihood that positive risks will occur. By contrast, of course, we wish to minimize, prevent, or eliminate the potentially negative impact of threats.

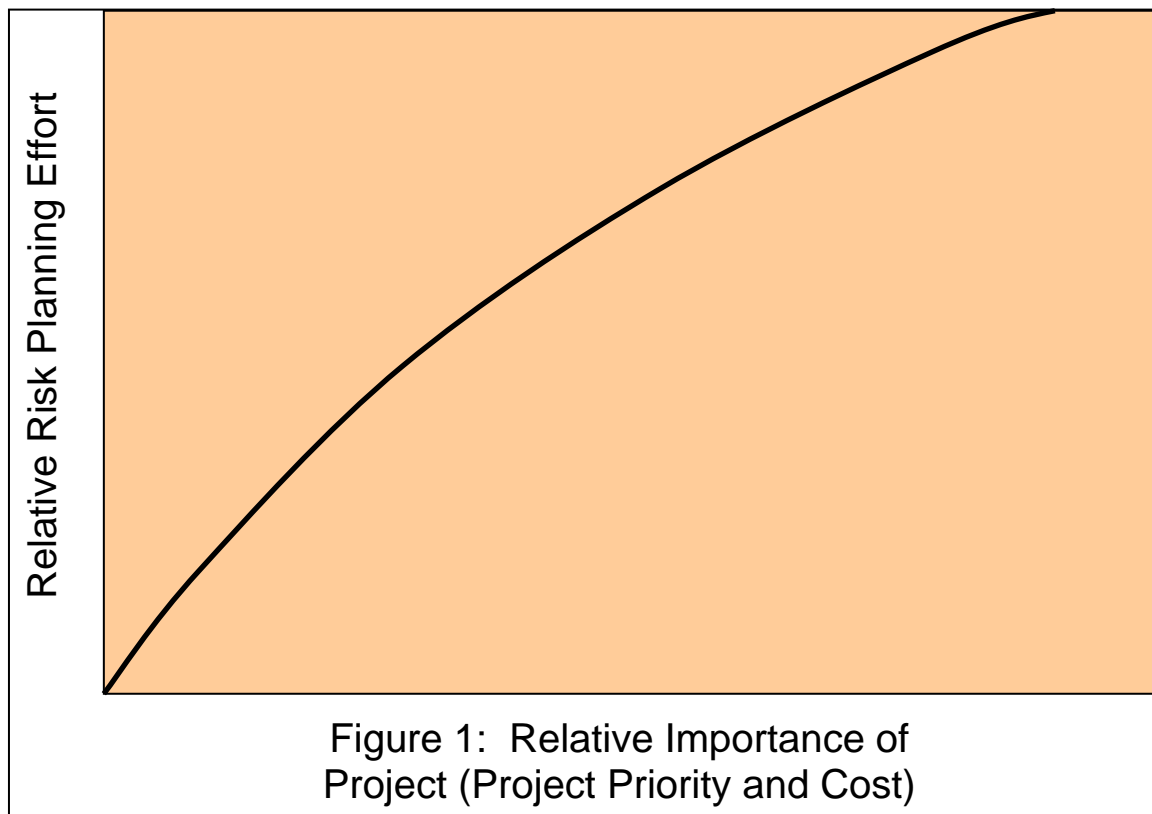
Formal project risk management includes planning for risks, identifying risks, analyzing risks, responding to risks, and monitoring and controlling risks.¹ In addition, the attitudes of the performing and requesting organizations toward risks can be a very important factor in risk management. In almost all organizations there must be a balance between a willingness to take risks and a desire to avoid risks. In all cases, excellent communication will be essential to good risk management.

From an insurance standpoint, we sometimes categorize risk into two categories: *pure risk* and *business risk*. Pure risk is the type of risk for which we can buy insurance, and the risk is transferred to the insurance company. Business risk is the type of risk that an organization assumes as part of its ongoing business. For example, the risk that we might not be able to sell all of our products would normally be considered business risk.

Plan for Project Risks

Good risk management planning can dramatically increase risk management effectiveness and efficiency. This is particularly true early in project planning, but applies throughout the project. Planning for risk requires us to be focused and attentive to the project from every angle. When planning for risks, we must remember the good solid principles that have worked in years past, but have the ability to learn new principles that have not previously been applied.² The objectives of risk management planning are (1) to decide upfront how to approach, plan, and execute risk-management activities throughout our project, (2) then to update those plans continually as we execute, monitor, and control project risk management activities, and (3) to establish an agreed-upon basis for project risk evaluation.

Of course, all of this risk management planning needs to be balanced against the project's needs, the project's importance, and the needs of the organization. There is no need to kill a tiny-project fly with a sledge hammer, but we do need a sledge hammer to break up the concrete of highly expensive, major project unknowns. If we don't manage the unknowns, they will end up managing us!



The effort and techniques we apply to the risk management planning will be affected by the culture of the organizations and the attitudes of the people involved on the project. Often there are organizational policies and standard procedures that we are required to follow. If this is the case, it is very important to become thoroughly familiar with those policies and procedures, as well as being careful to develop excellent communication channels with the key risk stakeholders.

When planning how we will management project risks, it is always important to learn all we can from experts who can provide insight, experience, and good judgment, especially with respect to the particular project at hand. We draw on their expertise especially during *risk-planning meetings*. During these meetings we should (1) define our basic risk-management plans, (2) define the risk-management terminology we will use, (3) identify project activities that will deal with risks that could affect project cost, schedule, and scope, and (4) make specific risk management activity assignments to specific people. These planned project activities all become part of the overall project plan, and therefore part of the cost baseline, schedule baseline, and scope baseline. These schedule activities will of course require resources and time to complete, and therefore they affect resource loading and leveling concerns.

One part of risk management planning is to establish project *risk categories*. These categories establish structure for the desired level of detail as we break down the risks into smaller and smaller, better defined risk elements. These risk categories should be reviewed and changed as needed throughout the risk identification and definition process. For example, we might develop risk categories such as technical risks, performance risks, cost risks, schedule risks, management risks, organizational risks, external risks—such as market risks, competition risks, and regulatory risks—and any other risk category that serves this particular project.

Another part of planning for risk management includes the need to clearly define what we mean by various levels of risk likelihood and risk impact. Some example *risk likelihood categories* might include *very low, low, moderate, high, and very high*. Alternatively, we might assign numerical weights to those same categories, such as 0.1, 0.3, 0.5, 0.7, and 0.9 respectively. A similar procedure would apply to the specification *risk impact categories*. While doing the risk impact categories, remember that risk impacts can be positive or negative, so both positive and negative numerical weightings might be assigned to those categories accordingly.

When defining the risk likelihood categories and the risk impact categories, it is evident that we need to clearly define what we mean by each category, so that classification of the various risks will be as straight forward and agreed-upon as is realistically possible. An important consideration when developing these likelihood and impact category definitions is to consider defining the categories as functions of the project deliverables.

Table 1: Example definitions of *Risk Impact Categories*

Project Objective	Impact = 0.8-1.0, or Very High	Impact = 0.6-0.8, or High	Impact = 0.4-0.6, or Medium	Impact = 0.2-0.4, or Low	Impact = 0.0-0.2, or Very Low
Cost	> 50% increase	20-50% increase	10-20% increase	5-10% increase	<5% increase
Time	> 30% increase	20-30% increase	10-20% increase	5-10% increase	<5% increase
Scope	Change is very large; kill or new project	Major change in objectives	Medium change in objectives	Small change in objectives	Very small or no change in objectives

Identify the Project Risks

Project risks can originate from many sources or situations, such as (1) external unpredictable risks—like regulatory or natural forces, (2) external predictable risks—like market risks, operational risks, inflation, or taxes, (3) internal non-technical risks—like management decisions, cash flows, or cost and schedule constraints, (4) technical risks—like changes in technology, design risks, or complexity risks, and (5) legal risks—like licensing risks, patent rights, contractual risks, or *force majeure*.³

As we attempt to identify project risks, our objective should be to determine risks that could affect the project, and then to clearly and fully document those risks and their characteristics. This is best done by experts, those who will be doing the work, and other key risk-affected or risk-associated stakeholders. This can be done in a combination of one-on-one meetings with the project leader, or better still as part of a risk planning meeting. The latter gives a chance for everyone to hear the various perspectives and to better achieve proper risk identification and definition. The process can be iterative between risk planning meetings and more focused expert interactions. The result of this iterative process will be the beginning of a *risk register*, which will list the project lists and their characteristics. This will prepare us for the next steps of analyzing risks, responding to risks, and monitoring and controlling risks.

To identify project risks, we use several resources and procedures. (1) We need to learn from past project plans, files, and risk documents. We need to learn from the successes and failures of past projects, as these successes and failures are often associated with how well or how poorly project risks were handled in the past. (2) We can use the Delphi technique of iteratively surveying experts and managers iteratively and anonymously to gain consensus on project risks, likelihoods, and impacts. (3) We can interview team members and other subject-matter experts and those who will be doing the work, as well as other key stakeholders. (4) We can use root-cause analysis and cause-and-effect diagram analysis. (5) We can use SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. (6) We can use brainstorming sessions to identify potential risks, and then follow the brainstorming with some type of qualitative analysis of the brainstormed risks.

The result of all of this risk identification will be the beginning of the risk register. This register will be expanded during later steps of risk planning. Shown below is an example beginning of a risk register.

Table 2: Example Risk Register Initial Format

Risk No.	Risk Description	Root Cause	Assumptions	Needed Response	Risk Category
1					
2					
3					
4					
5					

Analyze Risks

There are really two major categories of risk analysis: qualitative risk analysis and quantitative risk analysis. Sometimes these two analysis categories are done separately, and sometimes they are done simultaneously. In a few cases we go directly to quantitative risk analysis and skip qualitative risk analysis. However we go about the process, we need to end up with a clear understanding of the risks and their likelihoods and impacts, preferably on a numerically prioritized scale. Once the initial risk analysis is completed, it is important that we continue to review and update the analyses throughout the duration of the project—keep risk analysis alive!

The objective of qualitative risk analysis is to help us to focus quickly and inexpensively on high-priority risks, giving us a rough understanding of both the potential impact and likelihood of occurrence for each important risk. The analysis should look at risk impact on schedule, costs, scope, quality, risk tolerances, stakeholders, and specific project deliverables.

When qualitatively analyzing project risks, we estimate and record (1) risk probability and (2) risk impact, both positive and negative, on the project deliverables. Next, we repeat the process quantitatively. During these analyses, we use a *probability and impact matrix*, an example of which is found in Table 3, to help us prioritize the risk rating for each identified risk.

Kendrick recommends another graphical approach.² In this approach, we plot risks on axes indicating their impact on both the project schedule and budget, and indicate the likelihood of the risk occurring by the size of the circle representing the risk. This is illustrated by Figure 2.

Table 3: Example *Probability and Impact Matrix*

Example Risk Rating Priority Level:
0.60-1.00 = 1st
0.40-0.60 = 2nd
0.25-0.40 = 3rd

Probability		Negative Impact (Threats)					Positive Impact (Opportunities)				
		V. L. Neg.	Low Neg.	Mod. Neg.	High Neg.	V. H. Neg.	V. H. Pos.	High Pos.	Mod. Pos.	Low Pos.	V. L. Pos.
		0.1	0.3	0.5	0.7	0.9	0.9	0.7	0.5	0.3	0.1
V. H.	0.9	0.09	0.27	0.45	0.63	0.81	0.81	0.63	0.45	0.27	0.09
High	0.7	0.07	0.21	0.35	0.49	0.63	0.63	0.49	0.35	0.21	0.07
Mod.	0.5	0.05	0.15	0.25	0.35	0.45	0.45	0.35	0.25	0.15	0.05
Low	0.3	0.03	0.09	0.15	0.21	0.27	0.27	0.21	0.15	0.09	0.03
V. L.	0.1	0.01	0.03	0.05	0.07	0.09	0.09	0.07	0.05	0.03	0.01

Quantitative risk analysis can be aided by (1) interviewing of experts, (2) using probability distributions, (3) doing sensitivity analyses, (4) using Monte Carlo or other modeling and mathematical relationships and procedures, and (5) doing expected monetary value calculations.

Plan Risk Responses

The objectives of risk response planning include (1) determining the best options and backup plans to maximize our project opportunities and to minimize our project threats; (2) identifying those who will take responsibility for each important risk, including the possibility of passing some risks to an insurance company; (3) prioritizing risk responses; (4) adding risk response activities into the project plan; and identifying conditions that trigger execution of contingency plans, when conditions indicate that a particular risk is likely to occur in the near future.

When planning responses for negative risks—threats—there are several common approaches: (1) avoid the threat, (2) transfer the risk for the threat, and (3) mitigate the consequences of the threat.

To avoid the threat, we can (1) try to take some action which will eliminate the risk, (2) isolate the project from the threat, or (3) change the project objectives or constraints that are vulnerable to the threat.

To transfer the risk for the threat, the most common action is to purchase insurance for the particular negative consequence, if the threat occurs. This simply transfers risk ownership from us to the insurance company, within the constraints of the insurance contract.

Mitigation of project risk means that we acceptably reduce the impact and/or likelihood that a given threat will actually occur. We want to do this as early as possible—there is a reason for the saying, “An ounce of prevention is worth a pound of cure.” For example, we might try to reduce project complexity, do more detailed research before certain decisions are made, choose better, more reliable resources, or develop redundancy in high risk situations.

When planning responses for positive risks—opportunities—there are several common approaches: (1) exploit the opportunity, (2) share the opportunity with someone who has the ability better to help us to achieve the benefits of the opportunity, and (3) grow the likelihood that the opportunity will present itself.

Finally, for both positive and negative risks, one response strategy is to simply allow the threat to occur and plan contingencies accordingly, which will be activated if the threat materializes. Again, risk triggers should be identified during response planning so that we know as quickly as possible that a risk is about to actually happen.

Monitor and Control the Risks

Throughout the entire project we must continually monitor and control project risks. This means that we must also continue to plan and re-plan throughout the entire project. We need to monitor for risk triggers, identify when risks have occurred and whether or not the planned responses were satisfactory, make planning changes for risks that were not satisfactorily handled, and monitor any secondary risks that might occur as a result of a different risk occurring.

All of this means that we must pay constant attention to the project objectives, stakeholder expectations, project baseline deviation trends, contingency reserves, and new risks that might be developing or less important risks that might be changing in priority. Therefore, project risk needs to be an agenda for most, if not all, of the project meetings. We should also be monitoring how we as a project team are doing at following and executing risk response plans and procedures. When necessary, workaround plans should be developed—these are plans not originally planned, but developed as a result of new risk developments that were unexpected. These workaround plans should be carefully documented, to maintain the integrity of the risk management procedures and so as to allow lessons learned to be developed.

The risk register needs to be regularly updated as a result of our monitoring and controlling risks and risk responses. The changes to the risk register should be carefully documented, and we should carefully note any lessons learned for future use during our project or future projects.

Conclusion

Risk management is an essential part of project management! The tools, principles, and concepts presented in this paper are only an overview of the many important aspects of project risk management, but they are essential to good project risk management. To neglect good risk management is to endanger the very success of our projects.

References

1. *A Guide to the Project Management Body of Knowledge*, Third Edition, Project Management Institute, Inc., 2004.
2. Kendrick, Tom. *Identifying and Managing Project Risk: Essential Tools for Failure-Proofing Your Project*. AMACOM, 2003.
3. Wideman, R. Max. *Project and Program Risk Management: A guide to Managing Project Risks and Opportunities*. Project Management Institute, Inc., 1992.

Authors

ELDON R. LARSEN is a professor of engineering at Marshall University Graduate College (100 Angus E. Peyton Dr., South Charleston, WV 25303; Phone: 304-746-2047; Email: Larsene@marshall.edu) where he coordinates the M.S. in Engineering degree program. He has taught project management courses since 1994 in industrial and university settings; he also teaches operations management and management of technical human resources and organizations. Before joining Marshall full-time in 1999, he worked for 16.5 years at Union Carbide Corporation, where he led a major effort to develop and implement project management for research and development. He earned B.S. and M.S. degrees from Brigham Young University, and a Ph.D. from the University of California at Berkeley, all in chemical engineering. He is a senior member of AIChE, where he has served twice as chair of the Charleston local section. He has also served as chair of the AIChE Management Division, and served as chair of the Planning and Organizing committee for the 2007 AIChE/ACS Management Conference, and served as vice chair of the

conference. He is a past President and CEO of the West Virginia/Ohio Valley Chapter of the Project Management Institute (PMI).

RYLAND W. MUSICK, JR., PE., is a design engineer for the West Virginia Division of Highways in Princeton, WV. He earned a B.S. in civil engineering from the West Virginia Institute of Technology in Montgomery, WV, and an M.S. in engineering with an emphasis in engineering management from Marshall University in 2009. He is currently pursuing a Ph.D. in transportation infrastructure at Virginia Polytechnic Institute and State University in Blacksburg, VA.