PROJECT RISK MANAGEMENT PHASES

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Abstract: Risk management is the human activity which integrates recognition of risk, risk assessment, developing strategies to manage it, and mitigation of risk using managerial resources. Notwithstanding the domain of activities where they are conducted, projects often entail risks, and risk management has been widely recognized as a success factor in project management. Following a concept clarification on project risk management, this paper presents a generic list steps in the risk management process. Risk analysis is highlighted. I use expected value analysis for quantitative estimation. I propose to determine risk probability using Fishbone-Ishikawa diagrams and I provide an example that illustrates this theory.

1. Introduction

A major aspect of managing projects is the balancing of objectives and constraints involving project time, resources, costs, and work scope. These are four key dimensions of any project and for each of these elements there is always the risk of missing defined target.

In project management process the quantification of risk must be based on an assessment of risk in a similar manner in which the quantification of work is based on a project design or a project definition. Assessment of risk has reason to identify areas containing high degrees of risk - for instance, those activities associated with new research, technical developments. Risk may also be associated with the external environment, such as economic conditions, political uncertainties, weather, geography, public opinion, or labor-related factors.

As part of the risk analysis process, it is necessary to identify risks, the probability of the risk, and the impact of the risk. As part of the risk mitigation plan, it is necessary to identify actions that can be taken to avoid or minimize risks (or the negative effects of risks).

Risk avoidance and minimization assume identification of alternatives and decision points (when to consider implementing the alternatives). In many cases, rather than allowing for each individual risk, project managers gather risks into natural groups, for which they then provide for a collective contingency. These contingencies may involve time, resources, money, and even the scope of work. The amount of contingency will depend on the degree of risk and the penalties for missing targets.

Consequently, risk management of a project includes four main activities:

- Risk identification
- Risk analysis
- Risk minimization plans
- Contingency plans and reserves

Before applying risk management procedures, many organizations produce a *Risk Management Plan*. This is a document produced at the start of the project which sets

out the strategic requirements for risk assessment and the whole risk management procedure. The main contents of a Risk Management Plan are as follows:

- *General introduction* explaining the need for the risk management process;
- *Project description*. Only required if it is a stand-alone document and not part of the PMP;
- *Types of risks.* Political, technical, financial, environmental, security, safety, program etc.;
- *Risk processes*. Qualitative and/or quantitative methods;
- *Tools and techniques*. Risk identification methods, expected value analysis computer analysis etc.;
- *Risk reports*. Updating periods of Risk Register, exception reports, change reports etc.;
- *Attachments*. Important project requirements, dangers, exceptional problems etc.

2. Risk Identification

Many aspects of projects are unpredictable, despite of best efforts to nail them down. Some of the most common areas of uncertainty in project management process are:

- Scope,
- Time,
- Cost,
- Technology,
- Customer expectations,
- Resources,
- Organizational culture,
- Outside Factors.

From these sources of uncertainty springs risks. There are recommended a checklist to help stimulate thinking about potential problems. When manager meet with the team he would use this checklist to pass in review as many potential risks as he can, practicing brainstorming techniques.

Each element of a project is assessed for risk, based on the following:

• Status of technology being utilized,

• Status of planning,

• Status of the design (project stage).

Risk is higher when new or unproven technologies are required. Greater uncertainty is also expected when all aspects of a task or project element are not yet planned in detail.

Finally, risk is generally higher during the early stages of a project or task than when nearing completion.

3. Risk Analysis

In this phase manager shall identify the problems that threaten organization the most and therefore demand attention.

There are a number of methods for shortening the list. One of the most common and straightforward consists of making qualitative judgments about two characteristics of potential problems probability and impact. Probability is the likelihood that the potential problem will occur. Impact is the seriousness of the potential problem in terms of the effect on your project. Each risk can then be given a probability rating of HIGH, MEDIUM or LOW. In a similar way, by taking into account all the available statistical

data, past project histories and expert opinion, the impact or effect on the project can be rated as SEVERE, MEDIUM or LOW. Combining the probability of a risk with impact or effect on the project will result gravity of the risk.

A simple matrix can be drawn up which identifies whether a risk should be taken any further.

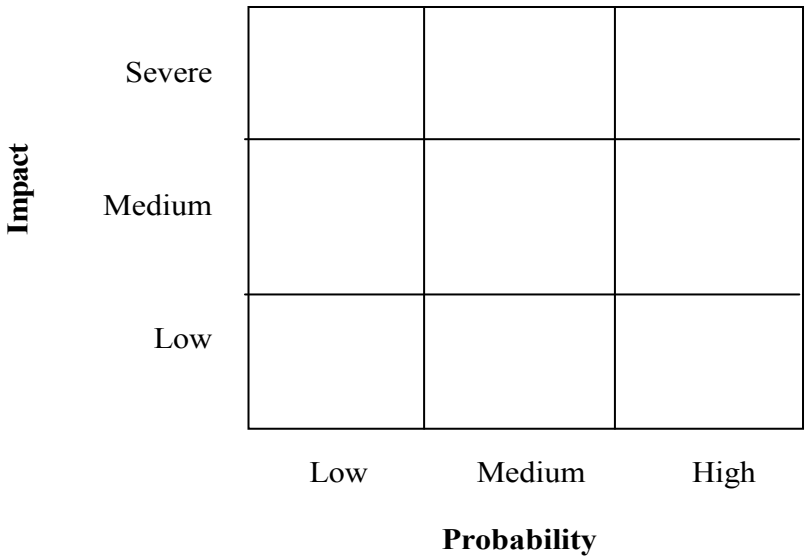

Fig. 1: Qualitative analysis

Each risk can now be given a risk number, so that it is now possible to draw up a simple chart which lists all the risks so far considered. This chart will show the risk number, a short description, the risk category, the probability rating, the impact rating (in terms of high, medium or low) and the risk owner who is charged with monitoring and managing the risk during the life of the project.

Risk analysis includes a detailed discussion of the risk, including both internal and external factors. There are several factors that can influence our response to a risk, including but not limited to:

• Amount and quality of information on the actual hazards that caused the risk (descriptive uncertainty);

• Amount and quality of information on the magnitude of the damage (measurement uncertainty);

• Amount and quality of information on probability of occurrence;

• Personal benefit to project manager for accepting the risk (voluntary risk);

• Risk forced upon project manager (involuntary risk);

• The existence of cost-effective alternatives (equitable risks);

• The existence of high-cost alternatives or possibly lack of options (inequitable risks);

• Length of exposure to the risk.

While qualitative analysis is less precise than quantitative analysis, evaluating the results is far less expensive in terms of both time and money. The results are good enough to indicate the overall risk of the project and identify the high-priority risks in order to begin taking some corrective action. Quantitative risk analysis attempts to

attach specific numerical values to the risks. The severity can be assessed from these numerical values for impact and probability.

In my opinion expected value analysis is the best non-computational way to determine severity in risks. To do this, we must measure the probability of the risk in numbers between 0.0 and 1.0. The values for the impact of the risks are estimated monetary value. By evaluating the impact and probability this way, we can multiply the two values together and come up with what is called the value of risk severity. This value for severity has quantitative meaning. If we were to do this project many times, the risk would happen some of the time and not happen some of the time. Adding up the severity of the risk each time it occurred and dividing by the number of times the project was done would give an average value. This is the expected value.

The best way to determine risk probability is Fishbone-Ishikawa diagrams (cause-and effect diagrams). The diagram, illustrated in Figure 2, is a useful way of organizing and analyzing a process into its subprocesses. The subprocesses can be further broken down into other subprocesses until a level of detail is reached where a small group can look into the subprocess in detail and the risks associated with each causes can be easily identified.

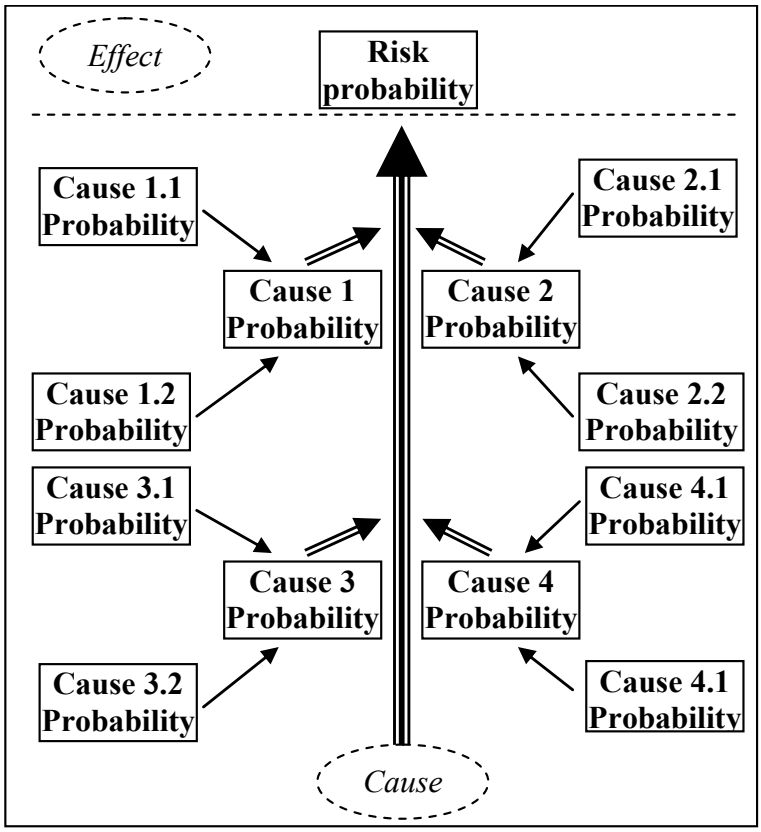

Fig. 2: Fishbone-Ishikawa diagrams for risk probability

To approximate risk probability I propose a balanced average of subprocesses (causes) probabilities.

$$Rp = \frac{\sum_{j=1}^{n} Cp_j \times \rho_j}{\sum_{j=1}^{n} \rho_j} \quad (1)$$

where:
Rp - risk probability,
Cp_j - causes probabilities,
ρ_j - probabilities rank (greatest rank for greatest probability).

To approximate the values of risks impact I use the product among quantity and estimated value for quantity.

$$\mathrm{Ri} = \mathrm{Q} \times \mathrm{P} \quad (2)$$

where:
Ri - risk impact,
Q - quantitative effect,
P - unit price.

The risk severity is the product among risk probability and risk impact. Table 1 shows a sample of values for impact and probability.

Table 1

Values for risks impact and probability

		Impact		
		Risk 1	**Risk 2**	**Risk 3**
Probability	**0,1**	2	143	23
	0,2	5	156	24
	0,3	6	162	27
	0,4	7	165	28
	0,5	8	168	33
	0,6	10	172	35
	0,7	11	178	37
	0,8	12	193	39
	0,9	14	195	42
	1,0	17	199	44

The assessment of several risks can be summarized into best-case, worst-case, and expected-value scenarios as well:

- The best-case scenario is the average of first five levels of severity.
- The worst-case scenario is the average of last five levels of severity.
- Expected-value scenario is the average of all levels of risk severity.

Table 2 illustrates severity quantification by evaluating the impact and probability.

Table 2

Best-case, worst-case and expected-value scenarios for risks severity

	Impact		
Probability	**Risk 1**	**Risk 2**	**Risk 3**
0,1	0,2	14,3	2,3
0,2	1	15,6	2,4
0,3	1,8	16,2	2,7
0,4	2,8	16,5	2,8
0,5	4	16,8	3,3
0,6	6	17,2	3,5
0,7	7,7	17,8	3,7
0,8	9,6	19,3	3,9
0,9	12,6	19,5	4,2
1,0	17	19,9	4,4
Expected-value scenario	6,27	17,31	3,32
The best-case scenario	1,96	15,88	2,7
The worst-case scenario	10,58	18,74	3,94

4. Risk Minimization Plans

Once the risks to the project have been identified and assessed, strategies are needed to minimize those risks.

Such strategies may include:

- *Acceptance*. Acceptance of a risk means that the severity of the risk is low enough that we will do nothing about the risk unless it occurs. Using the acceptance strategy means that the severity of the risk is lower than organization risk tolerance level. Once the risk occurs, project manager will fix the problem and move on. Many of the project risks will fall into this category. It is the category where the many insignificant risks are put.

There are two kinds of acceptance:

- Active,
- Passive.

Acceptance is active when a risk is identified as being acceptable but manager decide to make a plan for what to do when and if the risk occurs.

Acceptance is passive when nothing at all is done to plan for the risk occurrence. Many of the identified risks in the project will be passively accepted. These risks are simply too small to be of concern. The price of developing a plan and documenting it can be higher than the cost of dealing with the risk without preparation.

- *Transfer*. The transfer strategy in managing risk is to give responsibility for the risk to someone outside the project. The risk does not go away; the responsibility of the risk is simply given to someone else. This can be done a number of ways:
  - The refusal of a project deliverable that has a high risk of causing (for production risks)
  - Transfer to a contractor working for the project (for all kind of risks);

- INCOTERM clause (for transportation risks)
- Firm fixed price contract (for commercial risks);
- Insurance (for financial and all kind off risks).

➢ *Risk Avoidance*. This strategy is used to make the risk cease to be a possibility. In risk avoidance, it is completely eliminate the possibility of the risk. The simplest way to avoid a risk is to remove it from the project deliverables.

➢ *Mitigation*. Mitigation is a strategy where some work is done on unacceptable risks to reduce either their probability or their impact to a point where their severity falls below the maximum risk tolerance level.

5. Contingency Plans and Reserves

Changes in technical performance or schedules imply a new look at cost estimates and a reevaluation of contingency reserves. The amount of reserves depends on a number of factors, including funds available, overall risk ness of the project, and the management approach.

6. Conclusion

Risk is a reality in every undertaking. If project manager knew the outcome of everything in advance, there would be no risk. Unfortunately, for some undertakings, even though project manager do not know the details undertake. Project manager knows that he will be able to complete them; he just do not know precisely how much it will cost or how long it will take.

Consequently, he needs to recognize that risk exists. The plans, no matter how well conceived, need to acknowledge risk. Risk not only needs to be acknowledged; it needs to be managed (assessed and controlled).

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