Chapter 6

Qualitative Risk Analysis

6

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Qualitative Risk Analysis

As risks are identified, they are evaluated in the Perform Qualitative Risk Analysis process. The objective is to prioritize those project risks for potential action based on an evaluation of certain risk characteristics.

Using the risk register developed and updated during risk identification, this process will assess the probability (likelihood) that the risk will occur and the impact (effect) if it does occur.

Once evaluated based on probability and impact, the risks can be prioritized for appropriate action and response. Qualitative risk analysis provides a quick and cost-effective means of establishing priorities and serves as the foundation for potential quantitative risk analysis.

Because a qualitative analysis is a subjective evaluation of the project risks, the assessment will reflect the attitudes, tolerances, and biases of the assessors.

The qualitative analysis of the project risk should be revisited throughout the project to note changes in the project and environment. Trending risk data is a component of controlling risk.

Critical Success Factors

The following factors are necessary for success in qualitative risks analysis.

Agreed-Upon Approach

The organization must have an agreed-upon assessment approach that is applied to all project risks. The assessments generally include an evaluation of risk probability and impact, but they may also include an assessment of urgency (how quickly does the team need to take action on the risk?) and manageability (can the risk even be managed?).

The assessment and evaluation of the risks may result in the decision to establish contingency reserve and move forward with the project despite the level of risk, the decision to stop or re-scope the project, or the decision to inform the customer or sponsor of the risks and escalate to the appropriate parties for a go/no-go decision.

Definitions

Published and agreed-upon definitions of risk probability and impact aid in the accurate assessment of each project risk.

High-Quality Information

High-quality information, which may come from historical information and/or be gathered by workshops and interviews, is a necessary input to ensure accurate assessment of the project risks.

Ongoing analysis

Qualitative risk analysis is an ongoing and iterative process. It must be conducted periodically throughout the project and must not be viewed as a one-time activity.

Perform Qualitative Risk Analysis Process

The Perform Qualitative Risk Analysis process assesses and evaluates the probability of an individual risk occurring and assesses the impact of the risk if it were to occur. This type of evaluation is based on a pre-defined and communicated risk assessment scales, such as 0 – 1 or 1 – 5.

Using the probability and impact scores, the risks are then prioritized for additional analysis or response planning as appropriate.

Perform Qualitative Risk Analysis: Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
1. Risk management plan	1. Risk probability and impact assessment	1. Project documents updates
2. Scope baseline	2. Probability and impact matrix	
3. Risk register	3. Risk data quality assessment	
4. Enterprise environmental factors	4. Risk categorization	
5. Organizational process assets	5. Risk urgency assessment	
	6. Expert judgment	

Figure 6-1: Perform Qualitative Risk Analysis ITTOs

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Perform Qualitative Risk Analysis: Inputs

Risk Management Plan

The risk management plan, a subsidiary plan, will provide details and guidance on the qualitative risk analysis process, including the defined scales or measurements of risk probability and impact.

Scope Baseline

The scope baseline is an output of the Create WBS process and is made up of the project scope statement, the WBS, and the accompanying document to the WBS, the WBS dictionary.

Risk Register

The risk register is started during the Identify Risks process and is elaborated upon during the remaining risk management processes. The risk register lists all of the identified risks with a unique risk identification numbers and description of each risk.

Enterprise Environmental Factors and Organizational Process Assets

Environmental factors may include an increase in budget restrictions, which would increase the project cost risk. Organizational process assets may include past project files, which can be leveraged to identify risks identified on previous, similar projects.

Enterprise environmental factors and organizational process assets were discussed in Chapter 4.

Perform Qualitative Risk Analysis: Tools and Techniques

The *PMBOK® Guide* tools and techniques for the Perform Qualitative Risk Analysis process are:

- Risk probability and impact: assessment and matrix
- Risk data quality assessment
- Risk categorization
- Risk urgency assessment

In addition to the *PMBOK® Guide* tools and techniques, six other tools and techniques may be used to perform a qualitative risk analysis:

- Analytic hierarchy process
- RBS analysis
- Root cause analysis
- Pareto prioritization analysis
- Retrospective analysis
- Estimating techniques

Probability/Impact Evaluation and Matrix

Risk probability assessment investigates the likelihood that a specific risk will occur. Risk impact assessment investigates the potential effect of a risk on project objectives such as schedule, cost, quality, or performance and is attentive to both negative effects of threats and positive effects of opportunities.

Probability and impact are assessed for each identified risk in interviews or meetings with participants selected for their familiarity with the risk categories on the agenda.

The level of probability for each risk and its impact on each objective is evaluated during the interview or meeting and explanatory detail, including assumptions justifying the levels assigned, is recorded.

Risk probabilities and impacts are rated according to the definitions given in the risk management plan, with risks with low ratings of probability and impact included on a watchlist for future monitoring.

Many organizations will define probability on a 0 to 1 scale, with 1 equating to a 100% probability that the event will occur. The impact scale is defined by the organization and, alternatively, may be a 1 to 5 scale or a 1 to 10 scale.

Using this scale, the project team can add probability and impact to assess individual risk scores. In this example, probability is evaluated on a "0 to 1" scale and impact on a "1 to 5" scale.

Risk ID	Risk	Probability	Impact	Risk Score
1	Poor weather conditions	.3	4	1.2
2	Low morale of team members	.4	2	.8
3	Poor cost estimates	.8	3	2.4
4	Lack of technical equipment	.6	5	3
			Total	**7.4**
			Avg.	**1.85**

Figure 6-2: Probability and Impact Evaluation

Another common method for qualitative assessment is the use of ranges.

For example:

Probability

- High – 50% or higher (likely)
- Medium –10-50% (unlikely)
- Low – 10% or lower (very unlikely)

Impact

- High – A project objective is at risk, requiring a mandatory change to scope, schedule, and/or cost.
- Medium – Project objectives can be met, but significant replanning is required.
- Low – No major plan changes are required; the risk is an inconvenience or will be handled through overtime or other minor adjustments.

Risks can be prioritized for further quantitative analysis and response based on their risk rating. Usually these risk-rating rules are specified by the organization in advance of the project and included in organizational process assets. Risk-rating rules can be tailored to a specific project during the process of planning the risk management approach.

Evaluation of each risk's importance and hence its priority for attention is typically conducted using a probability and impact matrix. Such a matrix specifies combinations of probability and impact that add up to as low-, moderate-, or high-priority risks.

- The dark gray area (with the largest numbers) represents high risk
- The light gray area (with the smallest numbers) represents low risk
- The medium gray area (in the middle) represents moderate risk

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05	0.10	0.20	0.40	0.80	0.80	0.40	0.20	0.10	0.05

Impact (numerical scale) on an objective (e.g.. cost, time, scope, or quality)

Each risk is rated on its probability of occurring and impact on an objective if it were to occur. The organization's thresholds for low, moderate, or high risks are shown in the matrix and will determine whether the risk is scored as low, moderate, or high for that objective.

Figure 6-3: Probability Impact Matrix

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An organization can rate a risk separately for each objective. For example, there may be different ratings of a single risk's impact on cost, time, and scope. In addition, it can develop ways to determine one overall rating for each risk. An overall project rating scheme can be developed to reflect the organization's preference for one objective over another, and those preferences can be used to develop a weighting of the risks that are assessed by objective.

Opportunities and threats can be handled in the same matrix and separated by definitions of the different levels of impact that are appropriate for each.

Risk ratings help guide risk responses. Risks that have a negative impact on objectives if they occur and are in the high-risk zone of the matrix may require priority action and aggressive response strategies. Threats in the low-risk zone may not require proactive management action beyond placement on a watchlist or the addition of a contingency reserve.

Opportunities in the high-risk zone that can be obtained most easily and offer the greatest benefit should be targeted first. Opportunities in the low-risk zone should be monitored.

The number of steps in the scale is organizationally determined and organizationally dependent.

Risk Data Quality Assessment

The data used to analyze risks should be evaluated to ensure that it is appropriate, accurate, and timely.

For example, if risks are being analyzed based on real estate data from three years ago, the data may not be truly representative of the current market conditions for real estate.

Risk Categorization

Risks may be categorized by:

- Sources of project risk (for example, using the RBS)
- The area of the project affected by the risk (scope, time, cost, quality, etc.)
- Other useful categories (for example, project phase)

Grouping risks by common root causes can allow for effective response strategies.

Risk Urgency Assessment

A risk urgency assessment evaluates urgency in addressing identified risks and determines which risks need to be addressed the soonest. Urgency may be based on the time needed to implement a risk response, the risk warning signs, or the risk rating.

Analytic Hierarchy Process (AHP)

An analytic hierarchy process (AHP) allows risk scores to be calibrated according to which project objectives are the most important by creating a weighted evaluation of different options.

To conduct an AHP:

1. Using a preference scale, conduct a pair-wise comparison of the objectives.
2. Using the results from the comparison, determine the weighting factor for each objective.
3. Evaluate two identified options against each other as they relates to each of the objectives.
4. Calculate each option's average score and multiply that score by the objective weighting to determine the overall score.
5. Select the option with the highest score.

Example:

Using a preference factor scale, determine pair-wise comparisons.

Preference Factor Scale
1 The two factors are equally important.
2 One factor is slightly more important.
3 One factor is more important.
4 One factor is significantly more important.
5 One factor is absolutely more important.

Step 1

Below is a sample pair-wise comparison comparing scope, time, and cost.

	Scope	Time	Cost
Scope	1	5	3
Time	1/5 (0.2)	1	1/2 (0.5)
Cost	1/3 (0.3)	2	1
TOTAL	1.5	8	4.5

Step 2

Divide each number of the pair-wise comparison by the total and then calculate the average of each. This average is the objective weighting that will be used in step 4.

	Scope	Time	Cost	Average
Scope	.67	.63	.67	.66
Time	.13	.13	.11	.12
Cost	.20	.25	.22	.22

The result of the pair-wise comparison is that 66% of the weighting is on scope, 22% on cost, and 12% on time, meaning that scope is of the most concern, followed by budget and then time.

Step 3

Evaluate the two risks against each other as to the potential impact on the project objectives of scope, time, and cost. Calculate an average score for each risk against each project objective.

In this example, Risk 2 has a significantly larger impact on scope than Risk 1 has. However, Risk 1 has a larger impact on cost and time.

	Scope					Time					Cost				
	Risk 1		Risk 2		Avg.	Risk 1		Risk 2		Avg.	Risk 1		Risk 2		Avg.
Risk 1	1	.20	.25	.20	.20	1	.75	3	.75	.75	1	.83	5	.83	.83
Risk 2	4	.80	1	.80	.80	.33	.25	1	.25	.25	.20	.17	1	1.17	.17
TOTAL	5		1.25			1.33		4			1.2		6		

Average score for each risk against each objective:

	Risk 1	Risk 2
Scope	.20	.80
Time	.75	.25
Cost	.83	.17

Step 4

The risk's average score is then multiplied by the objective weighting to determine the overall score.

	Objective Weighting	Risk 1	Risk 2
Scope	.66	.20	.80
		.20 x .66 = .13	.80 x .66 = .53
Time	.12	.75	.25
		.75 x .12 = .09	.25 x .12 = .03
Cost	.22	.83	.17
		.83 x .22 = .18	.17 x .22 = .04
Overall Score		.40	.60

As a result of this AHP, it is determined that Risk 2 is of the most concern due to its potential scope impact, despite the fact that Risk 1 will have a bigger impact on time and cost.

RBS Analysis

As presented in Chapter 5, the risk breakdown structure (RBS) is a graphical, hierarchical depiction of risk categories and subcategories for the project. Risk data is organized and structured to provide a standard presentation of project risk categories that facilitates understanding, communication, and management.

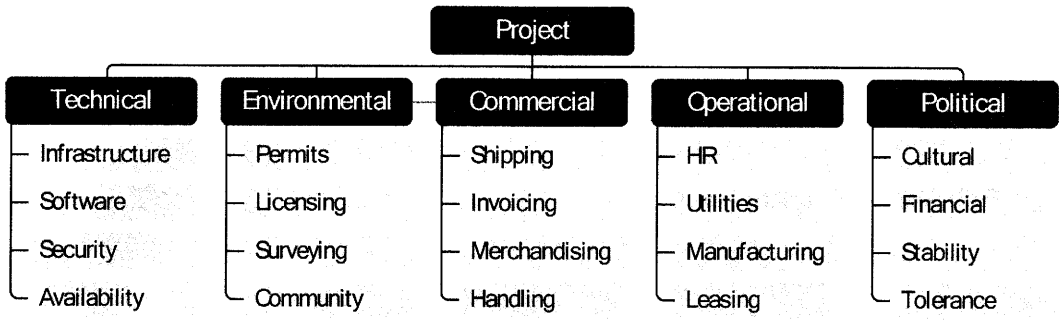

Figure 6-4: Risk Breakdown Structure

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An RBS analysis can also be used in qualitative analysis to provide the team with insight into the specific categories of risk that may have a higher probability or impact based on the defined project objectives.

Root Cause Analysis

As presented in Chapter 5, a root-cause analysis or cause-and-effect exercises may be used for risk identification. In addition, root cause analysis is helpful in the qualitative risk analysis process. Identifying the root cause of the risks can provide a more accurate assessment of the probability and/or impact of identified risks based on shared or related root causes.

Pareto Prioritization Analysis

The Pareto Principle is also known as the 80/20 Principle, and it can be applied to many things in life. Joseph Juran applied the Pareto Principle to quality issues to say that 80% of quality problems originate from just 20% of causes. It can also be used from a risk management perspective to see how 80% of risks originate from 20% of causes.

Pareto prioritization ranks the causes of poor quality or the causes of risk by overall influence. This data can be displayed in a Pareto chart, which is a special type of histogram that shows causes, frequency, and cumulative percentage.

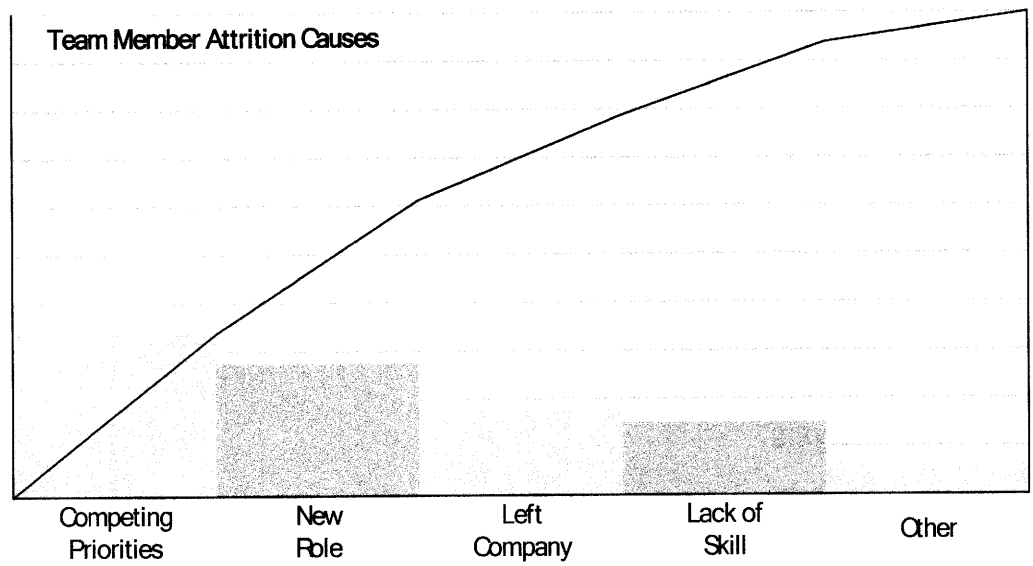

Figure 6-5: Pareto Chart

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A Pareto prioritization helps project team focus on the causes that will have the biggest impact. From a qualitative risk analysis perspective, a Pareto prioritization provides a visual representation of the impact of the identified root causes.

Retrospective Analysis

A retrospective analysis, as discussed previously, is the analysis of potential risks based upon what occurred in the past on previous projects or the current project. Also used for risk identification, a retrospective analysis is a valuable component of a qualitative risk analysis, as it provides evidence of risk probability and the impact or effect of those risk events if they were to occur.

This allows the team to prevent mistakes that were made on prior projects while also leveraging any possible opportunities similar to those missed or captured in the past. In turn, it contributes to organizational learning that may be applied on future projects.

While retrospective analysis is incredibly valuable for use on any project, it is not a complete approach, as it is not possible that all risks for a project were previously identified earlier in the project or in past projects.

Estimating Techniques

There are multiple approaches to estimating risk impact and risk probability. Simplifying impact and probability scales to project-specific data provides an easier mechanism for team members to use to determine the appropriate score.

Scale	Probability	± Impact on Project Objectives	
		Time	Cost
Very Low	1-10%	< 1 week	<$10k
Low	11-20%	1-2 weeks	$10-20k
Moderate	21-40%	3-5 weeks	$21-40k
High	41-60%	6-9 weeks	$41-70k
Very High	61-99%	> 9 weeks	>$70k

Figure 6-6: Probability and Imapct Scale

Perform Qualitative Risk Analysis: Outputs

The outputs of the Perform Qualitative Analysis process are project document updates. Specifically, the risk register that was established during the risk identification process is updated with all of the information from the qualitative risk analysis.

Updates can include the relative ranking or prioritization of risks, the categorization of risks, and the identification of causes of risk or areas that require particular attention. In addition, it is beneficial to identify which risks require responses in the short term, which need additional analysis, and which are considered low-risk.

Upon performing a qualitative risk analysis, the risk register can be updated with:

- Relative ranking or priority list of project risks – The probability and impact matrix can be used to classify risks according to their individual significance. Using combinations of each risk's probability of occurring and its impact on objectives if it were to occur, risks are prioritized relative to each other by sorting them into groups of high risk, moderate risk, and low risk. Risks may be listed by priority separately for schedule, cost, and performance since organizations may value one objective over another.
    - The project manager can then use the prioritized list of risks to focus attention on items of high significance (high risk) for the most important objectives, where responses can lead to better project outcomes.
- Risks grouped by categories – Risk categorization can reveal common root causes of risk or project areas requiring particular attention. Discovering concentrations of risk may improve the effectiveness of risk responses.
- List of risks requiring response in the short term – Risks that require an urgent response and risks that can be handled at a later date may be put into different groups.

- List of risks for additional analysis and response – Some risks might warrant more analysis, such as a quantitative analysis, as well as response action.
- Watchlists of low-priority risks – Risks that are not assessed as important when assessed qualitatively can be placed on a watchlist for continued monitoring.
- Trends in qualitative risk analysis results – As the analysis is repeated, a trend in particular risks may become apparent and can make risk response or further analysis more or less urgent/important.

As the qualitative risk analysis is repeated throughout the project, the risk register is updated with any trending information.