Project Risk Management

By Dr. T D Jainendrakumar

Project Risk Management is the processes of conducting risk management planning, identification, analysis, response planning and monitoring and control on a project. The Objectives are to increase the probability and impact of positive events and decrease the probability and impact of negative events in the project

Plan Risk Management

This is the first process in this knowledge area which comes in planning process group for defining how to conduct risk management activities for a project. And it take care of the Importance to provide sufficient resources and time for risk management activities, and to establish an agreed upon basis for evaluating risk.

Plan Risk Management: Inputs

1. Project Management Plan (all the approved subsidiary plans as well as base lines should be considered)
2. Project Charter (Includes the high level description of Risk, high level project descriptions and high level requirements)
3. Stakeholder Register (contains the role of each and every stakeholder)
4. Enterprise Environmental Factors (Risk attitudes and stakeholder risk tolerance etc.,
5. Organizational Process Assets, include but not limited to:
    - Risk Categories
    - Common definitions of concepts and terms
    - Risk statement formats
    - Standard templates
    - Roles and responsibilities
    - Authority levels for decision making
    - Lessons learned

Plan Risk Management T&T

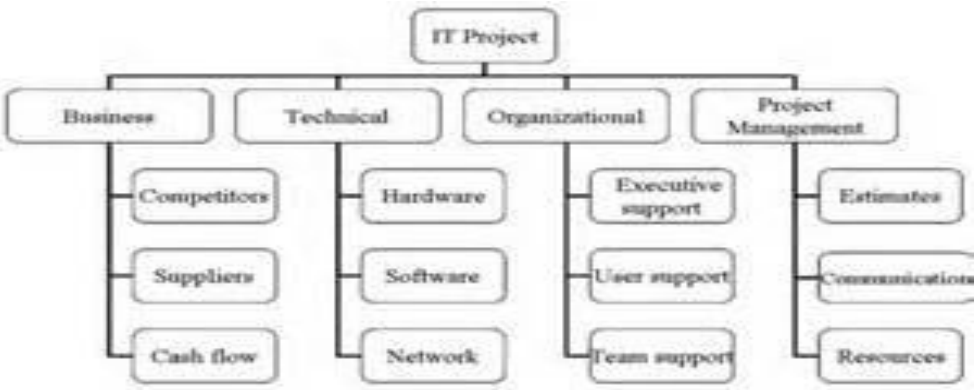
1. Analytical Techniques (along with risk scoring sheets, stakeholder risk profile analysis should be done to understand the risk tolerance)
2. Expert Judgment (Seek expertise from senior management0
3. Meetings (Project team with all stakeholders)

Plan Risk Management: Outputs

1. Risk Management Plan

a) Methodology (Strategic approach to carry out risk management plan)
b) Roles and Responsibilities (Risk management activities has to be assigned to team members)
c) Budgeting (Contingency reserve & Management reserve has to be included)
d) Timing (all the anticipated risk should be included in the schedule)
e) Risk Categories (Grouping of risk in a risk breakdown structure)
f) Definition of probability and impact(Defining the probability of occurrence of risk and its impact on quality and credibility of risk analysis)
g) Probability and Impact Matrix (Risks are prioritized by multiplying probability of occurrence with the impact score which is kept in a separate table in consultation with the stakeholders and risks are ranked and priorities are fixed.
h) Revised stakeholders' tolerance (the stakeholders capacity to risk tolerance)
i) Reporting format (Format for risk management documentation and control)
j) Tracking (tracking documents for auditing)

Risk Categories (Risk Break down Structure)



Definition of Risk Probability and Impact

Project Objective	Very Low 0.05	Low 0.10	Moderate 0.20	High 0.40	Very High 0.80
Cost	Insignificant cost impact	< 10% cost impact	10-20% cost impact	20-40% cost impact	> 40% cost impact
Schedule	Insignificant schedule impact	< 5% schedule impact	5-10% schedule impact	10-20% schedule impact	> 20% schedule impact
Scope	Barely noticeable	Minor areas impacted	Major areas impacted	Changes unacceptable to sponsor	Product becomes effectively useless
Quality	Barely noticeable	Only very demanding applications impacted	Sponsor must approve quality reduction	Quality reduction unacceptable to sponsor	Product becomes effectively useless

Risk Probability and Impact Matrix

Impact →	1	2	3	4	5
Probability ↓	Negligible	Minor	Moderate	Significant	Severe
(81-100)%	Low Risk	Moderate Risk	High Risk	Extreme Risk	Extreme Risk
(61-80)%	Minimum Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
(41-60)%	Minimum Risk	Low Risk	Moderate Risk	High Risk	High Risk
(21-40)%	Minimum Risk	Low Risk	Low Risk	Moderate Risk	High Risk
(1-20)%	Minimum Risk	Minimum Risk	Low Risk	Moderate Risk	High Risk

Identify Risks

Identify Risks is the second process in this knowledge area which comes in planning process group for determining which risks may affect the project more and documenting their characteristics. Experienced project managers start looking for risks from the start of the project.

Identify Risks: Inputs

1. Risk Management Plan (in order to identify the risk)
2. Cost management Plan (Plan for the contingency and reserve)
3. Schedule Management Plan (To see the time parameters of the project0
4. Quality Management Plan (Base line of quality measures and metrics are given in this)
5. Human Resource Management Plan (key information about the team carried out the risk activities)
6. Scope Baseline (Scope description assumption, constrains etc are important)
7. Activity Cost Estimates (To see the budgetary impact of risk)
8. Activity Duration Estimates (To see time allowances for dealing risk)
9. Stakeholder Register (Stake holders are involved in risk identification process)
10. Project Documents (project charter, Project Schedule, Schedule network diagram, issue log, Quality check list etc)
11. Procurement Documents (Contract documents are important to deal with risk)

12. Enterprise Environmental Factors (Published information like rates for each items of work, published check lists etc.)

13. Organizational Process Assets (Standard Operating procedures, Lessons Learned etc.)

Identify Risks: T & T

1. Documentation Reviews (documents such as plans, previous project files, agreements etc., has to be reviewed.)

2. Information Gathering Techniques

   Brainstorming (open discussion has to be performed with the team and experts with the help of a facilitator to identify risk or resolve issues or problems)

   Delphi Technique (In this consensus are obtained with the help of experts who are anonymous. The facilitator circulate the questionnaires and responses to the experts until the consensus are obtained)

   Interviewing

   Root Cause Analysis (Identifying an issue or problem and the root causes of it's occurrence)

3. Checklist Analysis (check list of risks are prepared from historical data and stored in the lessons learned achieves for future reference)
4. Assumptions Analysis (Or What if analysis is done by assuming anticipated risks from experience or some valid hypothesis)

5. Diagramming Techniques

   Cause-and-effect diagrams (Ishikawa/fishbone diagram find the root causes of issues)

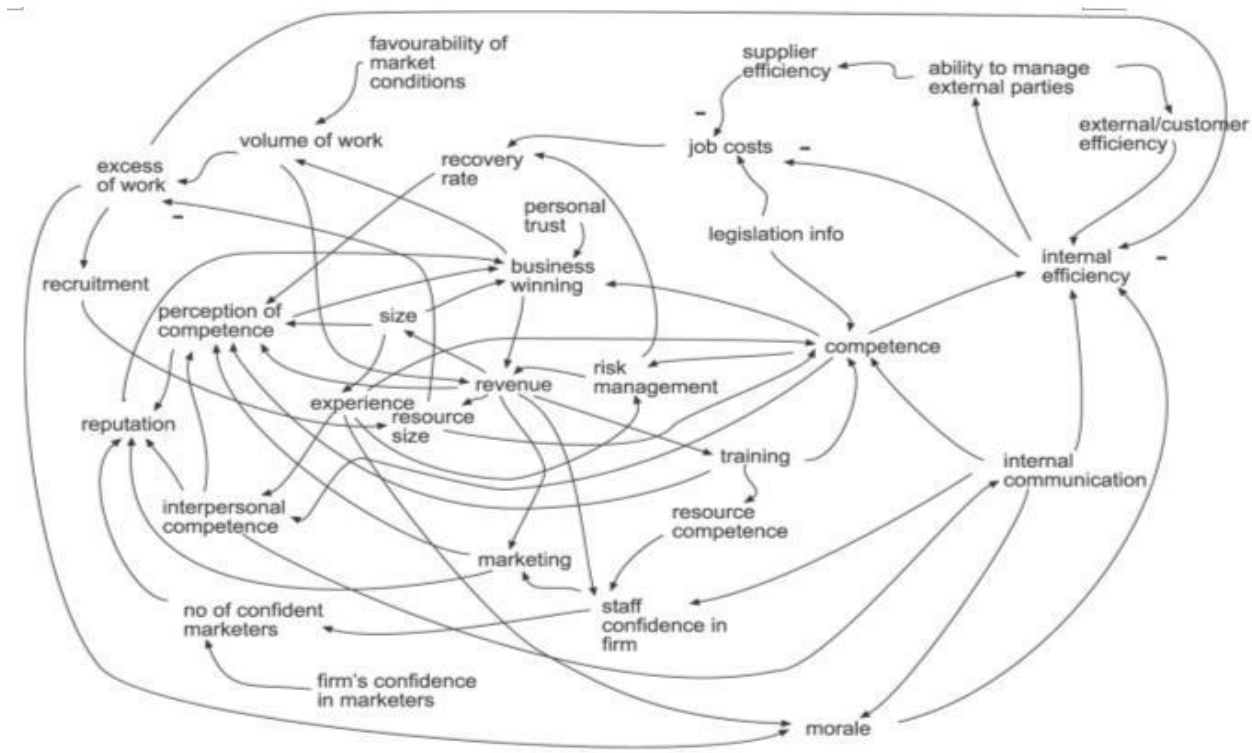
   System or process flow charts(Flow chart depicting the process flow to solve an issue)

   Influence diagrams(Relationships among different project variables and outcomes are represented in this diagram)

6. SWOT Analysis (Strength, Weakness, Opportunities, Threats)

7. Expert Judgment

Influence diagram



Identify Risks: Outputs

Risk Register: It usually contains the list of risk items, consequences, likelihood of occurrence and it's rating as shown in the table below:

ID	Risk	Consequence		Likelihood		Rating
		Current	Target	Current	Target	Level of Risk
1	Loss of IT (data)	Major	Insignificant	Moderate	Unlikely	Extreme
2	Loss of Precinct	Major	Minor	Rare	Rare	High
3	Loss of Building	Major	Minor	Unlikely	Unlikely	High
4	Denial of Access to Building	Major	Minor	Unlikely	Unlikely	High
5	Loss of Key Dependencies	Major	Minor	Unlikely	Unlikely	High
6	Loss of Vital Records	Major	Insignificant	Unlikely	Rare	High
7	Loss of Key Staff	Moderate	Minor	Unlikely	Unlikely	Low
8	Loss of IT (voice)	Minor	Insignificant	Unlikely	Unlikely	Low

Perform Qualitative Risk Analysis

This is the third process in this knowledge area which comes in planning process group, the previous process Identify Risks is the process of determining which risks may affect the project and documenting their characteristics where this is the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact

Perform Qualitative Risk Analysis: Inputs

1. Risk Management Plan (Contains the strategies for the risk management throughout the project)
2. Scope Baseline (Scope statement, WBS & WBS dictionary)
3. Risk Register (Information regarding the identified risk)
4. Enterprise Environmental Factors (Industry studies of the project risk etc.)
5. Organizational Process Assets (Lessons Learned, historical data etc.)

Perform Qualitative Risk Analysis: Tools & Techniques

1. Probability and Impact Matrix (To take appropriate action based on the rank of the risk)
2. Risk Probability and Impact Assessment (How the risk effects the schedule, cost scope etc. are assessed)
3. Risk Data Quality Assessment (Data gathered for risk assessment should be assessed periodically)
4. Risk Categorization (Risk can be categorized under similar head for effective risk responses)
5. Risk Urgency Assessment (Risk Symptoms, warning signs, risk ratings etc. has to be assessed for urgent tackling of risk)
6. Expert Judgment (get the opinion from experts)

Perform Qualitative Risk Analysis: Outputs

1. Risk Register /Project documents Updates

   Risk register updating Includes:

   - Relative ranking or priority list of project risks
   - Risks grouped by categories
   - Causes of risk or project areas requiring particular attention
   - List of risks requiring response in the near-term
   - List of risks for additional analysis and response
   - Watch lists of low-priority risks
   - Trends in qualitative risk analysis results

Perform Quantitative Risk Analysis

This is the fourth process in this knowledge area which comes in planning process group and doing the process of numerically analyzing the effect of identified risks on overall project objectives. Means Quantitative analysis is performed on risks that have been prioritized by the qualitative risk analysis process as potentially and substantially impacting the project's competing demands.

Perform Quantitative Risk Analysis: Inputs

1. Risk Management Plan (Guidelines, methods and tools are used)
2. Cost Management Plan (Risk reserves are planned in this)
3. Schedule Management Plan (Risk reserve of schedule is here)
4. Risk Register (this is a reference for quantitative analysis)
5. Enterprise Environmental Factors (Risk database and industry studies of similar project)
6. Organizational Process Assets (Historical Information of previous projects)

Perform Quantitative Risk Analysis: Tools & Techniques

1. Data Gathering and Representation Techniques
    - Interviewing
    - Probability Distribution

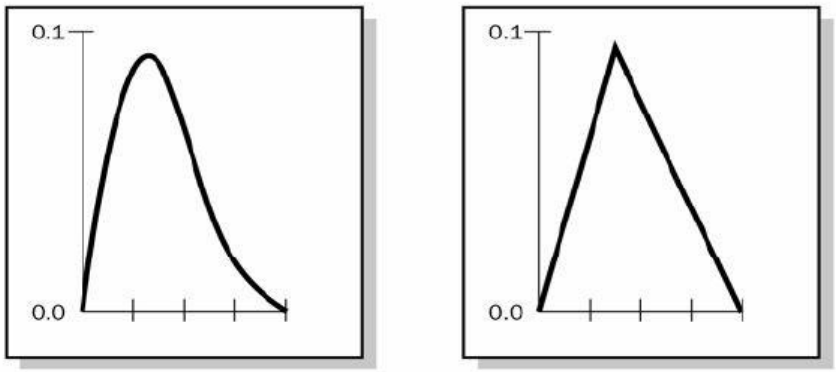
Range of Project Cost Estimates Collected during the Risk Interview is given below and find out the closer value using Progressive evaluation and review techniques using beta or triangular estimation.

Range of Project Cost Estimates

WBS Element	Low	Most Likely	High
Design	$4M	$6M	$10M
Build	$16M	$20M	$35M
Test	$11M	$15M	$23M
Total Project	$31M	$41M	$68M

Interviewing relevant stakeholders helps determine the three-point estimates for each WBS element for triangular, beta or other distributions. In this example, the likelihood of completing the project at or below the most likely estimate of $41 million is relatively small as shown in the simulation results in Figure 11-16 (Cost Risk Simulation Results).

Probability Distribution: Uncertainty in values is depicted as shown below to reach more closer values to avoid risk in estimation.



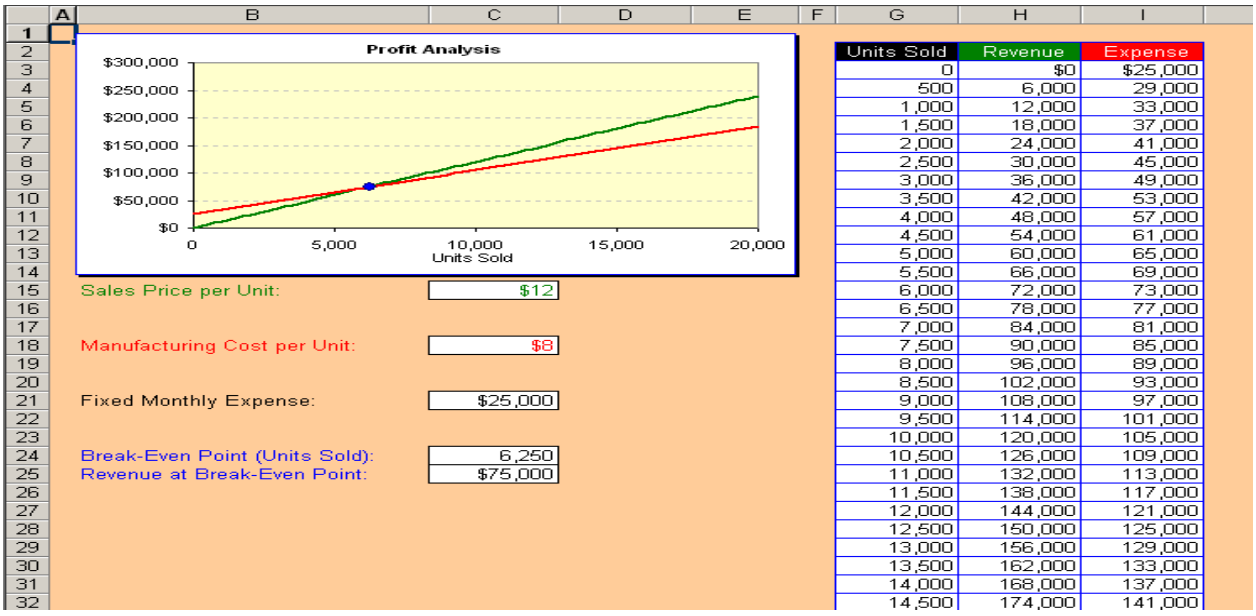
Beta and triangular distributions are frequently used in quantitative risk analysis. The data shown in the figure on the left (Beta Distribution) is one example of a family of such distributions determined by two "shape parameters". Other commonly used distributions include the uniform, normal and lognormal. In these charts the horizontal (X) axes represent possible values of time or cost and the vertical (Y) axes represent relative likelihood.

2. Quantitative Risk Analysis and Modeling Techniques

    - Sensitivity analysis
    - Expected monetary value analysis
    - Modeling and Simulation

3. Expert Judgment (Seek guidance from experts)

Sample Sensitivity Analysis: Identifies the massive risk, the red line below shows that sale is decreasing which means action is required to improve sales.



Units Sold	Revenue	Expense
0	$0	$25,000
500	6,000	29,000
1,000	12,000	33,000
1,500	18,000	37,000
2,000	24,000	41,000
2,500	30,000	45,000
3,000	36,000	49,000
3,500	42,000	53,000
4,000	48,000	57,000
4,500	54,000	61,000
5,000	60,000	65,000
5,500	66,000	69,000
6,000	72,000	73,000
6,500	78,000	77,000
7,000	84,000	81,000
7,500	90,000	85,000
8,000	96,000	89,000
8,500	102,000	93,000
9,000	108,000	97,000
9,500	114,000	101,000
10,000	120,000	105,000
10,500	126,000	109,000
11,000	132,000	113,000
11,500	138,000	117,000
12,000	144,000	121,000
12,500	150,000	125,000
13,000	156,000	129,000
13,500	162,000	133,000
14,000	168,000	137,000
14,500	174,000	141,000

Expected monetary value analysis:

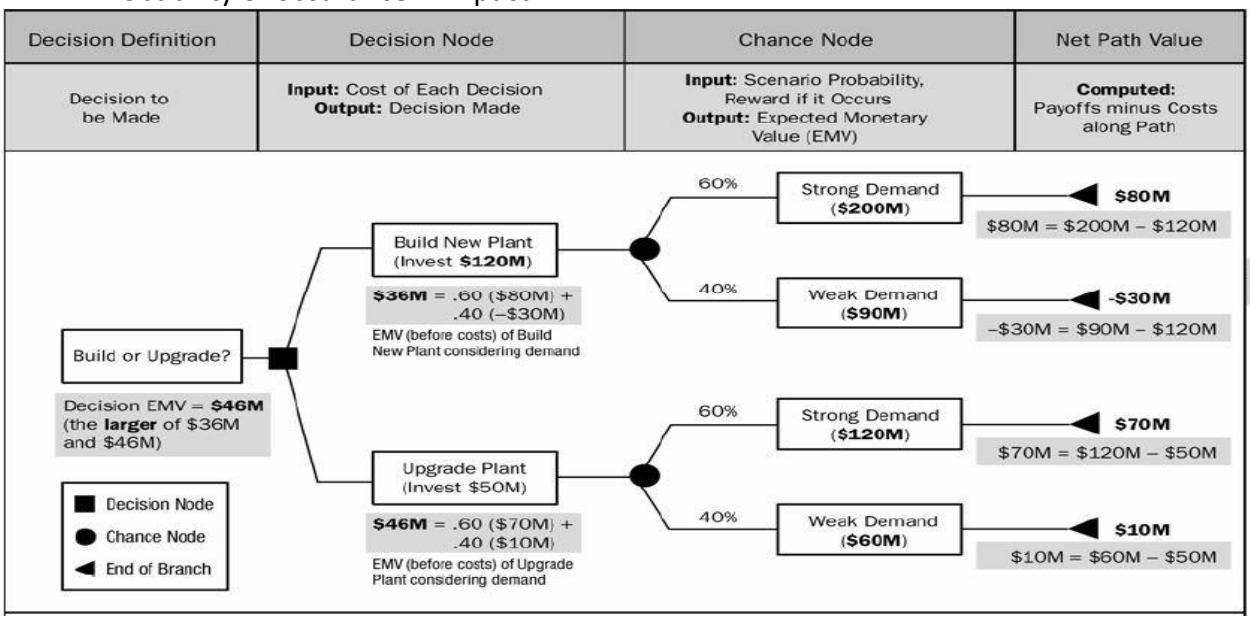
Here in this diagram a decision is making whether a plant has to be upgraded or to build a new plant. In this we are considering two cases that strong demand of product and weak demand of products manufactured each under 'build a new plant' or 'upgrading existing plant'

Case -1
Let us take the case of Building a new plant, for which we have to invest $120M here there are the possibility of 60% product sales in case of strong demand then weill have a sales of $200M or 40% possibility of product sales in weak demand and only sales of $90M. Here Net path value in case of strong demand is ($200-$120)= $80M, similarly in the case of weak deamand it is ($90-$120)=-$30M.

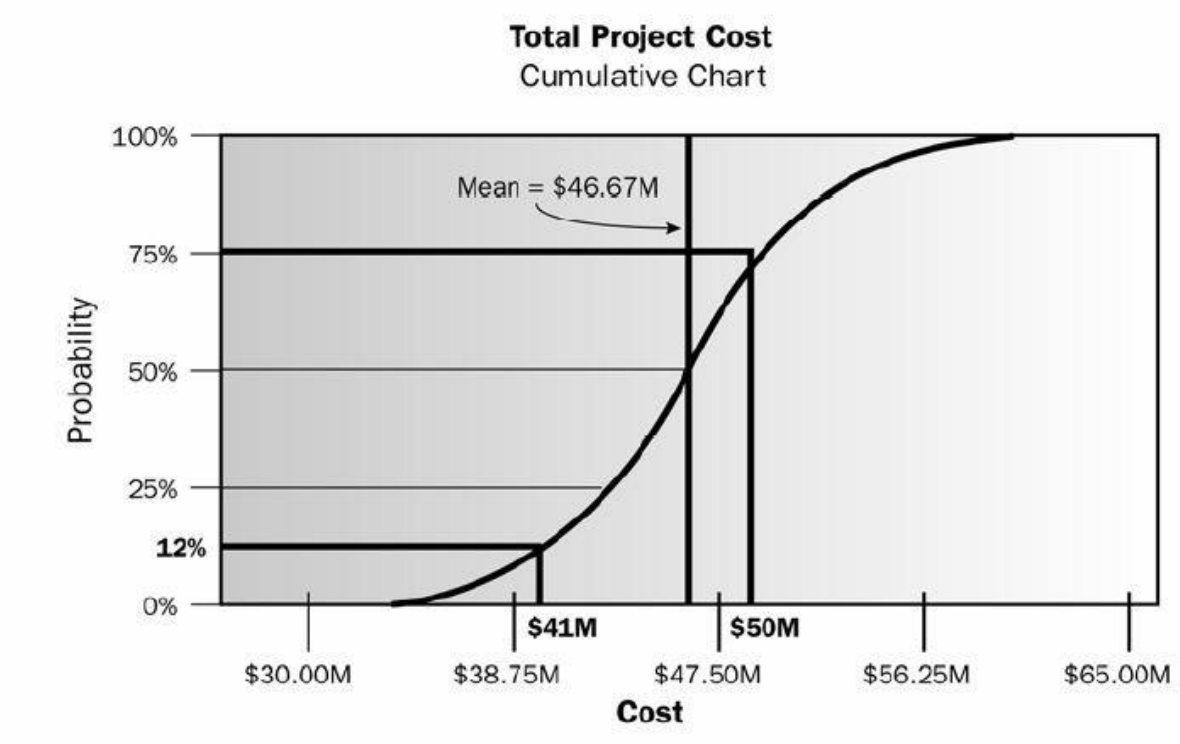
EMV for the Build case =0.60($80M)+0.40(-$30M)= $36

Case -2
Similarly In the case of upgrade plant from the figure shown below 0.60($70M)+0.40($10M)= $46
Therefore our decision EMV is the largest that is $46 and decided to upgrade the existing plant and build business.

EMV = Probability of occurance X Impact.



Modeling and Simulation ; Simulation performs numerous times and data generated regarding the cost of the project is plotted below as S Curve and find out the most closer probability of completing the percentage of project within the most appropriate cost ranges for better prediction .



Perform Quantitative Risk Analysis: Outputs

1. Project Document Updates

   Probabilistic analysis of the project (potential outcomes of schedule and cost are identified)

   Probability of achieving cost and time objectives

   Prioritized list of quantified risks (risk register updated)

   Trends in repetitive quantitative risk analysis results

Plan Risk Responses

This is the fifth process in this knowledge area which comes in planning process group and it is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. The key benefit is to address the risks by their priority, have strategies to handle the risks and assigned resources & budget to handle those risks.

Plan Risk Responses: Inputs

1. Risk Management Plan (Guides the risk response activities)

2. Risk Register (contains identified risk, root causes, list of potential responses, trends, etc.)

Plan Risk Responses: Tools & Techniques

1. Strategies for negative risks or threats

   Avoid

   Transfer

   Mitigate

   Accept

2. Response Strategies for Threats

Avoidance:

Risk prevention
Changing the plan to eliminate a risk by avoiding the cause/source of risk
Protect project from impact of risk
Examples:

1. Change the implementation strategy
2. Do it ourselves (do not subcontract)
3. Reduce scope to avoid high risk deliverables
4. Adopt a familiar technology or product

Mitigation

Seeks to reduce the impact or probability of the risk event to an acceptable threshold. Be proactive: Take early actions to reduce impact/probability and don't wait until the risk hits your project.
Examples:

1. Staging - More testing - Prototype
2. Redundancy planning
3. Use more qualified resources

Transfer

Shift responsibility of risk consequence to another party
It does not eliminate risk; risk is transferred to someone else.
And most effective in dealing with financial exposure
Examples:

1. Buy/subcontract: move liabilities
2. Selecting type of Procurement contracts: Fixed Price
3. Insurance: liabilities + bonds + Warranties

Acceptance

Used when project plan cannot be changed & other risk response strategy cannot be used is there are two types of acceptance called Active Acceptance and passive acceptance.

In active acceptance we develop a contingency plan to execute if the risk occurs. Contingency plan must be ready with the actual plan

Passive Acceptance is dealing with the risks as and when they occur, there is no contingency plan prepared. (**Contingency allowance/ reserve** established amount of reserve (e.g.: time and/or money) to account for the identified known risks. Amount is decided based on probability and impact of risk on the project)

3. Strategies for Positive Risks or Opportunities

Exploit: Ensure opportunity is realized Example: Assigning organization most talented resources to the project to reduce cost lower than originally planned.

Share: Allocating some or all of the ownership to third part best able to capture the opportunity. Example: Joint ventures, special-purpose companies

Enhance: Increase the probability and/or the positive impact of the opportunity. Example: Adding more resources to finish early

Accept: Willing to take advantage of opportunity if it comes, but not actively pursuing it. Example: whether forecasting predicted the rainfall on a specific day, therefore try to complete the concreting work one day before the rainfall and take the advantage of rain.

4. Contingent Response Strategies (for dealing known risks)

5. Expert Judgment (Help from experts)

Plan Risk Responses: Outputs

1. Project management Plan Updates (its subsidiary plans and baselines)

   - Schedule Management Plan
   - Cost Management Plan
   - Quality Management Plan
   - Procurement Management Plan
   - Human Resource Management Plan
   - Scope Baseline
   - Schedule Baseline
   - Cost Baseline

2. Project Documents Updates

    - Assumptions log updates
    - Technical Documentation Updates
    - Change Requests

Control Risks

This is the sixth and last process in this knowledge area which comes in monitoring and control process group and doing the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

Monitor and Control Risks: Inputs

1. Risk Register (It contains the information regarding the identified risk, probability of its occurrence and impact caused by it, Symptoms and warnings and all sensitive information will be there including the watch list for less sensitive risk.)

2. Project Management Plan (especially risk management plan state how to monitor and control risks)

3. Work Performance Data (Details of actual work performed)

4. Work Performance Reports (electronic or hard copy of the work performance information received when compare the planned work with the actual)

Monitor and Control Risks: Tools & Techniques

1. Risk Reassessment (risk reassessment should be done regularly as risks can creep in any time during the project life cycle)

2. Risk Audits (are performed in regular intervals to examine the effectiveness of risk responses and risk management processes and can be documented for necessary actions and follow up)

3. Variance and Trend Analysis (Variation in planned versus actual and finding the trend over a period of time)

4. Technical Performance Measurement (Measuring technical accomplishment during the project execution)

5. Reserve Analysis (to determine the availability of enough reserve to deal with the risk)

6. Meetings (to manage and control risk)

Monitor and Control Risks Outputs

1. Work Performance Information (received when compare the planned work with the actual)

2. Change Requests through change control board

   - For Recommended corrective actions
   - And Recommended preventive actions

3. Project management Plan Updates

   - Outcome of risk reassessment, risk audits, and periodic risk reviews
   - Actual outcome of the project's risks and the risk's response

4. Project Document Updates (Risk register, risk response plan etc.)

5. Organizational Process Assets Updates (Risk related templates and lessons learned)

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