

PROJECT COST MANAGEMENT
PROJECT TIME MANAGEMENT
PROJECT RISK MANAGEMENT

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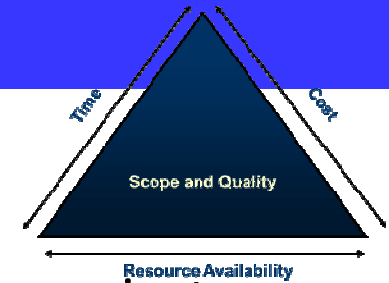


Overview

- Cost Management Processes
 - Resource Planning
 - Cost Estimating
 - Cost Budgeting
 - Cost Control
 - Resource Pool
- Time Management Processes
 - Duration and Labor
 - Resource Loading versus Task Duration
 - Causes of Variation in Duration
 - The Delphi Technique
 - The Three-Point Method
 - The Wide-Band Delphi Technique
 - Poker Planning
- Risk Management
 - Risk Identification
 - Risk Assessment
 - Risk Mitigation – Response Options
 - Risk Monitoring



Cost Management



Cost of doing the project is another variable that defines the project.

Cost management

- is primarily concerned with the cost of the resources needed to complete project activities.
- should also consider the effect of project decisions on the cost of using the project's product.
- planning includes building the project budget and mapping those costs into the project schedule.
- Controlling - variance reports and earned value reports

Project cost is the budget that has been established for the project.

- Important for projects that create deliverables that are sold either commercially or to an external customer.

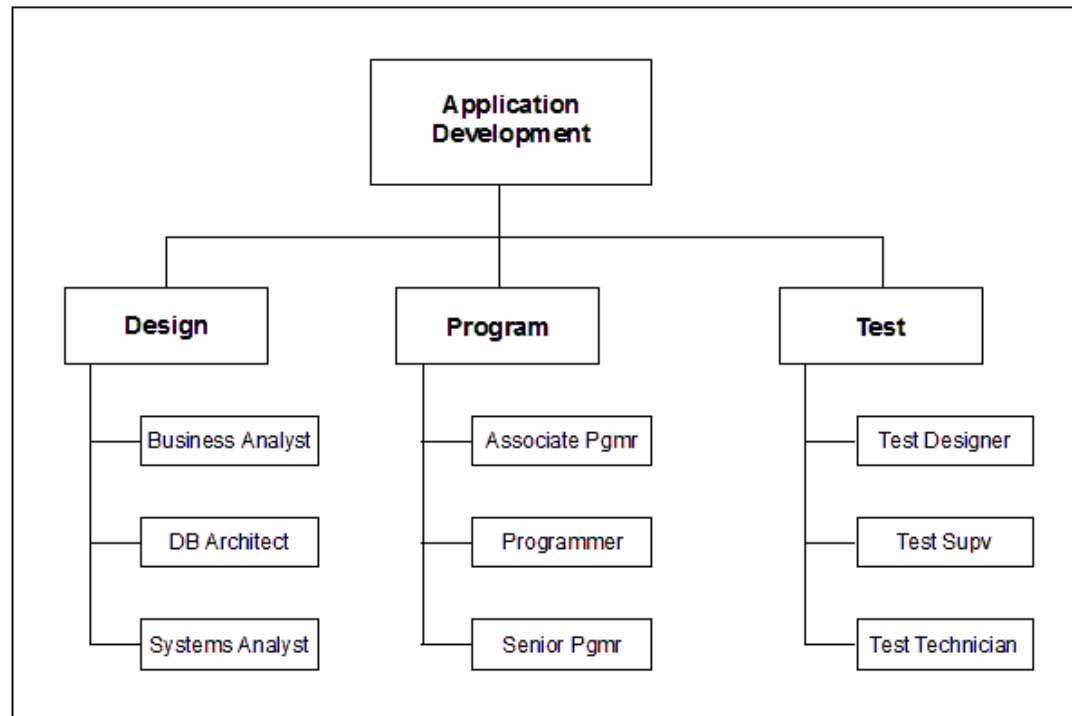
Cost Management Processes

- Resource planning
 - What resources (people, equipment, materials) and what quantities of each should be used to perform project activities
- Cost estimating
 - Developing an estimate of the costs of the resources needed to complete project activities
- Cost budgeting
 - Allocating the overall cost estimate to individual work activities
- Cost control
 - Controlling changes to the project budget
- Contracted Services



Estimating Resource Requirements

- People
 - Skill set
- Facilities
- Equipment
- Money
- Materials



- Resource Breakdown Structure is a subset of WBS
 - Determined by job families defined by HR



Resource Planning

- What resources (people, equipment, materials) and what quantities of each should be used to perform project activities
- Inputs
 - Work breakdown structure
 - Identifies the project deliverables and processes that will need resources
 - Historical information regarding what type of resources were required for similar work on previous projects
 - Scope statement contains the project justification and project objectives
 - Resource pool description
 - Knowledge of what resources (people, equipment, material) are potentially available
 - Organizational policies regarding staffing and the rental or purchase of the supplies and equipment
 - Activity duration estimates
- Outputs
 - Resource requirements: Description of what types of resources are required and in what quantities for each element at the lowest level of the WBS



Tools and Techniques for Resource Planning

- Expert judgement provided by any group or individual with specialized knowledge or training
 - Other units within the performing organization
 - Consultants
 - Professional and technical associations
 - Industry groups
- Alternatives identification
 - Any technique used to generate different approaches to the project such as brainstorming and lateral thinking
- Project management software



Resource Pool

- More often than not, the same resources work on more than one project, whether the projects all occur at once or conveniently follow one after the other.
- You can create a resource pool for the resources you use time and again, and then apply that resource pool to as many projects as you want.
- This is especially useful when using a project management software



Cost Estimating

- Developing an estimate of the costs of the resources needed to complete project activities
- When a project is performed under contract, be careful to distinguish cost estimating from pricing.
- Inputs
 - Work Breakdown Structure
 - Resource requirements
 - Resource rates
 - Activity duration estimates
 - Estimating publications
 - Historical information – available from one or more of the following sources:
 - Project files of previous project results
 - Commercial cost estimating databases
 - Project team knowledge
 - Chart of accounts
 - Risks



Tools and Techniques for Cost Estimating

- Analogous (top-down) estimating
 - Use the actual cost of a previous similar project as basis
- Parametric modeling
 - Use project characteristics (parameters) in a mathematical model to predict cost
- Bottom-up estimating
 - Estimate the cost of individual activities or work packages and then sum up to get a project total
- Computerized tools
- Ranges of estimates
 - Rough order of magnitude estimate (guesstimate, -25% to +75%, ...)
 - Budget estimate (based on more details, typically -25% to +10%)
 - Definitive estimate (facts based, typically -10% to +5%)



Outputs from Cost Estimating

- Cost estimates
 - May be expressed in units of currency, staff hours or staff days
- Supporting detail
 - Scope of the work estimated
 - Documentation of the basis for the estimate
 - Documentation of any assumptions made
 - An indication of the range of possible results
- Cost management plan



Cost Budgeting - 1

- Involves allocating the overall cost estimates to individual activities or work packages to establish a cost baseline for measuring project performance
- Inputs
 - Cost estimates
 - Work breakdown structure
 - Project schedule
 - Risk management plan
- Outputs
 - Cost baseline: a time-phased budget that will be used to measure and monitor cost performance on the project.



Cost Budgeting - 2

- Tools and techniques
 - Analogous (top-down) estimating
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Cost Control

- Influence the factors that create changes to the cost baseline to ensure that changes are agreed upon
- Determine that the cost baseline has changed
- Manage the actual changes when and as they occur
- Includes
 - Monitoring cost performance to detect and understand variances from plan
 - Ensuring that all appropriate changes are recorded accurately in the cost baseline
 - Preventing incorrect, inappropriate, or unauthorized changes from being included in the cost baseline
 - Informing appropriate stakeholders of authorized changes
 - Acting to bring expected costs within acceptable limits



Cost Control – Inputs and Outputs

- Inputs
 - Cost baseline
 - Performance reports provide information on project scope and cost performance
 - Change requests
 - Cost management plan
- Outputs
 - Weekly reports
 - Revised cost estimates
 - Budget updates
 - Corrective action
 - Estimate at completion – forecast of most likely total project costs based on project performance and risk quantification
 - Project closeout
 - Lessons learned



Tools and Techniques for Cost Control

- Cost change control system defines the procedures by which the cost baseline may be changed.
- Performance measurement techniques help to assess the magnitude of any variations that occur.
- Earned Value Management (EVM)
 - Compare actual work performed against planned and budgeted work
- Additional planning – revisions due to changes
- Computerized tools



Defining Costs for Work and Material Resources

- Labor and materials usually represent the bulk of cost for a project.
- When you assign costs to work and material resources, you can calculate project costs as well as the schedule.



Estimating Task Duration

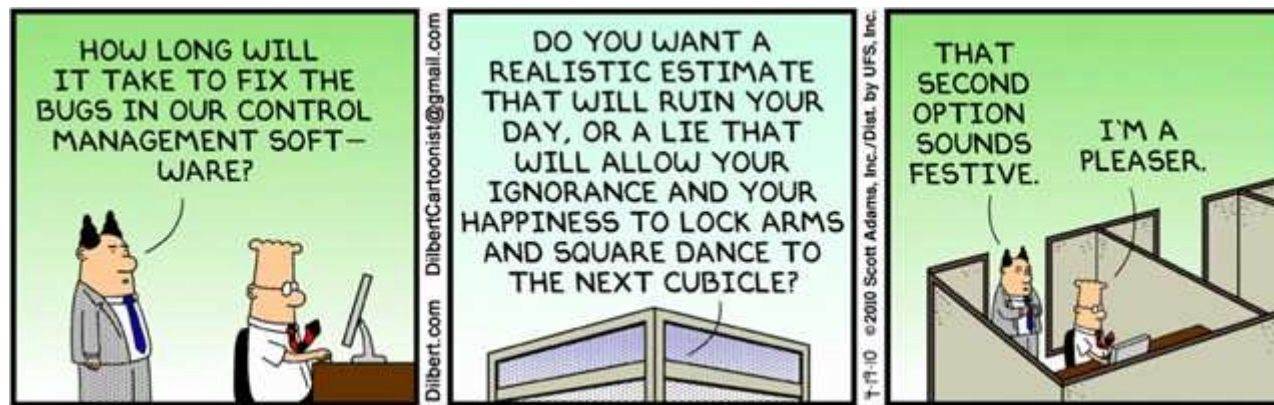
- Estimating is difficult because it is subjective.
 - A task's duration will vary simply because duration is a random variable.
- Better to have estimates from the team to have an average.
- Duration vs. Labor (effort)
 - Estimate duration to build the schedule and determine when the project will be completed
 - Estimate labor when you have to contain expenses within a budget
- Resource loading vs. Task duration



Time Management

There are two components of time management:

- **Planning** provides time estimates for both the duration of a project task and the actual effort or labor time required to complete the task.
- **Control** is part of the Monitoring and Controlling Process Group and involves comparing estimated times to actual times as well as managing the schedule and cost variances.



Time Management Processes

- Activity Definition
- Activity Sequencing
 - Identifying and sequencing interactivity dependencies
- Activity Duration Estimating
- Schedule Development
- Schedule Control



Time Management – Duration and Labor

- **Duration:** elapsed time in business working days, not including weekends, holidays, or other non-work days. It is used to estimate the total time needed to complete the project.
- **Work effort:** labor required to complete a task. That labor can be consecutive or nonconsecutive hours. The labor time is used to estimate the total labor cost of the project.
- Elapsed time (duration) versus work time (labor)
 - Estimate duration to build the schedule and determine when the project will be completed
 - Estimate labor when you have to contain expenses within a budget



Resource Loading versus Task Duration

- The duration of a task is influenced by the amount of resources scheduled to work on it.
- Crashing the task:
 - Adding more resources to hold a task's duration within the planning limits can be effective.
 - Crashpoint: the point where adding more resources will increase task duration.
- Considerations:
 - Optimum loading of a resource on a task
 - Amount of reduction in duration that results from adding resources
 - Impact on risk that results from adding another resource
 - Partitioning the task so that more than one resource can work on it simultaneously



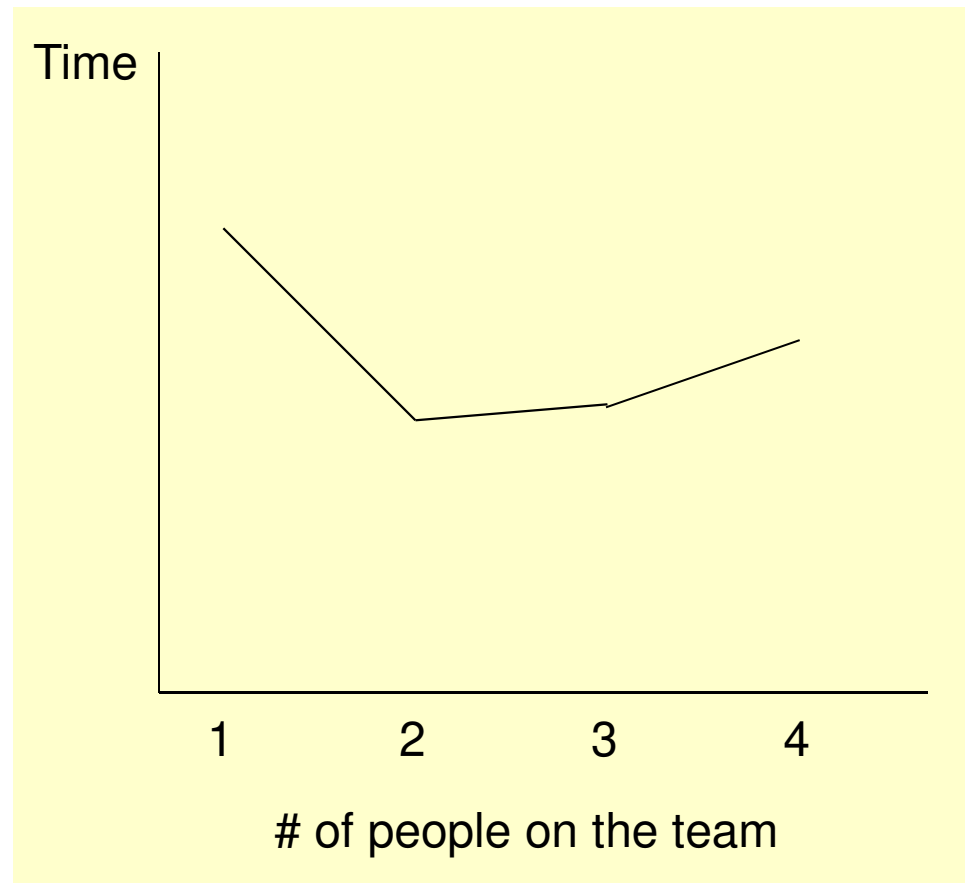
Crashing the Task Exercise

- Shapes ppt from different teams!



Resource Loading vs. Task Duration - Example

- Pick up the chair
- Carry it to the door
- Set the chair down
- Open the door
- Hold the door open with your foot as you pick up the chair
- Carry the chair out the door
- Set the chair in the hallway



Crashing is good only when ...

- Task is highly divisible



Brooks's Law

- Software projects are complex engineering endeavors.
- Adding manpower to a late software project makes it later.
- It is important to understand why:
 - Ramp up time
 - Communication overhead
 - Task divisibility: «nine women can't make a baby in one month»
- Refers to projects which are already late – so it could help to increase resources at an earlier stage (not always).



Causes of Variation in Duration

- Varying skill levels
- Unexpected events
- Efficiency of work time
- Mistakes and misunderstandings
- Variation within the capability of the system
- Common cause variation



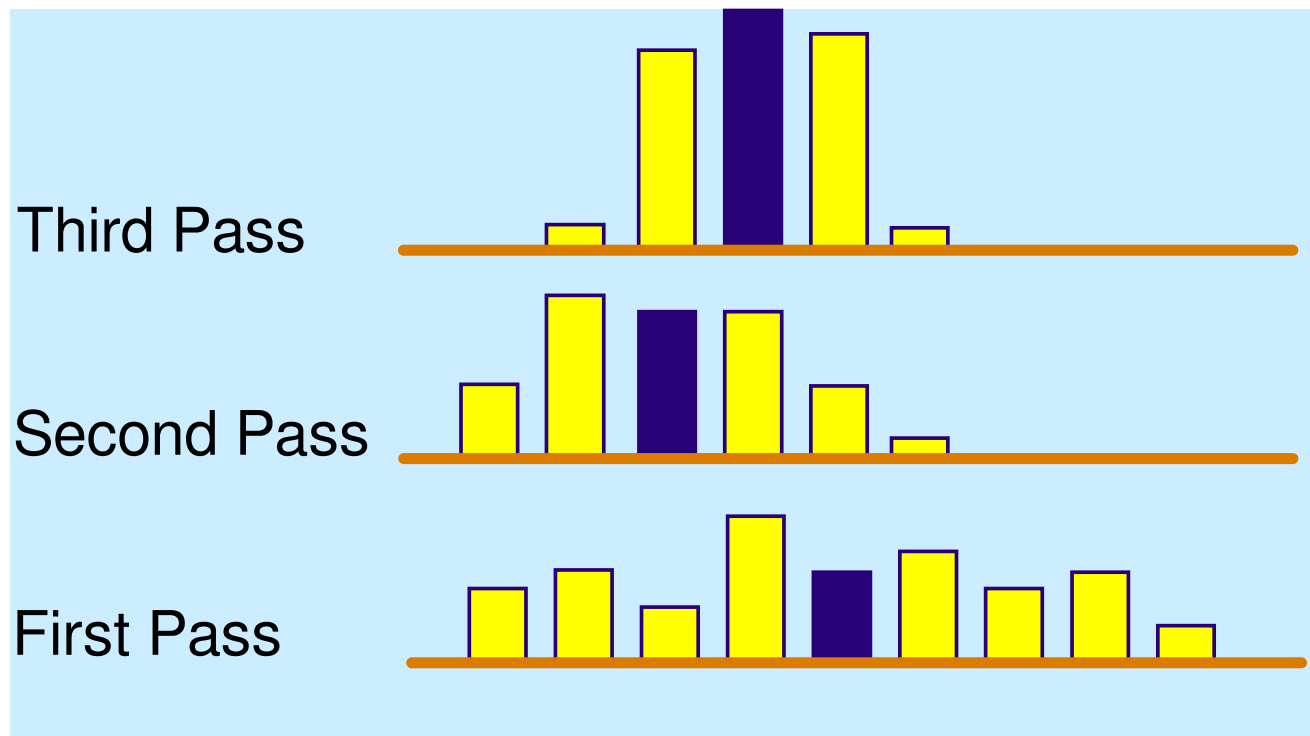
Six Simple Ways to Estimate Task Duration

- Similarity to other activities
- Historical data
- Expert advice
- Delphi technique
- Three-point technique
- Wide-band Delphi technique



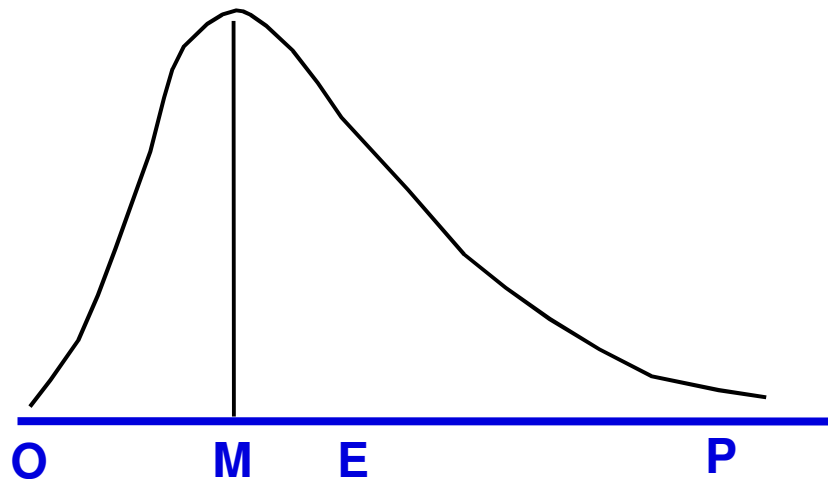
The Delphi Technique

Each group member makes a best guess of the task duration. Highest and lowest guesses are defended. After third iteration the average is used as the group's estimate.



The Three-Point Method

- Uses probabilistic statements about the likelihood of an estimate



O: Optimistic

P: Pessimistic

M: Most Likely

$$E = \frac{O + 4M + P}{6}$$

The Wide-Band Delphi Technique

- Combines the Delphi and three-point methods.
- At each iteration the group members give their optimistic, pessimistic, and most likely estimates for the duration of the chosen task.
- The results are compiled, and any extreme estimates are removed.
- Averages are computed and used as the optimistic, pessimistic, and most likely estimates of task duration.

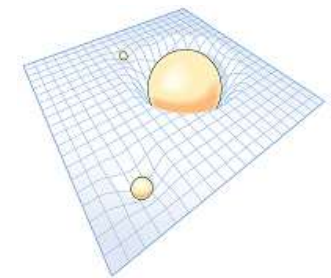


Bonus: Scrum Planning Poker

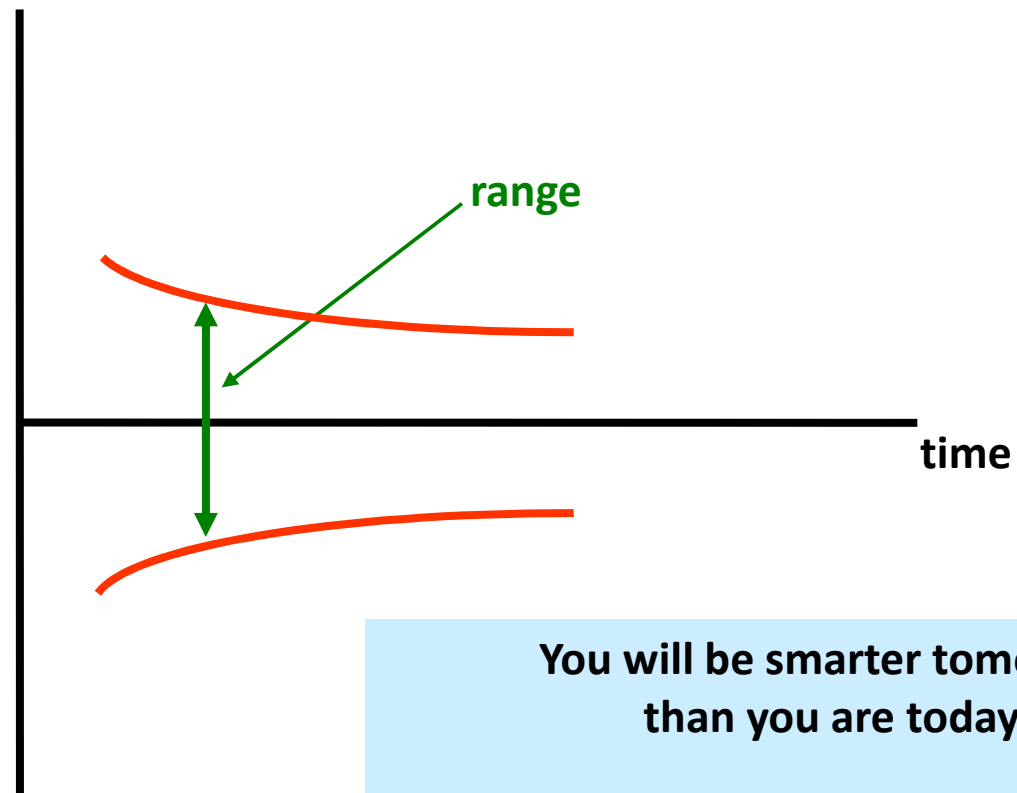
- Gamified technique for estimating, mostly used to estimate effort or relative size of development goals in software development.
 - Fibonacci or exponential (2^n)



- Be careful for less skilled team members estimates – they tend to mimic seniors without questioning



Estimates Have a Life Cycle Too



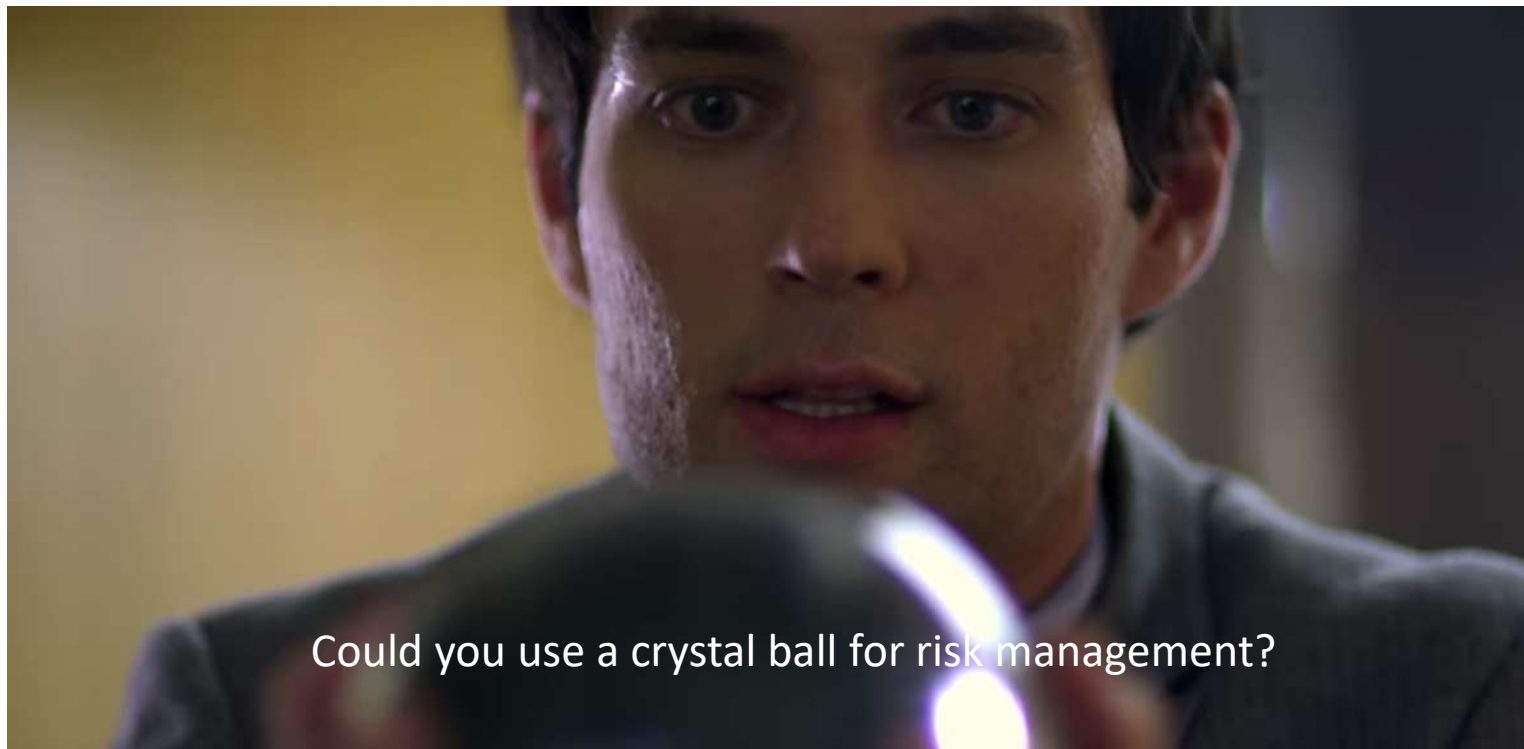
Risk Management

- A **risk** is some future event that happens with some probability and results in a change, either positive or negative, to the project.
- The risks that need to be managed are those that will hurt the project itself.
- When there is no probability for an event (it is certain) to occur, this type of event isn't handled by risk management. No probability, no risk.



You can't eliminate risk

But you can manage it intelligently...



Could you use a crystal ball for risk management?

Risk Management – The Life Cycle



Questions to be Answered by Your Risk Plan

- What are the risks?
- What is the probability of loss that results from them?
- How much are the losses likely to cost?
- What might the losses be if the worst happens?
- What are the alternatives?
- How can the losses be reduced or eliminated?
- Will the alternatives produce other risks?

Risk Management – Risk Identification



There are 4 basic industry accepted risk categories defined by PMI:

- Technical risks
- Project management risks
- Organizational risks
- External risks

Risk Category: Technical Risks

- Includes quality and performance goals generally relating to the technology of the project
- Technology: suitability, reliability, and the quality/performance standards surrounding the technology.
- Technology availability and complexity issues



Risk Category: Project Management Risks

- Poor allocation of the project's resources
- Inadequate project management structure – proper planning processes to define critical deliverables for each project phase
- Inadequate planning, resource inexperience, poor use of management disciplines
- Cost and schedule risks due to the aforementioned project management risks



Risk Category: Organizational Risks

- Supportability risks, lack of prioritization of projects
- Inadequacy or interrupted funding, inadequacy or interrupted resource assignment
- Conflicts with other competing projects
- Policies that do not support efficient management and could also include supportability risks
- Politics and agendas that impede the development of the project's executing objectives



Risk Category: External Risks

- Shifting legal or regulatory requirements
- Supplier and contractor risks and contract issues with same
- Force majeure risks, economic collapse, work stoppages (strikes)
- Programmatic or supportability risks caused by external parties
- Can also include deliverables from your teams that are external to your own (IT or client)
- Many of these risks will be “true risk” in nature



Simplified Risk Matrix Tool

A template that you can use for defining risks in each of these categories and making a preliminary assessment of how they might impact the scope matrix.

RISK CATEGORIES AND RISKS	SCOPE TRIANGLE ELEMENTS				
	Scope	Time	Cost	Quality	Resources
Technical					
Project Management					
Organizational					
External					



Risk Identification - Candidate Risk Drivers

Prioritize the top ten risk drivers for your project. E.g.:

- ___ Schedule is too aggressive
- ___ Overambitious performance
- ___ Too conservative a budget
- ___ Unrealistic expectations
- ___ Misunderstood contract terms
- ___ New/unfamiliar technology
- ___ Inadequate software sizing
- ___ Unsuitable development model
- ___ Unfamiliar new hardware
- ___ Poorly defined requirements
- ___ Frequent change requests
- ___ Poorly defined processes
- ___ Volatile business environment

- ___ Inadequately skilled personnel
- ___ Continuous requirements changes
- ___ Inadequate development plan
- ___ Unsuitable organizational structure
- ___ Testing facilities not available
- ___ Poor software engineering methods
- ___ Poor technology support
- ___ Lack of political support for project
- ___ Inconsistent client involvement
- ___ Loss of critical team member
- ___ Vendor/contractor relations
- ___ Market/competitor pressures



Risk Management – Risk Assessment



- What is the probability of loss that results from them?
- How much are the losses likely to cost?
- What might the losses be if the worst happens?

Definition of Risk Assessment

- Evaluating risks to assess the range of possible outcomes.
- To determine which events warrant response and more importantly what type of response
- Two factors are common
 - probability
 - severity (impact and/or loss)

Traditionally, this is the more difficult piece of formal risk management...yet a defined and metric based approach lessens the difficulty and subjectivity



Qualitative Risk Assessment - Risk Matrix

		Probability					
		L	M	H			
Loss	L	Ignore	Ignore	Consider			
	M	Ignore	Consider	Take Action			
	H	Consider	Take Action	Take Action			

Legend:

- Ignore (Green)
- Consider (Yellow)
- Take Action (Red)



Quantitative Risk Assessment Worksheet

After the risk drivers have been identified, ranked from most likely (A) to least likely (J) based on the impact on the project.

1=low risk, 2=medium risk, and 3 = high risk

Project Activity	A	B	C	D	E	F	G	H	I	J	Score
Rqmnts Anlys	2	3	3	2	3	3	2	2	1	1	22
Specifications	2	1	3	2	2	2	1	2	2	3	20
Prel Design	1	1	2	2	2	2	1	2	2	2	17
Design	2	1	2	2	2	3	1	2	2	1	18
Implement	1	2	2	3	3	2	1	2	2	1	19
Test	2	2	2	2	2	3	2	2	2	2	21
Integration	3	2	3	3	3	3	2	3	3	2	27
Checkout	1	2	2	3	3	3	2	3	2	2	23
<u>Operation</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>1</u>	<u>1</u>	24
Score	16	16	22	22	23	24	15	21	17	15	191

Columns are top risk drivers

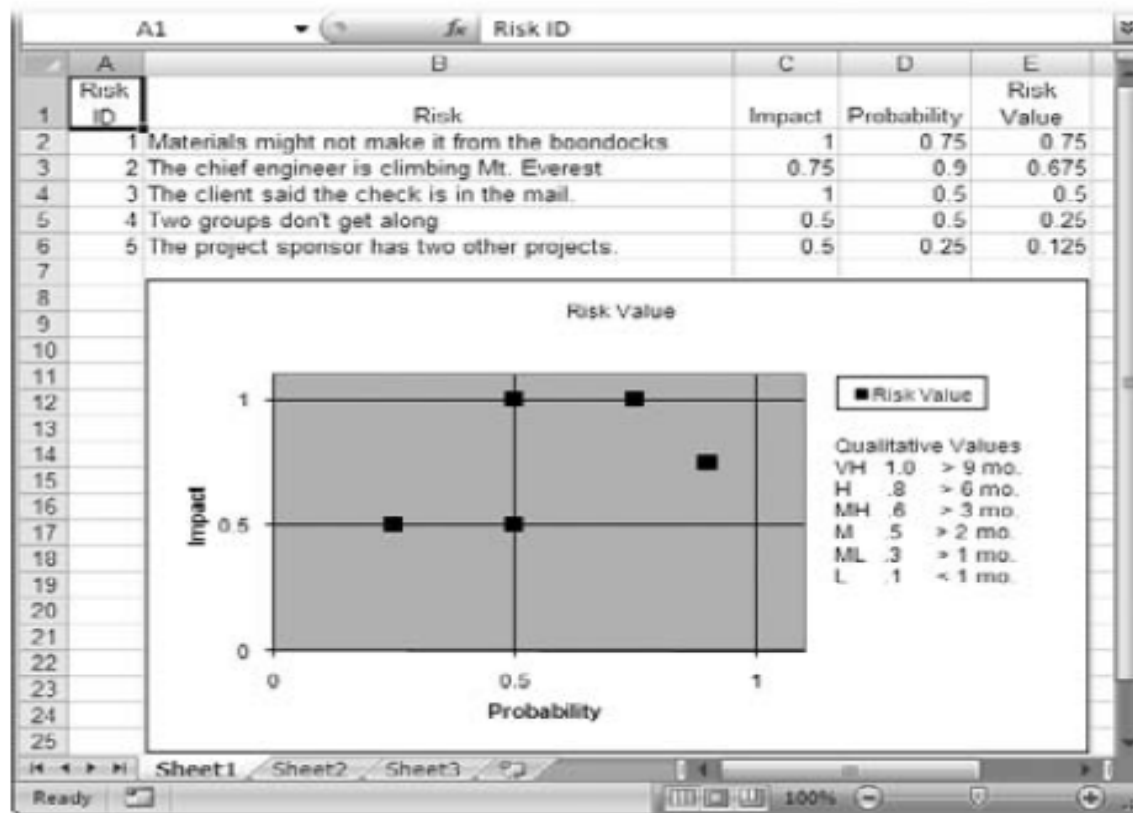
Rows are steps in a process

Maximum score is 270. Risk level for this project is $191/270 = 71\%$.



Risk Assessment Example

- The decision is based on the product of the probability of the event happening and the impact it will have.



Risk Management – Risk Mitigation



Plan the responses that will be used if the identified risks occur.

- What are the alternatives?
- How can the losses be reduced or eliminated?
 - Accept
 - Avoid
 - Contingency planning
 - Mitigate
 - Transfer
- Will the alternatives produce other risks?



Risk Mitigation – Response Options

- Accept - Do nothing because cure is more expensive than risk consequences
- Avoid - Elect to not do part of the project associated with the risk (do risk/return analysis; revisit scope). The risk doesn't affect the project's ability to achieve its objectives.
- Contingency planning - Frame plans to deal with risk consequence and monitor risk regularly (identify contingency decision point)
- Mitigate - Bring down risk probability by proactive approaches (training, buy vs. build, etc.)
- Transfer – e.g. outsource



Risk Management – Risk Monitoring



A **risk log** documents the status of each risk you've decided to manage.

- Lists all the risks that you want to manage
- Describes what the risk is
- Who is supposed to manage the risk
- What has been done to manage the risk event



Risk Log Entry Sample

ID #	Risk Description	Risk Owner	Action to be Taken	Outcome
<p>Always remains the same, even if the risk event has occurred and been managed. If you take the risk off the list and file it elsewhere, don't assign the old number to a new risk. Keep the original number with the discarded risk and never use it again, or there will be a great deal of confusion.</p>	<p>This is a short statement of the risk event.</p>	<p>This is the person who has the responsibility of monitoring the status of the listed risk.</p>	<p>Lists what the risk owner is going to do to deal with the risk event.</p>	<p>Describes what happened as a result of your mitigation Strategy.</p>



Summary

- Cost management involves resource planning, cost estimating, cost budgeting, and cost control.
- **Resource pool** is useful for repetitively used resources.
- Define and sequence activities and calculate the duration to be able to finalize schedule.
- Elapsed time (duration) versus work time (labor)
- **Crashpoint**: the point where adding more resources will increase task duration.
- Estimating duration
 - The Delphi Technique
 - The Three-Point Method
 - The Wide-Band Delphi Technique
 - Poker Planning
- The risks that need to be managed are those that will hurt the project itself.
- Ignore the risk if the cost of avoiding the risk is greater than the expected loss.
 - Risk Identification
 - Risk Assessment
 - Risk Mitigation – Response Options
 - Risk Monitoring
- Writing down the risks and assessing them creates an awareness in the project team.



References

- Agile poker planning:
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