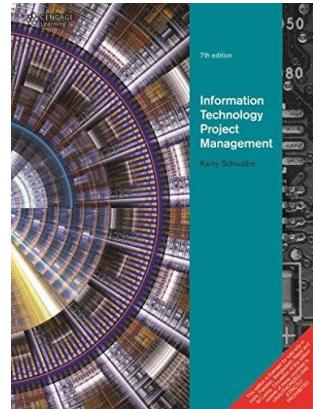


COMP313

Project Management

- ❖ Instructor: Andrew Siu
- ❖ Contact Info: kmsiu@ipm.edu.mo
- ❖ Office: A319
- ❖ Office hour:
 - ❖ Monday 9:30-13:00
 - ❖ Tuesday 14:30-17:00

- Textbook
 - Schwalbe, Kathy (2014). Information Technology Project Management (7th edition).
- Canvas – all lecture notes, and quizzes/exercises



- Marks breakdown

1. 25% term project using MS project
2. 5% class exercises
3. 30% tests
4. 40% exam

What I have learned so far?

- Programming Language 1 & 2
- Internet Programming 1 & 2
- Data structure
- Database
- Computer Network
- Operating Systems
- Software Engineering
- **Project Management**

3

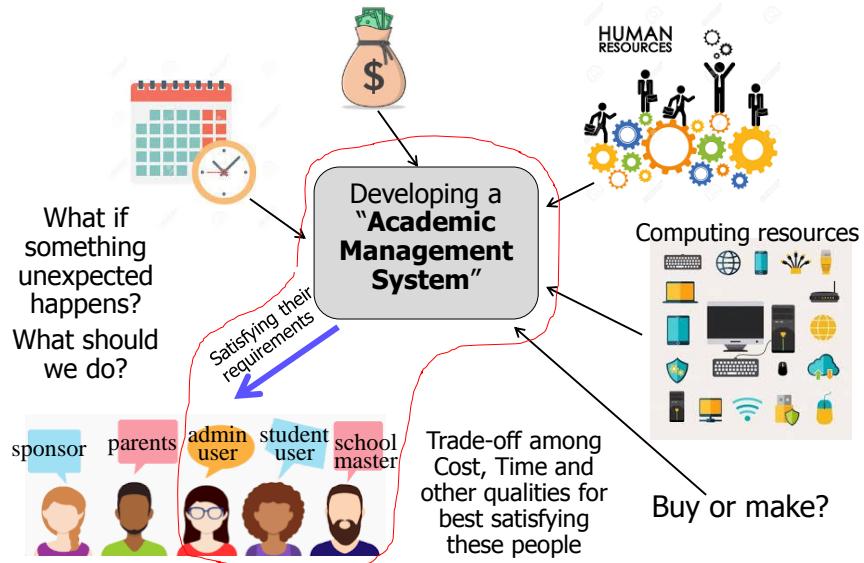
Why we need study them?

- SUCCESS – benefiting the people involved, not just the users.
- Sometimes, the bigger success is NOT to develop the software in the first place.

Project Management	Methods for managing the development of a “big” software for achieving better <u>success</u>
Software Engineering	Methods for developing a “big” software
Database design	Data scheme and storage for enormous size of data for better access based on specific application contexts
Internet Programming 1 & 2	Practical programming skills in Internet context
Data structure	Fundamental skills in organizing data for optimal access & better problem solving
Programming Language 1 & 2	Fundamental programming logics and skills

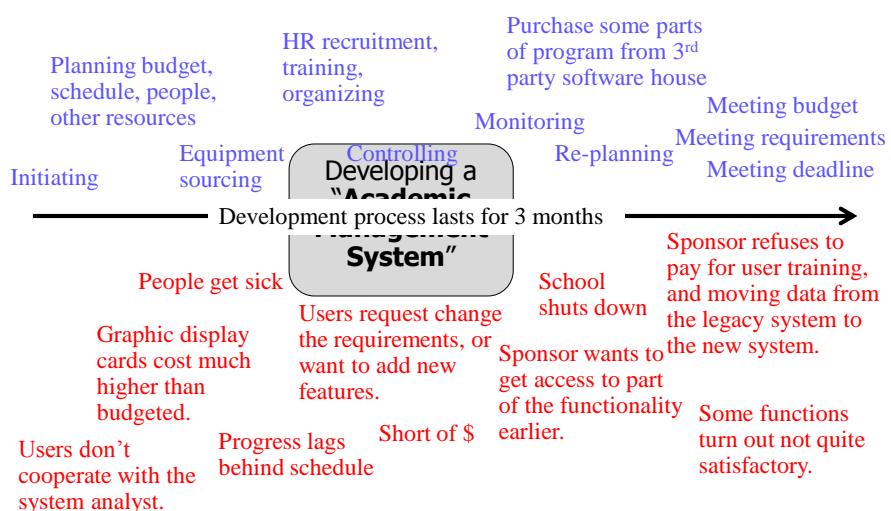
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There are more things we should be concerned about?



5

In Reality, we need to face...



Despite these difficulties, we aims to maximize the chance of success.

Chapter 1

Introduction to Project Management

What, Why, How, Who?

- What is Project and Project Management?
 - Why we need PM?
 - How to carry out a Project?
 - Who carries out Projects?

What Is a Project?

- A **project** is “a temporary endeavor undertaken to create a unique **product, service, or result.**”*
- **Operation** is a work done to sustain the on-going business and/or to produce repetitive products and services.
- A project ends when its objectives have been reached, or the project has been terminated.
- *There is no such thing as an Ongoing Project.*



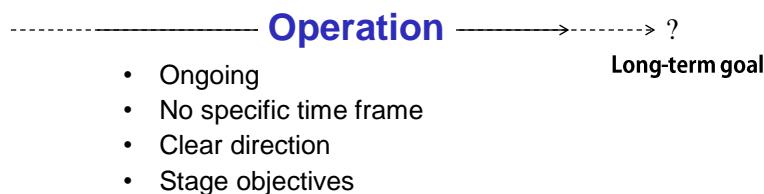
*PMI, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (2004), p. 5.

9

Project vs Operation



- Specific time frame (it ends when the objective reached or it's terminated.)
- Clear objective



10

Is it a project?

1. Developing a smartphone app
2. Design a driverless car
3. Assembling cars in an assembly line
4. Undertaking a car manufacturing business
5. Adding a new feature to an internal software application for the finance department.
6. Maintaining an academic software system
7. Working on a survey research
8. Upgrading a college's technology infrastructure to provide wireless Internet access across the campus
9. Repairing a car

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Project Attributes

- A **project**:
 - Has a unique purpose -- creating a unique **product, service or result**.
 - Is temporary and has a time frame.
 - Should have a primary **customer** or **sponsor**.
 - Is developed using ***progressive elaboration**.
 - Requires **resources**, often from various areas.
 - Involves uncertainty. (*so we need risk assessment*)

* **Progressive elaboration:** Start with more general ideas and substantiated in later stages. Keeping on improving, modifying and detailing the plan as time passes.

Is it a project? (*cont.*)

10. Organizing a trip to Hong Kong
11. Operating a railway transportation business
12. Making a financial statement by the end of each month
13. A bank teller services customers in line.
14. Launching a landing programme on Mars
15. Exploring the outer space
16. A government department develops a system to track child immunizations.
17. Peter writes a simple program for practicing programming skill.

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Is it a project? (*cont.*)

18. Health government department ensures the public health of the citizens.
19. Conducting a R&D for the UI of their new smartphone model
20. Handling daily customer complaints in sales department
21. Arranging a wedding ceremony
22. Investigating an accident
23. Constructing the Macao lite-railway facility
24. Operating the Macao lite-railway transportation business
25. Launching a rescue operation
26. Filming a movie

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Answers

1 – Y; 2 – Y; 3 – N; 4 – N; 5 – Y; 6 – N; 7 – Y; 8 – Y;
9 – Y; 10 – Y; 11 – N; 12 – N; 13 – N; 14 – Y; 15 – N ;
16 – Y; 17 – N; 18 – N; 19 – Y; 20 – N; 21 – Y; 22 – Y;
23 – Y; 24 – N; 25 – Y; 26 – Y

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Why Starts a Project?

When to End a Project?

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Why Starts a Project? (1)

- **Market Demand**
 - Building a more efficient car in response to fuel shortage
- **Strategic Opportunity / Business Need**
 - Creating a new App to increase revenue
 - Creating an inventory system to expedite the stocktaking process
- **Customer Request**
 - A corporate client requests to build a financial analytical software program
- **Technological Advance**
 - Developing a faster and more compact mobile phone by taking advantage of the newly developed technology (*similar to Business Need, but this one is triggered by a new technology, whereas the previous one is triggered by a business objective*)

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Why Starts a Project? (2)

- **Legal Requirement**
 - Creating a new security software program for fulfilling government regulations
 - Government regulations require new reporting of business data for gaming industry.
- **Social Needs**
 - A developing country is experiencing a fast-spreading disease that's infecting large portions of the population. Medical supplies and facilities are needed to vaccinate and treat those infected with the disease.
 - Gambling business is urged to go for Responsible Gambling practices.
- **Environmental Considerations**
 - Manufacturing or processing plants that voluntarily remove their waste products from water prior to putting the water back into a local river or stream to prevent contamination.

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When to End a Project?

- The project's objectives have been achieved.
- Its objectives will not or cannot be met anymore.
- The need for the project no longer exists.
- The client (customer, sponsor or champion^{*}) wishes to terminate the project.

** Champion – a project advocate, strong supporter.*

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Examples

- You are filming a movie. However, the main character suddenly quits and you don't think you could find anyone suitable for replacement.
- You are developing a Wei-Chi program with traditional algorithmic approach. However, a new approach has been adopted with AI technique, making the traditional approach obsolete.
- You develop a financial software system, but your company has been closed down.
- The project “Macao Int'l Firework Display Contest” has been cancelled because the gov't doesn't feel it a good time to do so due to the typhoon's aftermath.
- You plan to sell souvenirs during Olympic Games a month later, but you find out you cannot catch the schedule.

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Why Project Management is needed?

- How to recruit and dismiss a team?
- Does it guarantee the bridge can be built as expected?
- To be built in an acceptable time period?
- With suitable amount of money?
- Acceptably satisfying the “people”? Who are those people?
- Does it consider the maintenance problems?
- What if some unexpected incidents occur, what should you do?

Just want to ensure the uncertainties turning to be certain as much as possible.

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Cases of Project Failure (1)

- Care Records Service of National Health Service (UK) – 2008
 - Centralizing health records of the UK
 - Cost: \$24B project (World’s largest civil IT project)
 - Causes of failure:
 - Original scope and cost of project was radically underestimated since underestimating its complexity. Original budget was \$4.6B, it has subsequently grown to \$24B, could grow to as much as \$40B.

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Cases of Project Failure (2)

- Transit Ticketing Authority (Australia) – 2008
 - Constructing Smart card system to allow bus, rail and tram travel on a single ticket
 - Cost: up to \$350M AUD
 - It had been delayed by as much as 5 years and over budget by between \$200M and \$350M.
 - Causes of failure:
 - Underestimation of complexity, schedule underestimation, “technical flaws” etc.

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Cases of Project Failure (3)

- Virtual Case File – FBI (US) – 2005
 - Ambitious program to replace paper based reporting of crimes and investigations with an online system is scrapped. System was intended to aid efficiencies and allow pieces of information gathered through different channels at different times to be connected up thereby allowing for more effective investigations through better flows of information.
 - Cost : \$170M USD
 - The project was in serious trouble and was eventually deemed unfit for use. The project was ultimately scrapped in 2005.
 - Causes of failure :
 - Poor requirements, continual changes in specifications, poor communications, lack of planning, lack of central architecture, lack of oversight.

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Cases of Project Failure (4)

- “Jetsmart” engineering parts management system - **Qantas – Australian airline**
 - Cost: \$40M
 - Failure to engage the engineers who would be the eventual users of the system into the requirements and design processes resulted in a system that the engineers deemed to be unusable once it was launched. After just a few years in operation (during which time some staff refused to use it and unions threatened industrial action), the system is dumped and a new system introduced.
 - Causes of failure :
 - Lack of stakeholder engagement; Requirements solicitation management failure; Change management failure.

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Cases of Project Failure (5)

- Payroll and benefits system - University of Wisconsin – (2006)
 - **Cost :**\$28M USD
 - Payroll and benefits system project is abandoned after 5 years of effort. Board of governors had not received a single report on the project in its 5 years and was unaware that the University was facing a large scale project failure.
 - Causes of failure :
 - Poor leadership; Lack of progressive elaboration; Lack of planning; Bureaucratic infighting.

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Macao Lite-Rail Construction

- Constructing a Lite-Rail system of 21 km
 - Original budget (2007): MOP4.2b ;
Original schedule: End of 2011
 - As of 2019, only 9.3km had been built (Taipa branch);
Estimated total cost: MOP40b
Estimated schedule to completion: 2026

(From Macao daily post, 2017)

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Causes of the Failure

- Original scope and cost of project was radically underestimated
- Underestimation of complexity
- Schedule underestimation
- Poor requirements
- Continual changes in specifications
- Poor communications
- Lack of planning
- Lack of central architecture
- Lack of oversight
- “technical flaws”
- Programming errors
- Failure to test the system with realistic load
- Failure to establish and stabilize requirements
- Lack of risk management
- Lack of stakeholder engagement
- Requirements solicitation management failure
- Change management failure
- Poor leadership
- Lack of progressive elaboration
- Lack of planning
- Bureaucratic infighting
- Poorly planned and managed
- Lack of staff training
- Poor staff morale

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Statistics of Failure

- IT projects have a terrible track record.
 - A 1995 Standish Group study (CHAOS) found that only 16.2% of IT projects were successful in meeting scope, time, and cost goals.
 - Over 31% of IT projects were canceled before completion, costing over \$81 billion in the U.S. alone.*

*The Standish Group, "The CHAOS Report" (www.standishgroup.com) (1995). Another reference is Johnson, Jim, "CHAOS: The Dollar Drain of IT Project Failures," *Application Development Trends* (January 1995).

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Improved Project Performance

- The Standish Group's CHAOS studies show improvements in IT projects in the past decade.*

Measure	1994 Data	2002 Data	Result
Successful projects	16%	34%	Doubled
Failed projects	31%	15%	Halved
Money wasted on challenged and failed projects	\$140 B out of \$250 B	\$55 B out of \$255 B	More than halved

*The Standish Group, "Latest Standish Group CHAOS Report Shows Project Success Rates Have Improved by 50%" (March 25, 2003).

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Why the Improvements?

Better tools have been created to monitor and control progress

Better skilled project managers with better management processes are being used*

**The Standish Group, “CHAOS 2001: A Recipe for Success” (2001).*

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What is Project Management?

- **Project Management** is “the application of knowledge, skills, tools and techniques to project activities to meet project requirements.”*

**PMI, A Guide to the Project Management Body of Knowledge (PMBOK® Guide) (2004), p. 8.*

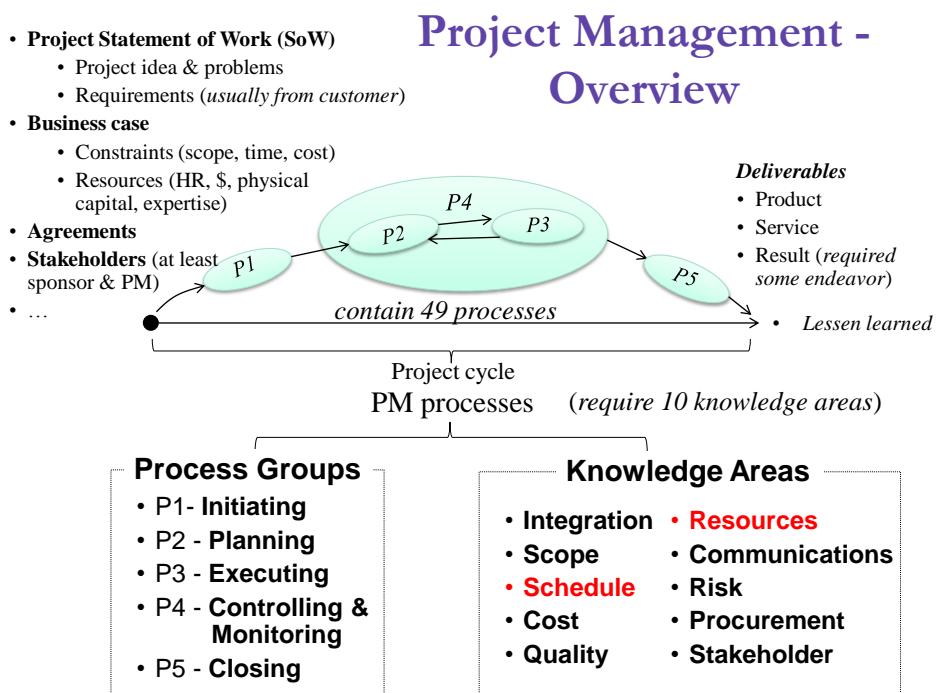


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Advantages of Using Project Management

- Helping meet strategic goals
- Better control of financial, physical, and human resources
- Meeting predetermined development times
- On-budget
- Higher quality and increased reliability
- Improved productivity
- Better internal coordination
- Improved customer relations
- Higher worker morale

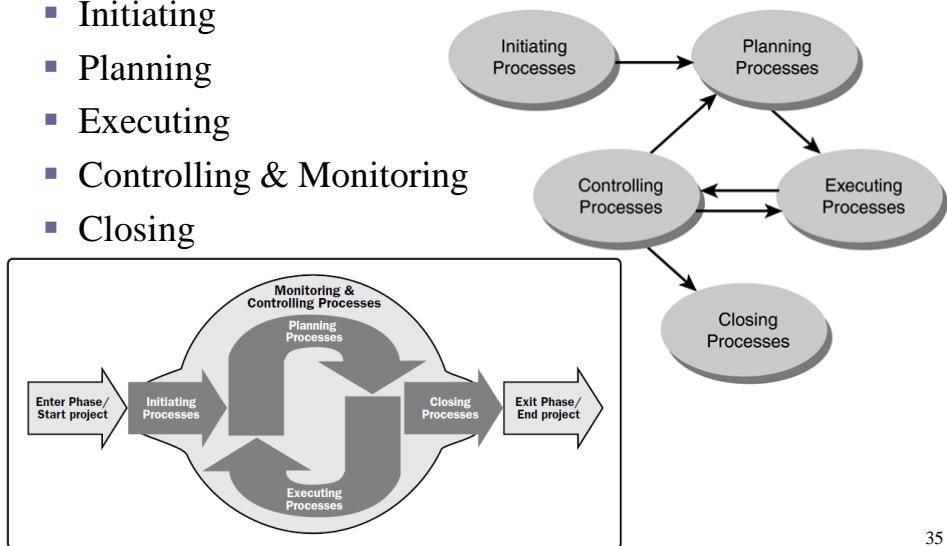
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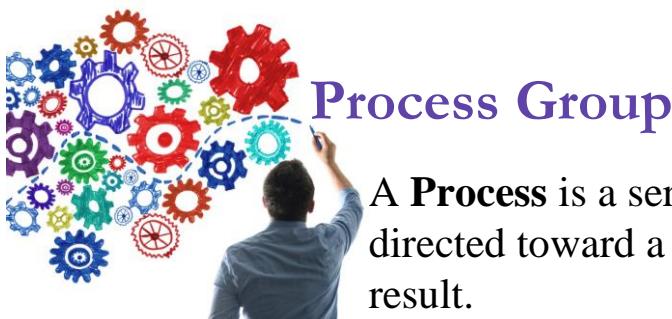
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5 Process Groups

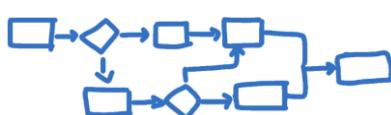
- Initiating
- Planning
- Executing
- Controlling & Monitoring
- Closing



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A Process is a series of actions directed toward a particular result.



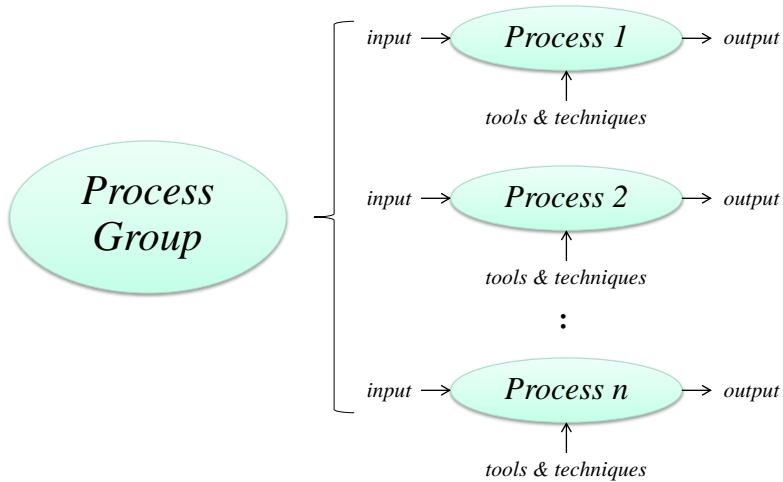
A Process Group is a group of related processes at a certain stage of project.

Process Groups

- **Initiating**
 - Defining and authorizing a project
 - Identifying important stakeholders
- **Planning**
 - Devising and maintaining a workable plan to ensure that the project addresses the organization's needs
- **Executing**
 - Coordinating people and other resources to carry out the various plans and create the products, service or results of the project
- **Monitoring and controlling**
 - Regularly measuring and monitoring progress to ensure that the project team meets the project objectives
- **Closing**
 - Formalizing acceptance of the project and ending it
 - Ex: closing out contracts, informing the relevant stakeholders of the closure, documenting lessons learned, and receiving formal acceptance of the delivered work, restoring everything for the next project, returning the resources to the original owners etc.

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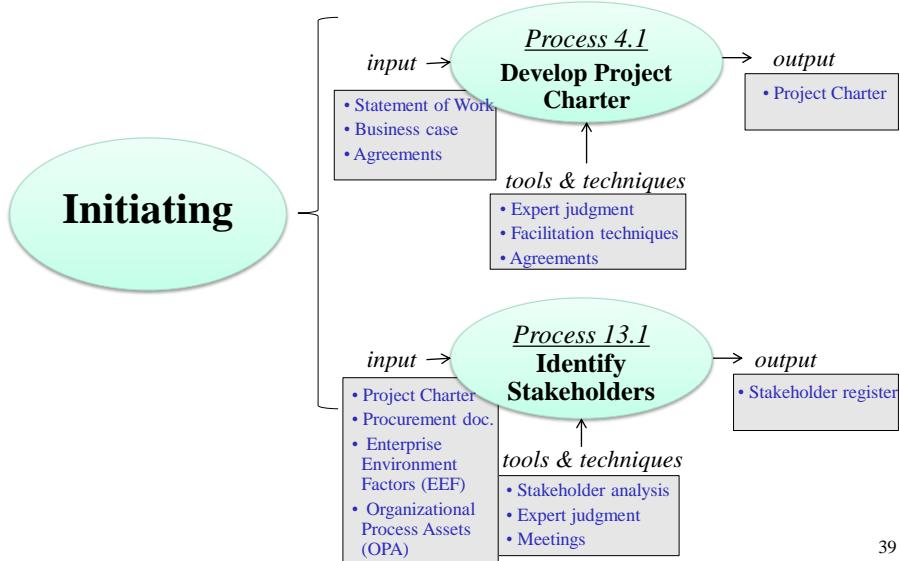
Process Group & Processes



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Process Group & Processes

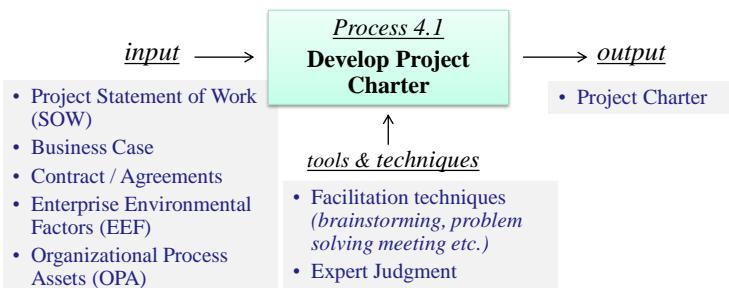
(Example: Process Group: “*Initiating*“)



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Process (*example: Process 4.1*)

- For developing the Project Charter:
 - formally authorizes a project or phase
 - documenting initial requirements that satisfy the stakeholders' needs and expectations
 - establishes partnership between performing group and requesting group and **formally initiates the project**.



Process Group \ Knowledge Area	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Integration Management	4.1 Develop Project Charter ^{v3}	4.2 Develop Project Management Plan ^{v3}	4.3 Direct and Manage Project Work ^{v3} 4.4 Manage Project Knowledge	4.4 Monitor and Control Project Work ^{v3} 4.5 Perform Integrate Change Control ^{v3}	4.6 Close Project or Phase ^{v3}
Scope Management	^{v3}	5.1 Plan Scope Management ^{v3} 5.2 Collect Requirements ^{v3} 5.3 Define Scope ^{v3} 5.4 Create WBS ^{v3}	^{v3}	5.5 Validate Scope ^{v3} 5.6 Control Scope ^{v3}	^{v3}
Time Management - Schedule	^{v3}	6.1 Plan Schedule Management ^{v3} 6.2 Define Activities ^{v3} 6.3 Sequence Activities ^{v3} 6.4 Estimate Activity Resources^{v3} 6.5 Estimate Activity Duration ^{v3} 6.6 Develop Schedule ^{v3}	^{v3}	6.7 Control Schedule ^{v3}	^{v3}
Cost Management	^{v3}	7.1 Plan Cost Management ^{v3} 7.2 Estimate Costs ^{v3} 7.3 Determine Budget ^{v3}	^{v3}	7.4 Control Costs ^{v3}	^{v3}
Quality Management	^{v3}	8.1 Plan Quality Management ^{v3}	8.2 Perform Quality Assurance ^{v3}	8.3 Control Quality ^{v3}	^{v3}
Human Resource Management	^{v3}	9.1 Plan Human Resource Management ^{v3}	9.2 Acquire Project Team ^{v3} 9.3 Develop Project Team^{v3} 9.4 Manage Project Team ^{v3}	Control Resources	^{v3}
Communications Management	^{v3}	10.1 Plan Communication Management ^{v3}	10.2 Manage Communications ^{v3}	10.3 Control Communications ^{v3}	^{v3}
Risk Management	^{v3}	11.1 Plan Risk Management ^{v3} 11.2 Identify Risks ^{v3} 11.3 Perform Qualitative Risk Analysis ^{v3} 11.4 Perform Quantitative Risk Analysis ^{v3} 11.5 Plan Risk Responses ^{v3}	^{v3} Implement Risk Responses	11.6 Control Risks ^{v3} Monitor	^{v3}
Procurement Mgmt	^{v3}	12.1 Plan Procurement Management ^{v3}	12.2 Conduct Procurements ^{v3}	12.3 Control Procurement ^{v3}	12.4 Close Procurements^{v3}
Stakeholder Management	13.1 Identify Stakeholders ^{v3}	13.2 Plan Stakeholder Management ^{v3} Engagement	13.3 Manage Stakeholder Engagement ^{v3}	13.4 Control Stakeholder Monitoring ^{v3} Engagement	^{v3}

PMBOK 5 – PMP (5 Process Groups, 10 Knowledge Areas, and 47 Processes)

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PROCESS GROUP AND KNOWLEDGE AREA MAPPING PMBOK v6					
Knowledge Areas	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring and Controlling	Closing
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management			11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks
12. Project Procurement Management			12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Monitoring	

<https://www.deepfriedbrainproject.com/assets/files/pmbok-guide-6th-edition-process-group-knowledge-area.pdf>

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Exercise: Manage the project

“Going for a field trip to Hong Kong”

0. Before Initiating

- SOW
- Biz case
- Important stakeholders

1. Initiating

2. Planning (Scope, Time, Cost, Quality, Communication, Procurement and Risk)

3. Executing

4. Monitoring & Controlling

5. Closing

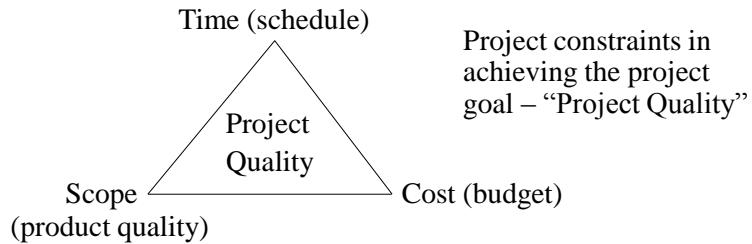
43

The Triple Constraints

- Every project is constrained in different ways by its:
 - **Scope** goals: What work will be done?
 - **Time** goals: How long should it take to complete?
 - **Cost** goals: What should it cost?
- It is the project manager’s duty to balance these three often-competing goals while satisfying the sponsors and end users.

Balancing the competing constraints

Project management involves in balancing the **3** competing constraints:



Ideal combination: Cheap, Fast, Good
= Good project management

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Some questions

1. If the sponsor wants a program to be delivered on time with a lower Cost, how does it affect the Scope?
2. If the sponsor wants to add a few more functions in the program (bigger Scope), how does it affect the Time and Cost?
3. If the sponsor wants a program to be delivered much earlier, how does it affect the Scope and Cost?
What if he/she doesn't want to cut the Scope?

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Some questions

4. If you had planned for a project with a budget of \$1 mil and you ended up spending \$200,000 only (assuming that the Scope and Time didn't change), is it good?

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Project Stakeholders

- **Stakeholders** are the people involved in or affected by project activities.
- Stakeholders include:
 - Project sponsor
 - Project manager
 - Project team
 - Support staff
 - Customers/Users
 - Suppliers
 - Opponents to the project

Example – Home renovation

- Sponsor
 - You, your father (maybe)
- Customer/User
 - You & your family
- Project manager
 - General contactor
- Project team
 - construction staff, designers, electricians, carpenters, ...
- Support staff
 - Admin office assistants of general contractor who are responsible for coordinating the meeting, making doc., filing government applications

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Example – Home renovation (*cont.*)

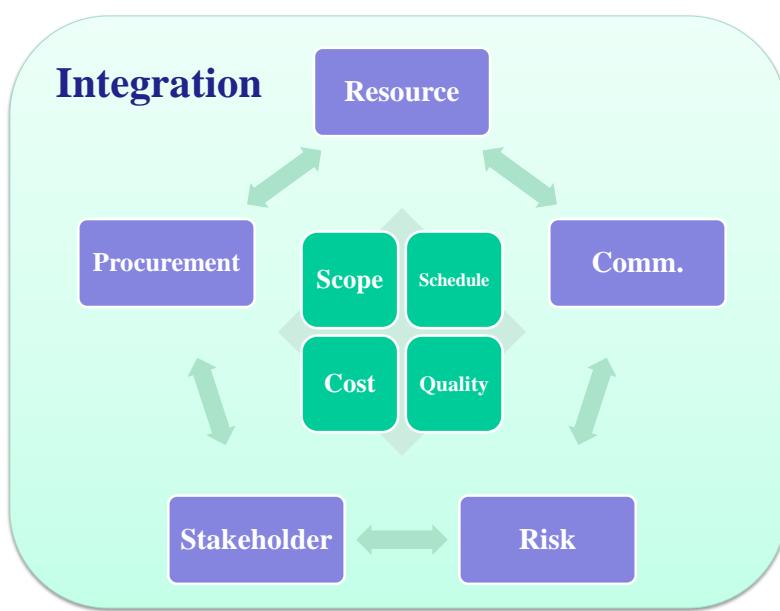
- Suppliers
 - who provide the materials (wood, windows, doors, floor, paint,...) for the renovation, and maybe deliver the materials to the construction site.
- Opponents
 - Your neighbors, property management office, home owners' committee, your landlord (if you rent the flat)
 - Government - construction works bureau, fire department, ...

10 Project Management Knowledge Areas

- Knowledge areas describe the key competencies that project managers must develop.
 - 4 core knowledge areas lead to specific project objectives (**scope, schedule (time), cost, and quality**).
 - 5 facilitating knowledge areas are the means through which the project objectives are achieved (**resources, communication, risk, procurement, and stakeholder management**).
 - 1 connecting knowledge area (project integration management) affects and is affected by all of the other knowledge areas.

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10 Knowledge Areas

- **Project Scope Management**
 - Clear scope statement
 - Prevent scope creep
- **Project Schedule Management**
 - Planning time and schedule
 - Controlling schedule
- **Project Cost Management**
 - Budget estimating and planning
 - Budget control
- **Project Quality Management**
 - Planning quality
 - Enforcing quality
 - Checking quality control

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10 Knowledge Areas

- **Project Resource Management**
 - Planning the use of resources (people, equipment, machines ...)
 - Organizational planning
 - Making a team; motivating a team
- **Project Communications Management**
 - Communication plan
- **Project Risk Management**
 - Identifying and analyzing risks;
 - Planning risk responses
- **Project Procurement Management**
 - Acquisition of services and products
 - Contract management

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10 Knowledge Areas

- **Project Integration Management**
 - Fitting everything together
 - Making a master plan
- **Project Stakeholder Management** (*in new version*)
 - Identifying and Analyzing stakeholders
 - Managing and controlling their engagement throughout the life of the project

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Project Management Tools and Techniques

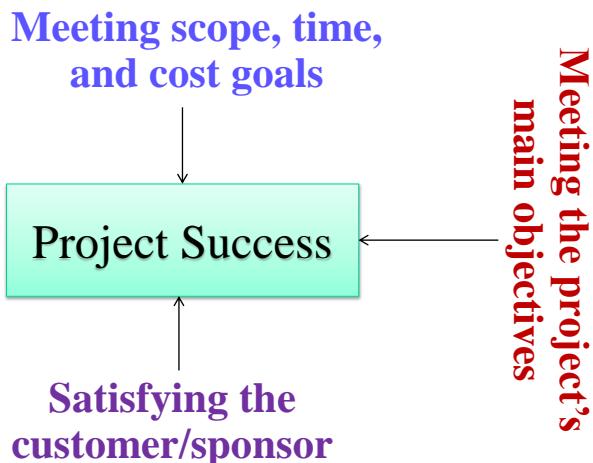
- Project management tools and techniques assist project managers and their teams to carry out processes.
- Specific tools and techniques include:
 - Project charters, scope statements, and WBS (scope).
 - Gantt charts, network diagrams, critical path analyses, critical chain scheduling (time).
 - Cost estimates and Earned Value Management (cost).
 - *See Table 1-1 (P.13) for more examples.*



Project Success

- There are several ways to define project success:
 - Meeting scope, time, and cost goals
 - Satisfying the customer/sponsor
 - Meeting the project's sponsors' objectives, *such as:*
 - Making or saving a certain amount of money
 - Providing a good return on investment
 - Simply making the sponsors happy

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Examples of Meeting Sponsor's Objectives

- The Objectives of the project – “Repairing the car”:
 1. For good quality to run as long as it can (*a valuable antique car*)
 2. For passing the annual car quality check (*just use it for another year*)
 3. For increasing its bargaining power to sell out (*just make it looks nice*)

How does each of these affect the Scope, Time and Cost?

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Project Success Factors*

- | | |
|-------------------------------------|--|
| 1. User involvement | 6. Agile process |
| 2. Executive support | 7. Project management expertise |
| 3. Clear business objectives | 8. Skilled resources |
| 4. Emotional maturity | 9. Execution |
| 5. Optimizing scope | 10. Tools and infrastructure |

*The Standish Group, “CHAOS Activity News” (2011).

Table 1-3. Fifteen Project Management Job Functions*

- Define scope of project.
- Identify stakeholders, decision-makers.
- Develop detailed task list (work breakdown structures).
- Estimate time requirements.
- Identify required resources and budget.
- Report project status.
- Evaluate project requirements.
- Identify and evaluate risks.
- Prepare contingency plan.
- Identify interdependencies.
- Identify and track critical milestones.
- Participate in project phase review.
- Secure needed resources.
- Manage the change control process.

*Northwest Center for Emerging Technologies, “Building a Foundation for Tomorrow: Skills Standards for Information Technology,” Bellevue, WA, 1999.

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Suggested Skills for Project Managers

- **Communication skills:** Listens, persuades.
- **Team-building skills:** Shows empathy, motivates, promotes *esprit de corps*.
- **Leadership skills:** Sets examples, provides vision (big picture), delegates, positive, energetic.
- **Coping skills:** Flexible, creative, patient, persistent.
- **Organizational skills:** Plans, sets goals, analyzes.
- **Technical skills:** Experience, project knowledge.

Soft skills
Hard skills

Portfolio, Program and Project



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Program and Portfolio

- **Program:** “A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.”*
 - Examples of common programs in the IT field include infrastructure, applications development, and user support
- **Portfolio:** “A group of related programs and projects managed as a portfolio of investments that contribute to the entire enterprise’s success – or meeting the enterprise’s strategic goals.”

*PMI, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (2004), p. 16.

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Program and Portfolio Managers

- **Program managers** provide leadership and direction for the project managers heading the projects within the program
- **Portfolio managers** help their organizations make wise investment decisions by helping to select and analyze projects from a strategic perspective

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Top 10 IT Skills in Demand for 2017

- Software / Application Developers (with Python, Java, C#, PHP)
- Help Desk / Technical Support
- Security Analyst with a focus on Governance, Risk & Compliance (GRC)
- Cloud Skills with a focus on SaaS
- Business Intelligence (BI) / Data Analytics / Visualization
- Web Development
- Database Administration (DBA)
- Project Management (PM)
- Big Data
- Mobile Application Development

<http://www.itcareerfinder.com/brain-food/blog/entry/top-10-it-skills-in-demand-for-2017.html>

67

10 hottest tech skills for 2016

1. IT architecture (42%)
2. Programming/application development (40%)
- 3. Project management (39%)**
4. Big data (36%)
5. Business intelligence/analytics (34%)
6. Help desk/technical support (30%)
7. Database administration (25%)
8. Security/compliance/governance (25%)
9. Cloud/SaaS (25%)
10. Web development (24%)

The % of respondents with hiring plans said they will be seeking people with this skill in the next 12 months

* From Computerworld | Dec 7,2015.

68

Project Management Office (PMO)

- A PMO is an organizational group responsible for coordinating the project management function throughout an organization.
- Possible goals include:
 - Manage shared resources across all projects administered by the PMO.
 - Coordinate communication across projects
 - Collect, organize, and integrate project data for the entire organization.
 - Develop and maintain policies, templates and standards for project documents.
 - Develop or coordinate training in various project management topics.
 - Develop and provide a formal career path for project managers.
 - Provide project management consulting and training services.
 - Provide a structure to house project managers while they are acting in those roles or are between projects.

Project Management Certification

- PMI provides certification as a Project Management Professional (PMP).
- A PMP has documented sufficient project experience, agreed to follow a code of ethics, and passed the PMP exam.
- The number of people earning PMP certification is increasing quickly.

Ethics in Project Management

- Ethics is an important part of all professions.
- Project managers often face ethical dilemmas regarding honesty, responsibility, attitude, fairness ...
- In order to earn PMP certification, applicants must agree to the PMP code of professional conduct.
- Several questions on the PMP exam are related to professional responsibility, including ethics.

(Refer to page 32-33 for some examples)

VALUE: Honesty, Responsibility, Respect and Fairness

Chapter Summary

- As the number and complexity of projects continue to grow, it is becoming even more important to practice good project management.
- A project has several attributes, such as being unique, temporary and developed incrementally.
- A framework for project management includes project stakeholders, the nine knowledge areas, tools and techniques, and creating project portfolios to ensure enterprise success.
- Successful project managers must possess and development many skills and lead their teams by example.
- The project management profession continues to mature as more people become certified and more tools are created.

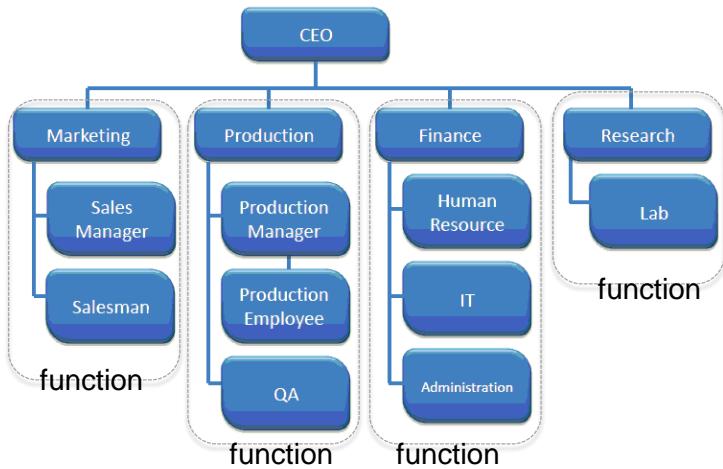
Chapter 2.1

Understanding Organization Structures

Learning Objectives

- Understanding the Project Organizational Structures
- Understanding the Project Organizational Culture
- Understanding the Project Infrastructure
 - Enterprise Environment Factors (EEF) and Organizational Process Assets (OPA)
 - Understand organizations, including the organizational structures and organizational culture

An Organization Chart



3



4

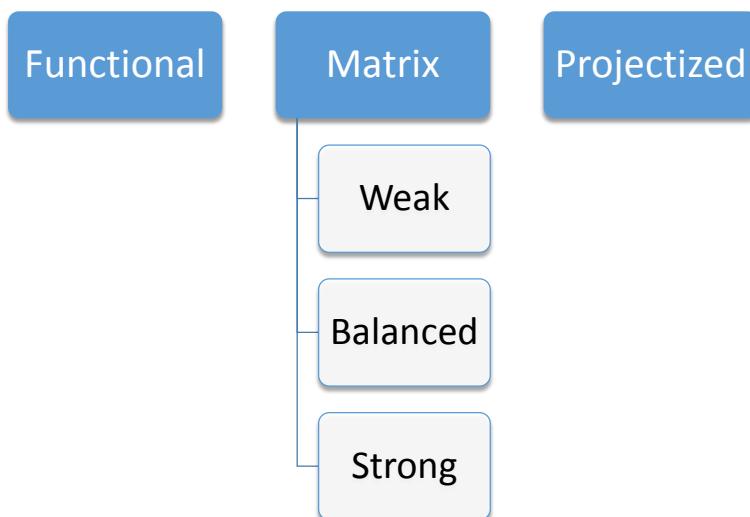
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A project organization

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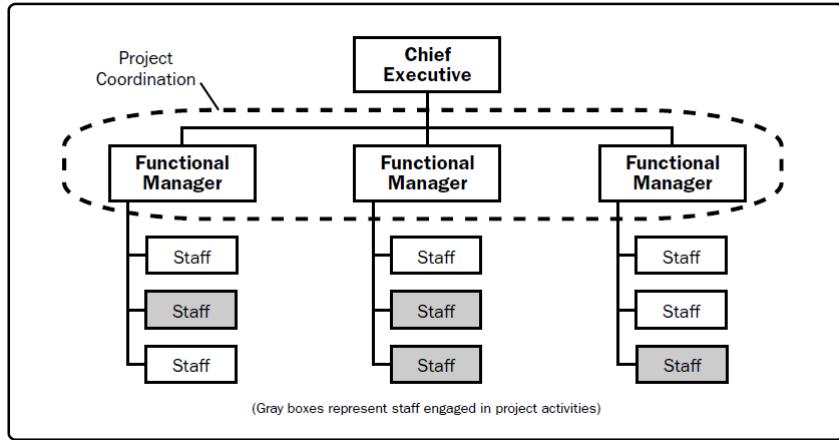
5

Organizational Structures



6

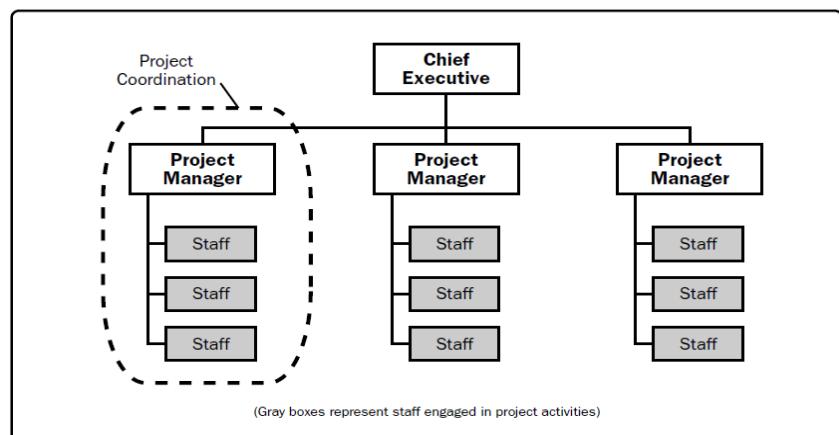
Functional Organization



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7

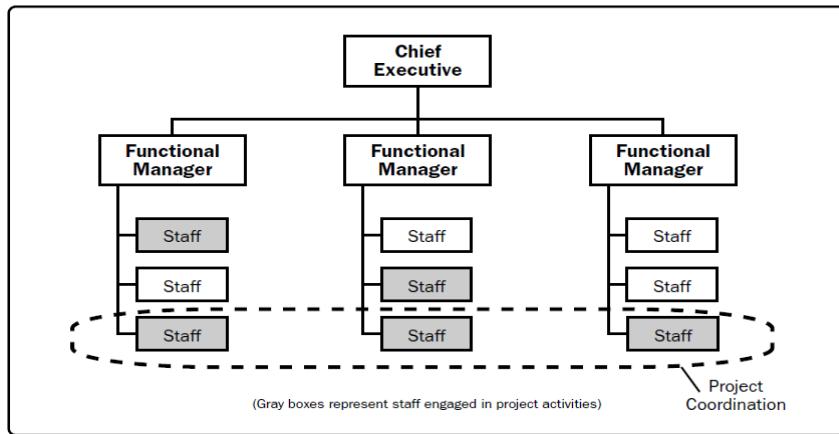
Project (*Projectized*) Organization



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8

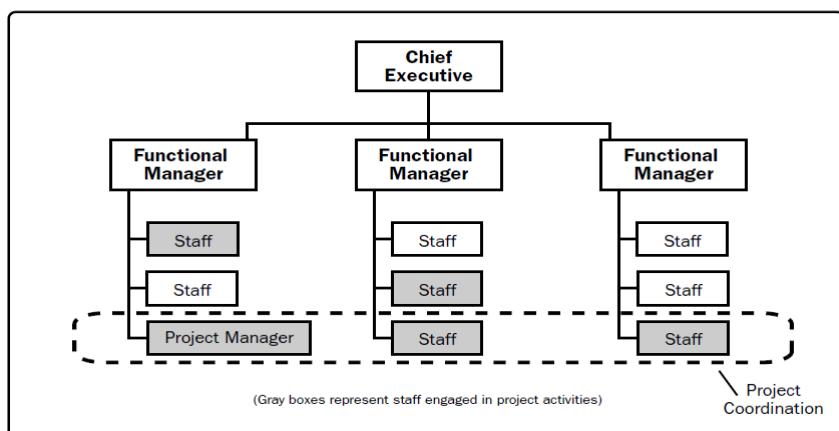
Weak Matrix Organization



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9

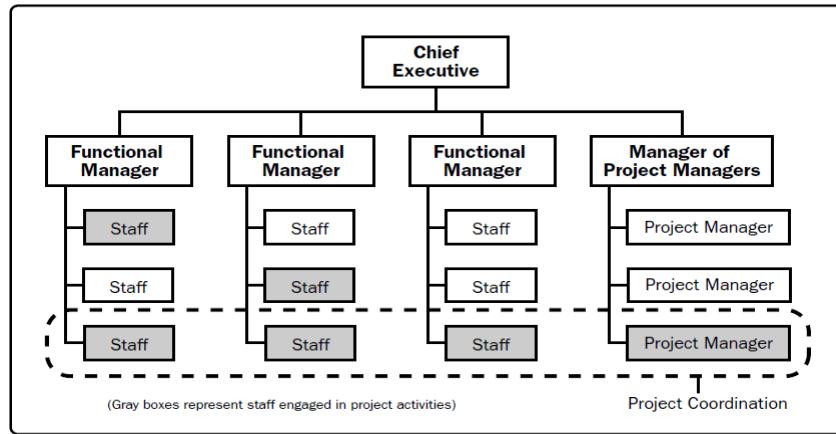
Balanced Matrix Organization



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10

Strong Matrix Organization



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11

Table 2-1. Organizational Structure Influences on Projects

Resource Availability	Project Characteristics	Organizational Structure Type				
		Functional	Weak Matrix	Balanced Matrix	Strong Matrix	Project
	Project manager's authority	Little or none	Limited	Low to Moderate	Moderate to high	High to almost total
	Percent of performing organization's personnel assigned full-time to project work	Virtually none	0-25%	15-60%	50-95%	85-100%
	Who controls the project budget	Functional manager	Functional manager	Mixed	Project manager	Project manager
	Project manager's role	Part-time	Part-time	Full-time	Full-time	Full-time
	Common title for project manager's role	Project Coordinator/Project Leader	Project Coordinator/Project Leader	Project Manager/Project Officer	Project Manager/Program Manager	Project Manager/Program Manager
	Project management administrative staff	Part-time	Part-time	Part-time	Full-time	Full-time

PMBOK® Guide, 2000, 19, and PMBOK® Guide 2004, 28.

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12

Pros and Cons of Functional Org. Structure

▶ Pros:

- > Stable organization structure
- > Employees have one superior and have a clear chain of command
- > Efficient use of resources

▶ Cons:

- > PM (project coordinator) has no or little authority over staff (functional managers have higher authority over PM)
- > PM has limited control of resources or low priority in using resources

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Pros and Cons of Projectized Org. Structure

▶ Pros:

- > PM have full authority
- > Fast decision making
- > Effective to solve highly changing and unclear problems
- > Employees have one supervisor and have a clear chain of command.

▶ Cons:

- > Costs are sometimes higher.
- > Resources are not efficiently shared.

14

Pros and Cons of Matrix Org. Structure

▶ Pros:

- > Improves PM control over resources.
- > Resources can be used efficiently and can be shared across projects.
- > Products and projects are formally coordinated across functional departments

▶ Cons:

- > Requires extra administrative support.
- > Team members have more than one boss to report to
- > More complex to monitor and control
- > More effort in communication and coordination between PM and functional managers

15

Which Org Structure is more suitable?

Your organization is producing a product whose specifications rarely change, and the project is neither complex nor mission-critical. In this case, what kind of organization structure is more suitable?

Either functional or weak matrix organizational structure is more suitable because they are good for a team organization involved in production operation with stable requirements and non-critical tasks. It is because the project manager does not have strong control over staff and other resources.

16

Which Org Structure is more suitable? (cont.)

Your organization is a software house consisting of 10 people, whose primary business is to provide full IT solutions based on clients' requests. In this case, what kind of structure is more suitable?

Since your organization is primarily dealing with projects, the projectized organization structure is more suitable because it allows PMs to have more controls of the team members and other resources.

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Your organization receives a contract of the construction of Macao light railway transportation system. What kind of organizational structure is more suitable?

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18

Organizational Culture

- **Organizational culture** is a set of shared assumptions, values, and behaviors that characterize the functioning of an organization.
- Many experts believe the underlying causes of many companies' problems are not the structure or staff, but the culture

10 Characteristics of Organizational Culture

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|--------------------|--------------------------|
| • Member identity | • Risk tolerance |
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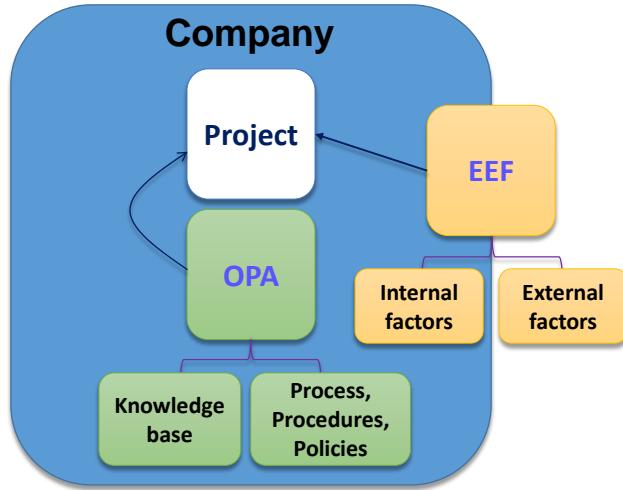
Project work is most successful in an organizational culture where these items are strong/high or balanced.

- Member identify – the degree to which employees have a strong sense of belonging, agree with what the org does, are proud of being a member.
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- Conflict tolerance – the degree to which employees are encouraged to air their conflicts and criticism openly, that in turn encourages better communication.
- Means-ends orientation – the degree to which management focuses on outcomes rather than on tech and process. Looking for balanced approach.
- Open-systems focus – the degree to which the organization monitors and responds to chance in the external environment.
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The Importance of Top Management Commitment (Executive Support)

- People in top management positions are key stakeholders in projects
- A very important factor in helping project managers successfully lead projects is the level of commitment and support they receive from top management
- Without top management commitment, many projects will fail
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Project, EEF and OPA



EEF – Enterprise Environmental Factors

OPA – Organizational Process Assets

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Enterprise Environmental Factors (EEF)

EEF refers to the conditions, not under the control of the project team, that influence, constrain, or direct the project.

26



- | | |
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|--|--|

27

Organizational Process Assets (OPA)

OPA are the plan, processes, policies, procedures, guidelines, information systems, financial systems, management systems, lessons learned and historical information that can help a project.

28

OPA

Knowledge base

- Lesser learned
- Project archives
- Financial database (Labor rates, working hours)
- Best practices
- Risk / stakeholder registers

Process, Procedure, Policies

- Organization's standardized processes
- Policies
- Guidelines
- Standard templates
- Communication channels
- Work authorization procedures
- Financial control procedures

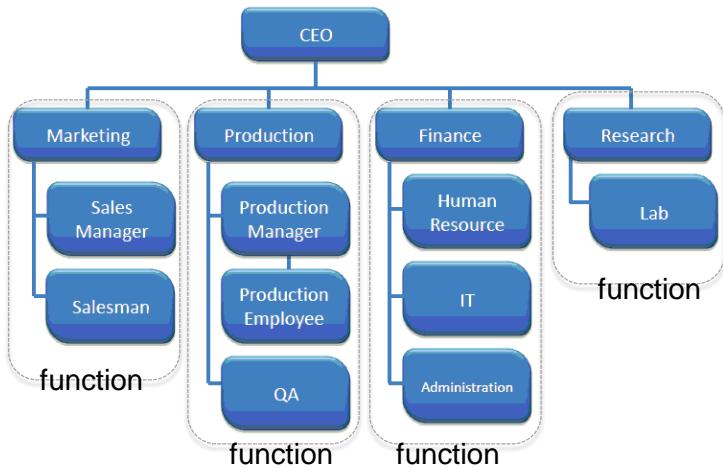
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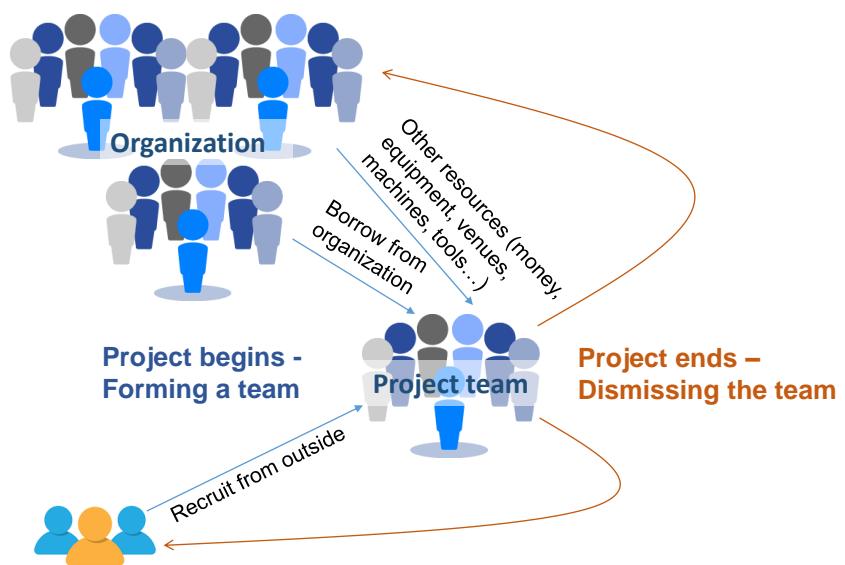
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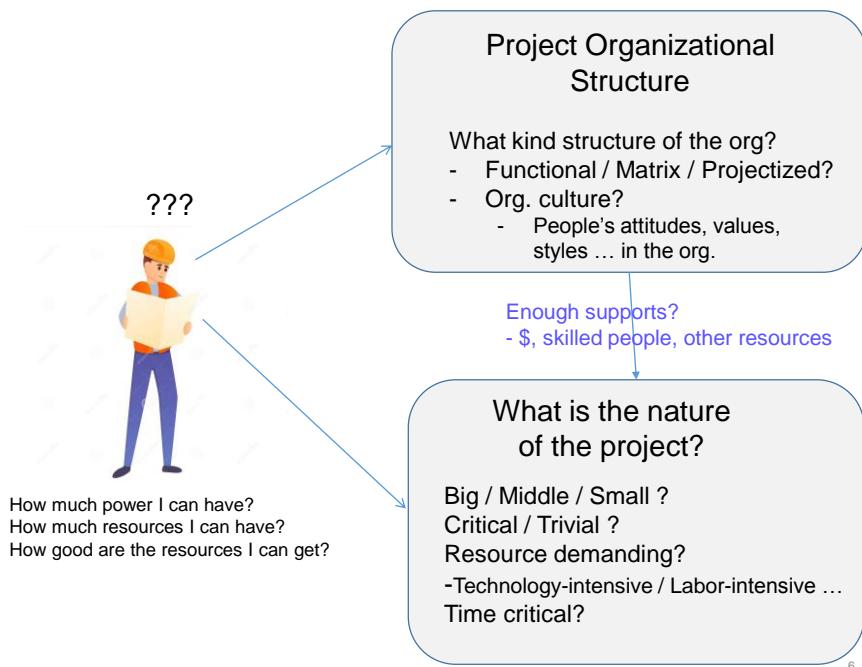
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Project Organizational Structure

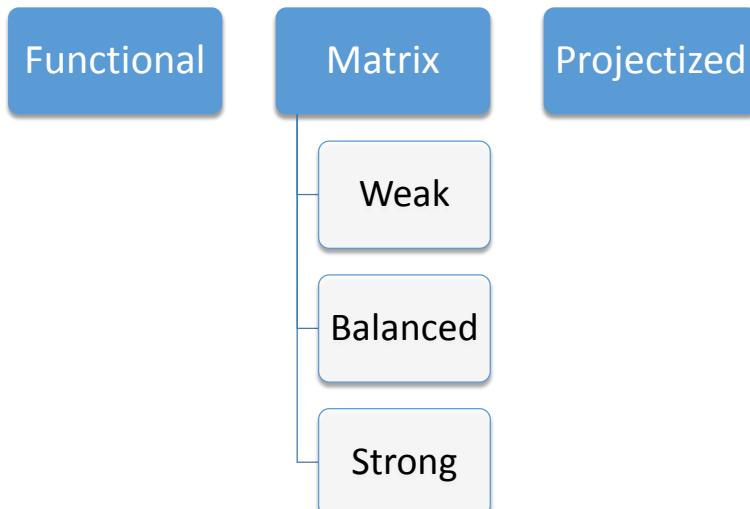
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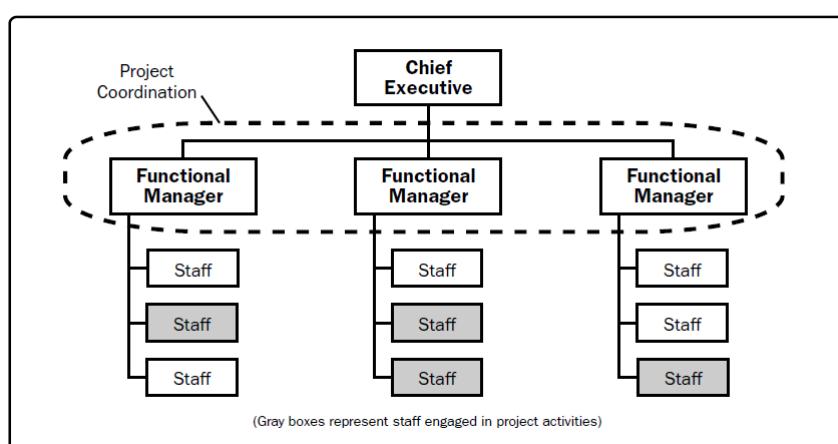


Organizational Structures



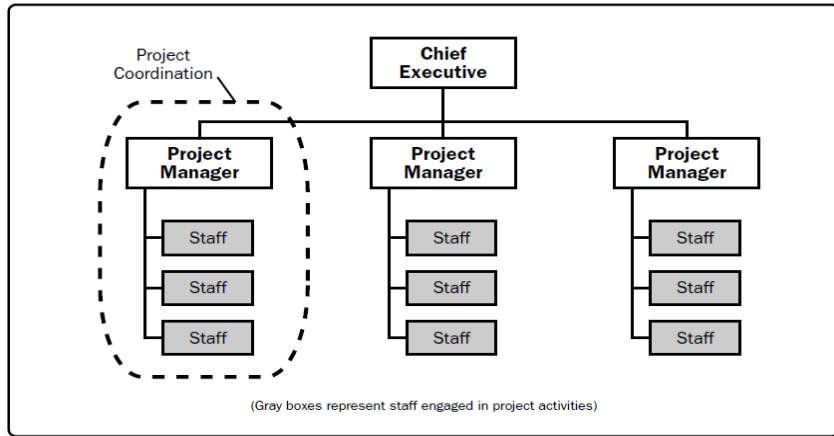
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Functional Organization



The most typical type of organization type found in companies.

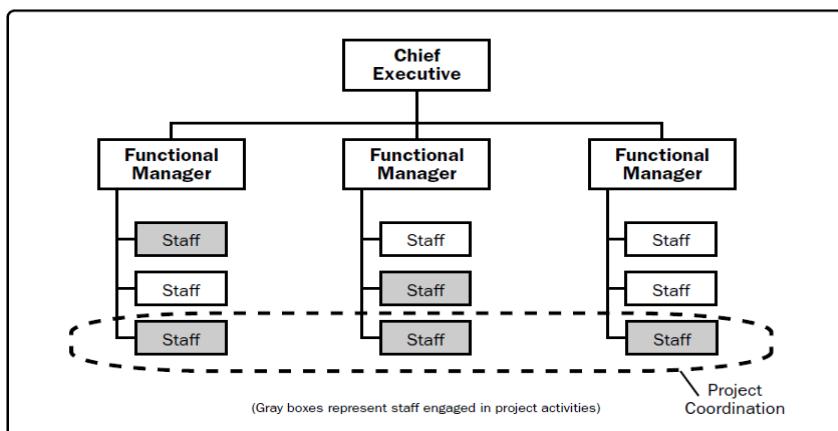
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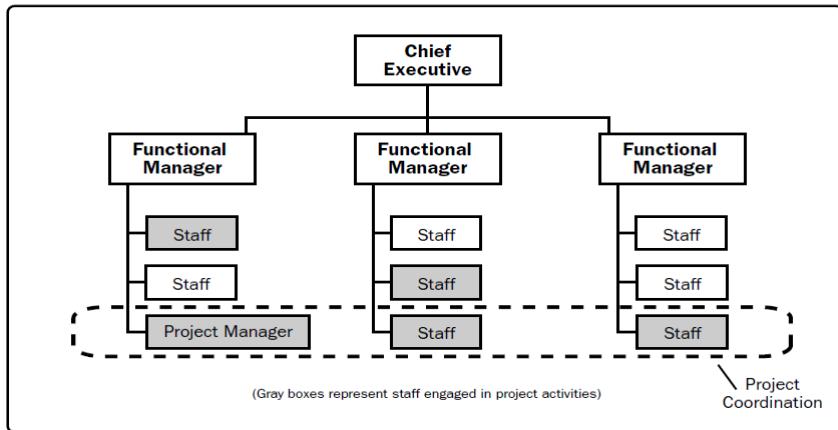
Only a few types of companies use this structure, such as consulting, design, construction companies, software houses, or other companies that provide contract-based services as their core business.

9

Weak Matrix Organization



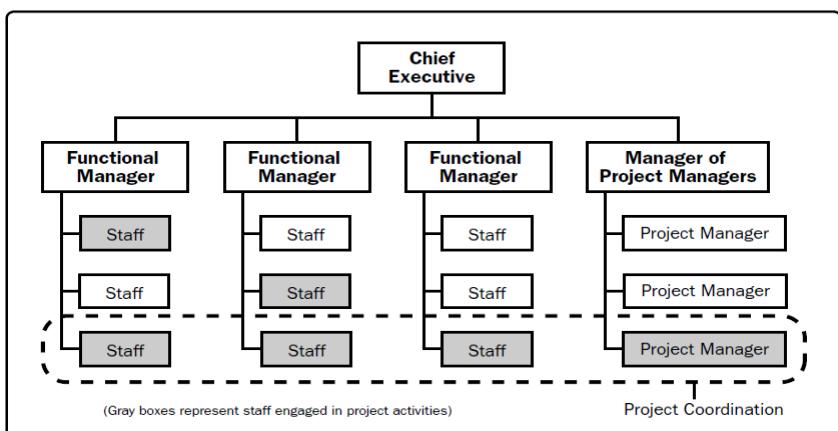
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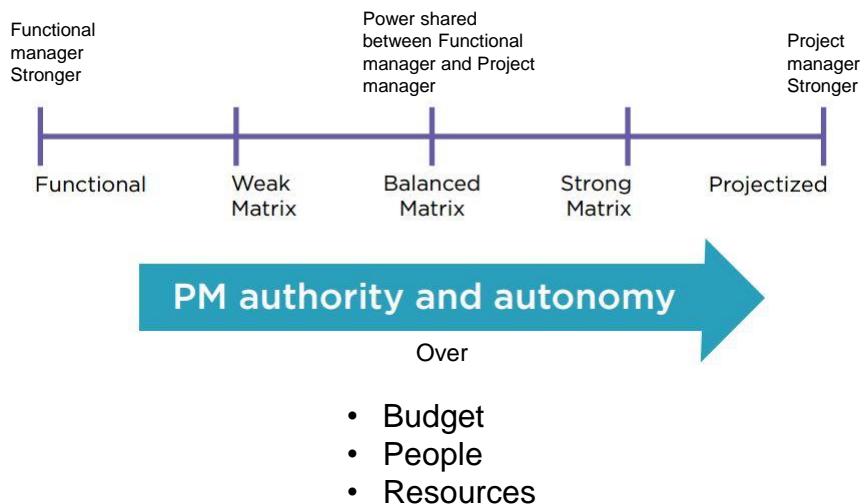
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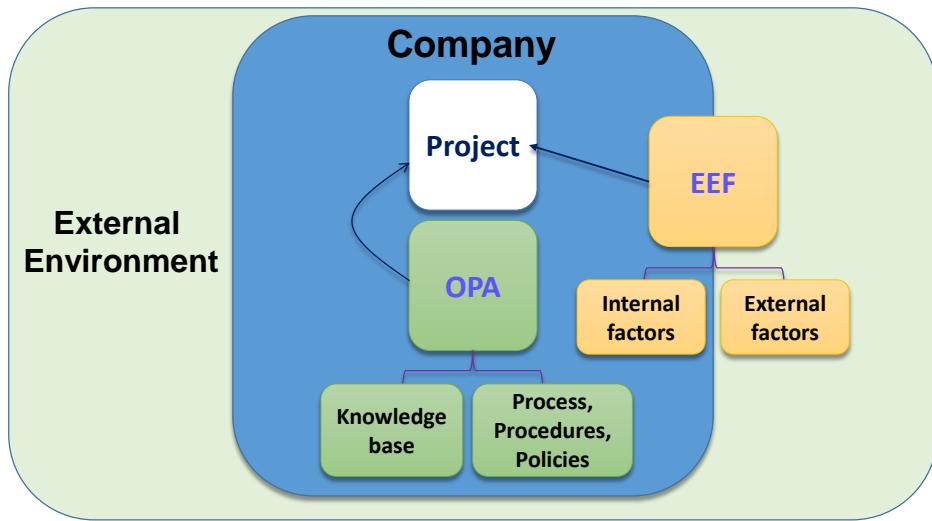
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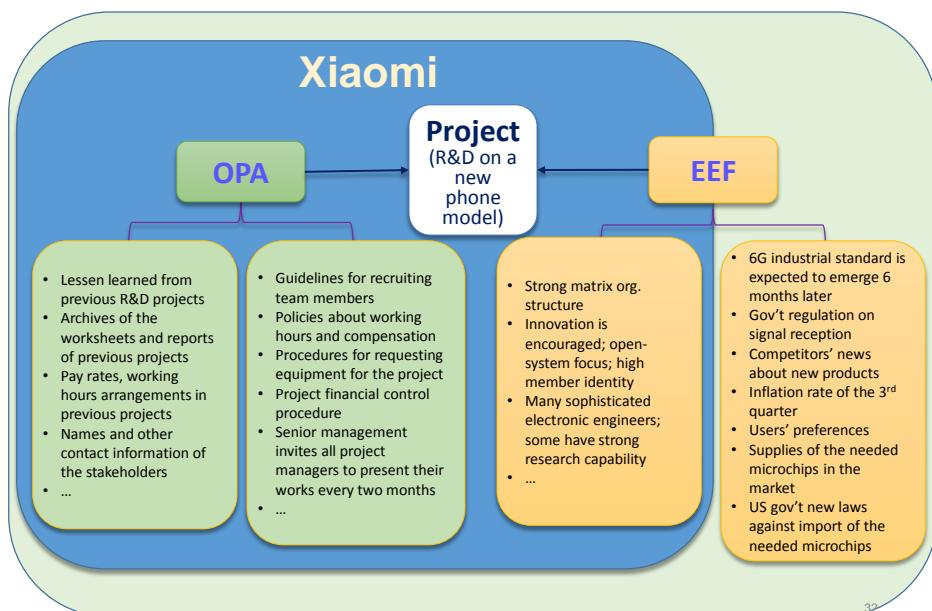
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31

Example of EEF and OPA



32

Chapter 2.2

The Agile Approach

Software Engineering vs Project Management

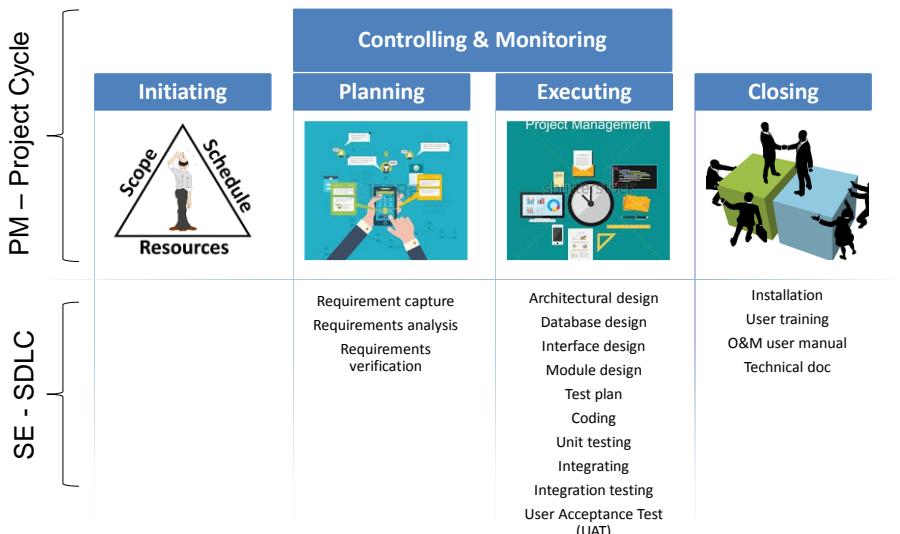
Project Management (PM)

- Work out a project through the 5 stages – **Initiating, Planning, Executing, Monitoring & Controlling, Closing.**
- Make sure the project to satisfy all related stakeholders.
- Work with different stakeholders of a project to identify and meet the project goals.
- Allocate human resource, time, budget and other resources for a project
- Handle much bigger scope - software is only a part of a project; so need to coordinate the software with other deliverables

Software Engineering (SE)

- Work out a software through the development processes – **Analysis, Designing, Coding, Integrating, Testing, Documenting, Maintaining**
- Make sure the software to satisfy the user requirements.
- Work with different users of the software to identify and meet the requirements
- Work under the constraints of the pre-determined man power, time, budget and other resources.
- Provide the project management with technical details, such as time and resource requirements for the development

SDLC in Project Management



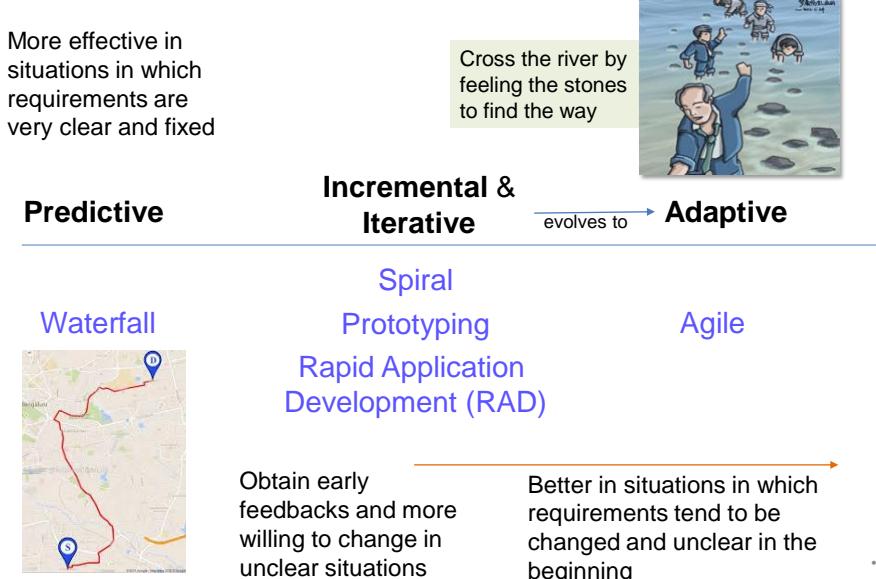
*3

Systems Development Life Cycles

- The **Systems Development Life Cycle (SDLC)** is a framework for describing the phases involved in developing and maintaining information systems
- Systems development projects can follow:
 - Predictive life cycle:** The scope of the project can be clearly articulated and the schedule and cost can be predicted
 - Incremental & Iterative:** Provides for progressive development of operational software after a scope of the project is roughly defined.
 - Adaptive Software Development (ASD) life cycle:** Requirements cannot be clearly expressed, projects are mission driven and component based, using time-based cycles to meet target dates

*4

Systems Development Life Cycles and their Approaches

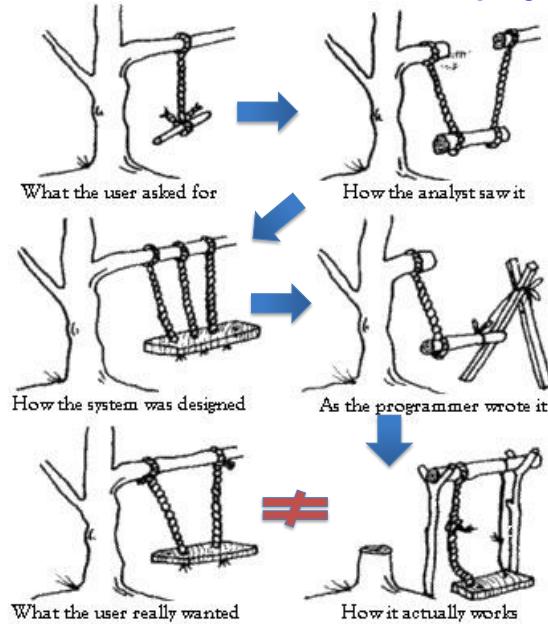


Software Development Life Cycle Models

- **Predictive**
 - **Waterfall model**: has well-defined, linear stages of systems development and support
- **Incremental & Iterative**
 - **Spiral model**: shows that software is developed using an iterative or spiral approach rather than a linear approach
 - **Prototyping model**: used for developing prototypes to clarify user requirements
 - **Rapid Application Development (RAD) model**: used to produce systems quickly without sacrificing quality
- **Adaptive**
 - **Agile**: ...

•6

Why Waterfall Model doesn't work for some projects?



Agile Approach

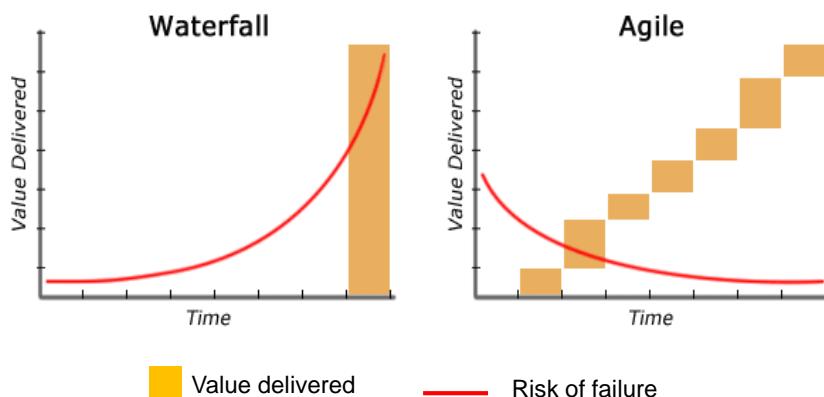
- » Agile
 - > Is NOT a software development methodology
 - > Is NOT a development framework or process
- > Is essentially a set of **Values** and **Principles** as guideline which help developers to practice and make decisions in software development.

Agile Manifesto - Agile's Values

- | | |
|---|---|
| ✓ | ✗ |
| <ul style="list-style-type: none">• Individual + Interaction• Working software• Customer collaboration• Responding to change | <ul style="list-style-type: none">• Process + Tools• Comprehensive doc• Contract + Negotiation• Following a plan |

*9

Value Delivery and Risk of failure between Waterfall and Agile



*10

Agile's 12 Principles

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantages.
3. Deliver working software frequently from a couple of weeks to a couple of months with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.

*11

Agile's 12 Principles (cont.)

5. Build projects around motivated individuals. Give them the environment and support their need and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is a primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

*12

Agile's 12 Principles (cont.)

9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.
11. The best architecture, requirements and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

*13

Not Agile

The developer realizes that he needs a database to make the feature work. Then, the first idea that comes to mind is to stop working on the feature and building out a robust database layer that will handle the needs of the features and provides the need for other development that will be needed later.

Agile

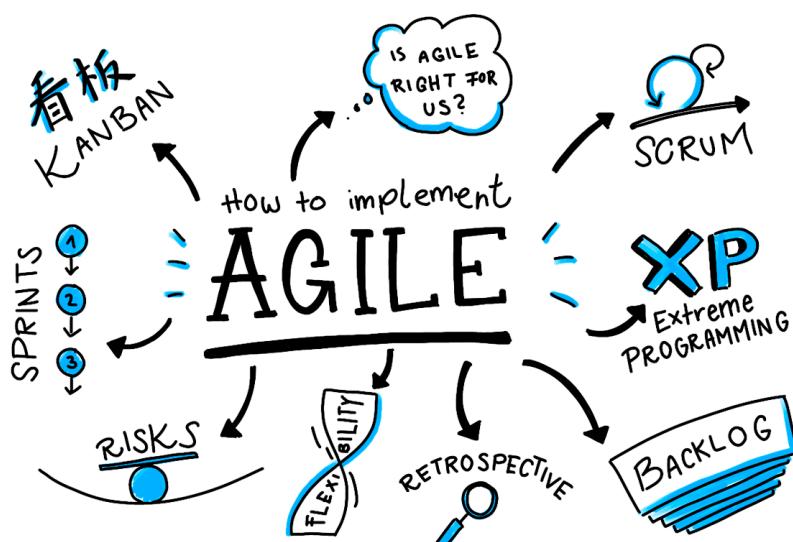
If the developer follows Agile, they would think “But building up the layer means I would have to delay delivering what the customer sees as valuable software. If I can find a way to build just what is necessary to deliver this feature, it would better align with Agile principles.”

*14

Not Agile X

- We must write down all the requirements and get the biz owner and end users to agree and sign off before the work starts.
- The requirements should not be changed. Even though a minor change is raised, a strict procedure and approval are needed.
- In order to save time, we collect all necessary requirements from end users. Then, we will not meet them until UAT.
- Basically, the development team only meets once in a while after all the jobs have been clearly assigned to each of them.

*15



*17

Scrum – An Agile development method

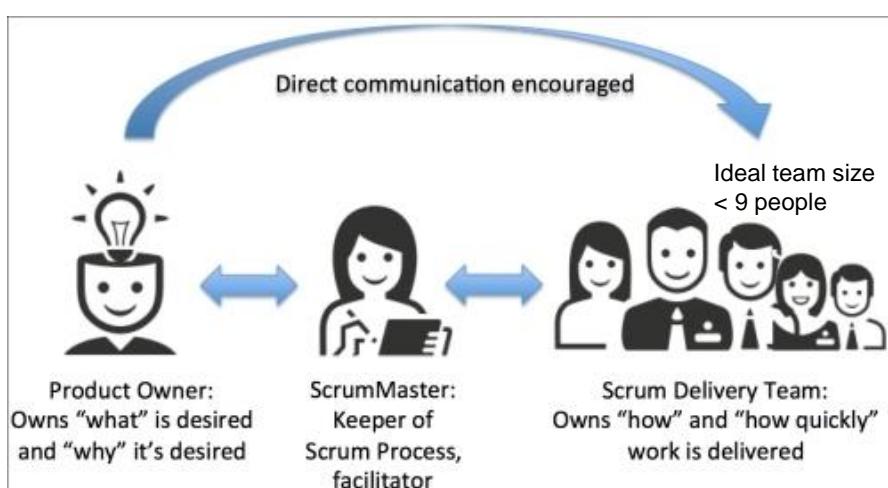
Scrum is a software development method that follows Agile's values and principles.

“Scrum” comes from the scrum formation of a rugby team because it emphasizes that team members should have a short daily meeting (15min) in each morning.



*18

Scrum Team

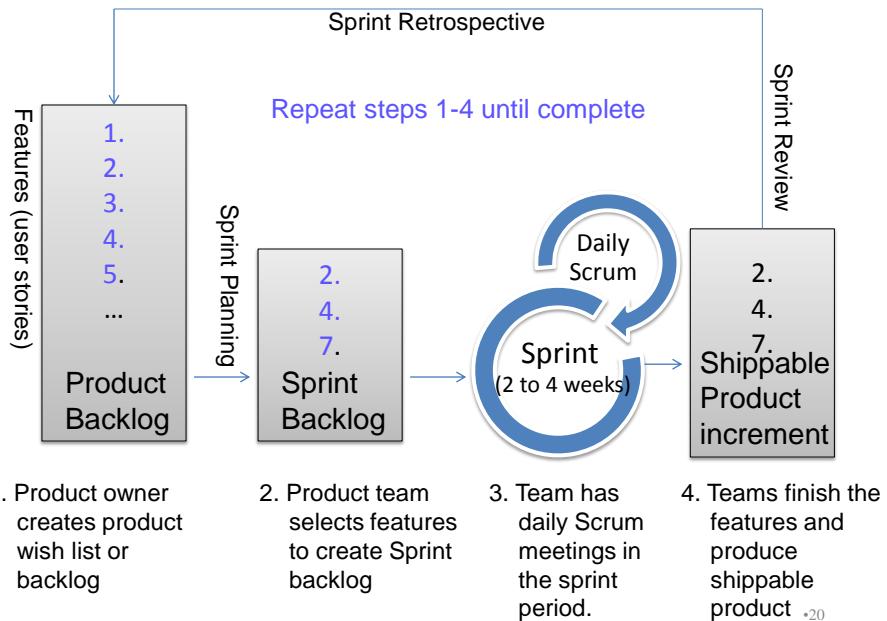


Role of Scrum Master:

<https://www.youtube.com/watch?v=f-rsUA2VLn8>

*19

Scrum framework – An Agile development method



Criteria for selecting the features into the **Sprint Backlog**

- Early delivery
- Users' expectation
- Dependencies
- Known requirements

Scrum Framework

1. A **Product owner** creates a prioritized wish list called a **product backlog**
2. During **sprint planning**, the **team** pulls a small chunk from the top of that wish list (a **sprint backlog**), and decides how to implement those pieces.
3. The team has a certain amount of time (a **sprint** or **iteration**) to complete its work, usually 2 – 4 weeks. And meet each day to know the progress and impediments (called **daily Scrum**).
4. Along the way, the **ScrumMaster** keeps the team focused on its goal.
5. At the end of the **sprint**, the work should be potentially shippable to users for testing or using.
6. The sprint ends with a **sprint review** and **retrospective**.
7. As the next sprint begins, the team chooses another chunk of the **product backlog** and begins working again.

*22

Terminologies of Scrum

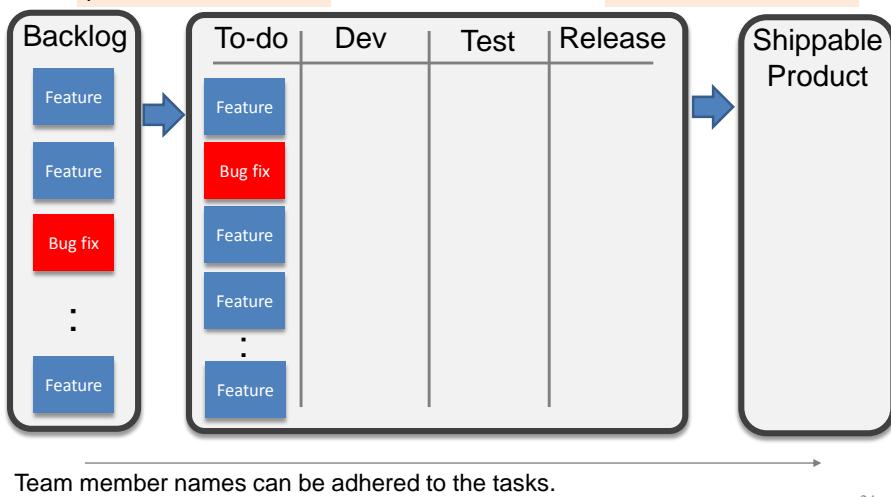
- » **Sprint** – a small, complete deliverable during a short duration
- » **Sprint planning** – a meeting for planning a sprint, such as clearing the requirements, selecting product backlogs for the coming sprint.)
- » **Sprint backlogs** – the works that are selected for the current sprint
- » **Product backlogs** – the works need to be done to complete the product
- » **Daily Scrum** – a short daily meeting (usually 15 min.) of the team members to identify the progress and impediments
- » **Sprint review** – a meeting held at the end of the sprint to inspect the deliverables. ScrumMaster, Product Owner, Development team and End users join the meeting.
- » **Retrospective** – an opportunity for the Scrum Team to inspect itself and create a plan for improvements during the next sprint.

*23

Scrum / Agile Board (1)

Sprint planning session – select and prioritize the tasks.

By end of the sprint, all features in release column are packaged to shippable product.



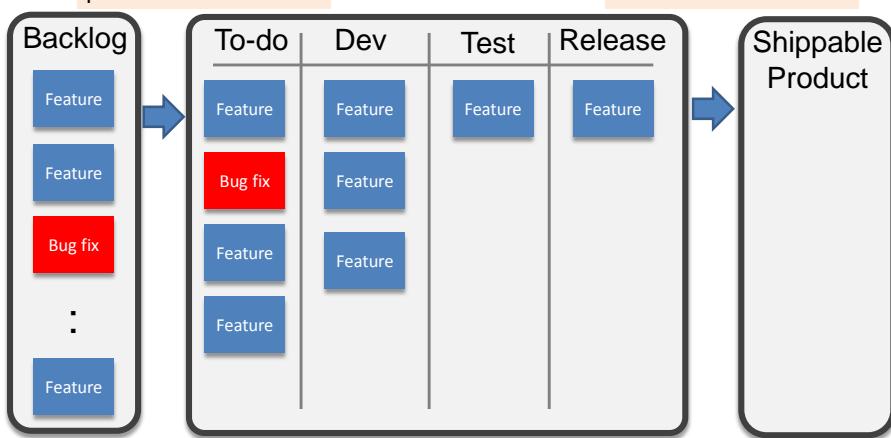
Team member names can be adhered to the tasks.

*24

Scrum / Agile Board (2)

Sprint planning session – select and prioritize the tasks.

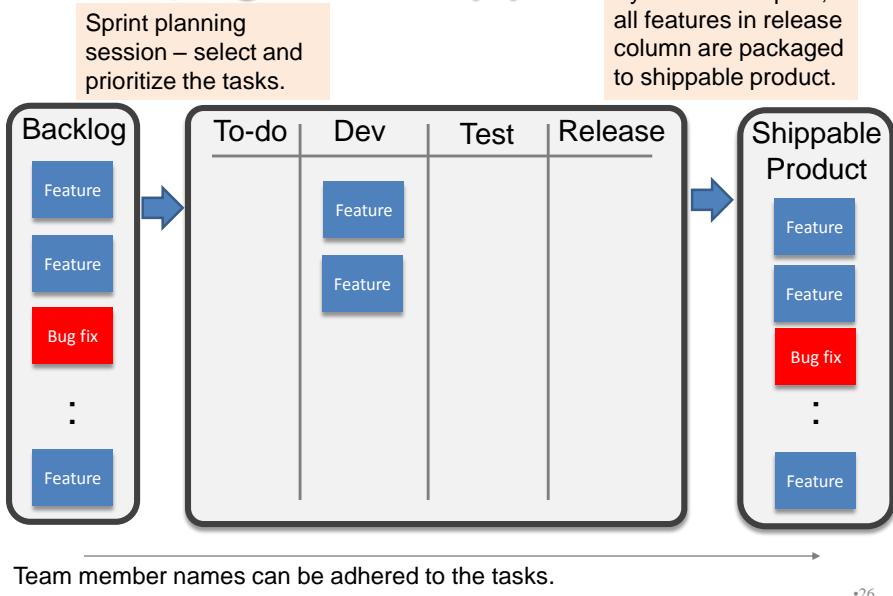
By end of the sprint, all features in release column are packaged to shippable product.



Team member names can be adhered to the tasks.

*25

Scrum / Agile Board (3)

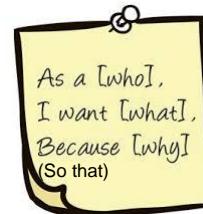


Team member names can be adhered to the tasks.

*26

User Story

User stories are short, simple description of a feature told from the perspective of the person who desires the new capability, usually a user or customer of the system. They typically follow a simple template as:

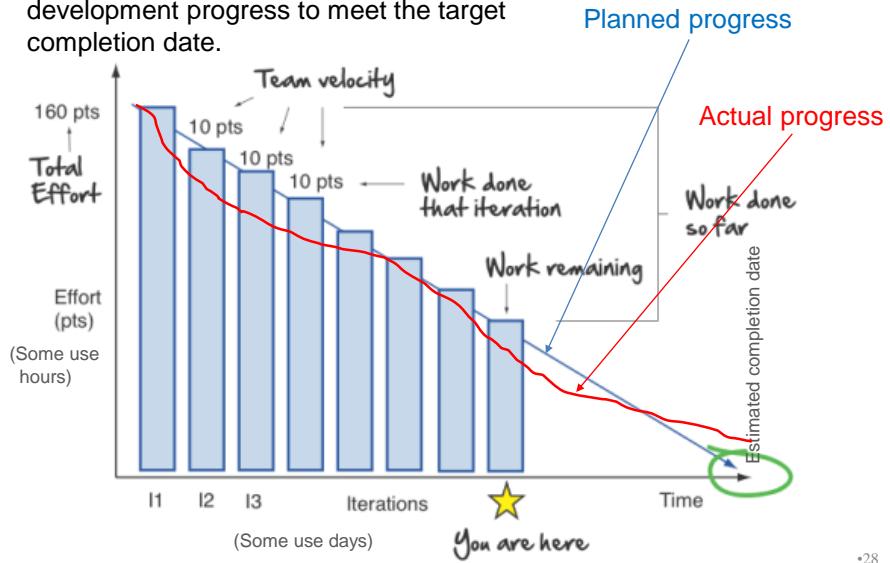


Difficulty level

#	Backlog Item (User Story)	Story Point
1	As a Teller I want to be able to find clients by last name, so that I can find their profile faster	4
2	As a System Admin I want to be able to configure user settings so that I can control access	2
3	As a System Administrator I want to be able to add new users when required so that...	2
4	As a data entry clerk, I want the system to automatically check my spelling so that...	1

Burndown Chart

This is a scheduling tool to help manage the development progress to meet the target completion date.



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Chapter 3: Project Integration Management

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Learning Objectives

- * Describe an overall framework for project integration management as it relates to the other PM knowledge areas and the project life cycle
- * Explain the strategic planning process and apply different project selection methods
- * Explain the importance of creating a project charter to formally initiate projects

Learning Objectives (continued)

- * Describe project management plan development, understand the content of these plans, and review approaches for creating them
- * Explain project execution, its relationship to project planning, the factors related to successful results, and tools and techniques to assist in project execution
- * Describe the process of monitoring and controlling project work

Learning Objectives (continued)

- * Understand the integrated change control process, planning for and managing changes on information technology projects, and developing and using a change control system
- * Explain the importance of developing and following good procedures for closing projects

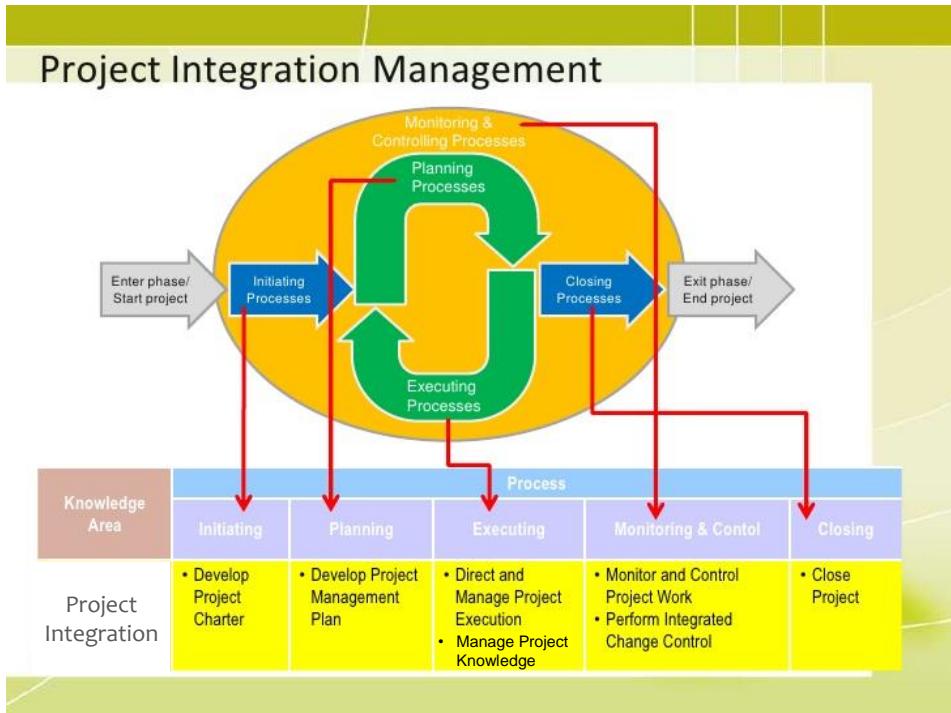
The Key to Overall Project Success: Good Project Integration Management

- * Project managers must coordinate all of the other knowledge areas throughout a project's life cycle



- * Many new project managers have trouble looking at the “big picture” and want to focus on too many details (see opening case for a real example)

5



Project Integration Management Processes

- * **4.1 Develop the project charter:** working with stakeholders to create the document that formally authorizes a project—the charter
- * **4.2 Develop the project management plan:** coordinating all planning efforts to create a consistent, coherent document—the project management plan
- * **4.3 Direct and manage project execution:** carrying out the project management plan by performing the activities included in it

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Project Integration Management Processes (continued)

- * **4.4 Manage project knowledge:** using existing knowledge and creating new knowledge to achieve the project's objectives and contribute to organizational learning.
- * **4.5 Monitor and control the project work:** overseeing project work to meet the performance objectives of the project
- * **4.6 Perform integrated change control:** coordinating and evaluating changes that affect the project's deliverables

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Project Integration Management Processes (continued)

- * **4.7 Close the project or phase:** finalizing all project activities to formally close the project or phase

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Project Pre-initiation

- * Lay the groundwork for a project before it officially starts
- * Senior managers often perform several pre-initiation tasks, including the following:
 - * Determine the high-level scope, time, and cost constraints for the project
 - * Identify the project sponsor
 - * Select the project manager
 - * Develop a **business case** for a project (see Table 3-2 for an example)
 - * Meet with the to-be project manager to review the process and expectations for managing the project
 - * Determine if the project should be divided into two or more smaller projects
 - * Obtain the authorization so the financial resource is committed

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4.1 Develop Project Charter

- * Agreement when applicable
 - * e.g. contract, Memorandums of Understanding – MOUs, Service Level Agreement – SLA, etc.)
- * Project Statement of Work (SOW)
- * Business Case
- * Enterprise Environment Factors (EEF)
- * Organizational Process Assets (OPA)

4.1 Develop Project Charter

Project Charter

- Facilitation Techniques
 - e.g. Brainstorming, problem solving, meeting etc.
- Expert Judgment
 - Expertise provided by people with specialized knowledge in technical and management details

Project Charter

A **project charter** is a document that formally recognizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities.

- * Key project stakeholders should sign a project charter to acknowledge agreement on the need and intent of the project; a signed charter is a key output of project integration management

Tools and Techniques

- * **Facilitation Techniques**
 - * e.g. Brainstorming, problem solving, meeting, etc.
- * **Expert Judgment**
 - * Such judgment and expertise are applied to any technical and management details
 - * Such expertise is provided by any group or individual with specialized knowledge or training, and is available from many sources.

4.2 Develop Project Management Plan

- * Develop Project Management Plan is the process of defining, preparing, and coordinating all subsidiary plans (from the other 9 knowledge areas) and integrating them into a comprehensive project management plan. The key benefit of this process is a central document that defines the basis of all project work.

4.2 Develop Project Management Plan

- * What to do on planning?
 - * Generally plan before you plan
 - * Communicate (make sure people know where they are in)
 - * Implement Process (Process to have a standardized documented ways to do planning)
 - * Setup your repository (where to store and place)
 - * Get your sign-offs, when and how
 - * All the time know who doing what and where

4.2 Develop Project Management Plan



Project Management Plans

A **project management plan** is a document used to coordinate all project planning documents and help guide a project's execution and control

- * Plans created in the other knowledge areas are subsidiary parts of the overall project management plan
- * Provide a **baseline** for progress measurement and project control.
- * Subject to change as necessary

* A **Baseline** is the defined requirements (plus approved changes) confirmed by relevant people, which are used in validating certain aspects of the project.

Project Management plan



9 subsidiary management plans



3 Baselines

- Scope baseline
- Schedule baseline
- Cost baseline

4.3 Direct and Manage Project Work

- * The process of leading and performing the work defined in the **project management plan** and implementing approved changes to achieve the project's objectives.
- * The majority of time and money is usually spent on execution

Coordinating Planning and Execution

- * Project planning and execution are intertwined and inseparable activities
- * Those who will do the work should help to plan the work
- * Project managers must solicit input from the team to develop realistic plans

Project Execution Tools and Techniques

- * **Expert judgment:** experts can help project managers and their teams make many decisions related to project execution
- * **Project management information systems:** there are hundreds of project management software products available on the market today, and many organizations are moving toward powerful enterprise project management systems that are accessible via the Internet
- * See the What Went Right? example of Kuala Lumpur's Integrated Transport Information System on p. 159

4.4 Manage Project Knowledge

- * The process of using existing knowledge and creating new knowledge to achieve the project's objectives and contribute to organizational learning.
- * The key benefits of this process are that prior organizational knowledge is leveraged to produce or improve the project outcomes, and knowledge created by the project is available to support organizational operations and future projects or phases.

4.4 Manage Project Knowledge



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4.5 Monitor and Control Project Work

- * The process of tracking, reviewing, and reporting project progress against the performance objectives defined in the **project management plan**.
- * Changes are inevitable on most projects, so it's important to develop and follow a process to monitor and control changes
- * Monitoring project work includes collecting, measuring, and disseminating performance information

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4.5 Monitor and Control Project Work



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4.6 Perform Integrated Change Control

- * The process of reviewing all change requests; approving changes and managing changes to deliverables, Organizational Process Assets, project documents, and the project management plan; and communicating their situations.

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Change Control on Information Technology Projects

Former view:

- * The project team should strive to do exactly what was planned on time and within budget
- * *Problem:* stakeholders rarely agreed up-front on the project scope, and time and cost estimates were inaccurate

Modern view:

- * project management is a process of constant communication and negotiation
- * *Solution:* changes are often beneficial, and the project team should plan for them

Change Control Board (CCB)

- * There must be a system (policies) to govern how changes are handled and authorized.
- * A formal group of people responsible for approving or rejecting changes on a project
- * CCBs provide guidelines for preparing change requests, evaluate change requests, and manage the implementation of approved changes

4.7 Closing Projects and Phases

- * The process of finalizing all activities across all of the Project Management Process Groups to formally complete the phase or project.
- * Major things to do:
 - * Delivery of final product, service or result
 - * Final acceptance of the project
 - * Procurement contract closure
 - * Human resources returned
 - * Equipment and facility returned
 - * Lessen Learnt (into Organizational Process Asset)

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4.7 Close Project or Phase



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Chapter 3 **Project Integration Management** **(Part II)**

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The Project Management Documents

- **SoW (Statement of Work)**
- **Business Case**
- **NPV (Net Present Value),
ROI (Return On Investment), Payback
Analysis**
- **SLA (Service Level Agreement)**
- **Project Charter**
- **Project Management Plan**
- **Stakeholder Register**

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SoW (Statement of Work)

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Project Statement of Work (SOW)

A **Statement of Work (SOW)** is a narrative description of products, services or results to be delivered by the project.

- * Source of SOW:
 - * **Internal:**
 - * Projects Sponsor provides the SOW based on business needs, product, or service requirements
 - * **External:**
 - * SOW can be received from the customer as part of a bid document (or tenders)
- * SOW can help define below:
 - * Business needs, strategic plan (in Biz case)
 - * Product scope description (requirements, characteristics etc.)

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Contents of SOW

* Objective

- * Why are we doing this project? A purpose statement attempts to answer this?

* Scope of work

- * This describes the works to be done and specifies the hardware and software involved.

* Location of work

- * This describes where the work is to be performed, including the location of hardware and software and where people will meet to do the work.

* Deliverables schedule

- * This part lists and describes what is due and when

It answers the question “WHAT to do?”.

Contents of SOW (cont.)

* Applicable standards

- * This describes any industry specific standards that need to be adhered to in fulfilling the contract.

* Acceptance criteria

- * This specifies how the buyer or receiver of goods will determine if the product or service is acceptable, usually with objective criteria

* Payment schedule

- * A breakdown of payments by whether they are up-front or phased will usually be negotiated in an early stage, esp. for a project with long period.

Business Case

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Business Case

A **Business Case** provides the necessary information from a business standpoint to determine whether or not the project is worth the required investment.

- * The business case is created as a result of one or more of the following:
 - * Market demand, Organization needs, Customer needs, Customer requests, Technological advance, Legal requirements, Ecological impact, Social needs

It answers the question “WHY to do it?”.

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TABLE 3-2 JWD Consulting's business case

1.0 Introduction/Background

JWD Consulting's core business goal is to provide world-class project management consulting services to various organizations. The CEO, Joe Fleming, believes the firm can streamline operations and increase business by providing information related to project management on its intranet site, making some information and services accessible to current and potential clients.

2.0 Business Objective

JWD Consulting's strategic goals include continuing growth and profitability. The project management intranet site project will support these goals by increasing visibility of the firm's expertise to current and potential clients by allowing client and public access to some sections of the intranet. The project will also improve profitability by reducing internal costs by providing standard tools, techniques, templates, and project management knowledge to all internal consultants. Because JWD Consulting focuses on identifying profitable projects and measuring their value after completion, this project must meet those criteria.

3.0 Current Situation and Problem/Opportunity Statement

JWD Consulting has a corporate Web site as well as an intranet. The firm currently uses the Web site for marketing information. The primary use of the intranet is for human resource information, such as where consultants enter their hours on various projects, change and view their benefits information, and access an online directory and Web-based e-mail system. The firm also uses an enterprise-wide project management system to track all project information, focusing on the status of deliverables and meeting scope, time, and cost goals. There is an opportunity to provide a new section on the intranet dedicated to sharing consultants' project management knowledge across the organization. JWD Consulting only hires experienced consultants and gives them freedom to manage projects as they see fit. However, as the business grows and projects become more complex, even experienced project managers are looking for suggestions on how to work more effectively.

4.0 Critical Assumptions and Constraints

The proposed intranet site must be a valuable asset for JWD Consulting. Current consultants and clients must actively support the project, and it must pay for itself within one year by reducing internal operating costs and generating new business. The Project Management Office manager must lead the effort, and the project team must include participants from several parts of the company, as well as from current client organizations. The new system must run on existing hardware and software, and it should require minimal technical support. It must be easily accessible by consultants and clients and be secure from unauthorized users.

5.0 Analysis of Options and Recommendation

There are three options for addressing this opportunity:

1. Do nothing. The business is doing well, and we can continue to operate without this new project.
2. Purchase access to specialized software to support this new capability with little in-house development.
3. Design and implement the new intranet capabilities in-house, using mostly existing hardware and software.

Based on discussions with stakeholders, we believe that option 3 is the best option.

6.0 Preliminary Project Requirements

The main features of the project management intranet site include the following:

1. Access to several project management templates and tools. Users must be able to search for templates and tools, read instructions for using these templates and tools, and see examples of how to

- apply them to real projects. Users must also be able to submit new templates and tools, which should first be screened or edited by the Project Management Office.
2. Access to relevant project management articles. Many consultants and clients sense an information overload when they research project management information. They often waste time they should be spending with their clients. The new intranet should include access to several important articles on various project management topics, which are searchable by topic, and allow users to ask the Project Management Office staff to find additional articles to meet their needs.
 3. Links to other, up-to-date Web sites, with brief descriptions of the main features of the external sites.
 4. An "Ask the Expert" feature to help build relationships with current and future clients and share knowledge with internal consultants.
 5. Appropriate security to make the entire intranet site accessible to internal consultants and certain sections accessible to others.
 6. The ability to charge money for access to some information. Some of the information and features of the intranet site should prompt external users to pay for the information or service. Payment options should include a credit card option or similar online payment transactions. After the system verifies payment, the user should be able to access or download the desired information.
 7. Other features suggested by users, if they add value to the business.

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7.0 Budget Estimate and Financial Analysis

A preliminary estimate of costs for the entire project is \$140,000. This estimate is based on the project manager working about 20 hours per week for six months and other internal staff working a total of about 60 hours per week for six months. The customer representatives would not be paid for their assistance. A staff project manager would earn \$50 per hour. The hourly rate for the other project team members would be \$70 per hour, because some hours normally billed to clients may be needed for this project. The initial cost estimate also includes \$10,000 for purchasing software and services from suppliers. After the project is completed, maintenance costs of \$40,000 are included for each year, primarily to update the information and coordinate the "Ask the Expert" feature and online articles.

Projected benefits are based on a reduction in hours that consultants spend researching project management information, appropriate tools, and templates. Projected benefits are also based on a small increase in profits due to new business generated by this project. If each of 400 consultants saved just 40 hours each year (less than one hour per week) and could bill that time to other projects that generate a conservative estimate of \$10 per hour in profits, then the projected benefit would be \$160,000 per year. If the new intranet increased business by just 1 percent, using past profit information, increased profits due to new business would be at least \$40,000 each year. Total projected benefits, therefore, are about \$200,000 per year. Exhibit A summarizes the projected costs and benefits and shows the estimated net present value (NPV), return on investment (ROI), and year in which payback occurs. It also lists assumptions made in performing this preliminary financial analysis. All of the financial estimates are very encouraging. The estimated payback is within one year, as requested by the sponsor. The NPV is \$272,800, and the discounted ROI based on a three-year system life is excellent at 112 percent.

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8.0 Schedule Estimate

The sponsor would like to see the project completed within six months, but there is some flexibility in the schedule. We also assume that the new system will have a useful life of at least three years.

9.0 Potential Risks

This project carries several risks. The foremost risk is a lack of interest in the new system by our internal consultants and external clients. User inputs are crucial for populating information into this system and realizing the potential benefits from using the system. There are some technical risks in choosing the type of software used to search the system, check security, process payments, and so on, but the features of this system all use proven technologies. The main business risk is investing the time and money into this project and not realizing the projected benefits.

10. Financial Cos-Benefit analysis

Using NPV (Net Present Value) method

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Methods for Selecting Projects

- * There are usually more projects (options) than available time and resources to implement them
- * Methods for selecting projects include:
 - * Focusing on broad organizational needs with strategic planning
 - * Performing **Net Present Value** or other financial analyses
 - * Using a **weighted scoring model**

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Strategic Planning and Project Selection

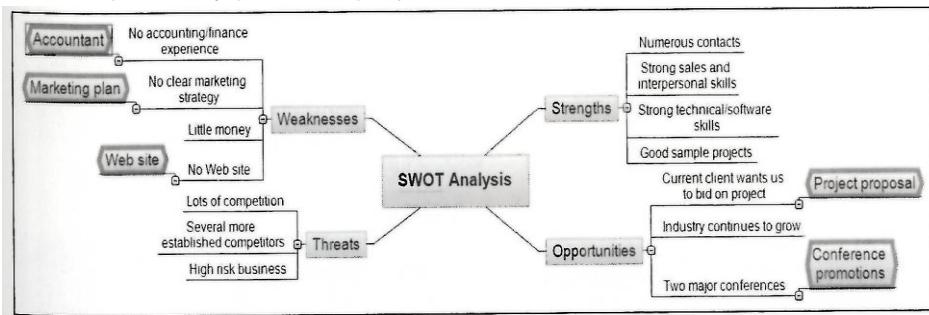
- * **Strategic planning** involves determining long-term objectives, predicting future trends, and projecting the need for new products and services
- * Organizations often perform a **SWOT analysis**
 - * Analyzing **Strengths**, **Weaknesses**, **Opportunities**, and **Threats**
- * As part of strategic planning, organizations:
 - * Identify potential projects
 - * Use realistic methods to select which projects to work on

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Figure 4-2. Mind Map of a SWOT Analysis to Help Identify Potential Projects

For example, a group of 4 people who want to start a new business in the film industry perform a SWOT analysis to help identify potential projects.



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Weighted Scoring Model

- * A weighted scoring model is a tool that provides a systematic process for selecting projects based on many criteria
 - * Identify criteria important to the project selection process
 - * Assign weights (percentages) to each criterion so they add up to 100%
 - * Assign scores to each criterion for each project
 - * Multiply the scores by the weights and get the total weighted scores
- * The higher the weighted score, the better

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Figure 4-7. Sample Weighted Scoring Model for Project Selection

A	B	C	D	E	F
1 Criteria	Weight	Project 1	Project 2	Project 3	Project 4
2 Supports key business objectives	25%	90	90	50	20
3 Has strong internal sponsor	15%	70	90	50	20
4 Has strong customer support	15%	50	90	50	20
5 Uses realistic level of technology	10%	25	90	50	70
6 Can be implemented in one year or less	5%	20	20	50	90
7 Provides positive NPV	20%	50	70	50	50
8 Has low risk in meeting scope, time, and cost goals	10%	20	50	50	90
9 Weighted Project Scores	100%	56	78.5	50	41.5
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

Weighted Score by Project

Project	Score
Project 4	56
Project 3	78.5
Project 2	50
Project 1	41.5

NPV (Net Present Value), ROI (Return On Investment, Payback Analysis

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Financial Analysis of Projects

- * Financial considerations are often an important consideration in selecting projects
- * Three primary methods for determining the projected financial value of projects:
 - * Net present value (**NPV**) analysis
 - * Return on investment (**ROI**)
 - * Payback analysis

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Net Present Value Analysis

- * Net present value (NPV) analysis is a method of calculating the expected net monetary gain or loss from a project by discounting all expected future cash inflows and outflows to the present point in time
- * Projects with a positive NPV should be considered if financial value is a key criterion
- * The higher the NPV, the better

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Figure 4-4. Net Present Value Example

	A	B	C	D	E	F	G
1	Discount rate	10%					
2							
3	PROJECT 1	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
4	Benefits	\$0	\$2,000	\$3,000	\$4,000	\$5,000	\$14,000
5	Costs	\$5,000	\$1,000	\$1,000	\$1,000	\$1,000	\$9,000
6	Cash flow	(\$5,000)	\$1,000	\$2,000	\$3,000	\$4,000	\$5,000
7	NPV	→ \$2,316					
8		Formula =npv(b1,b6:f6)					
9							
10	PROJECT 2	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
11	Benefits	\$1,000	\$2,000	\$4,000	\$4,000	\$4,000	\$15,000
12	Costs	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000	\$10,000
13	Cash flow	(\$1,000)	\$0	\$2,000	\$2,000	\$2,000	\$5,000
14	NPV	→ \$3,201					
15		Formula =npv(b1,b13:f13)					
16							
17							

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Note that totals are equal, but NPVs are not because of the time value of money

Examples of NPV, ROI and Payback period

Discount rate:	8%				
	Year 1	Year 2	Year 3	Year 4	total
Costs	140,000	40,000	40,000	40,000	
Discounted Costs	129,630	34,294	31,753	29,401	225,078
Benefits	0	200000	200000	200000	
Discounted Benefits	-	171,468	158,766	147,006	477,240
Discounted Net	- 129,630	137,174	127,013	117,605	252,163
Cumulative Net	- 129,630	7,545	134,558	252,163	

↑
Payback in year 2

ROI = (Discounted Benefits – Discounted Cost) / Discounted Costs

ROI = (477240 - 225078) / 225078 = 112%

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NPV Calculations

- * Determine estimated costs and benefits for the life of the project and the products it produces
- * Determine the discount rate (check with your organization on what to use)
- * Calculate the NPV (see text for details)
- * Notes: Some organizations consider the investment year as year 0, while others start in year 1; some people enter costs as negative numbers, while others do not
- * Check with your organization for their preferences

Return on Investment

- * **Return on investment (ROI)** is calculated by subtracting the project costs from the benefits and then dividing by the costs
$$\text{ROI} = (\text{total discounted benefits} - \text{total discounted costs}) / \text{discounted costs}$$
- * The higher the ROI, the better
- * Many organizations have a **required rate of return** or minimum acceptable rate of return on investment for projects
- * **Internal rate of return (IRR)** can be calculated by finding the discount rate that makes the NPV equal to zero

Payback Analysis

- * Another important financial consideration is payback analysis
- * The **payback period** is the amount of time it will take to recoup, in the form of net cash inflows, the total dollars invested in a project
- * Payback occurs when the net cumulative discounted benefits equals the costs
- * Many organizations want IT projects to have a fairly short payback period

Service-Level Agreement (SLA)

- * An official agreement between service provider and end users, which defined specific and measurable aspects of quality, availability and responsibility of deliverable services.
- * Ex. Internet service providers usually provide SLA with the level of downtime, say less than 100 min (or 0.05%) of downtime within one year. Besides, mean time to recovery, throughput, data rates...



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Project Charter

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Project Charter

- * It should addresses following information
 - * High-level project description
 - * The purpose of the project or justification
 - * High-level requirements
 - * Describe the product your project has to make
 - * Assigned project manager and authority level
 - * Key scheduled milestone
 - * A list of dates that your project needs to meet
 - * Summary of budget
 - * Project approval requirements
 - * Name and authority of the sponsor

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Table 4-1. Project Charter for the DNA-Sequencing Instrument Completion Project

Project Title: DNA-Sequencing Instrument Completion Project	Date of Authorization: February 1	Project Start Date: February 1	Projected Finish Date: November 1
Key Schedule Milestones: <ul style="list-style-type: none">• Complete first version of the software by June 1• Complete production version of the software by November 1			
Budget Information: The firm has allocated \$1.5 million for this project, and more funds are available if needed. The majority of costs for this project will be internal labor. All hardware will be outsourced.			
Project Manager: Nick Carson, (650) 949-0707, ncarson@dniconsulting.com			
Project Objectives: The DNA-sequencing instrument project has been underway for three years. It is a crucial project for our company. This is the first charter for the project, and the objective is to complete the first version of the software for the instrument in four months and a production version in nine months.			
Main Project Success Criteria: The software must meet all written specifications, be thoroughly tested, and be completed on time. The CEO will formally approve the project with advice from other key stakeholders.			

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Approach:

- Hire a technical replacement for Nick Carson and a part-time assistant as soon as possible.
- Within one month, develop a clear work breakdown structure, scope statement, and Gantt chart detailing the work required to complete the DNA sequencing instrument.
- Purchase all required hardware upgrades within two months.
- Hold weekly progress review meetings with the core project team and the sponsor.
- Conduct thorough software testing per the approved test plans.

ROLES AND RESPONSIBILITIES

Name	Role	Position	Contact Information
Ahmed Abrams	Sponsor	CEO	aabrams@dniconsulting.com
Nick Carson	Project Manager	Manager	ncarson@dniconsulting.com
Susan Johnson	Team Member	DNA expert	sjohnson@dniconsulting.com
Renyong Chi	Team Member	Testing expert	rchi@dniconsulting.com
Erik Haus	Team Member	Programmer	ehaus@dniconsulting.com
Bill Strom	Team Member	Programmer	bstrom@dniconsulting.com
Maggie Elliot	Team Member	Programmer	melliot@dniconsulting.com

Sign-off: (Signatures of all the above stakeholders)

Ahmed Abrams

Susan Johnson

Erik Haus

Maggie Elliot

Nick Carson

Renyong Chi

Bill Strom

Comments: (Handwritten or typed comments from above stakeholders, if applicable)

"I want to be heavily involved in this project. It is crucial to our company's success, and I expect everyone to help make it succeed." —Ahmed Abrams

"The software test plans are complete and well documented. If anyone has questions, do not hesitate to contact me." —Renyong Chi

Project Management Plan

Project Management Plans

A **project management plan** is a document used to coordinate all project planning documents and help guide a project's execution and control

- * Plans created in the other knowledge areas are subsidiary parts of the overall project management plan
- * Provide a **baseline** for progress measurement and project control.
- * Subject to change as necessary

* A **Baseline** is the defined requirements confirmed by relevant people, which are used in validating certain aspects of the project.

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Common Elements of a Project Management Plan

- * Overview of the project
- * Description of how the project is organized
- * Subsidiary management plans
- * Baselines
- * Additional components

The Common Elements (detailed)

* Overview of the project

- * project name
- * Brief description of the project and the need it addresses
- * Sponsor's name and contact
- * Names of the PM and key team members
- * Deliverables

* Description of how the project is organized

- * Org Chart
- * Project responsibilities (who responsible for what)

The Common Elements (detailed) *cont.*

* Subsidiary management plans

- * Scope management plan
- * Requirements management plan
- * Schedule management plan
- * Cost management plan
- * Quality management plan
- * Resource management plan
- * Communications management plan
- * Risk management plan
- * Procurement management plan
- * Stakeholder management plan

The Common Elements (detailed) *cont.*

* Baselines

- * Scope baseline
- * Schedule baseline
- * Cost baseline

* Additional components

- * Change management plan
- * Project life cycle
- * Development approach (Predictive, Iterative, Adaptive)
- * etc.

13.1 Identify Stakeholders

* **Project Stakeholder Management** includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decision and execution.

Stakeholder Register

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13.1 Identify Stakeholders

- EEF / OPA
- Project Charter
- Procurement doc

13.1 Identify Stakeholders

Stakeholder Register

- Meeting
- Expert Judgment
- Stakeholder analysis

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Identify Stakeholders

- * The Identify stakeholders is the process of identifying the people, groups or organizations that could impact or impacted by the project, and documenting relevant information regarding their interests, involvement, interdependencies, influence and potential impact on project success.
- * Identify the stakeholders early, and to analyze their levels of interest, expectations, importance and influence

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Stakeholder Register

- * This document contains:
 - * **Identification information**
 - * Name, Organization position, location, roles in the project
 - * **Assessment information**
 - * Major requirements, main expectations, potential influence
 - * **Stakeholder classification**
 - * Internal / External, supporter/natural/resistor
 - * **Stakeholder management strategy**
 - * Define an approach to increase the support and minimize negative impacts.
 - * Key Stakeholders who can significantly impact the project
 - * Level of participation in the project desired for each identified stakeholder
 - * Stakeholder groups and their management

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Table 3-4. Stakeholder Register

Name	Position	Internal/ External	Project Role	Contact Information
Joe Fleming	CEO	Internal	Sponsor	joe_fleming@jwdeconsulting.com
Erica Bell	PMO Director	Internal	Project manager	erica_bell@jwdeconsulting.com
Michael Chen	Team member	Internal	Team member	michael_chen@jwdeconsulting.com
Kim Phuong	Business analyst	External	Advisor	kim_phuong@client1.com
Louise Mills	PR Director	Internal	Advisor	louise_mills@jwdeconsulting.com

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Table 3-4. Stakeholder Management Strategy

Name	Level of Interest	Level of Influence	Potential Management Strategies
Joe Fleming	High	High	Joe likes to stay on top of key projects and make money. Have a lot of short, face-to-face meetings and focus on achieving the financial benefits of the project.
Louise Mills	Low	High	Louise has a lot of things on her plate, and she does not seem excited about this project. She may be looking at other job opportunities. Show her how this project will help the company and her resume.

Contents are often sensitive, so do not publish this document.

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Chapter Summary

- * Project integration management involves coordinating all of the other knowledge areas throughout a project's life cycle
- * Main processes include:
 - * Develop project charter
 - * Develop project management plan
 - * Direct and manage project execution
 - * Monitor and control project work
 - * Perform integrated change control
 - * Close the project or phase

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CHAPTER 4: PROJECT SCOPE MANAGEMENT

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LEARNING OBJECTIVES

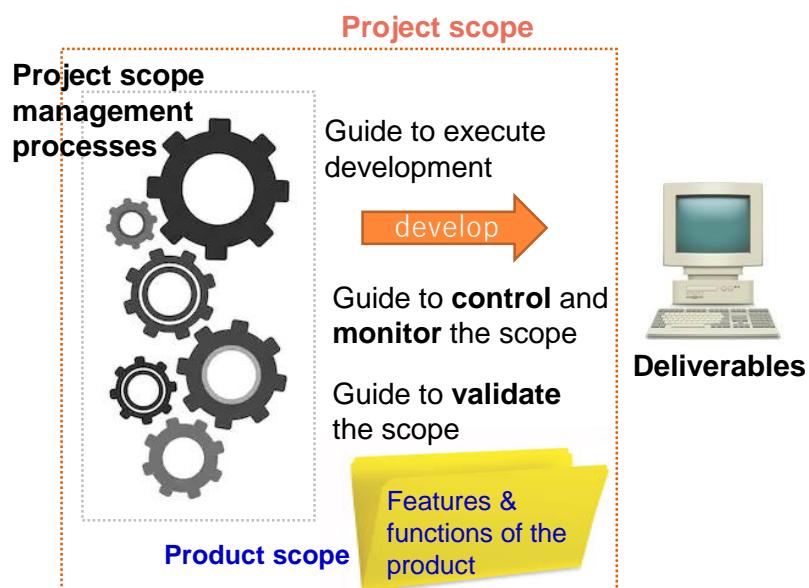
- Understand the importance of good project scope management
- Discuss methods for collecting and documenting requirements in order to meet stakeholder needs and expectations
- Explain the scope definition process and describe the contents of a project scope statement
- Discuss the process for creating a work breakdown structure using the analogy, top-down, bottom-up, and mind-mapping approaches
- Explain the importance of verifying scope and how it relates to defining and controlling scope
- Understand the importance of controlling scope and approaches for preventing scope-related problems on information technology projects

WHAT IS PROJECT SCOPE MANAGEMENT?

- **Project Scope** refers to *all* the work involved in creating the products of the project
- A **deliverable** is a product produced as part of a project, such as hardware or software, planning documents, or meeting minutes
- **Project scope management** includes the processes involved in defining and controlling what is or is not included in a project

3

WHAT IS PROJECT SCOPE MANAGEMENT?



4

PROJECT SCOPE MANAGEMENT PROCESSES

○ 5.1 Plan Scope Management

- Creating a **scope management plan** that documents how the project scope will be defined, validated and controlled.

○ 5.2 Collect requirements

- Determining and documenting the features and functions of the products to be produced to meet the project objectives

○ 5.3 Define scope

- Reviewing the **project charter**, requirements documents, and **organizational process assets** to create a **scope statement**

5

PROJECT SCOPE MANAGEMENT PROCESSES (CONT.)

○ 5.4 Create the WBS

- Subdividing the major project deliverables into smaller, more manageable components

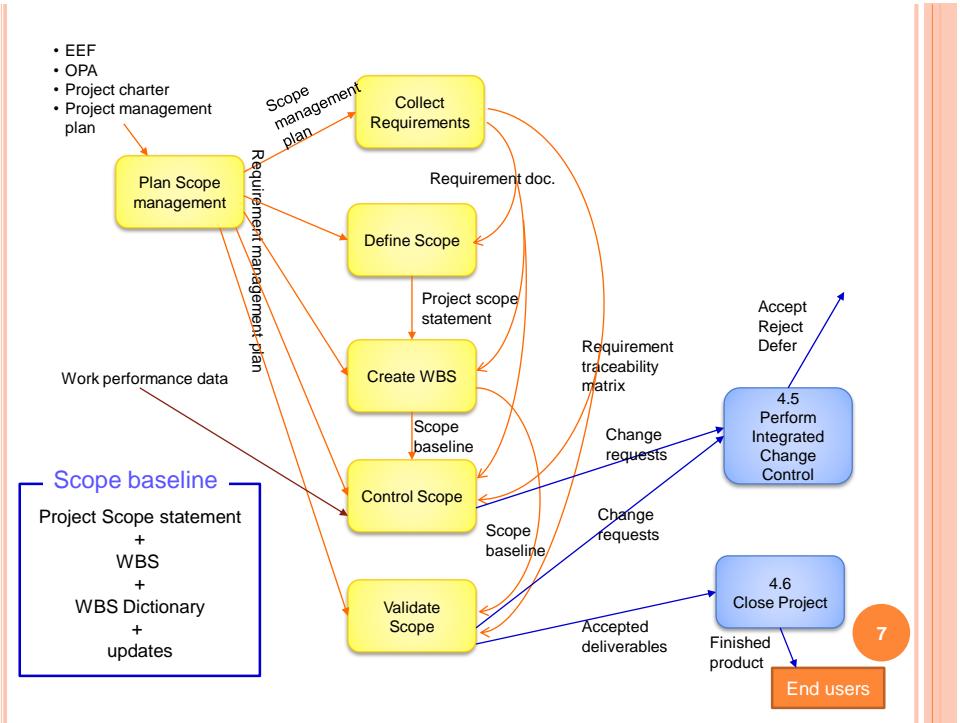
○ 5.5 Validate scope

- Formalizing acceptance of the project deliverables

○ 5.6 Control scope

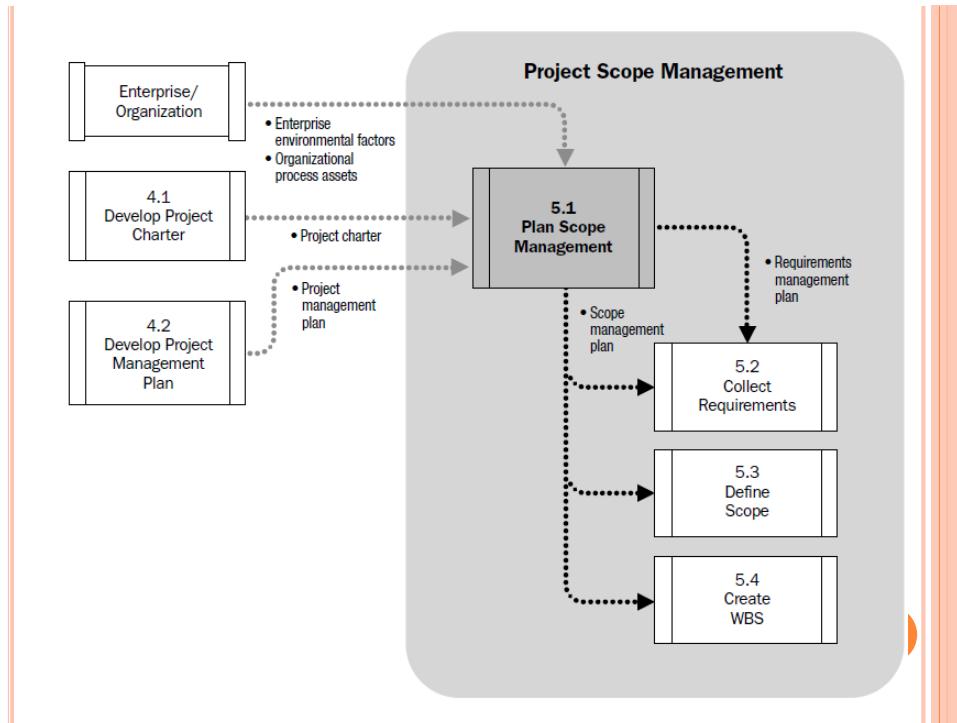
- Controlling changes to **project scope baseline**

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5.1 Plan Scope Management

- The process of creating a **scope management plan** that documents how the project scope will be defined, validated and controlled.
- It provides guidance and direction on how scope will be managed throughout the project.
- The output includes:
 - Scope management plan**
 - Describes how the scope will be defined, developed, monitored, controlled, and validated.
 - Requirement management plan**
 - Describes how project and product requirements will be collected, analyzed, documented, and managed.



SCOPE VS REQUIREMENTS

○ Scope

- Works to be done in order to fulfill the requirements
- From the developers' point of view
- Produced in “**5.3 Define Scope**” process

○ Requirements

- Indicates what features and functions users want from the product (*plus the project requirements*)
- From the other stakeholders' (*user, sponsor, etc.*) point of view
- Collected in “**5.2 Collect Requirements**” process

REQUIREMENTS (USER)



End users

I am a driver and
I want a vehicle that is:
• Safe
• Fast
• Looking nice
• ...

affecting

PROJECT SCOPE



Developers



What should be done?

What are required to fulfilled?

SCOPE VS REQUIREMENT (EXAMPLE)

Academic management system

Project Scope

A number of programmable modules that aim at fulfilling the requirements: programme, payment of tuition fee, grade, syllabus, student portal, teacher portal, attendance, scholarship; Developing database; Sourcing necessary open-sources; System analysis; Software architecture design; User-interface design; Test cases design, Testing...

Requirements (user)

- Teachers can view students' grades.
- Admin staff can maintain the curriculum of a program.
- Students can use credit card to pay tuition fees.
- Students can add/drop a class with the approval of programme director.
- Admin staff can merge the grades of the old system with the new system.
- The data of the previous system can be assessed by the admin staff.
- :

SCOPE MANAGEMENT PLAN

The **scope management plan** is a component of the **project management plan** that describes how the scope will be defined, developed, monitored, controlled, and validated.

It includes:

- Process for preparing a [project scope statement](#);
- Process that enables the [creation of the WBS \(Work Breakdown Structure\)](#) from the detailed [project scope statement](#);
- Process that establishes how the [scope baseline](#) will be approved and maintained; and
- Process that specifies how formal acceptance of the completed project deliverables will be obtained

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SAMPLE SCOPE MANAGEMENT PLAN

Project Name: Information Technology (IT) Upgrade Project

Introduction

The purpose of this document is to provide suggestions and guidance for preparing several important scope management documents related to this project.

Preparing the Scope Statement

The preliminary scope statement will provide the basis for preparing more detailed scope statements. The scope statement needs to be reviewed with key stakeholders, especially the project sponsor, potential suppliers, and users of the project deliverables. Follow corporate templates when available, and be sure to have expert input in defining the scope. Since the scope statement becomes more detailed and therefore longer as the project progresses, limit the length and complexity of the scope statement by placing details in attachments, such as product descriptions, specifications, corporate standards, etc. Each version of the scope statement must be clearly labeled and dated to ensure that everyone uses the most recent version. Changes and additions will be highlighted and communicated to the appropriate personnel. The scope statement will be available on the password-protected project Web site.

Creating the Work Breakdown Structure (WBS)

The project team will work together to create the WBS. The project sponsor and steering committee will review the WBS to ensure that all of the work required to complete the project is included in the WBS. The project team will review WBSs of similar projects, review the company's corporate guidelines for creating WBSs, and focus on determining all of the deliverables required for the project. The project team will determine the tasks required to complete each deliverable, which will be reviewed and agreed to by the project manager, sponsor, and steering committee. These tasks should include product- and process-related tasks. A general guideline to follow for determining the level of detail is that the lowest level of the WBS should normally take no longer than two weeks to complete. The WBS can be revised as needed, and the sponsor and steering committee must approve these revisions.

Verifying Completion of Project Deliverables

The project manager will work with the sponsor and steering committee to develop a process for verifying successful completion of project deliverables. In general, the project sponsor will be responsible for verifying the completion of major deliverables. The contract administrator will also be involved in verifying successful completion of deliverables received from outside sources. Contracts will include clauses describing the scope verification process.

Managing Requests for Changes to Project Scope

All requests for changes to project scope that may have a significant effect on meetings and project requirements must follow the formal change control procedures specified in Attachment 1. A change request form will be completed and reviewed by the designated group. It is crucial to follow these procedures to prevent scope creep.

REQUIREMENTS MANAGEMENT PLAN

The **requirements management plan** is a component of the **project management plan** that describes how project and product requirements will be collected, analyzed, documented, and managed.

- It includes, but not limited to:
 - How requirements activities will be planned, tracked, and reported;
 - How to perform change management activities (i.e. *how changes to the product will be initiated; how impacts will be analyzed; how the authorization levels will be required to approve these changes*)
 - How to prioritize requirements
 - How to trace attributes of requirements

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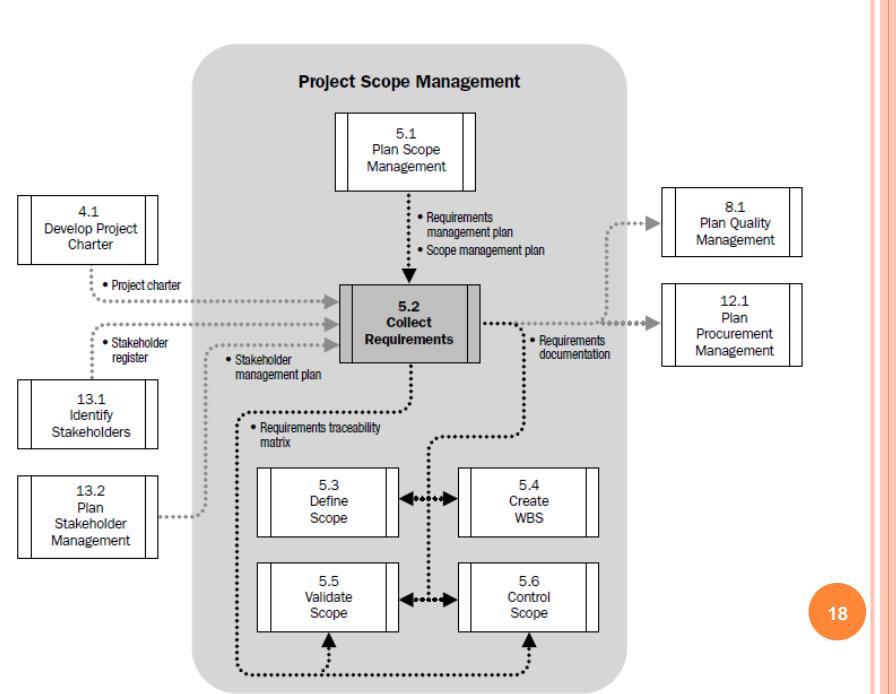
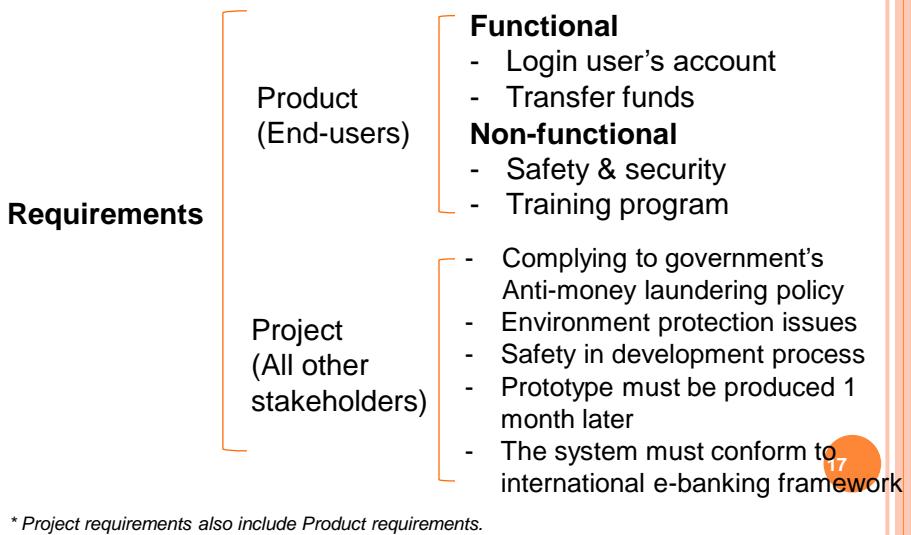
5.2 COLLECT REQUIREMENTS

A **requirement** is “a condition or capability that must be met or possessed by a system, product, service, result, or component to satisfy a contract, standard, specification, or other formal document” (PMBOK® Guide, v5)

- For some IT projects, it is helpful to divide requirements development into categories called elicitation, analysis, specification, and validation
- It is important to use an *iterative approach* to defining requirements since they are often unclear early in a project

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EXAMPLES OF REQUIREMENTS



METHODS FOR COLLECTING REQUIREMENTS (TOOLS & TECHNIQUES)

- Interviewing
- Focus groups and facilitated workshops
- Using group creativity and decision-making techniques
- Questionnaires and surveys
- Observation
- Prototyping

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DOCUMENTING REQUIREMENTS

- **Requirements documents** describe how individual requirements meet the business need for the project.
- They are often broken down into different categories such as ***functional, non-functional*** (performance, user-interface, ease-of-use, security & safety, other qualities), ***standards & compliance, training requirements*** and also the requirements from other stakeholders.
- A **requirements traceability matrix (RTM)** is a table that lists requirements, various attributes of each requirement, and the status of the requirements to ensure that all requirements are addressed

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TABLE 5-1. SAMPLE REQUIREMENTS TRACEABILITY MATRIX

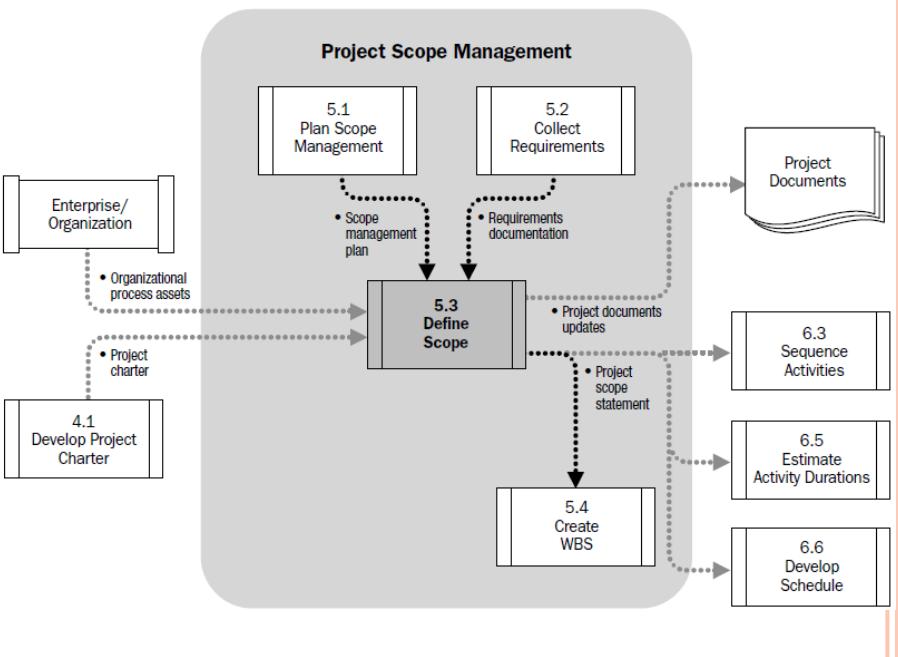
Requirement No.	Name	Category	Source	Status
R32	Laptop memory	Hardware	Project charter and corporate laptop specifications	Complete. Laptops ordered meet requirement by having 4GB of memory.

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5.3 DEFINE SCOPE

- Define Scope is a process developing a detailed descriptions of the project and product
- It describes the product, service and result boundaries by defining which of the requirements collected are included or excluded from the project scope.
- As time progresses, the scope of a project should become more clear and specific

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PROJECT SCOPE STATEMENT

- The output of the process is **Project Scope Statement** that provides:
 - A detailed description of the project
 - Deliverables
 - Constraints
 - Exclusions
 - Assumptions and;
 - Acceptance criteria.

Project Scope Statement

- **Product scope description**
 - Characteristics of product, service and result
- **Product acceptance criteria**
 - A set of conditions that is required to be met before deliverables are accepted
- **Project deliverables**
- **Project exclusions**
 - Generally identifies what is excluded from the project.
- **Project constraints**
 - Limiting factors/conditions that affect the execution of a project or process. (i.e. resource or technology constraints, you have only 2 computers)
- **Project assumptions**
 - The factors in the planning process that are considered to be true. (i.e. users are very supportive to the project; the network bandwidth will be high enough for the video transmission.)

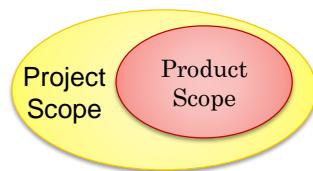
Constraints and Assumptions

Project constraints	Project assumptions
<ul style="list-style-type: none">• This must be finished before the commencement of the opening ceremony.• The amount of funding is around 100,000.• Use Paypal as the payment gateway.• We do not have the domain knowledge and past experience for that project.• We must use the Linux OS for the software.• The software must support Java 1.12 or above.• The core part of the system can only be revealed to a few appointed persons – biz secret.• The weather in this region is rainy and windy quite often in this season.• The network bandwidth is quite low for smooth video transmission.• The delivery of the needed equipment will take at least 3 weeks.• The effort relies on voluntary participation by multiple government agencies.	<ul style="list-style-type: none">• The weather in this region will be fine in this season.• Customers will provide necessary business expertise as needed during development.• The network bandwidth will be high enough for smooth video transmission.• All imported data will be in XML format.• Government regulation will not be changed in these 2 years.• The 5G networks will be widespread in the region.• Users will fully support the project.• The sponsor really desires the project to finish with high quality and allows the high quality to justify the budget.• The sun will rise from the east tomorrow. (Does it matter to your project?)

*26

PRODUCT SCOPE VS PROJECT SCOPE

- Product Scope
 - The features and functions that characterize a product, service or result
- Project Scope
 - The work performed to deliver a product, service or result with the specified features and functions.



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5.4 CREATE WORK BREAKDOWN STRUCTURE (WBS)

- A **WBS** is a deliverable-oriented grouping of the work involved in a project that defines the total scope of the project
- WBS is a foundation document that provides the basis for planning and managing project schedules, costs, resources, and changes
- **Decomposition** is subdividing project deliverables into smaller pieces
 - *Why we need to decompose the project work?*
- A **work package** is a task at the lowest level of the WBS

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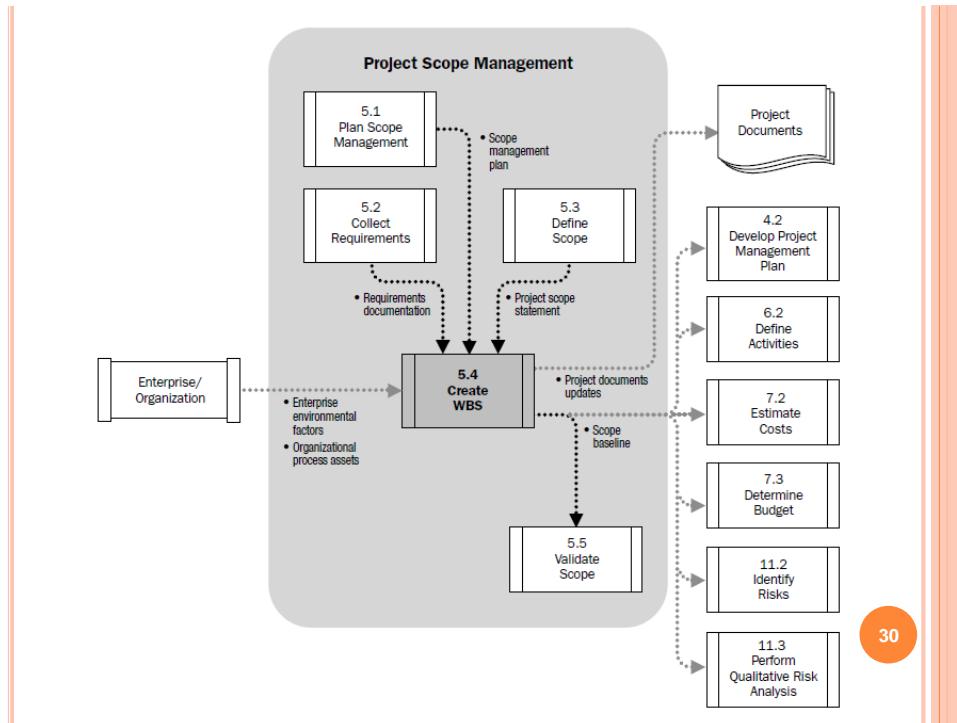
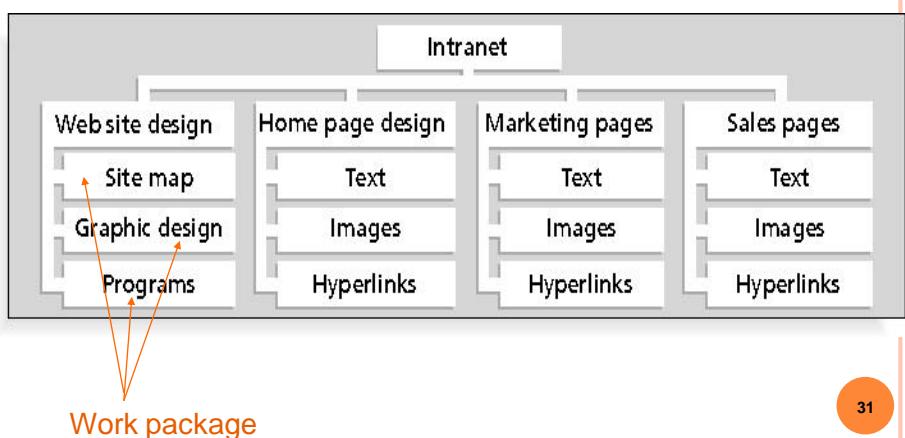


FIGURE 5-3. SAMPLE INTRANET WBS
ORGANIZED BY PRODUCT



FACILITATING COST AND TIME ESTIMATIONS

Purchase – take 1 week for delivery, \$500 Make – take 4 days, \$100



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FIGURE 5-4. SAMPLE INTRANET WBS ORGANIZED BY PHASE

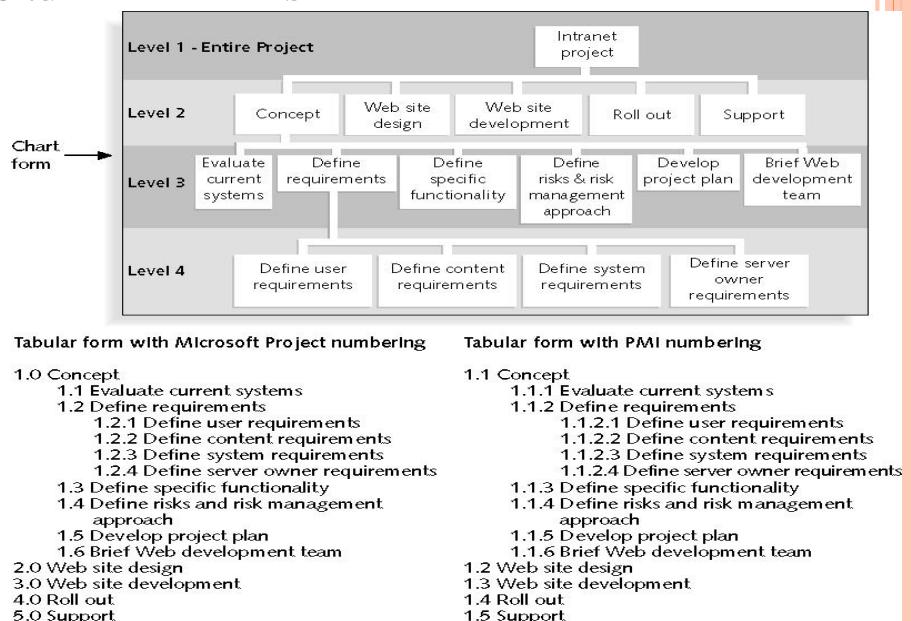


FIGURE 5-5. INTRANET WBS AND GANTT CHART IN MICROSOFT PROJECT

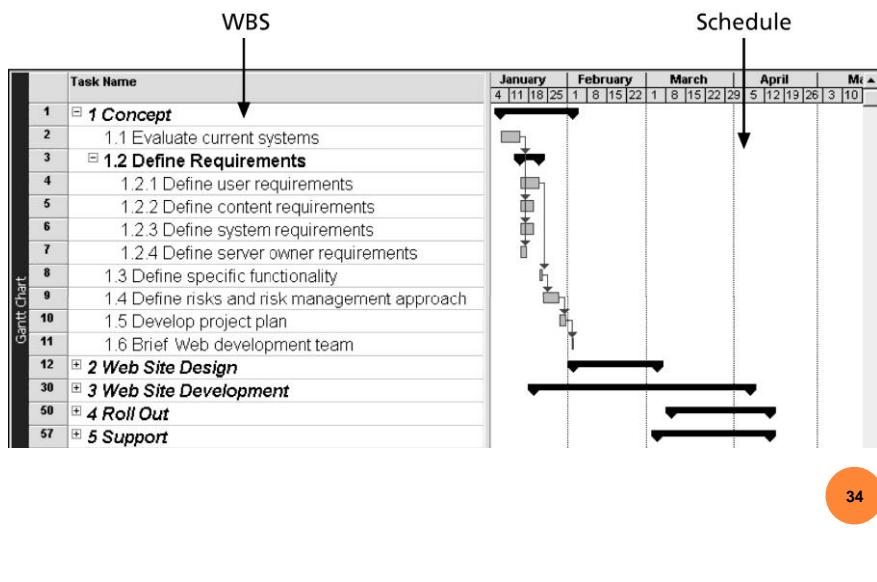
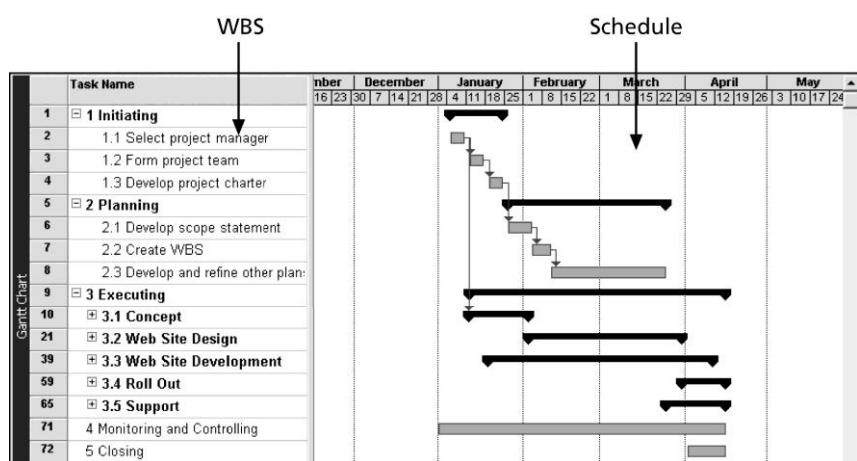
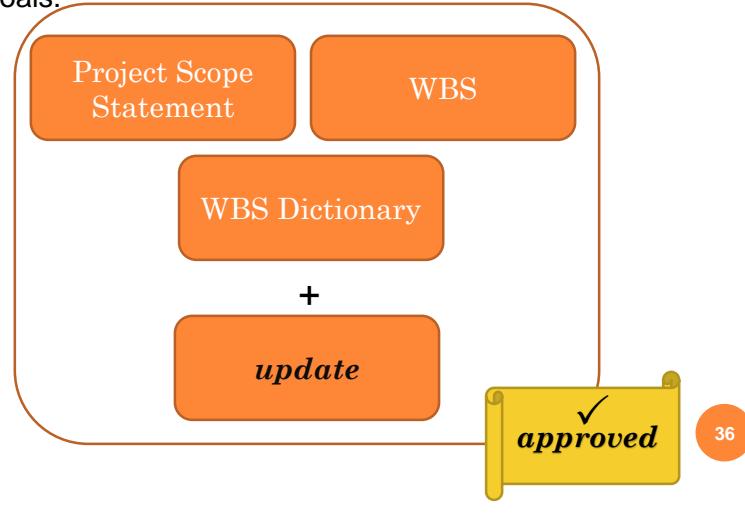


FIGURE 5-6. INTRANET GANTT CHART ORGANIZED BY PROJECT MANAGEMENT PROCESS GROUPS



SCOPE BASELINE

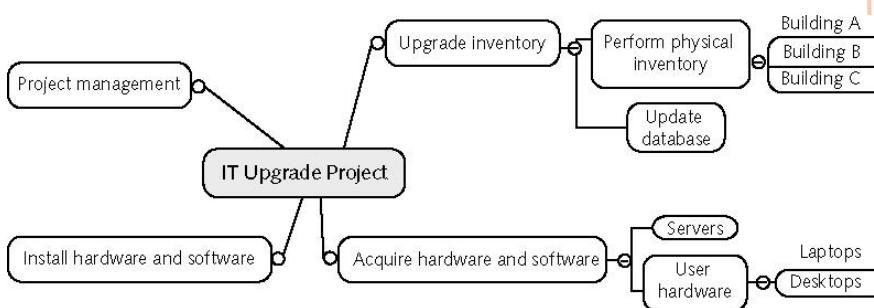
The approved **project scope statement** and its **WBS** and **WBS dictionary** form the **scope baseline** (update version), which is used to measure performance in meeting project scope goals.



APPROACHES TO DEVELOPING WBSS

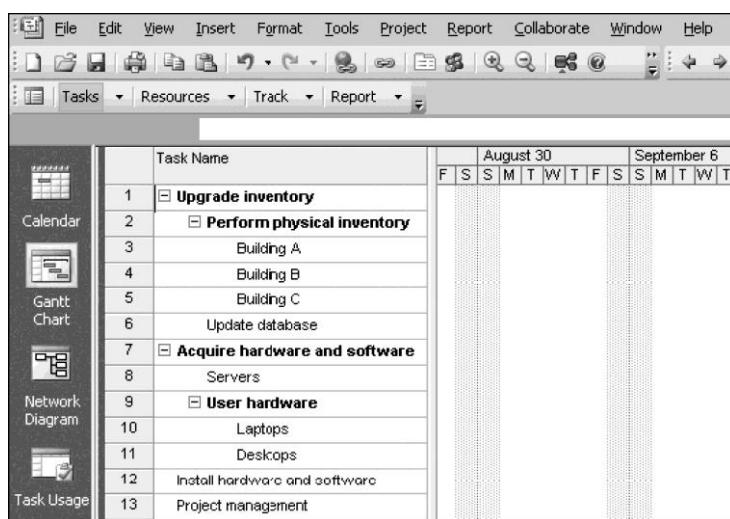
- The **analogy approach**: review WBSSs of similar projects and tailor to your project
- The **top-down approach**: start with the largest items of the project and break them down
- The **bottom-up approach**: start with the specific tasks and roll them up
- Mind-mapping approach: **mind mapping** is a technique that uses branches radiating out from a core idea to structure thoughts and ideas

FIGURE 5-7. SAMPLE MIND-MAPPING APPROACH FOR CREATING A WBS



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FIGURE 5-8. PROJECT 2007 FILE WITH WBS GENERATED FROM A MIND MAP



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THE WBS DICTIONARY

- Many WBS tasks are vague and must be explained more so people know what to do and can estimate how long it will take and what it will cost to do the work
- A **WBS dictionary** is a document that describes detailed information about each WBS item

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WBS DICTIONARY ATTRIBUTES

- Description of work
- Responsible person
- Assumptions and constraints
- Deliverables (*what the work produces?*)
- Quality requirements
- Acceptance criteria
- Resources required
- Cost estimates
- WBS dependencies
- etc.

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ADVICE FOR CREATING A WBS AND WBS DICTIONARY

- A unit of work should appear at only one place in the WBS
- The work content of a WBS item is the sum of the WBS items below it
- A WBS item is the responsibility of only one individual, even though many people may be working on it
- The WBS must be consistent with the way in which work is actually going to be performed

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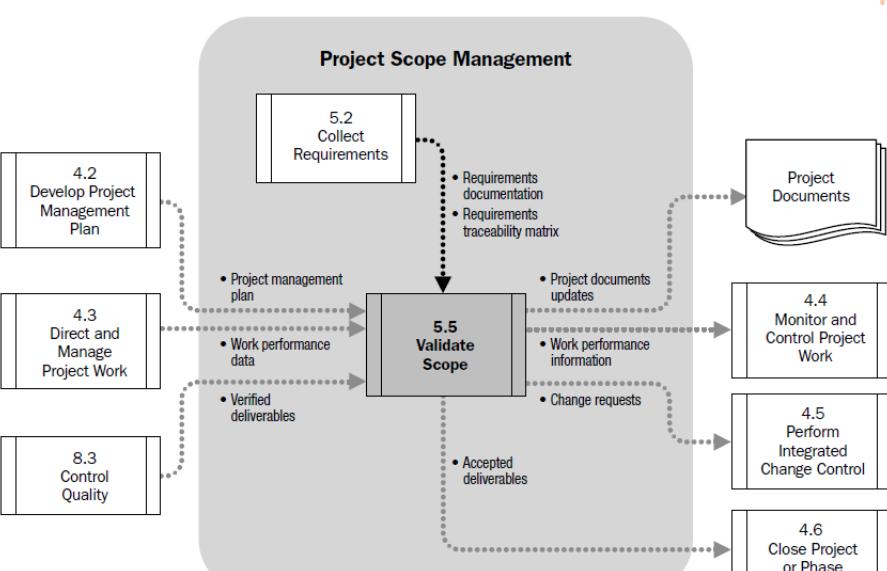
ADVICE FOR CREATING A WBS AND WBS DICTIONARY (CONT.)

- Project team members should be involved in developing the WBS to ensure consistency and buy-in
- Each WBS item must be documented in a WBS dictionary to ensure accurate understanding of the scope of work included and not included in that item
- The WBS must be a flexible tool to accommodate inevitable changes while properly maintaining control of the work content in the project according to the scope statement

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5.5 VALIDATE SCOPE

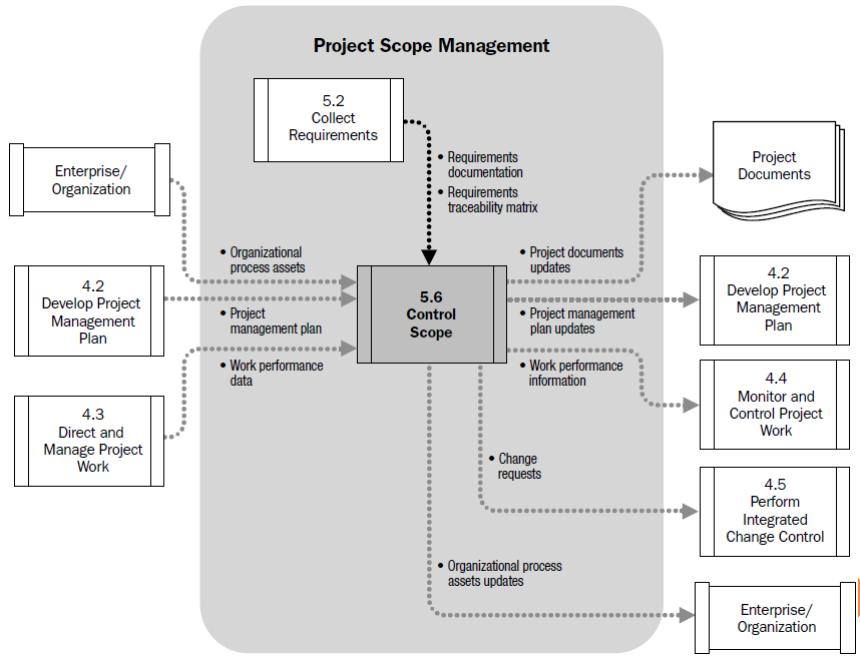
- **Scope validation** involves formal acceptance of the completed project scope by the stakeholders
- Acceptance is often achieved by a customer inspection and then sign-off on key deliverables



5.6 CONTROL SCOPE

- Scope control involves controlling changes to the project scope
- Goals of scope control are to:
 - Identify the factors that cause scope changes
 - Assure changes are processed according to procedures developed as part of integrated change control
 - Manage changes when they occur (able to identify, control and think of a way to make change.)
 - Maintain the project scope baseline (avoid **Scope creep**)

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CHAPTER SUMMARY

- Project scope management includes the processes required to ensure that the project addresses all the work required, and only the work required, to complete the project successfully
- Main processes include:
 - Collect requirements
 - Define scope
 - Create WBS
 - Validate scope
 - Control scope

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Chapter 5: Project Schedule Management

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Note: See the text itself for full citations.

Project Time Management Processes

- **Plan Schedule Management**

Plan the workflow and guideline of executing the Project Schedule Management

- **Define activities**

Details down the works

- **Sequence activities**

Identifies their dependencies

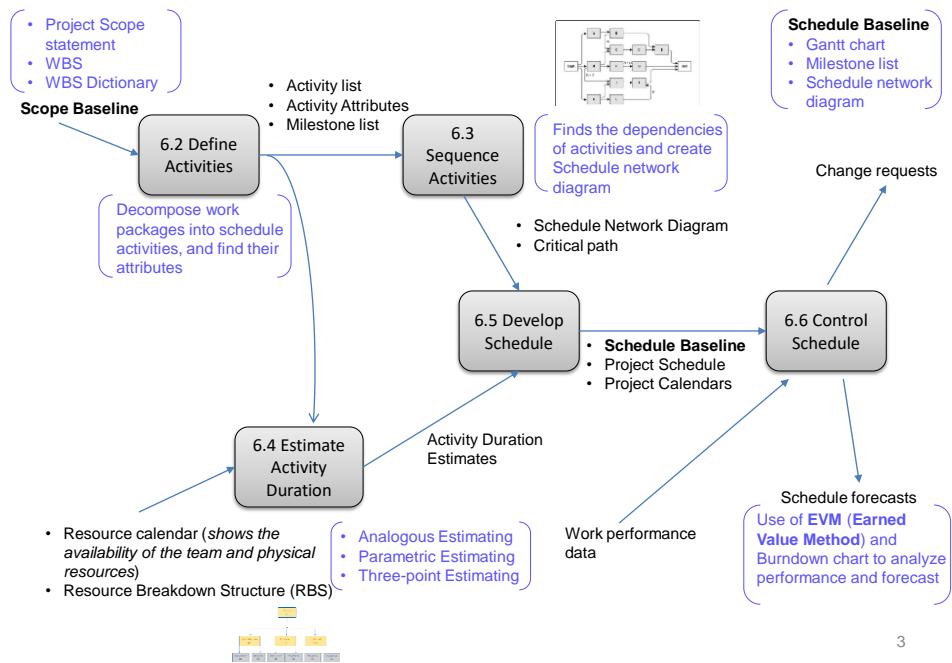
- **Estimate activity durations**

- **Develop the schedule**

Produces the essential output – **Schedule Baseline**

- **Control the schedule**

Makes sure the works go as scheduled



3

6.2 Define Activities

- An **activity** or **task** is an element of work normally found on the work breakdown structure (WBS) that has an expected duration, a cost, and resource requirements
- Things to do:
 - Developing a more detailed WBS
 - Supporting explanations to understand all the work to be done so you can develop realistic cost and duration estimates

4

Activity Lists and Attributes

- An **Activity list** is a tabulation of activities to be included on a project schedule that includes:
 - The activity name
 - An activity identifier or number
 - A brief description of the activity
- **Activity attributes** provide more information such as:
 - who is responsible
 - Where: the place where the work has to be performed
 - When: time constraints,
 - Dependency: predecessors, successors
 - Resource and skill requirements
 - Assumptions and constraints related to the activity

5

Done in 6.3 Sequence activities
Example of Activity List

Activity	Description	duration	predecessor
A	Elicit user requirements	3	
B	Write requirement specification	14	A
C	Requirement validation	2	B
D	High level architectural design	5	C
E	Database design	3	D
F	Interface design	3	C
G	Module design	10	C
H.1	Coding (Module A, B, C) + Unit testing	20	E, F, G
H.2	Coding (Modules D,E) + Unit testing	14	E, F, G
H.3	Coding (Modules F) + Unit testing	8	H.1, H.2
I	Integration	5	H.3
J	Test case design	3	C
K	User Acceptance Test (UAT)	3	I, J
L	Installation & training	10	K

Done in 6.4 Estimate Activity durations

6

Example of Activity Attributes

E	Database design
Activity ID:	0032
WBS No:	3.2.5
Activity Description:	This activity involves the design of the database for the online shop mobile app.
Location:	All work associated with this activity will take place at the company.
Responsible by:	John Chan
Resources and Skill sets required:	This activity requires the sophisticated database design knowledge with MySQL experience; this workload requires 2 people.
Predecessors:	High level architectural design
Successors:	Coding (Module A, B, C) + Unit testing, Coding (Module D, E) + Unit testing
Assumption:	There will be 2 computers dedicated for this task and each of them will be installed with MySQL version xxx.xx and ...
Constraints:	This activity must be finished with full verification by Nov. 5 at latest;

7

Milestones

- A **milestone** is a significant event that normally has no duration (it is just a point in time.)
- It often takes several activities and a lot of work to complete a milestone
- They're useful tools for setting schedule goals and monitoring progress
- Sometimes, it is required by contract, i.e. intermediate report, certain functions
- Examples include obtaining customer sign-off on key documents or completion of specific products

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Milestones

Activity	Description	Milestone (event completed)
A	Elicit user requirements	
B	Write requirement specification	
C	Requirement validation	Requirement specification
D	High level architectural design	
E	Database design	
F	Interface design	
G	Module design	Completion of design
H.1	Coding (Module A, B, C) + Unit testing	Intermediate delivery 1
H.2	Coding (Modules D,E) + Unit testing	
H.3	Coding (Modules F) + Unit testing	
I	Integration	Program release
J	Test case design	
K	User Acceptance Test (UAT)	UAT passed
L	Installation & training	Program delivery, O&M documentation

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6.3 Sequence Activities

- Involves reviewing activities and determining dependencies
- A **dependency or relationship** is the sequencing of project activities or tasks
- You *must* determine dependencies in order to use **Critical Path Analysis**

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Three types of Dependencies

- **Mandatory dependencies (Internal dependencies)**
 - inherent in the nature of the work being performed on a project, sometimes referred to as hard logic.
 - i.e. coding → testing
- **Discretionary dependencies**
 - defined by the project team; sometimes referred to as soft logic and should be used with care since they may limit later scheduling options
- **External dependencies**
 - involve relationships between project and non-project activities
 - i.e. delivery of a computer (vendor) → coding

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Example of dependencies

Considering 2 activities A and B.

- If B has a Mandatory Dependency on A then it means action B cannot be performed until Action A has been completed.
 - A – Coding; B – Testing
 - A – Build car prototype; B – Perform crash testing
- If B has a Discretionary Dependency on A, then it means action B can be performed even before Action A has been completed for some reasons (better use of resources).
 - A – Book airline ticket; B – Buy insurance
 - A – paint the wall of dining room; B – paint the wall of bedroom

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Example of dependencies (cont.)

- B has an External Dependency on A. It means B is a project activity while A is a non-project activity.
 - A – Delivery of computer equipment;
B – Coding
 - A – Delivery of raw materials;
B – Build the product
 - A – Licensed by government;
B – Sell the slot machines to casinos

Since you have less control over them, you need to pay close attention to when they can get things done and do not delay your project.

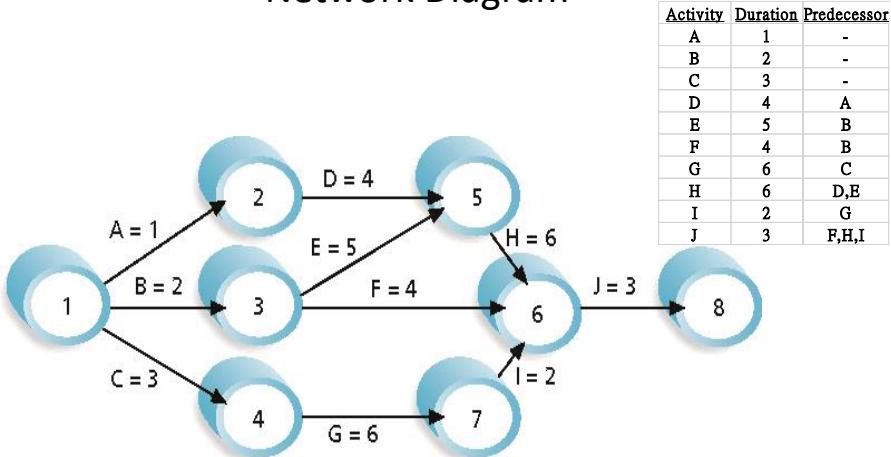
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Network Diagrams

- A **network diagram** is a schematic display of the logical relationships among, or sequencing of, project activities
- *Two main formats:*
 - **Activity-on-Arrow diagramming method**
 - **Precedence Diagramming Method (PDM)**

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Figure 6-2. Sample Activity-on-Arrow (AOA) Network Diagram



Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

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Arrow Diagramming Method (ADM)

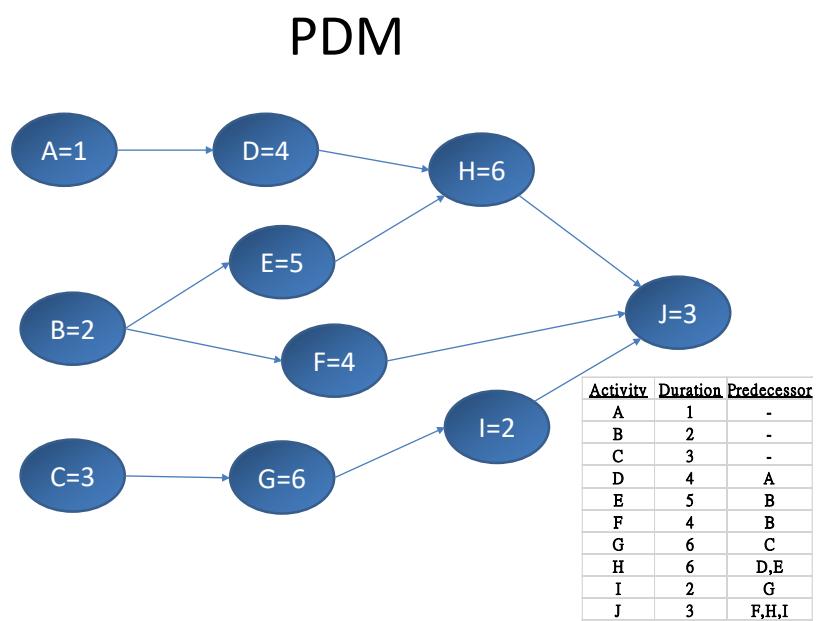
- Also called **activity-on-arrow (AOA)** network diagrams
- Activities are represented by arrows
- Nodes or circles are the starting and ending points of activities
- Can only show *finish-to-start* dependencies

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Precedence Diagramming Method (PDM)

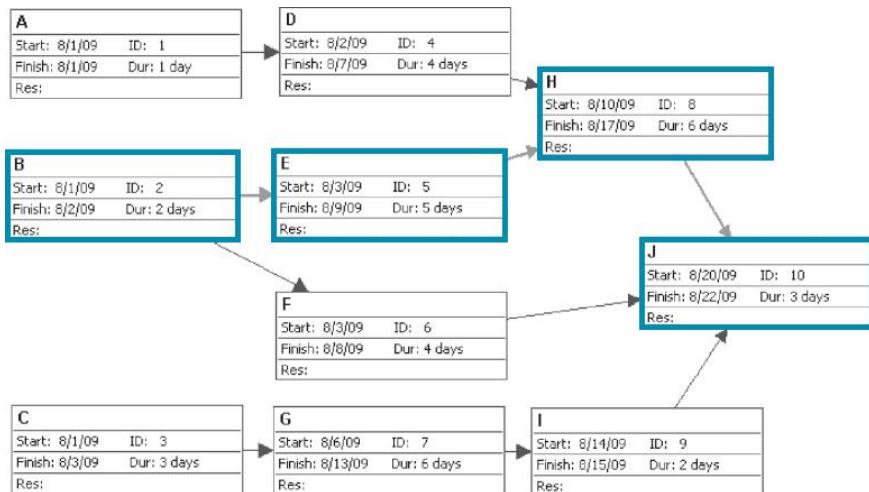
- Activities are represented by boxes
- Arrows show relationships between activities
- More popular than ADM method and used by project management software
- Better at showing different types of dependencies

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Figure 6-4. Sample PDM Network Diagram



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Task Dependency Types

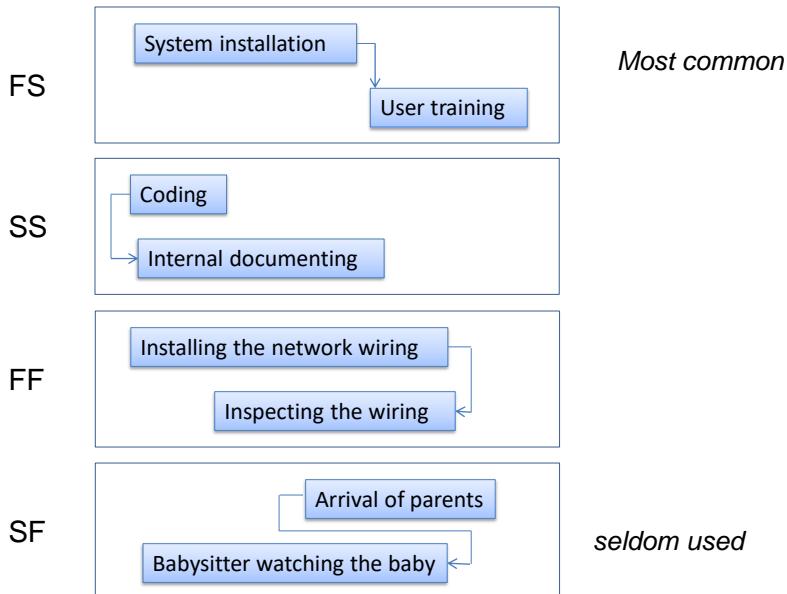
Task dependencies

The nature of the dependencies between linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project:

Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A) starts.

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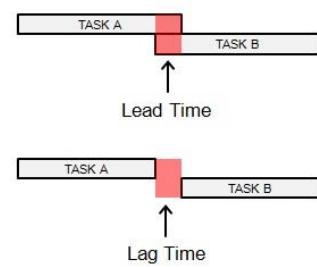
Examples of dependency types



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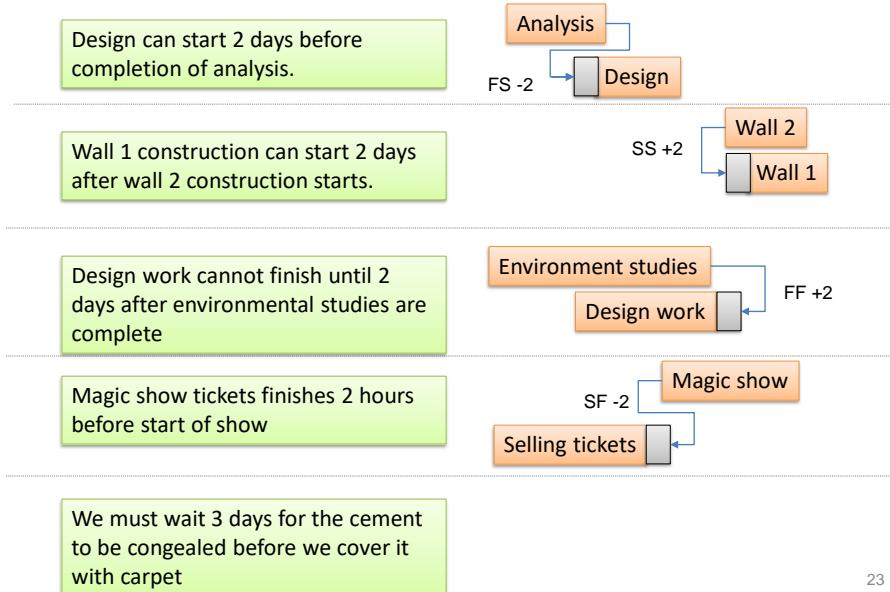
Lead and Lag

- **Lead**
 - The period of time that a task starts before the predecessor finishes.
 - Ex.
 - FS-5D (starts 5 days before the predecessor finishes)
 - The coding starts 5 days before the module design is completed
- **Lag**
 - The period of time that a task starts after a predecessor finishes.
 - Ex.
 - FS+3D (starts 3 days after the predecessor finishes)
 - The UAT test will start 3 days after the completion of the test plan design



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Examples



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6.5 Estimate Activity Duration

- **Duration** includes the actual amount of time worked on an activity *plus* elapsed time
- **Effort** is the number of workdays or work hours required to complete a task
- **Effort** does not normally equal to **Duration**
- People doing the work should help create estimates, and an expert should review them

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Duration Estimations

- Tools and Techniques used in “Estimate Activity Durations”
 - **Analogous Estimating**
 - based on historical data from a similar activity
 - Easier, but less accurate
 - **Parametric Estimating**
 - Based on statistical relationship between historical data and other variables (e.g., square footage in construction, meter/hour)
 - e.g. if the assigned resource is capable of installing 25 meters of cable/hour, the duration required to install 1,000 meters is 40 hours.
 - **Three-point Estimating**
 - **PERT** (Program Evaluation & Review Technique) uses three-point estimates to define an approximate range for an activity's duration: **Most likely, Optimistic and Pessimistic**
- These techniques can also be applied to cost estimations.

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Program Evaluation and Review Technique (PERT)

- **PERT** is an analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates
- PERT uses **probabilistic time estimates**
 - Duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations, or a three-point estimate

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PERT Weighted Average and Example

- **PERT weighted average =**
$$\frac{\text{optimistic time} + 4 \times \text{most likely time} + \text{pessimistic time}}{6}$$

- *Example:*

By the estimation, we find out:

- optimistic time = 8 days
- most likely time = 10 days
- pessimistic time = 24 days

PERT weighted average =

$$\frac{8 \text{ workdays} + 4 \times 10 \text{ workdays} + 24 \text{ workdays}}{6} = \mathbf{12 \text{ days}}$$

Therefore, you'd use **12 days** on the network diagram instead of 10 when using PERT for the above example

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6.6 Develop Schedule

- Uses results of the other time management processes to determine the start and end date of the project
- Ultimate goal is to create a realistic **Project schedule** that provides a basis for monitoring project progress for the time dimension of the project
- Important tools and techniques include **Gantt charts**, **critical path analysis** and **PERT analysis**

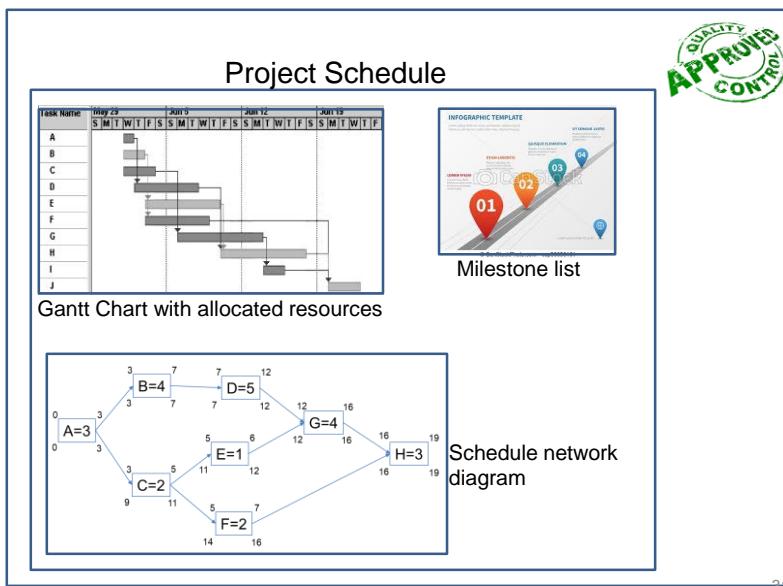
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Outputs of “Develop Schedule”

- **Project Schedule** – an output of a schedule model that presents linked activities with planned dates, durations, milestones and resources. (GANTT Chart)
- **Schedule Baseline** – the final approved version of the Project Schedule.
- **Project Calendars** – identifies working days and shifts that are available for scheduled activities. (with the consideration of holidays, shift time of workers etc.)

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Schedule Baseline



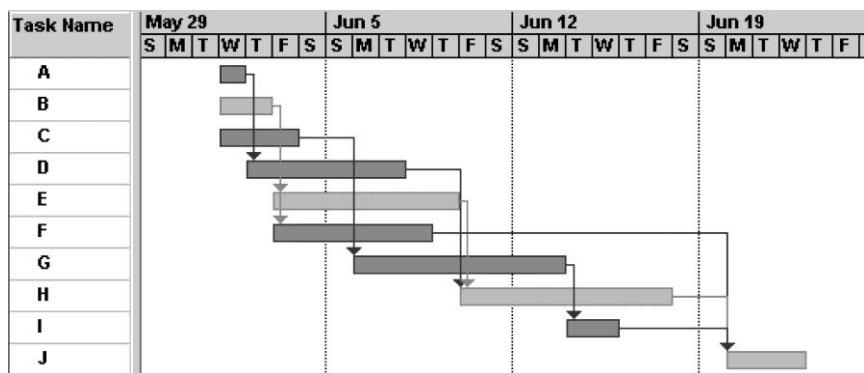
34

Gantt Charts

- **Gantt charts** provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format
- Symbols include:
 - **Black diamonds**: milestones
 - **Thick black bars**: summary tasks
 - **Lighter horizontal bars**: durations of tasks
 - **Arrows**: dependencies between tasks

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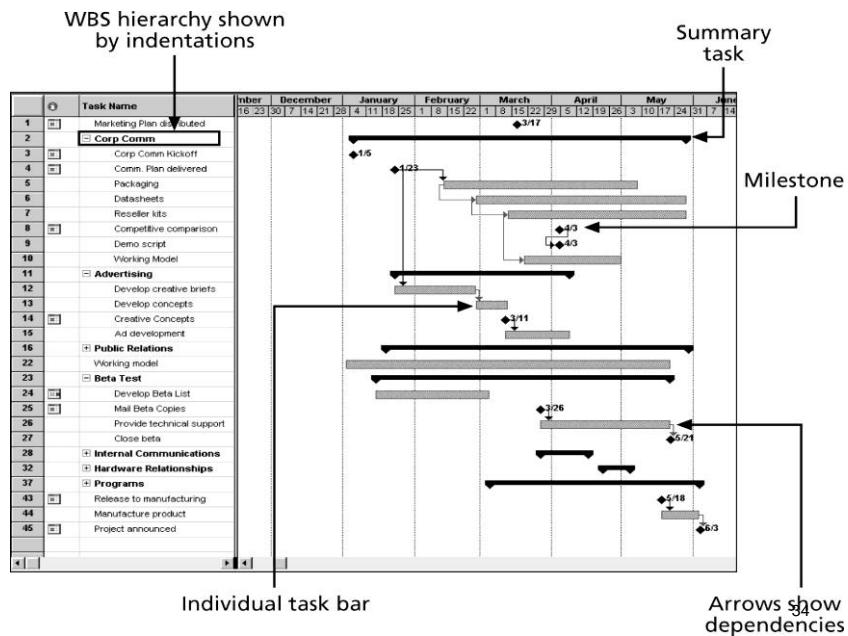
Figure 6-5. Gantt Chart for Project X



Note: Darker bars would be red in Project 2007 to represent critical tasks.

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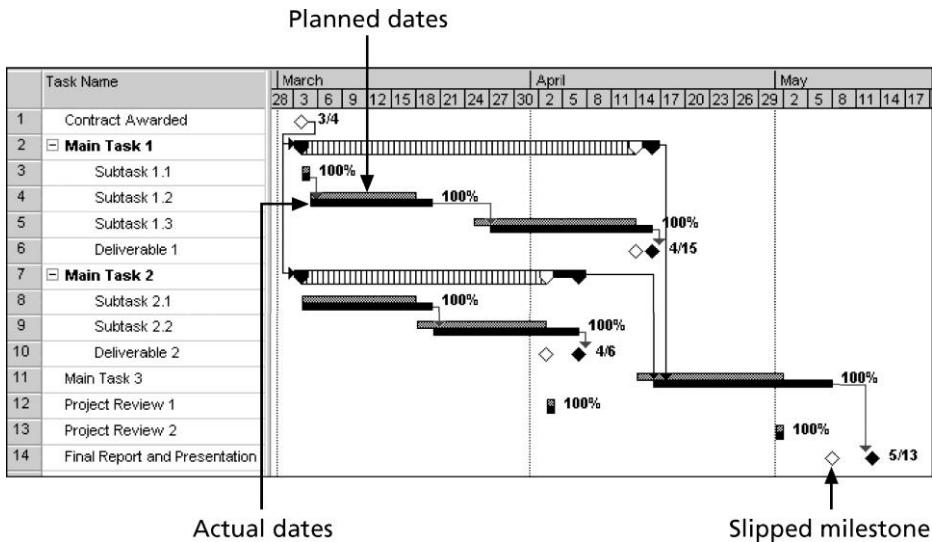
Figure 6-6. Gantt Chart for Software Launch Project



Adding Milestones to Gantt Charts

- Many people (esp. sponsor & developers) tend to focus on meeting milestones, especially for large projects
- Milestones emphasize important events or accomplishments on projects
- Normally create milestone by entering tasks with a zero duration, or you can mark any task as a milestone

Figure 6-7. Sample Tracking Gantt Chart



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Critical Path Method (CPM)

- **CPM** is a network diagramming technique used to predict total project duration.
- A **critical path** for a project is the series of activities that determines the *earliest time* by which the project can be completed.

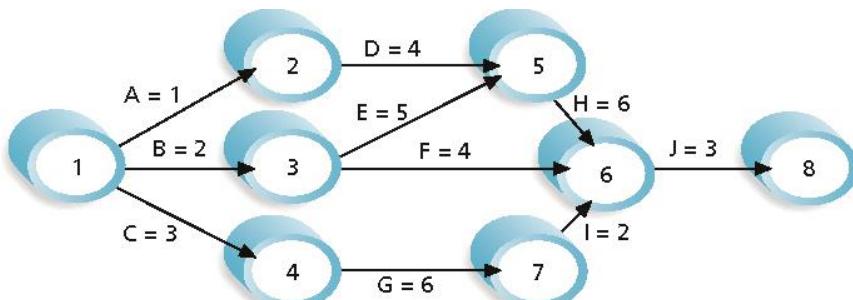
37

Calculating the Critical Path

- First develop a network diagram.
- Add the duration estimates for all activities on each path through the network diagram.
- Figure out all the paths.
- The longest path is the critical path.
- If one or more of the activities on the critical path takes longer than planned, the whole project schedule will slip *unless* the project manager takes corrective action.

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Figure 6-8. Determining the Critical Path for a Project



Note: Assume all durations are in days.

Path 1: A-D-H-J Length = $1+4+6+3 = 14$ days
Path 2: B-E-H-J Length = $2+5+6+3 = 16$ days
Path 3: B-F-J Length = $2+4+3 = 9$ days
Path 4: C-G-I-J Length = $3+6+2+3 = 14$ days

Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

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More on the Critical Path

- The critical path is *not* the one with all the critical activities; it only accounts for time.
- There can be more than one critical path if the lengths of two or more paths are the same.
- The critical path can change as the project progresses

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Slack – Schedule Flexibility

- **Slack** or **float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date.
 - **Free slack** or **free float** is the amount of time an activity can be delayed without delaying the early start of any immediately following activities (successor).
 - **Total slack** or **total float** is the amount of time an activity may be delayed from its early start without delaying the planned project finish date.

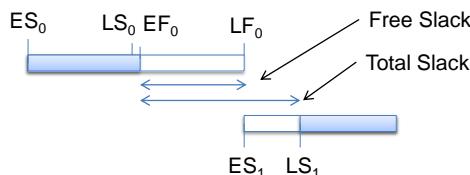
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Calculation of Free Slack and Total Slack

- $$\begin{aligned}\text{Free Slack} &= ES_1 - ES_0 - \text{Duration}_0 \\ &= ES_1 - EF_0\end{aligned}$$

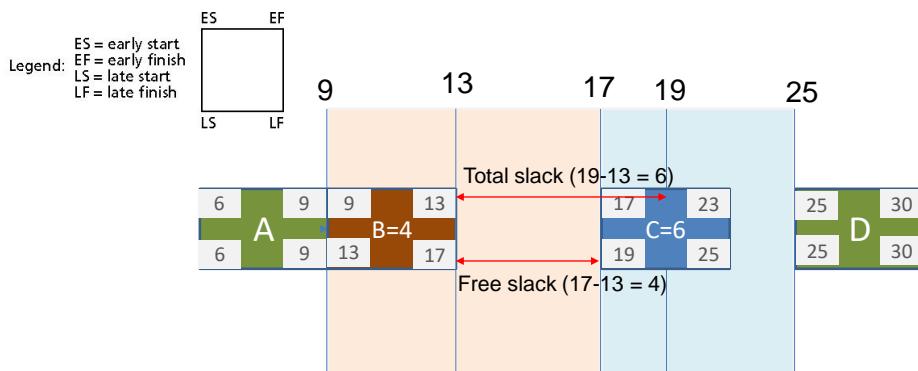
0 – current
1 – successor

- $$\begin{aligned}\text{Total Slack} &= LS_1 - ES_0 - \text{Duration}_0 \\ &= LS_1 - EF_0\end{aligned}$$



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Free Slack and Total Slack



With Free slack, B has 8 days to work on it.
With Total slack, B has 10 days to work on it.

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Determining the ES,EF,LS,LF

- A **forward pass** through the network diagram determines the **early start (ES)** and **early finish (EF)** dates
- A **backward pass** determines the **late start (LS)** and **late finish (LF)** dates

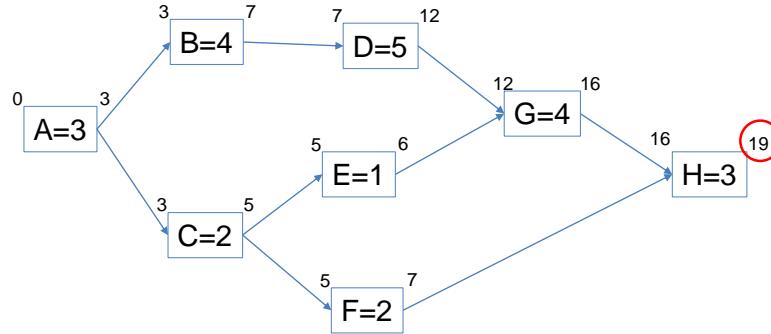
45

Demo of forward pass and backward pass

Activity	Predecessor	Duration
A	-	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D,E	4
H	F,G	3

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Forward pass – finding the ES, EF

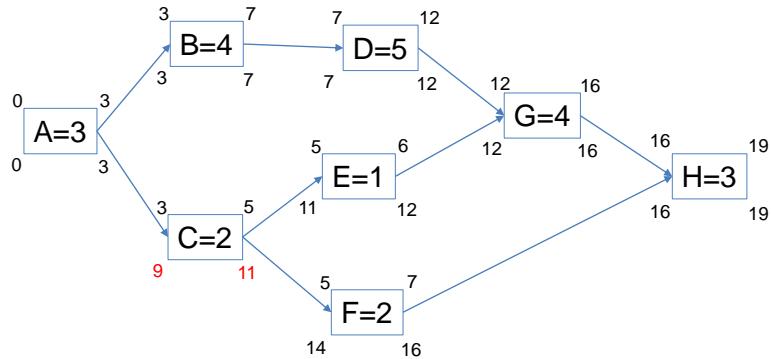


* Without considering Leads and Lags.

It takes 19 days to finish the project.

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Backward pass – finding the LS, LF



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When you find that your schedule is lagging behind or your boss push you to deliver your product much earlier.

What should you do?

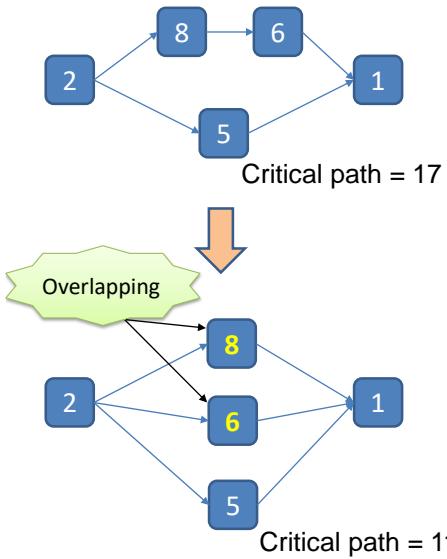
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Shortening (Compressing) a Project Schedule

- Two main techniques for shortening schedules:
 - **Fast tracking** activities by doing them in parallel or overlapping them (i.e. adding lead time)
 - **Crashing** activities by obtaining the greatest amount of schedule compression for the least incremental cost

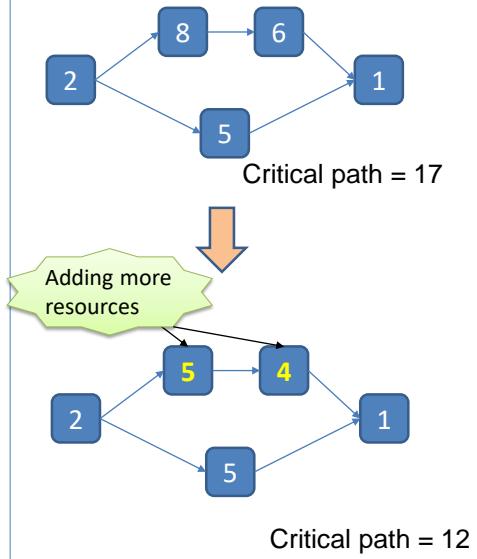
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Fast Tracking



Risk&Quality - Schedule trade-offs

Crashing



Cost - Schedule trade-offs

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Fast Tracking vs Crashing



Better coordination required
and Higher risk

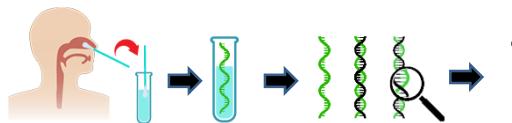
Better coordination required
and Higher cost

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Fast Tracking Example

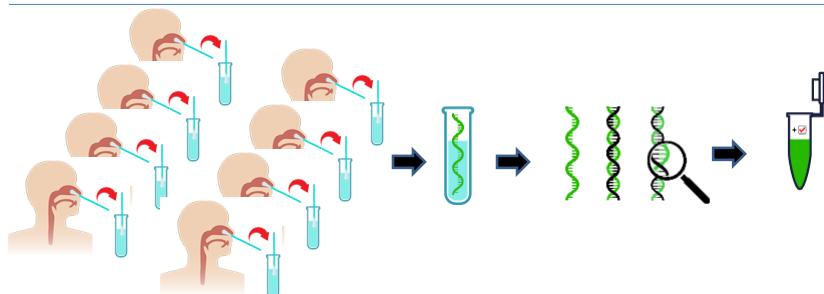
Comparison of COVID-19 Molecular Tests using Nasopharyngeal (NP) specimen collection and SalivaDirect collection

Molecular Tests (Nucleic Acid Detection)



1. Obtain Specimen:
NP swab 2. Extract RNA
from specimen
and convert to
DNA. 3. Amplify by PCR
with SARS-CoV-2
specific primers.

4. Interpret results:
presence of viral
RNA indicates
active SARS-CoV-2
infection.



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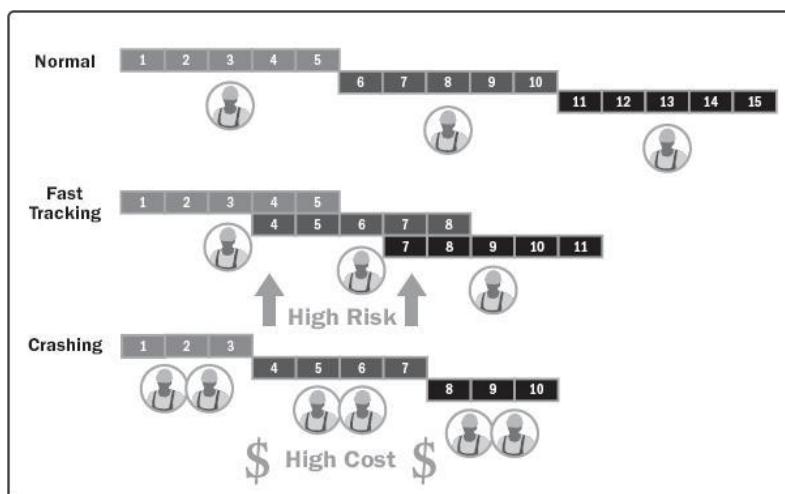


Figure 6-19. Schedule Compression Comparison

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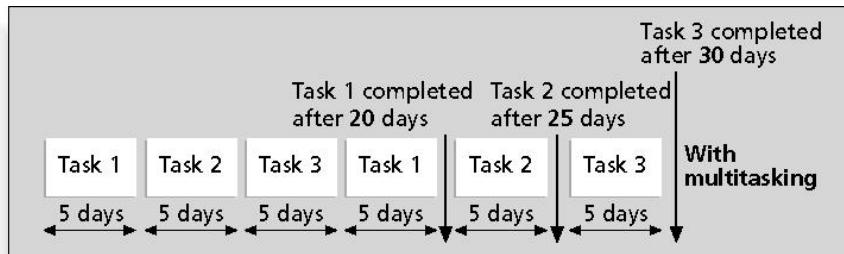
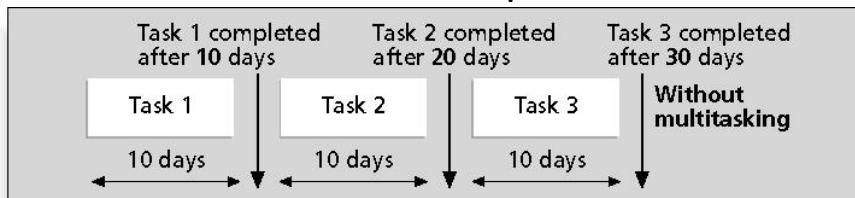
Phenomena pointed out by Goldratt

- **Parkinson Law** states that work expands to fill the time allowed
- **Self-Protection** – there is no incentive for early submission; but could be “punished” to shorten the time for next similar assigned tasks.
- **Student Syndrome** – student will procrastinate until the last moment to start doing the assigned tasks.
- **Gold-plating** – When tasks are done early, they may spend some time to beautify the works, which is unnecessary.
- **Multitasking** – minimizing multitasking since it can slow down the completion. We should concentrate one task at a time.

The management philosophy developed by Eliyahu M. Goldratt and introduced in his book “The Goal”.

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Figures 6-10a and 6-10b. Multitasking Example



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6.7 Control Schedule

- Goals are to know the status of the schedule, influence factors that cause schedule changes, determine that the schedule has changed, and manage changes when they occur
- Tools and techniques include:
 - Progress reports
 - A schedule change control system
 - Project management software, including schedule comparison charts like the tracking Gantt chart
 - Variance analysis, such as analyzing float or slack
 - Performance management, such as earned value (Chapter 7)

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Schedule Control Suggestions

- Perform reality checks on schedules
- Allow for contingencies
- Don't plan for everyone to work at 100% capacity all the time
- Hold progress meetings with stakeholders and be clear and honest in communicating schedule issues

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Chapter Summary

- Project time management is often cited as the main source of conflict on projects, and most IT projects exceed time estimates
- Main processes include:
 - Define activities
 - Sequence activities
 - Estimate activity resources
 - Estimate activity durations
 - Develop schedule
 - Control schedule

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CHAPTER 6: PROJECT COST MANAGEMENT

Information Technology Project Management, Sixth Edition



LEARNING OBJECTIVES

- Understand the importance of project cost management
- Explain basic project cost management principles, concepts, and terms
- Discuss different types of cost estimates and methods for preparing them

LEARNING OBJECTIVES (CONTINUED)

- Understand the processes involved in cost budgeting and preparing a cost estimate and budget for an information technology project
- Understand the benefits of earned value management and project portfolio management to assist in cost control
- Describe how project management software can assist in project cost management

THE IMPORTANCE OF PROJECT COST MANAGEMENT

- IT projects have a poor track record for meeting budget goals
- The CHAOS studies found the average cost **overrun** ranged from 180% in 1994 to 56% in 2004; other studies found overruns to be 33-34%

WHAT IS PROJECT COST MANAGEMENT?

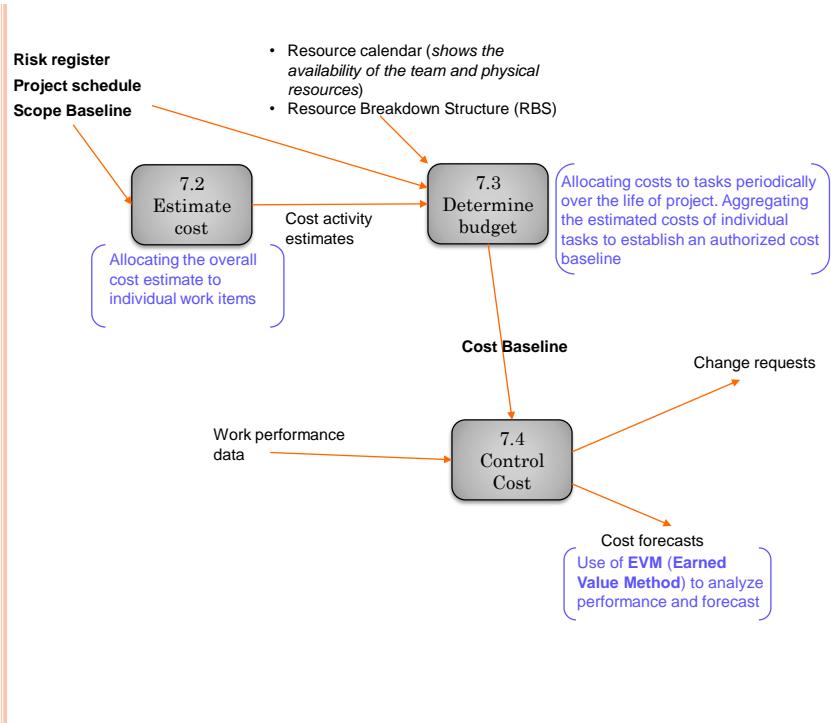
- **Project cost management** includes the processes involved in planning, estimating, budgeting, managing, and controlling costs so that the project can be completed within the approved budget.

5

PROJECT COST MANAGEMENT PROCESSES

- **7.1 Plan cost management :** establishing the policies, procedures and documentation for estimating, managing, expending, and controlling project costs
- **7.2 Estimating costs:** allocating the overall cost estimate to individual work items to establish a baseline for measuring performance (in Planning)
- **7.3 Determining the budget:** developing an approximation or estimate of the costs of the resources needed to complete a project (in Planning)
- **7.4 Controlling costs:** monitoring the status of the project to update project cost and managing changes to the cost baseline.

6



7.2 ESTIMATE COSTS

Estimate Costs involves developing an approximation of the monetary resources needed to complete project activity.

- Project managers must take cost estimates seriously if they want to complete projects within budget constraints
- It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates

COST ESTIMATION TOOLS AND TECHNIQUES

- Basic tools and techniques for cost estimates:
 - **Analogous estimates:** use the actual cost of a previous, similar project as the basis for estimating the cost of the current project
 - **Bottom-up estimates:** involve estimating individual work items or activities and summing them to get a project total
 - **Parametric modeling** uses project characteristics (parameters) in a mathematical model to estimate project costs
 - **Three-point Estimate**
 - Most likely, Optimistic, Pessimistic

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FIGURE 7-2. SURVEYOR PRO PROJECT COST ESTIMATE

	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 1 Totals	% of Total
WBS Items					
1. Project Management				\$306,300	20%
Project manager	960	\$100	\$96,000		
Project team members	1920	\$75	\$144,000		
Contractors (10% of software development and testing)			\$66,300		
2. Hardware				\$76,000	5%
2.1 Handheld devices	100	\$600	\$60,000		
2.2 Servers	4	\$4,000	\$16,000		
3. Software				\$614,000	40%
3.1 Licensed software	100	\$200	\$20,000		
3.2 Software development*			\$594,000		
4. Testing (10% of total hardware and software costs)			\$69,000	\$69,000	5%
5. Training and Support				\$202,400	13%
Trainee cost	100	\$500	\$50,000		
Travel cost	12	\$700	\$8,400		
Project team members	1920	\$75	\$144,000		
6. Reserves (20% of total estimate)			\$253,540	\$253,540	17%
Total project cost estimate				\$1,521,240	

* See software development estimate

Contingency reserve

20%

RESERVES

- **Reserves** are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
 - **Contingency reserves** allow for future situations that may be partially planned for (sometimes called **known unknowns**) and are included in the project cost baseline
 - **Management reserves** allow for future situations that are unpredictable (sometimes called **unknown unknowns**)
- When do you use them?
 - Identified risks vs Unidentified risks
- The project manager has authority over the contingency reserve. For management reserve they need management's permission.

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7.3 DETERMINE THE BUDGET

Determine Budget is the process of aggregating the estimated costs of individual tasks to establish an authorized cost baseline

- Cost budgeting involves allocating the project cost estimate to individual work items over time
- The WBS is a required input to the cost budgeting process since it defines the work items
- Important goal is to produce a **Cost Baseline**
 - A time-phased budget that project managers use to measure and monitor cost performance

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SURVEYOR PRO PROJECT COST BASELINE

(The project spans 12 months.)

Surveyor Pro Project Cost Baseline Created October 10*

WBS Items	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1. Project Management													96,000
1.1 Project manager	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	96,000
1.2 Project team members	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	144,000
1.3 Contractors	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	66,300
2. Hardware													
2.1 Handheld devices				30,000	30,000								60,000
2.2 Servers				8,000	8,000								16,000
3. Software													
3.1 Licensed software				10,000	10,000								20,000
3.2 Software development	60,000	60,000	80,000	127,000	127,000	90,000	50,000						594,000
4. Testing				6,000	8,000	12,000	15,000	15,000	13,000				69,000
5. Training and Support										50,000			50,000
5.1 Trainee cost										8,400			8,400
5.2 Travel cost													
5.3 Project team members							24,000	24,000	24,000	24,000	24,000	24,000	144,000
6. Reserves						10,000	10,000	30,000	30,000	60,000	40,000	40,000	253,540
Total	20,000	86,027	92,027	172,027	223,027	198,027	185,027	173,027	148,427	90,027	80,027	53,567	1,521,240

Contingency reserve

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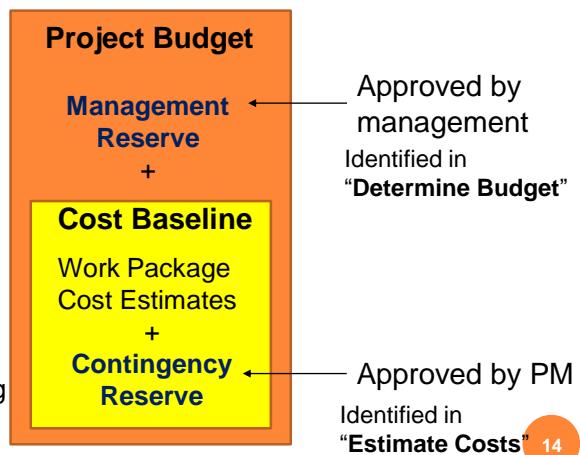
COMPOSITION OF PROJECT BUDGET

Unidentified risks (M.R.)

- Financial crisis
- Chief engineers get sick and are not able to complete the project
- Natural disaster
- Hackers attack and lock up files

Identified risks (C.R.)

- Cost overrun
- Catching up schedule by exercising Crashing
- Computer breakdown and need repair
- Inflation rate is a bit higher than expected



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7.4 CONTROL COSTS

Control costs is the process of monitoring the status of the project to update project cost and managing changes to the cost baseline.

- Project cost control includes:
 - Monitoring cost performance (*by adopting EVM*)
 - Ensuring that only appropriate project changes are included in a revised cost baseline
 - Informing project stakeholders of authorized changes to the project that will affect costs

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EARNED VALUE MANAGEMENT (EVM)

- **EVM** is a project performance measurement technique that integrates scope, time, and cost data
- Given a **baseline** (original plan plus approved changes), you can determine how well the project is meeting its goals
- You must enter actual information periodically to use EVM
- More and more organizations around the world are using EVM to help control project costs

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FUNCTIONS OF EVM

○ Performance Measurement

- EVM is a commonly used method of performance measurement
- Integrates project scope, cost and schedule measures to help the project management team assess and measure project performance and progress

○ Variance Analysis

- The variance between planned and actual performance

○ Forecasting

- Making estimate or predictions of conditions and events in the project's future based on information and knowledge available at the time of the forecast.

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EARNED VALUE MANAGEMENT TERMS

○ Planned Value (PV)

- also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period

○ Actual Cost (AC)

- the total of direct and indirect costs incurred in accomplishing work on an activity during a given period.

○ Earned Value (EV)

- an estimate of the value of the physical work actually completed, based on the original planned costs for the project.

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EARNED VALUE MANAGEMENT TERMS (CONT.)

○ Rate of Performance (RP)

- the ratio of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity
- *For example:* Suppose the server installation was halfway completed by the end of week 1: the rate of performance would be 50% because by the end of week 1, the planned schedule reflects that the task should be 100% complete and only 50% of that work has been completed.

○ Cost Variance (CV)

- the difference between the actual cost and the budgeted cost, so it is an indicator of whether a project cost is below or under budget.

○ Schedule Variance (SV)

- the difference between the actual value of work done and the budgeted cost, so it is an indicator of whether a project schedule is ahead or behind schedule.

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EARNED VALUE MANAGEMENT TERMS (CONT.)

○ Cost Performance Index (CPI)

- a ratio that measures the financial effectiveness of a project by dividing the budgeted cost of work performed by the actual cost of work performed.

○ Schedule Performance Index (SPI)

- a measure of how close the project is to being completed compared to the schedule.

○ Estimate At Completion (EAC)

- the estimated total amount of money needed to finish a project.

○ Budget At Completion (BAC)

- total planned budgeted cost

○ Estimated Time to Complete (ETC)

- Number of time unit required to complete a project

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EARNED VALUE FORMULAS

TERM	FORMULA
Earned Value	$EV = PV \text{ to date} \times RP$
Cost Variance	$CV = EV - AC$
Schedule Variance	$SV = EV - PV$
Cost Performance Index	$CPI = EV/AC$
Schedule Performance Index	$SPI = EV/PV$
Estimate at Completion (EAC)	$EAC = BAC/CPI$
Estimated Time to Complete	Original Time Estimate/SPI

Table 7-5.

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INDICATIONS FOR PROJECT PERFORMANCE

- Negative numbers for **Cost** and **Schedule variance** indicate over budget and behind schedule.
 - $CV > 0$ (Under budget); $CV < 0$ (Over budget)
 - $SV > 0$ (Ahead of schedule); $SV < 0$ (Behind schedule)
- CPI and SPI $< 100\%$ indicate the project is costing more than planned (over budget) or taking longer than planned (behind schedule)

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EXAMPLE:

- Based on the Cost Baseline developed earlier.

Month	Acc. Cost
1	20000
2	106000
3	198027
4	370054
5	593081
6	791108
7	976135
8	1149135
9	1297535
10	1387535
11	1467535
12	1521102

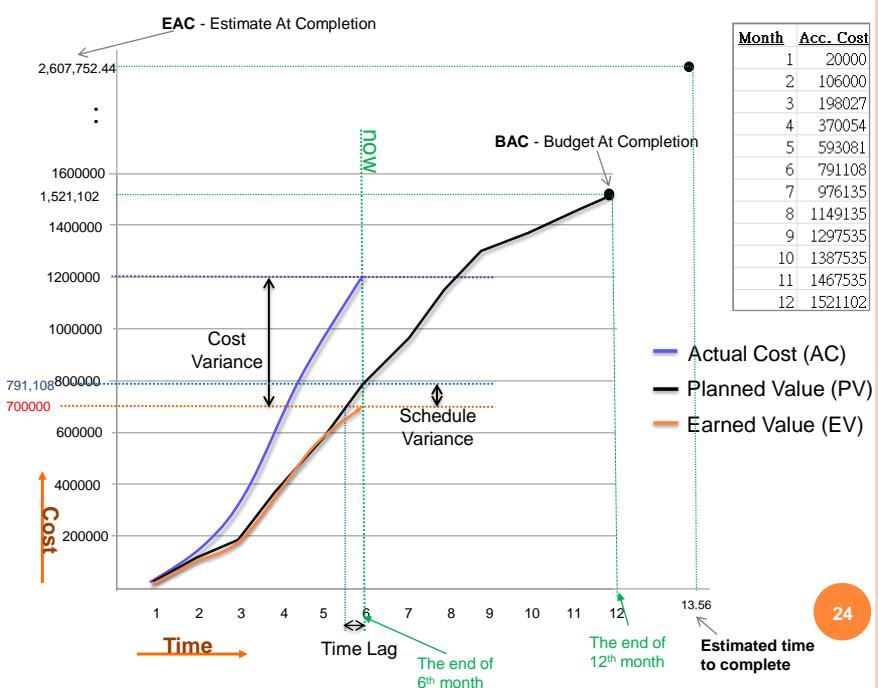
- At the end of 6th month, we have:

- Budget At Completion (BAC) = 1,521,102
- Planned Value (PV) = 791,108
- Actual Cost (AC) = 1,200,000
- Earned Value (EV) = 700,000

- Find out:

- CV, SV, CPI, SPI, EAC, RP ?
- When will be the estimated time to complete?
- How much will be the estimated cost to complete?

23



24

ANSWERS

- Cost Variance (CV) = EV – AC
= 700,000 – 1,200,000
= -500,000 ----- *negative over budget*
- Schedule Variance (SV) = EV – PV
= 700,000 – 791,108
= - 91,108 ----- *negative behind schedule*
- Cost Performance Index (CPI) = EV/AC
= 700,000 / 1,200,000
= 58.33%

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ANSWERS (CONT.)

- Schedule Performance Index (SPI) = EV/PV
= 700,000 / 791,108 = 88.48%
- Estimate At Completion (EAC) = BAC/CPI
= 1,521,102 / 58.33% = 2,607,752.44
- **Estimated time to complete** = time estimate / SPI
= 12 / 88.48% = 13.56 (month)
- Rate of Performance (RP) = EV/PV
= 700,000 / 791,108 = 88.48% ----- *same as SPI*

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CHAPTER SUMMARY

- Project cost management is a traditionally weak area of IT projects, and project managers must work to improve their ability to deliver projects within approved budgets
- Main processes include:
 - Estimate costs
 - Determine the budget
 - Control costs

Chapter 8:

Project Quality Management

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Learning Objectives

- Understand the importance of project quality management for information technology products and services
- Define project quality management and understand how quality relates to various aspects of information technology projects
- Describe quality planning and its relationship to project scope management
- Discuss the importance of quality assurance
- Explain the main outputs of the quality control process

Learning Objectives (continued)

- Understand the tools and techniques for quality control, such as the Seven Basic Tools of Quality, statistical sampling, Six Sigma, and testing
- Summarize the contributions of noteworthy quality experts to modern quality management
- Describe how leadership, the cost of quality, organizational influences, expectations, cultural differences, and maturity models relate to improving quality in information technology projects
- Discuss how software can assist in project quality management

3

What is Quality?

What is Quality?

It is about “how good it is”.

4

If GM goes like IT advancement, we should have cars as cheap as \$25, can run 1,000 miles with only a gallon of gasoline.

If GM development tech like Microsoft, we would be all driving a car with the following characteristics:

- *Such as breaking down twice a day for no reason whatsoever;*
- *Occasionally, the car will lock you out for no reason, and you need to re-start to run again.*



Responded by GM's CEO

5

What Is Project Quality?

- The International Organization for Standardization (ISO) defines **quality** in ISO9000:2000 as:

“The degree to which a set of inherent characteristics fulfils requirements”

- In PM, **Quality** is commonly defined based on:

- **Conformance to requirements**: the project's processes and products meet written specifications
- **Fitness for use**: a product can be used as it was intended

6

Inherent characteristics and functions or Fitness for use

- A product should be suitable for its intended purpose.

Examples:

- The car is for driving, transporting something
- The chair is for being seated
- The telephone is for voice communication (more now...)
- The lamp is for providing light

(These do not match with their intended purposes.)

- The pen is very sharp for drilling holes in wood
- The bus/truck has an instantaneous pickup speed.

7

Quality vs Grade



• Quality

- The degree to which a set of inherent characteristics fulfill requirements.
- A measure of conformance to requirements and fitness for use

• Grade

- A category assigned to deliverables having the same functional use but different technical characteristics

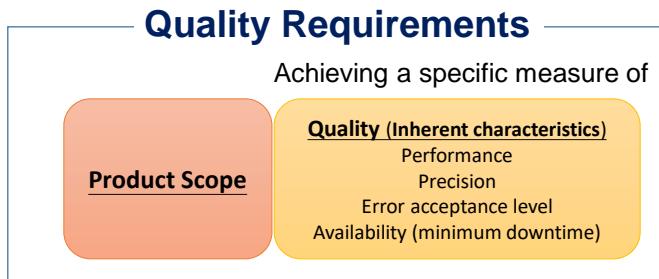
Low grade is acceptable to end users,
but Low quality is not.

High Quality - Low Grade: Ordinary car with good condition ✓

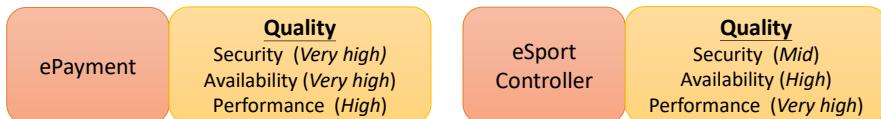
Low Quality - High Grade: High-performance sports car with X
engine problems

8

Quality, Scope and Requirement's Attributes



Let's compare the two systems...



What about ...?



Standards of quality

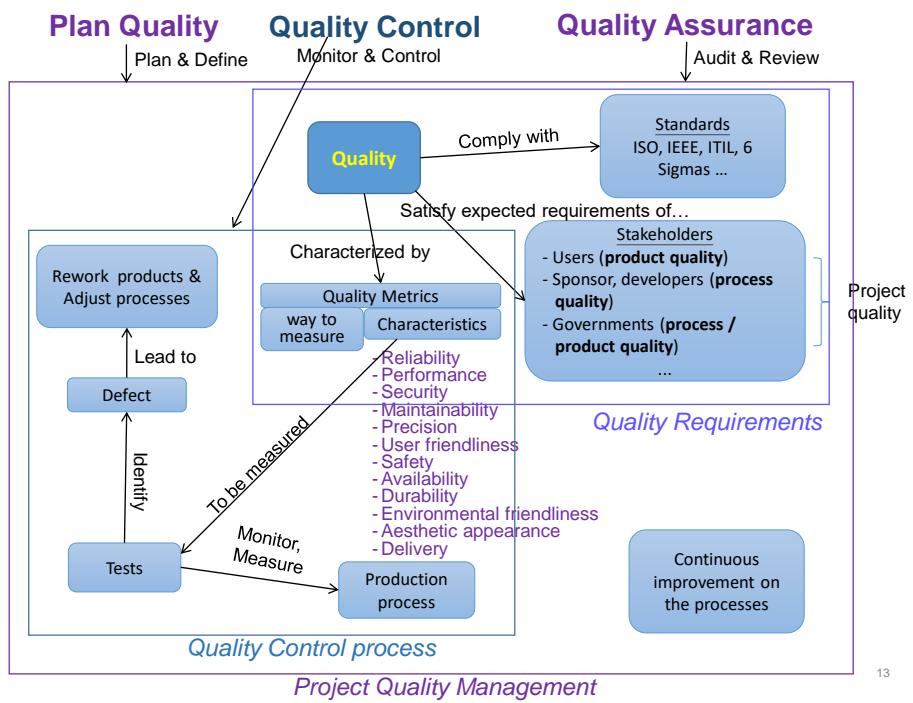
- Standard organizations and references can help project managers and their teams understand quality
 - **ISO 9000:2000** (International Organization for Standardization)
 - **IEEE** (Institute of Electrical and Electronics Engineers)
 - **CMMI** (Capability Maturity Model Integration)
 - **ITIL** (Information Technology Infrastructure Library)
 - **Six Sigma**
 - Greenhouse gas Emission control standards
 - etc.

11

What Is Project Quality Management?

- **Project quality management** ensures that the project will satisfy the needs for which it was undertaken
- Processes include:
 - **Planning quality**: identifying which quality standards are relevant to the project and how to satisfy them; a **metric** is a quantifiable standard of measurement
 - **Performing quality assurance**: periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
 - **Performing quality control**: monitoring specific project results to ensure that they comply with the relevant quality standards

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Planning Quality

Plan Quality is the process of identifying quality requirements and/or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with quality requirements.

- Set quality goal for the project
- Not just product process, but also project process
- Plan time and resources to do QC and QA

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Performing Quality Assurance

Quality Assurance (QA) is the process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used.

- It involves establishing specific processes
 - to assure the product to be able to meet the quality requirements
 - to audit the results from quality control and to adjust it as needed for continuous quality improvement

Quality Control

Control Quality (QC) involves the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes.

- The main outputs of quality control are:
 - **Acceptance decisions**
 - It determines if the products (or part of them) produced will be accepted or rejected.
 - **Rework**
 - It is action taken to bring rejected items into compliance with product requirements, or other stakeholder expectations.
 - **Process adjustments**
 - It correct or prevent further quality problems based on quality control measurements.
- There are Seven Basic Tools of Quality that help in performing quality control



- Focuses on defect prevention
 - Ensures process quality
 - Improves product quality by improving test process quality
 - To achieve, need a good quality management and auditing system
 - Audit QC info, establish standards, plan for improvement
- Focuses on defect inspection & correction
 - Ensures product quality
 - Improves product quality by testing on products
 - To achieve, find and eliminate product quality problems
 - Inspect, perform test

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Seven Basic Tools for the control processes

- **Cause-and-Effect Diagram (Fishbone Diagram)**
 - Identifying the causes
- **Flowchart**
 - Identifying failing process steps and process improvement opportunities
- **Scatter diagram**
 - Collecting data/documenting steps for defeat analysis
- **Histograms**
 - Sampling the frequency of failures for analysis
- **Pareto Chart**
 - Identifying critical issues in descending order of frequency
- **Control Chart**
 - Determining if a process is stable using statistical sampling
- **Run Chart**
 - Recording the controlled data

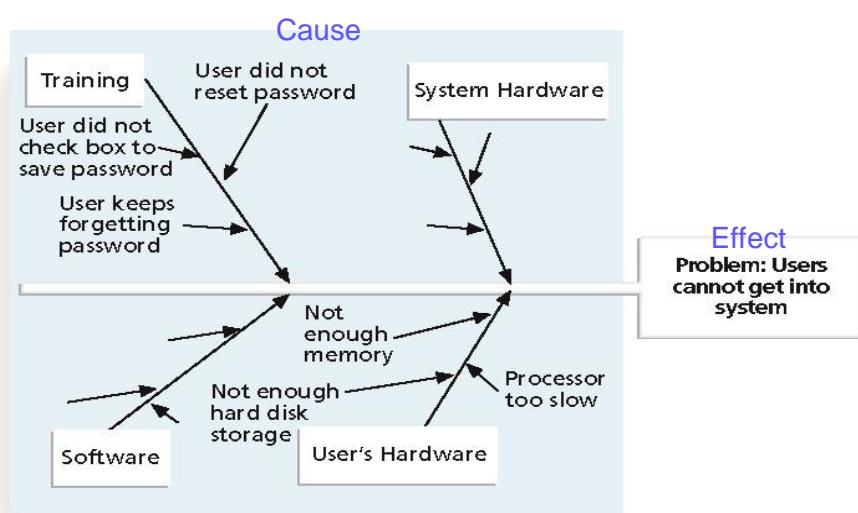
18

Cause-and-Effect Diagrams

- **Cause-and-effect diagrams** trace complaints about quality problems back to the responsible production operations
- They help you find the root cause of a problem
- Also known as **fishbone** or **Ishikawa diagrams**
- Can also use the **5 whys** technique where you repeatedly ask the question “Why” (five is a good rule of thumb) to peel away the layers of symptoms that can lead to the root cause

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Figure 8-2. Sample Cause-and-Effect Diagram



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Quality Control Charts

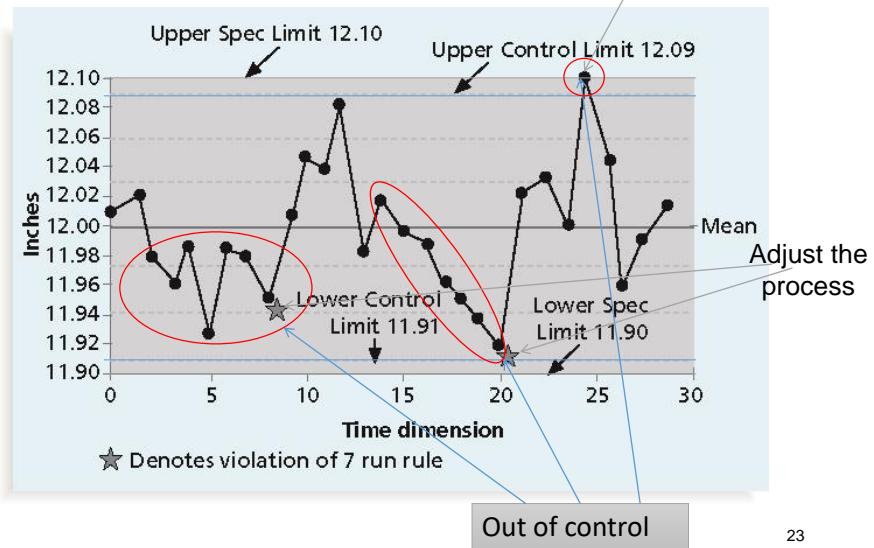
- A **control chart** is a graphic display of data that illustrates the results of a process over time
- The main use of control charts is to prevent defects, rather than to detect or reject them
- Quality control charts allow you to determine whether a process is in control or out of control
 - When a process is in control, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
 - When a process is out of control, variations in the results of the process are caused by non-random events; you need to identify the causes of those non-random events and adjust the process to correct or eliminate them

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The Seven Run Rule

- You can use quality control charts and the seven run rule to look for patterns in data
- The **seven run rule** states that if seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing, then the process needs to be examined for non-random problems

Figure 8-3. Sample Quality Control Chart



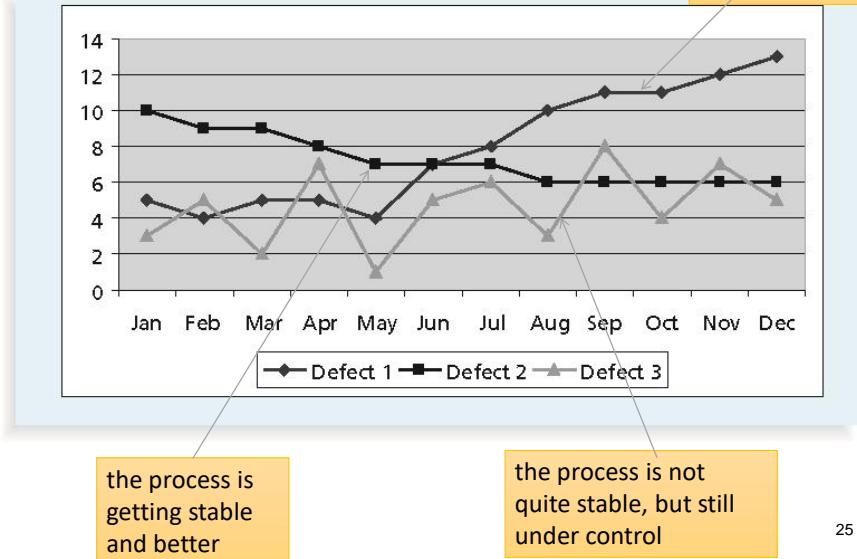
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Run Chart

- A run chart displays the history and pattern of variation of a process over time
- It is a line chart that shows data points plotted in the order in which they occur
- Can be used to perform trend analysis to forecast future outcomes based on historical patterns

Figure 8-4. Sample Run Chart

the trend of getting out of control



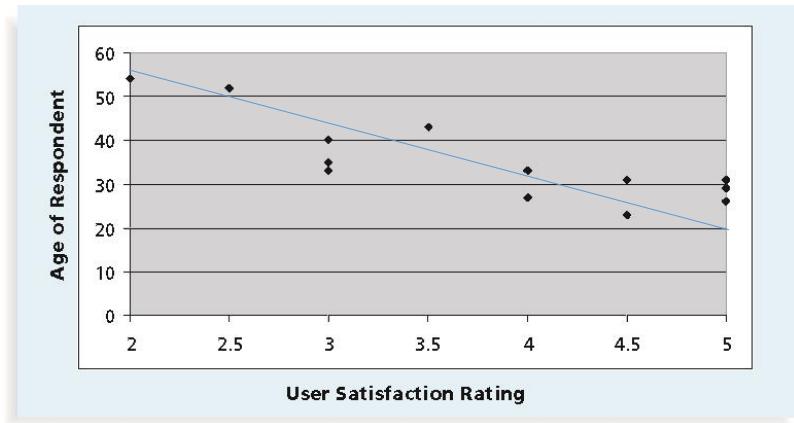
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Scatter Diagram

- A **scatter diagram** helps to show if there is a relationship between two variables
- The closer data points are to a diagonal line, the more closely the two variables are related

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Figure 8-5. Sample Scatter Diagram



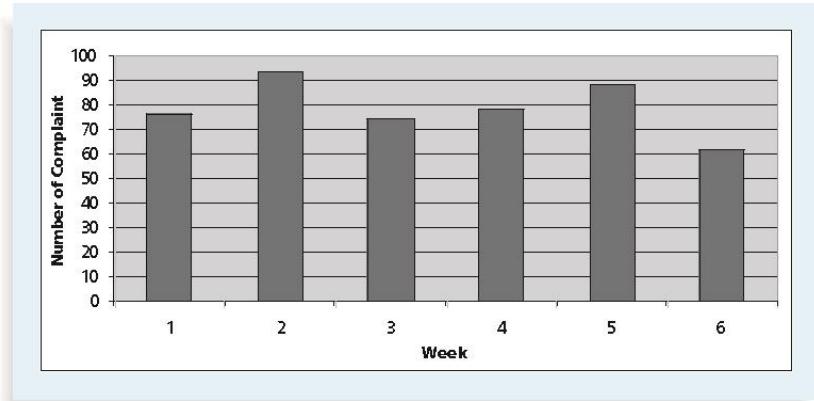
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Histograms

- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency
 - Problem: Survey about people's satisfaction
 - Attribute: Age ranges (12-18; 19-29; 30-40; 50-60; 60+)
 - Frequency: The number of people who fall into the corresponding ranges.

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Figure 8-6. Sample Histogram



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Pareto Charts

- A **Pareto chart** is a histogram that can help you identify and prioritize problem areas, or critical problems
- **Pareto analysis** is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes

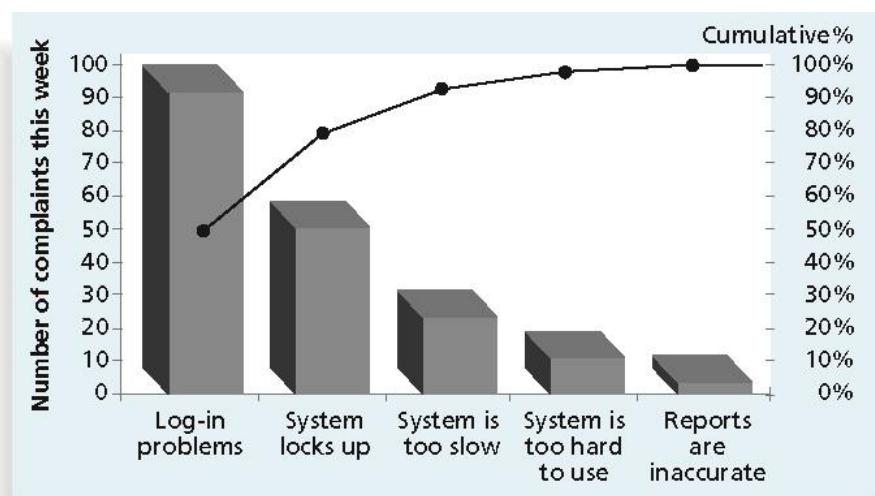
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80-20 rule

- In a nation's health-care system, 20% of the population (or 20% of the diseases) consumes 80% of the nation's medication resource
- 80% of the world's fortune is owned by 24% of people
- 80% of the world's resource is used up by 15% of population
- 80% of the enterprise's core value is created by the 20% of employees
- 80% of the task is accomplished by the 20% key actions
- 80% of the supermarket's profit comes from the 20% of the commodities

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Figure 8-7. Sample Pareto Chart



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Six Sigma

- **Six Sigma** is “a comprehensive and flexible system for achieving, sustaining, and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes.”*

*Pande, Peter S., Robert P. Neuman, and Roland R. Cavanagh, *The Six Sigma Way*, New York: McGraw-Hill, 2000, p. xi.

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Basic Information on Six Sigma

- The target for perfection is the achievement of no more than **3.4 defects per million opportunities**
- The principles can apply to a wide variety of processes
- Six Sigma projects normally follow a five-phase improvement process called DMAIC

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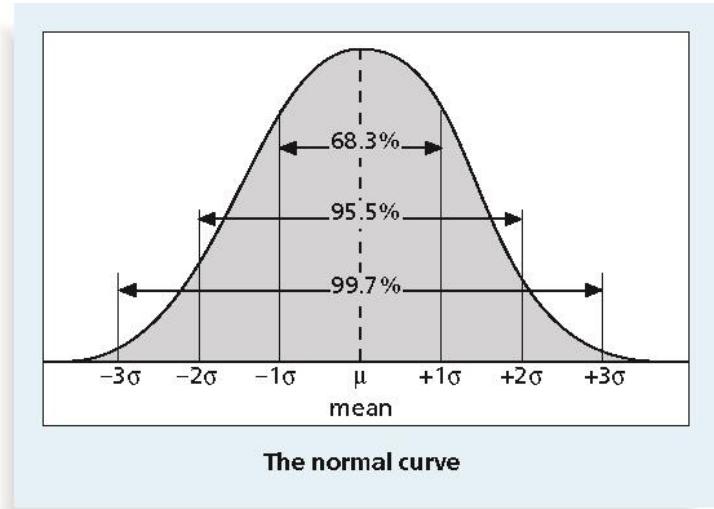
Six Sigma and Statistics

- The term *sigma* means standard deviation
- **Standard deviation** measures how much variation exists in a distribution of data
- Standard deviation is a key factor in determining the acceptable number of defective units found in a population
- Six Sigma projects strive for no more than 3.4 defects per million opportunities, yet this number is confusing to many statisticians

Six Sigma Uses a Conversion Table

- **Yield** represents the number of units handled correctly through the process steps
- A **defect** is any instance where the product or service fails to meet customer requirements

Figure 8-9. Normal Distribution and Standard Deviation



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Six 9s of Quality

- **Six 9s of quality** is a measure of quality control equal to 1 fault in 1 million opportunities
- In the telecommunications industry, it means 99.9999 percent service availability or *30 seconds of down time a year*
- This level of quality has also been stated as the target goal for the number of errors in a communications circuit, system failures, or errors in lines of code

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ISO Standards

- **ISO 9000** is a quality system standard that:
 - Is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization
 - Provides minimum requirements needed for an organization to meet its quality certification standards
 - Helps organizations around the world reduce costs and improve customer satisfaction

See www.iso.org for more information

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Improving Information Technology Project Quality

- Suggestions for improving quality for IT projects include:
 - Establish leadership that promotes quality
 - Understand the cost of quality
 - Focus on organizational influences and workplace factors that affect quality
 - Follow maturity models

40

The Cost of Quality

- The **cost of quality** is the cost of conformance plus the cost of nonconformance
 - **Conformance** means delivering products that meet requirements and *fitness for use*
 - i.e. the costs associated with developing a quality plan, analyzing and managing product requirements, testing etc.
 - **Cost of nonconformance** means taking responsibility for failures or not meeting quality expectations
 - i.e. the costs of downtime of the system, loss of business, damage of reputation etc.
- A study reported that software bugs cost the U.S. economy \$59.6 billion each year and that one third of the bugs could be eliminated by an improved testing infrastructure

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Five Cost Categories Related to Quality

- **Prevention cost:** cost of planning and executing a project so it is error-free or within an acceptable error range.
 - Planning, training, quality surveys of suppliers and subcontractors etc.
 - Y2K example: if companies planned well and made use of 4 digits to represent years instead of 2, they would've saved billions of dollars shortly before year 2000.
- **Appraisal cost:** cost of evaluating processes and their outputs to ensure quality
 - Inspection, testing of products, maintenance of inspection equipment etc.
- **Internal failure cost:** cost incurred to correct an identified defect before the customer receives the product
 - Scrap, rework, charges related to delay of processes -- delivery, inventory costs, correction of a design error, etc.

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FIVE COST CATEGORIES RELATED TO QUALITY (CONT.)

- **External failure cost:** cost that relates to all errors not detected and corrected before delivery to the customer
 - Warranty cost, field service maintenance, all expenses in the recall of products, product liability lawsuits, complaint handling, future business losses etc.
- **Measurement and test equipment costs:** capital cost of equipment used to perform prevention and appraisal activities

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Maturity Models

- **Maturity models** are frameworks for helping organizations improve their processes and systems
 - The **Software Quality Function Deployment Model** focuses on defining user requirements and planning software projects
 - The Software Engineering Institute's **Capability Maturity Model Integration** is a process improvement approach that provides organizations with the essential elements of effective processes
 - It helps guide process improvement across a project, a division or an entire organization.

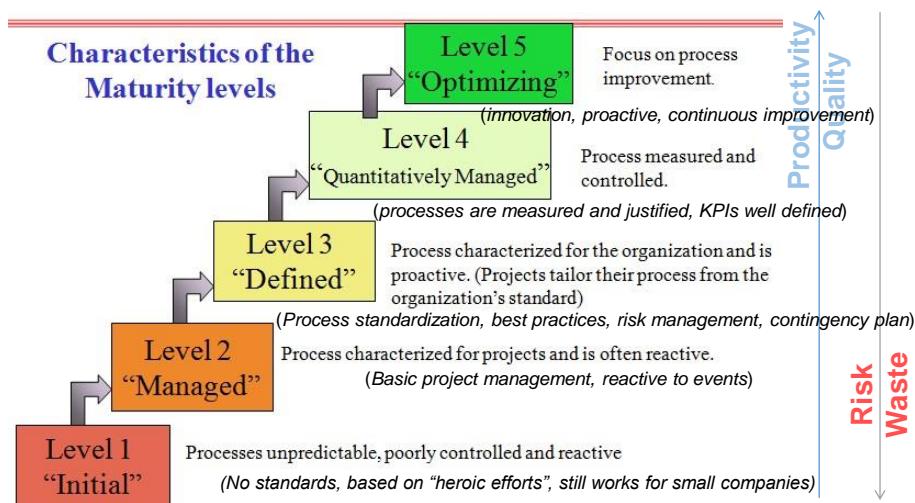
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- It can be used to
 - Help integrate traditionally separate organizational functions
 - Set process improvement goals and priorities
 - Provide guidance for quality processes
 - Provide a point of reference for appraising current processes

CMMI Levels

- Capability levels of the CMMI, from lowest to highest, are:
 - Initial
 - Managed
 - Defined
 - Quantitatively Managed
 - Optimizing
- Companies may not get to bid on government projects unless they have a CMMI Level 3

5 CMMI Levels



PMI's Maturity Model

- PMI released the Organizational Project Management Maturity Model (OPM3) in December 2003
- Model is based on market research surveys sent to more than 30,000 project management professionals and incorporates 180 best practices and more than 2,400 capabilities, outcomes, and key performance indicators
- Addresses standards for excellence in project, program, and portfolio management best practices and explains the capabilities necessary to achieve those best practices

CHAPTER 9: PROJECT RESOURCE MANAGEMENT

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Note: See the text itself for full citations.



LEARNING OBJECTIVES

- Explain the importance of good human resource management on projects, including the current state and future implications of the global IT workforce
- Define project human resource management and understand its processes
- Summarize key concepts for managing people by understanding the theories of Abraham Maslow, Frederick Herzberg, David McClelland, and Douglas McGregor on motivation, H. J. Thamhain and D. L. Wilemon on influencing workers, and Stephen Covey on how people and teams can become more effective

LEARNING OBJECTIVES (CONTINUED)

- Discuss human resource planning and be able to create a human resource plan, project organizational chart, responsibility assignment matrix, and resource histogram
- Understand important issues involved in project staff acquisition and explain the concepts of resource assignments, resource loading, and resource leveling
- Assist in team development with training, team-building activities, and reward systems
- Explain and apply several tools and techniques to help manage a project team and summarize general advice on managing teams
- Describe how project management software can assist in project human resource management

3

THE IMPORTANCE OF HUMAN RESOURCE MANAGEMENT

- Many corporate executives have said, “People are our most important asset”
- People determine the success and failure of organizations and projects

4

PROJECT RESOURCE MANAGEMENT

- o Including the processes to identify, acquire, and manage the resources needed for the successful completion of the project.

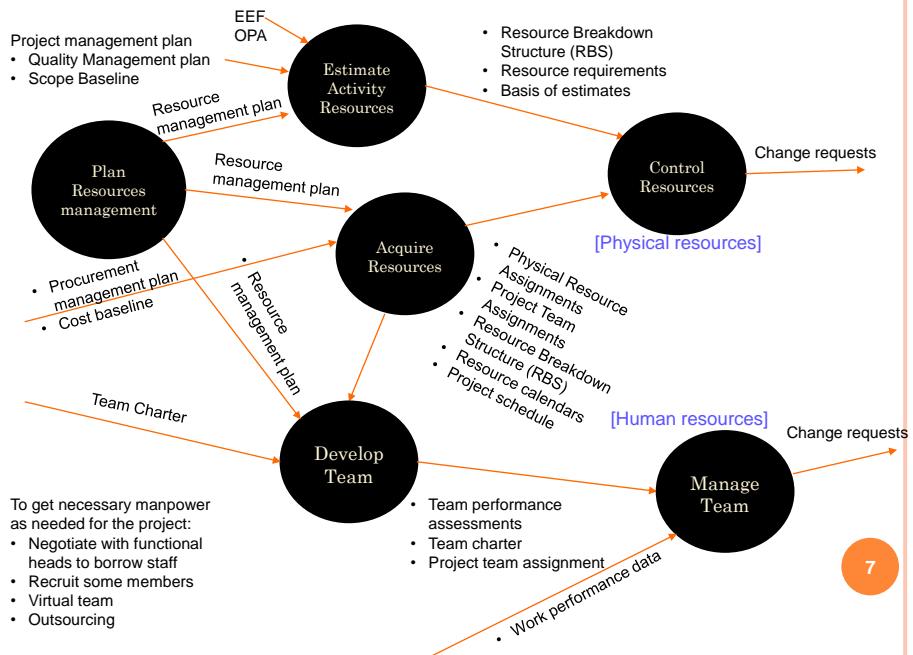
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PROCESSES OF PROJECT RESOURCE MANAGEMENT

- o **9.1 Plan Resource Management**—The process of defining how to estimate, acquire, manage, and utilize physical and team resources.
- o **9.2 Estimate Activity Resources**—The process of estimating team resources and the type and quantities of material, equipment, and supplies necessary to perform project work.
- o **9.3 Acquire Resources**—The process of obtaining team members, facilities, equipment, materials, supplies, and other resources necessary to complete project work.
- o **9.4 Develop Team**—The process of improving competencies, team member interaction, and the overall team environment to enhance project performance.
- o **9.5 Manage Team**—The process of tracking team member performance, providing feedback, resolving issues, and managing team changes to optimize project performance.
- o **9.6 Control Resources**—The process of ensuring that the physical resources assigned and allocated to the project are available as planned, as well as monitoring the planned versus actual use of resources, and performing corrective action as necessary.

6

PROJECT HUMAN RESOURCE MANAGEMENT



7

MOTIVATION AND LEADERSHIP THEORIES

- Maslow's Hierarchy of Needs
- Herzberg's Motivational and Hygiene Factors
- McGregor's Theory X and Y
- McClelland's Acquired-Needs Theory
- Thamhain and Wilemon's Ways to Have Influence on Projects
- Influential Power
- Covey and Improving Effectiveness
- Leadership Styles
- ...

10

9.1 PLAN RESOURCE MANAGEMENT

- Involves identifying and documenting project roles, responsibilities, and reporting relationships
- Contents include:
 - Project organizational charts
 - Staffing management plan
 - Responsibility assignment matrixes
 - Resource histograms

11

RESPONSIBILITY ASSIGNMENT MATRICES

- A **Responsibility Assignment Matrix (RAM)** is a matrix used to define project responsibilities among the project team.

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RACI CHART

RACI charts are a form of RAM.

	Group A	Group B	Group C	Group D	Group E
Test Plans	R	A	C	C	I
Unit Test	C	I	R	A	I
Integration Test	A	R	I	C	C
System Test	I	C	A	I	R
User Acceptance Test	R	I	C	R	A

R = responsibility

A = accountability, only one "A" per task

C = consultation

I = informed

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STAFFING MANAGEMENT PLANS

- A **Staffing Management Plan** describes when and how people will be added to and taken off the project team.

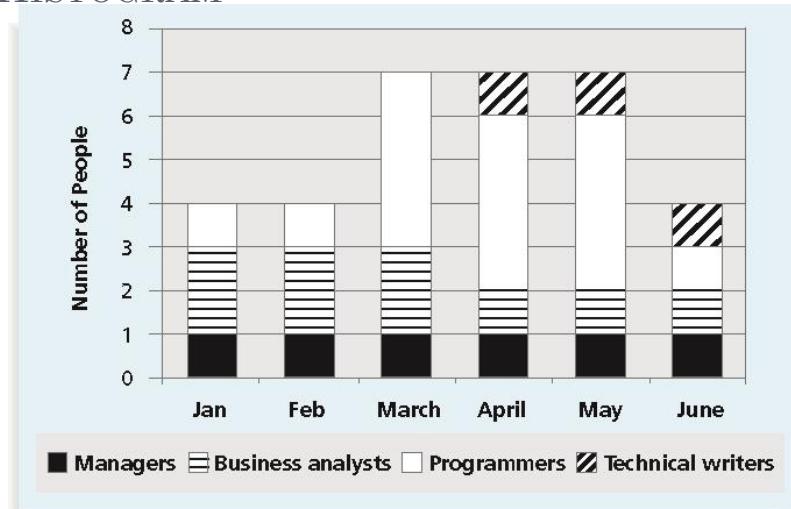
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RESOURCE HISTOGRAMS

- A **Resource Histogram** is a column chart that shows the number of resources assigned to a project over time.

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FIGURE 9-7. SAMPLE RESOURCE HISTOGRAM



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Project Calendar



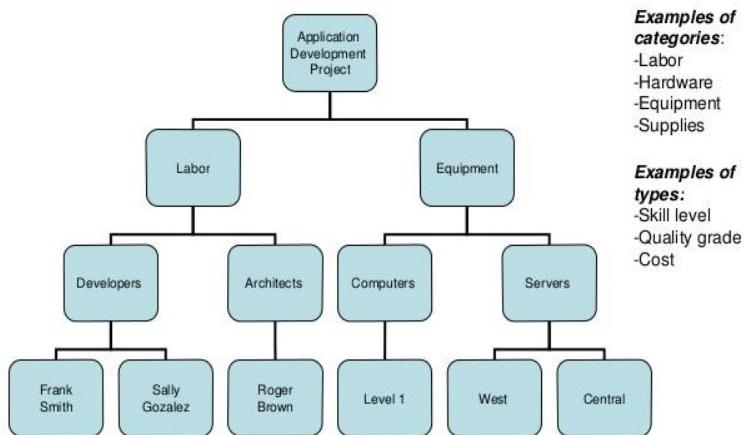
Resource Calendar



9.2 ESTIMATE ACTIVITY RESOURCES

- The process of estimating the types, quantities and characteristics of material, human resources, equipment, or supplies required to perform each activity.

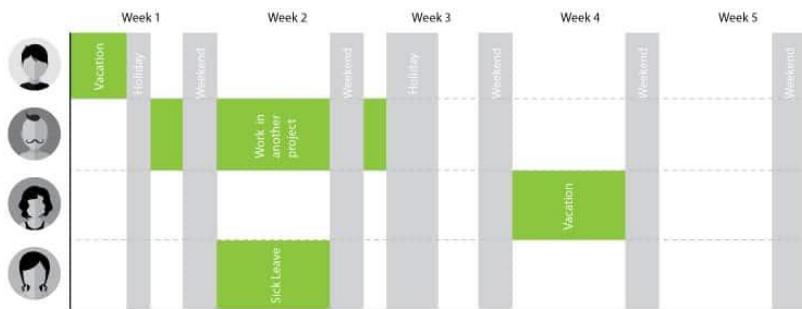
Resource Breakdown Structure



Project Calendar



Resource Calendar



9.2 ACQUIRE PROJECT TEAM

- Acquiring qualified people for teams is crucial
- Recruiting and Selection
- It's important to assign the appropriate type and number of people to work on projects at the appropriate times

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9.3 DEVELOP PROJECT TEAM

- The main goal of **team development** is to help people work together more effectively to improve project performance

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TUCKMAN MODEL OF TEAM DEVELOPMENT



- The team formally comes together
- The team may have disagreements.
- Trust develops within the team.
- The team starts delivering results.
- The team is disseminated after completion.

23

TRAINING

- Training can help people understand themselves, each other, and how to work better in teams
- Team building activities include:
 - Physical challenges
 - Psychological preference indicator tools

24

REWARD AND RECOGNITION SYSTEMS

- Team-based reward and recognition systems can promote teamwork
- Focus on rewarding teams for achieving specific goals
- Allow time for team members to mentor and help each other to meet project goals and develop human resources

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9.4 MANAGE PROJECT TEAM

- It involves the following tasks for delivering their best work
 - Leading team to work
 - Tracking team member's performance
 - Giving team members feedback
 - Change team members as necessary
- After assessing team performance and related information, the project manager must decide:
 - If changes should be requested
 - If corrective or preventive actions should be recommended
 - If updates are needed to the project management plan or organizational process assets

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GENERAL ADVICE ON TEAMS

- Be patient and kind with your team (respect your team members)
- Fix the problem instead of blaming people
- Establish regular, effective meetings
- Limit the size of work teams to three to seven members
- Plan some social activities to help project team members and other stakeholders get to know each other better
- Stress team identity

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GENERAL ADVICE ON TEAMS (CONTINUED)

- Nurture team members and encourage them to help each other
- Take additional actions to work with virtual team members

Virtual Team usually refers to a group of individuals who work together from different geographic locations and rely on communication technology.

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SCOPE COMMUNICATION MANAGEMENT

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IMPORTANCE OF FACE-TO-FACE COMMUNICATION

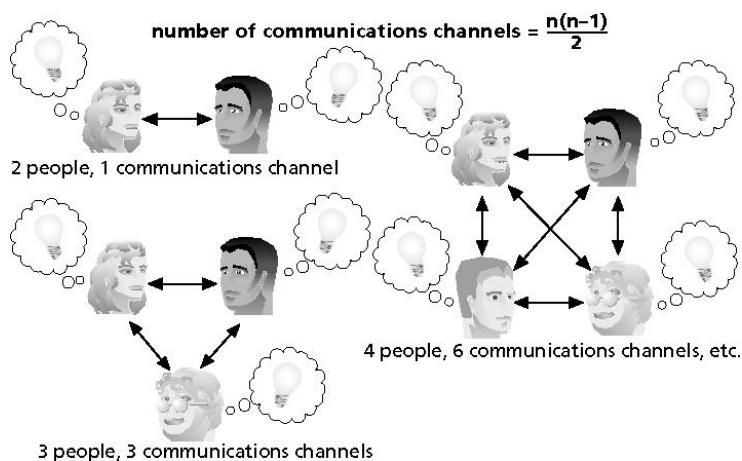
- Research says that in a face-to-face interaction:
 - 58 percent of communication is through body language
 - 35 percent of communication is through how the words are said
 - 7 percent of communication is through the content or words that are spoken
- Pay attention to more than just the actual words someone is saying
- A person's tone of voice and body language say a lot about how he or she really feels

HOW WELL MEDIUM IS SUITED TO:	KEY: 1 = EXCELLENT		2 = ADEQUATE		3 = INAPPROPRIATE		
	HARD COPY	TELEPHONE CALL	VOICE MAIL	E-MAIL	MEETING	WEB SITE	
Assessing commitment	3	2	3	3	1		3
Building consensus	3	2	3	3	1		3
Mediating a conflict	3	2	3	3	1		3
Resolving a misunderstanding	3	1	3	3	2		3
Addressing negative behavior	3	2	3	2	1		3
Expressing support/appreciation	1	2	2	1	2		3
Encouraging creative thinking	2	3	3	1	3		3
Making an ironic statement	3	2	2	3	1		3
Conveying a reference document	1	3	3	3	3		1
Reinforcing one's authority	1	2	3	3	1		2
Providing a permanent record	1	3	3	1	3		1
Maintaining confidentiality	2	1	2	3	1		3
Conveying simple information	3	2	1	1	2		3
Asking an informational question	3	2	1	1	3		3
Making a simple request	3	3	1	1	3		3
Giving complex instructions	3	3	3	2	1		2
Addressing many people	2	3	3 or 1*	2	3		1

Galati, Tess. Email Composition and Communication (EmC2) Practical Communications, Inc. (www.praccomm.com) (2001).

*Depends on system functionality

FIGURE 10-2. THE IMPACT OF THE NUMBER OF PEOPLE ON COMMUNICATIONS CHANNELS



FIVE DYSFUNCTIONS OF A TEAM

- Patrick Lencioni, author of several books on teams, says that “Teamwork remains the one sustainable competitive advantage that has been largely untapped”*
- The five dysfunctions of teams are:
 1. Absence of trust
 2. Fear of conflict
 3. Lack of commitment
 4. Avoidance of accountability
 5. Inattention to results

*Lencioni, Patrick, “Overcoming the Five Dysfunctions of a Team,” Jossey-Bass: San Francisco, CA (2005), p. 3.

Chapter 11:

Project Risk Management

Information Technology Project Management, Sixth Edition

Note: See the text itself for full citations.



Learning Objectives

- * Understand what risk is and the importance of good project risk management
- * Discuss the elements involved in risk management planning and the contents of a risk management plan
- * List common sources of risks in information technology projects

Learning Objectives (continued)

- * Describe the process of identifying risks and be able to create a risk register
- * Discuss the qualitative risk analysis process and explain how to calculate risk factors, create probability/impact matrixes, and apply the Top Ten Risk Item Tracking technique to rank risks

3

Learning Objectives (continued)

- * Explain the quantitative risk analysis process and how to apply decision trees, simulation, and sensitivity analysis to quantify risks
- * Provide examples of using different risk response planning strategies to address both negative and positive risks
- * Discuss what is involved in monitoring and controlling risks
- * Describe how software can assist in project risk management

4

What is Project Risk?

- * What is Project Risk?
 - * Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective.

- * What are the Project Risk Management objectives?
 - * The objectives of project risk management is to minimize potential **negative risks** while maximizing potential **positive risks**.

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Negative Risk (Threat)

- * Negative risk involves understanding potential problems that might occur in the project and how they might impede project success

- * Examples:
 - * The price for purchasing the computers rise higher than planned 2 months ago
 - * The main programmer on the project quitting the job
 - * A certain function or class will no longer be supported in the next version of Java programming language

7

Risk Can Be Positive (Opportunity)

- * Positive risks are risks that result in good things happening; sometimes called opportunities
- * Examples:
 - * The price for purchasing the computers falls lower than planned 2 months ago
 - * A special offer for bulk purchase
 - * The teacher unexpectedly postpones the deadline for project submission
 - * There is a chance that you may get some highly skilled workers from another project at lower rates
 - * Found a good open source module that spare the team a week that is otherwise needed for development

Possible Project Risks

1. The prices for computers rise higher than planned.
2. Found a good open source module that spare the team a week that is otherwise needed for development
3. The prices for computers fall lower than planned
4. A special offer for bulk purchase
5. The main programmer on the project quitting the job
6. The teacher unexpectedly postpones the deadline for project submission
7. A certain function or class will no longer be supported in the next version of Java programming language.

Possible Project Risks (Cont.)

7. There is a chance that you may get some highly skilled workers from another project at lower rates.
8. The suppliers may delay the delivery of the servers for building up our data center.
9. The coming Flu season may hit your team and key engineers might get sick.
10. Our neighbors may complain to the govt about our construction.
11. Building a project that doesn't fit the users' needs

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Possible Project Risks (Cont.)

13. The accidents caused by auto-pilot vehicles.
14. Software system may be hacked (during operation)
15. The delay of organ deliveries in the drone delivery system
16. Malfunctioning of a life-supporting medical system
17. User data stolen by hackers

*They should be considered as “**safety quality**”
to be managed in Project Quality
Management, and have a Cost implication.*

11

Project Risk Management Processes

- * **Planning risk management:** deciding how to approach and plan the risk management activities for the project
- * **Identifying risks:** determining which risks are likely to affect a project and documenting the characteristics of each
- * **Performing qualitative risk analysis:** prioritizing risks based on their probability and impact of occurrence

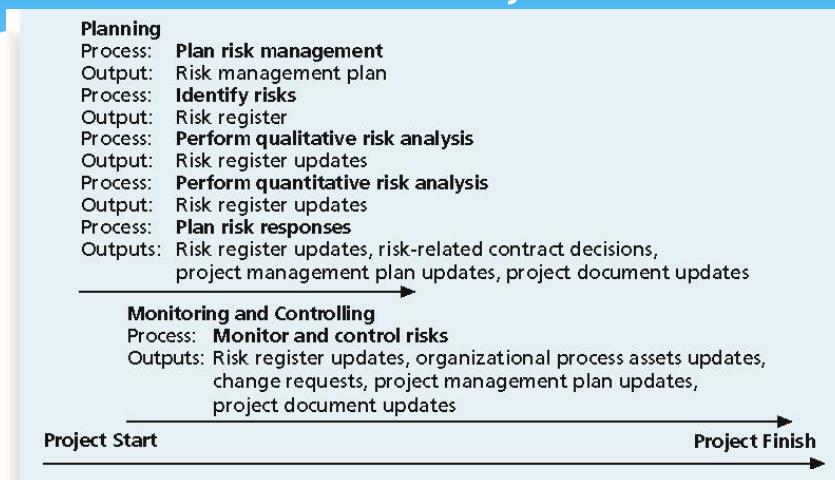
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Project Risk Management Processes (continued)

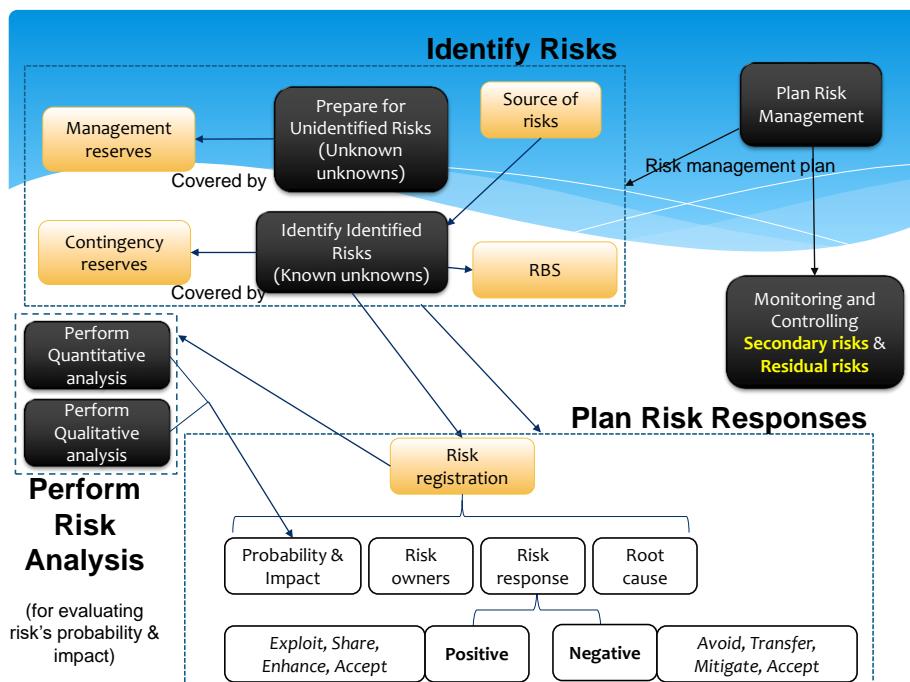
- * **Performing quantitative risk analysis:** numerically estimating the effects of risks on project objectives
- * **Planning risk responses:** taking steps to enhance opportunities and reduce threats to meeting project objectives
- * **Monitoring and controlling risks:** monitoring identified and residual risks, identifying secondary risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project

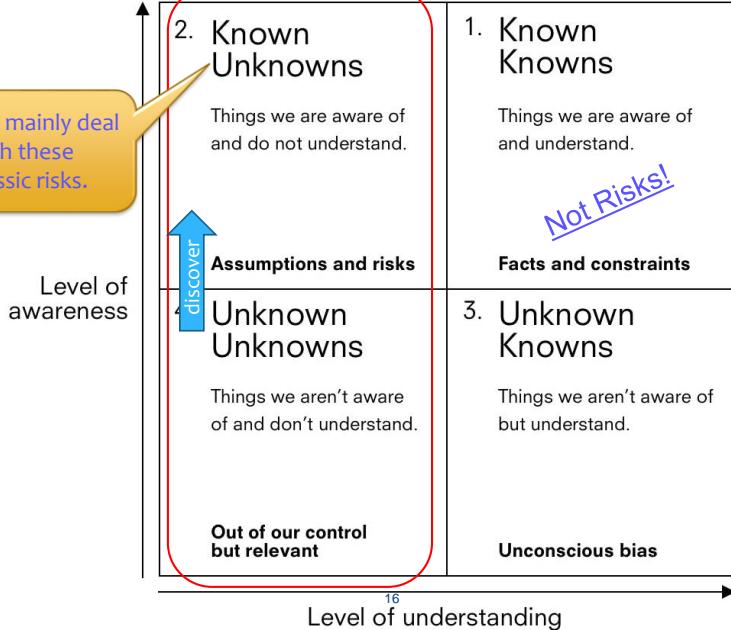
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Figure 11-3. Project Risk Management Summary



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Risk Management Planning

The Plan Risk Management defining how to conduct risk management activities for a project.

- * The main output of risk management planning is a **risk management plan**, a plan that documents the procedures for managing risk throughout a project
- * The project team should review project documents and understand the organization's and the sponsor's approaches and attitudes to risk

Identifying Risks

- * Identifying risks is the process of understanding what potential events might hurt or enhance a particular project
- * Risk identification tools and techniques include (Information gathering):
 - * Brainstorming
 - * The Delphi Technique
 - * Interviewing

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Common Sources of Risk in Information Technology Projects

- * **Sources of risk:**
 - * The Standish Group developed an IT success potential scoring sheet based on potential risks
 - * Other broad categories of risk help identify potential risks
 - * Constraints & Assumptions
 - * Categorization by each knowledge area

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Table 11-3. Information Technology Success Potential Scoring Sheet

Success Criterion	Relative Importance
User Involvement	19
Executive Management support	16
Clear Statement of Requirements	15
Proper Planning	11
Realistic Expectations	10
Smaller Project Milestones	9
Competent Staff	8
Ownership	6
Clear Visions and Objectives	3
Hard-Working, Focused Staff	3
Total	100

Broad Categories of Risk

- * **Market risk**
 - * deliverables useful, helpful, sellable, competitive?
- * **Financial risk**
 - * Affordable, worth doing the project, Benefit>Cost?
- * **Technology risk**
 - * Technically feasible, tech proven and available?
- * **People risk**
 - * Needed talents available, with senior management's and user's support?
- * **Structure / process risk**
 - * Maturity of the organization, complexity of the stockholder groups, adaptation to and interoperation with existing infrastructure

Assumptions Analysis

- * **Constraints** and **Assumptions** are common sources of risk
 - * Constraint: Something limit your options
 - * Assumption: You think they are true

Assumption or Constraint	Could this assumption/constraint prove false? (Y/N)	If false would it affect project? (Y/N)	Convert to a risk?

Constraints and Assumptions

Project constraints

- This must be finished before the commencement of the opening ceremony.
- The amount of funding is around 100,000.
- Use Paypal as the payment gateway.
- We do not have the domain knowledge and past experience for that project.
- We must use the Linux OS for the software.
- The software must support Java 1.12 or above.
- The core part of the system can only be revealed to a few appointed persons – biz secret.
- The weather in this region is rainy and windy quite often in this season.
- The network bandwidth is quite low for smooth video transmission.
- The delivery of the needed equipment will take at least 3 weeks.
- The effort relies on voluntary participation by multiple government agencies.

Project assumptions

- The weather in this region will be fine in this season.
- Customers will provide necessary business expertise as needed during development.
- The network bandwidth will be high enough for smooth video transmission.
- All imported data will be in XML format.
- Government regulation will not be changed in these 2 years.
- The 5G networks will be widespread in the region.
- Users will fully support the project.
- The sponsor really desires the project to finish with high quality and allows the high quality to justify the budget.

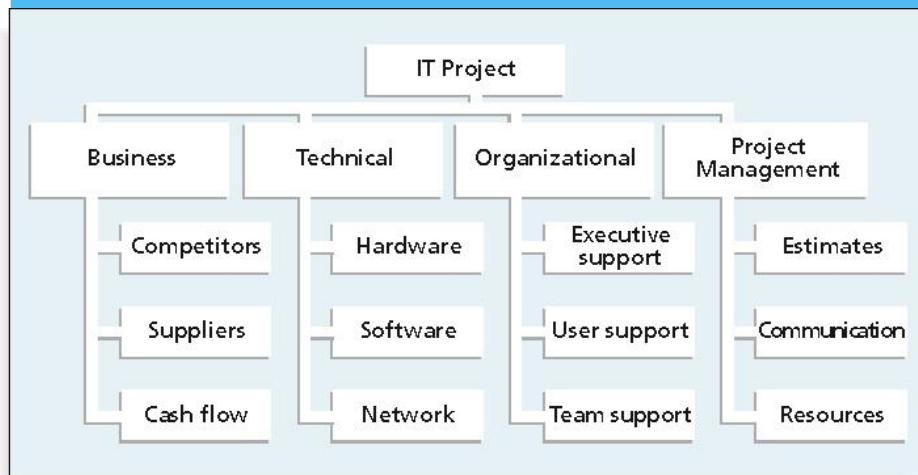
Table 11-4. Potential Negative Risk Conditions Associated with Each Knowledge Area

KNOWLEDGE AREA	RISK CONDITIONS
<i>Integration</i>	Inadequate planning; poor resource allocation; poor integration management; lack of post-project review
<i>Scope</i>	Poor definition of scope or work packages; incomplete definition
<i>Time</i>	Errors in estimating time or resource availability; errors in determining the critical path; poor allocation and management of float; early release of competitive products
<i>Cost</i>	Estimating errors; inadequate productivity, cost, change, or contingency
<i>Quality</i>	Poor attitude toward quality; substandard design/materials/workmanship; inadequate quality assurance program
<i>Human Resources</i>	Poor conflict management; poor project organization and definition of responsibilities; absence of leadership
<i>Communications</i>	Carelessness in planning or communicating; lack of consultation with key stakeholders
<i>Risk</i>	Ignoring risk; unclear analysis of risk; poor insurance management
<i>Procurement</i>	Unenforceable conditions or contract clauses; adversarial relations

Risk Breakdown Structure

- * A **risk breakdown structure (RBS)** is a hierarchy of potential risk categories for a project
- * Similar to a work breakdown structure but used to identify and categorize risks

Figure 11-4. Sample Risk Breakdown Structure



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Brainstorming

- * **Brainstorming** is a technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment
- * An experienced facilitator should run the brainstorming session
- * Be careful not to overuse or misuse brainstorming
 - * Psychology literature shows that individuals produce a greater number of ideas working alone than they do through brainstorming in small, face-to-face groups
 - * Group effects often inhibit idea generation

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Delphi Technique

- * The **Delphi Technique** is used to derive a consensus among a panel of experts who make predictions about future developments
- * Provides independent and anonymous input regarding future events
- * Uses repeated rounds of questioning and written responses and avoids the biasing effects possible in oral methods, such as brainstorming

Interviewing

- * **Interviewing** is a fact-finding technique for collecting information in face-to-face, phone, e-mail, or instant-messaging discussions
- * Interviewing people with similar project experience is an important tool for identifying potential risks

Risk Register

- * The main output of the risk identification process is a list of identified risks and other information needed to begin creating a risk register
- * **A risk register is:**
 - * A document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format
 - * A tool for documenting potential risk events and related information
- * **Risk events** refer to specific, uncertain events that may occur to the detriment or enhancement of the project

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Risk Register Contents

For each entry of the risk register, there are:

- * An identification number for the risk event
- * A rank for the risk event
- * The name of the risk event
- * A description of the risk event
- * The category under which the risk event falls
- * The root cause of the risk

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Risk Register Contents (continued)

- * **Triggers** for each risk; triggers are indicators or symptoms of actual risk events for triggering the risk responses
- * Potential responses to each risk
- * The **risk owner** or person who will own or take responsibility for each risk
- * The probability and impact of each risk occurring
- * The status of each risk

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Table 11-5. Sample Risk Register

NO.	RANK	RISK DESCRIPTION	CATEGORY	ROOT CAUSE	TRIGGERS	POTENTIAL RESPONSES	RISK OWNER	PROBABILITY	IMPACT	STATUS
R44	1									
R21	2									
R7	3									

Identified Risk: The computer equipment may not be delivered on time.

Root Cause: This kind of equipment is often short of supply.

Potential Responses: Order in advance; Identify alternative vendors.

Identified Risk: Loss of data

Root Cause : System down

Potential Responses: Backup frequently; Redundancy

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Performing Qualitative Risk Analysis

- * Assess the likelihood and impact of all identified risks (in Risk Register) to determine their magnitude and priority
- * It is a subjective analysis

- * Risk quantification tools and techniques include:
 - * Probability/impact matrixes
 - * The Top Ten Risk Item Tracking
 - * Expert judgment

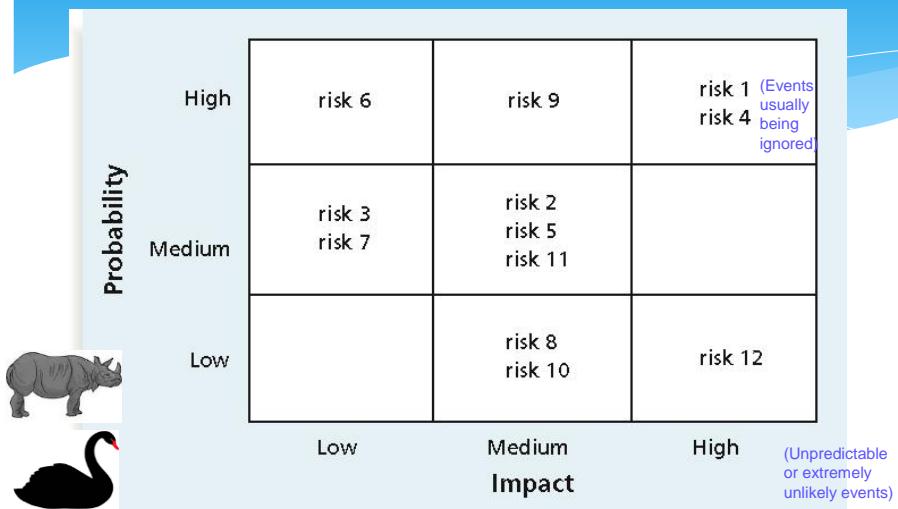
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Probability/Impact Matrix

- * A **probability/impact matrix or chart** lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other
- * List the risks and then label each one as high, medium, or low in terms of its probability of occurrence and its impact if it did occur
- * Can also calculate **risk factors**
 - * Numbers that represent the overall risk of specific events based on their probability of occurring and the consequences to the project if they do occur

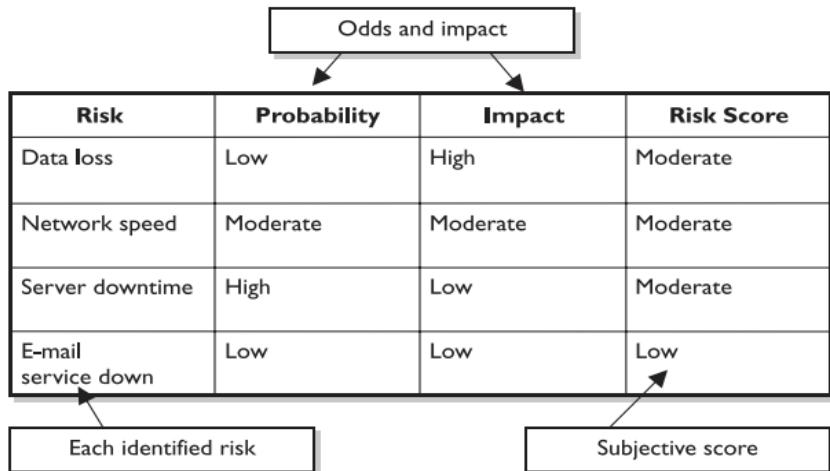
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Figure 11-5. Sample Probability/Impact Matrix



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How to use a Probability/Impact Matrix?



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Top Ten Risk Item Tracking

- * **Top Ten Risk Item Tracking** is a qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project
- * Establish a periodic review of the top ten project risk items
- * List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item

Table 11-6. Example of Top Ten Risk Item Tracking

MONTHLY RANKING				
RISK EVENT	RANK THIS MONTH	RANK LAST MONTH	NUMBER OF MONTHS IN TOP TEN	RISK RESOLUTION PROGRESS
Inadequate planning	1	2	4	Working on revising the entire project management plan
Poor definition	2	3	3	Holding meetings with project customer and sponsor to clarify scope
Absence of leadership	3	1	2	After previous project manager quit, assigned a new one to lead the project
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Watch List

- * A **watch list** is a list of risks that are low priority but are still identified as potential risks
- * Qualitative analysis can also identify risks that should be evaluated on a quantitative basis

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Performing Quantitative Risk Analysis

- * Often follows qualitative risk analysis, but both can be done together
- * Usually performed on risks that have been prioritized by the “Performing Qualitative Risk Analysis”
- * Large, complex projects involving leading edge technologies often require extensive quantitative risk analysis
- * Main techniques include:
 - * Decision tree analysis and EMV
 - * Simulation (Monte Carlo simulation)

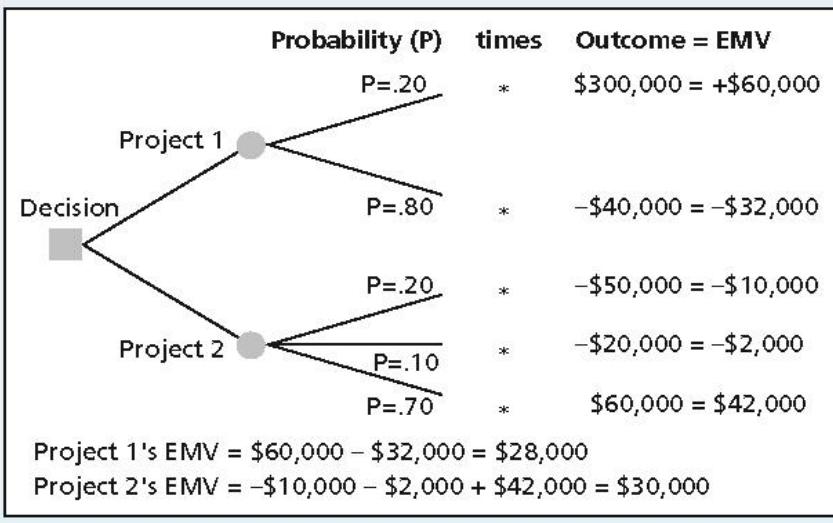
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Decision Trees and Expected Monetary Value (EMV)

- * A **decision tree** is a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain
- * **Estimated monetary value (EMV)** is the product of a risk event probability and the risk event's monetary value
- * You can draw a decision tree to help find the EMV

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Figure 11-7. Expected Monetary Value (EMV) Example



Planning Risk Responses

- * After identifying and quantifying risks, you must decide how to respond to them
- * Four main response strategies for **negative risks**
 - * Risk avoidance
 - * Risk acceptance
 - * Risk transference
 - * Risk mitigation

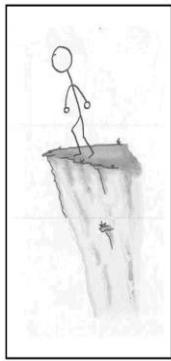
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Risk responses for negative risks (threats)

- * **Avoid** - Changing the project management plan to eliminate the threat posed by an adverse risk, to isolate the project objectives from the risk's impact
 - * Example: Cancel the delivery by ship due to the high probability of piracy, and choose lorry transportation instead
- * **Transfer** - Shifting the negative impact of a threat, along with ownership of the response, to a third party
 - * Examples : Insurance, warranties
- * **Mitigate** - Implying a reduction in the probability and/or impact of an adverse risk event to an acceptable threshold
 - * Examples: prototypes, system redundancy
 - * Examples: Shipping partial goods in multiple shipments to minimize the potential loss
- * **Accept**—Some risk you can't avoid or mitigate or transfer
 - * Do nothing, but just document it

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Risk responses for negative risks (threats)



Your project

Avoid

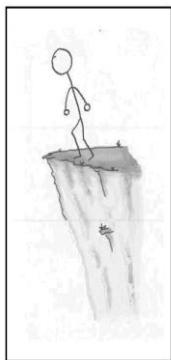
Mitigate

Transfer

Accept

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Risk responses for negative risks (threats)



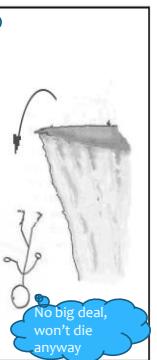
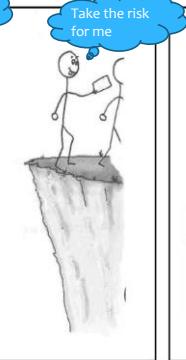
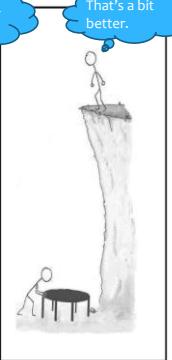
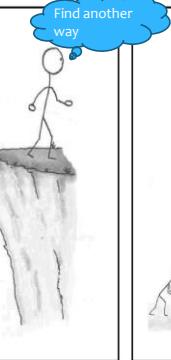
Your project

Avoid

Mitigate

Transfer

Accept



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Risk Response for Positive Risks (Opportunities)

- * Risk exploitation
- * Risk sharing
- * Risk enhancement
- * Risk acceptance

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Risk Response for Positive Risks (Opportunities)

- * **Exploit** – To do everything to make sure that to take advantage of an opportunity
 - * Assign best resources to exploit it
- * **Share** – Allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project.
- * **Enhance** – by increasing probability and/or positive impacts, and by identifying and maximizing key drivers of these positive impact risks

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Residual and Secondary Risks

- * It's also important to identify residual and secondary risks
- * **Secondary risks** are the risks that arise as a direct result of implementing a risk response
- * **Residual risks** are the risks that remain after all of the response strategies have been implemented

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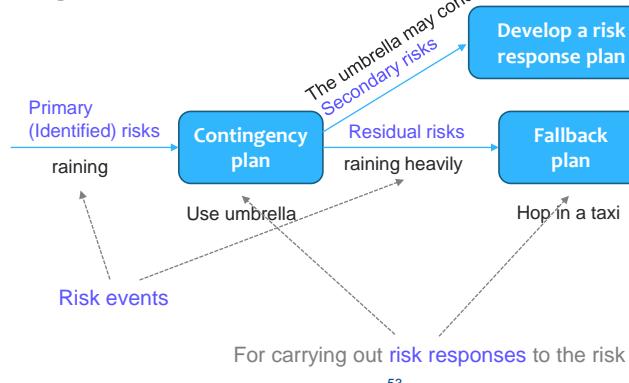
Contingency and Fallback Plans, Contingency Reserves

- * **Contingency plans** are predefined actions that the project team will take if an identified risk event occurs
- * **Fallback plans** are developed for risks that have a high impact on meeting project objectives and are put into effect if attempts to reduce the risk are not effective
- * **Contingency reserves** or **allowances** are provisions held by the project sponsor or organization to reduce the risk of cost or schedule overruns to an acceptable level

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Example of Contingency and Fallback plans

We want to travel to a place without getting soaked.



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Monitoring and Controlling Risks

- * Involves executing the risk management process to respond to risk events
- * **Workarounds** are unplanned responses to risk events that must be done when there are no contingency plans
- * Main outputs of risk monitoring and control are:
 - * Risk register updates
 - * Organizational process assets updates
 - * Change requests
 - * Updates to the project management plan and other project documents

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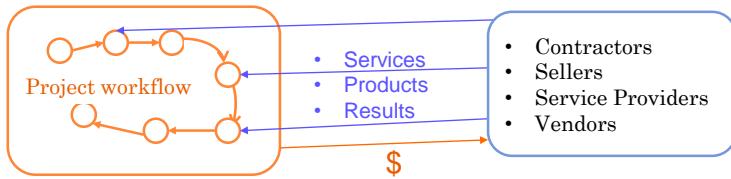
CHAPTER 12: PROJECT PROCUREMENT MANAGEMENT

Information Technology Project
Management, Sixth Edition

Note: See the text itself for full citations.

IMPORTANCE OF PROJECT PROCUREMENT MANAGEMENT

- **Procurement** means acquiring goods and/or services from an outside source
- Other terms include purchasing and outsourcing
- People continue to debate whether offshore outsourcing helps their own country or not



How can you be sure the services/products:

- Meeting the **scope** and **quality** requirements as you specified
- To be delivered on **time**
- **Costing** within your expected range

Due to the Agency problem and External dependencies, we rely on a **contract**.

4

CONTRACTS

- A **contract** is a mutually binding agreement that obligates the seller to provide the specified products or services and obligates the buyer to pay for them
- Contracts can clarify responsibilities and sharpen focus on key deliverables of a project

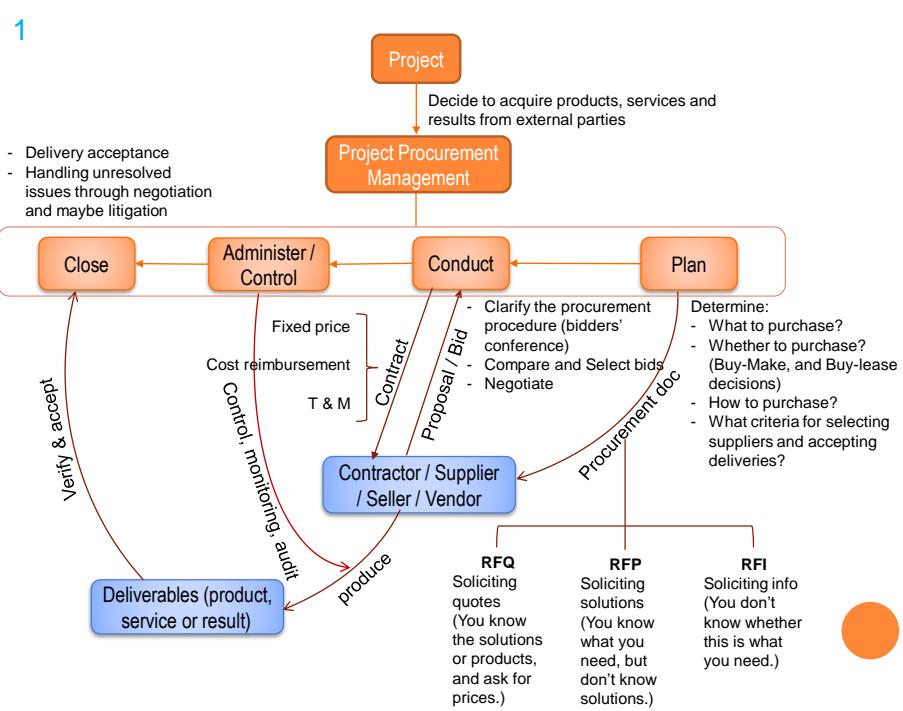


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PROJECT PROCUREMENT MANAGEMENT PROCESSES

- **Project procurement management:** acquiring goods and services for a project from outside the performing organization
- Processes include:
 - **Planning procurements:** determining what to procure, when, and how
 - **Conducting procurements:** obtaining seller responses, selecting sellers, and awarding contracts
 - **Administering/Controlling procurements:** managing relationships with sellers, monitoring contract performance, and making changes as needed
 - **Closing procurements:** completing and settling each contract, including resolving of any open items

6



PLANNING PROCUREMENTS

- Identifying which project needs can best be met by using products or services outside the organization
- If there is no need to buy any products or services from outside the organization, then there is no need to perform any of the other procurement management processes

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TOOLS AND TECHNIQUES FOR PLANNING PURCHASES AND ACQUISITIONS

- **Make-or-buy analysis:** general management technique used to determine whether an organization should make or perform a particular product or service inside the organization or buy from someone else.
- **Buy-or-lease analysis:** determining the cost-effectiveness between buying some resources and renting them.
- Mainly focusing on financial consideration

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BUY-OR-LEASE EXAMPLE

- Assume you can lease an item you need for a project for \$800/day; to purchase the item, the cost is \$12,000 plus a daily operational cost of \$400/day

How long will it take for the purchase cost to be the same as the lease cost?

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BUY-OR-LEASE SOLUTION

- Set up an equation so both options, purchase and lease, are equal
- In this example, use the following equation; let d be the number of days to use the item:

$$\$12,000 + \$400d = \$800d$$

$$\$12,000 = \$400d$$

$$d = 30$$

- If you need the item for more than 30 days, it is more economical to purchase it

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TYPES OF CONTRACTS

- Different types of contracts can be used in different situations:
 - **Fixed price or lump sum** contracts: involve a fixed total price for a well-defined product or service
 - **Cost reimbursable** contracts: involve payment to the seller for direct and indirect costs, plus the contractor's income.
 - **Time and material** contracts: involve a cost calculation on the basis of direct labor hours at a set rate and cost-reimbursable for materials.
 - Outsourcing IT service (hiring a temporary contract IT¹⁴ staff or consultant from supplier for a period of time)

WHEN TO USE THEM

- **Fixed price**
 - Watch out for **quality**
 - Used when buyer knows the details, you have experience
- **Cost reimbursable**
 - Watch out for **Cost**
 - Used when seller knows the details, they have experience, but you should trust them and rely on their experience and morality
- **Time and material (T&M)**
 - Watch out for **Time and Cost**
 - Used when both don't know the details, but you need to monitor to make sure they would not delay the works

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Time and Material Pricing

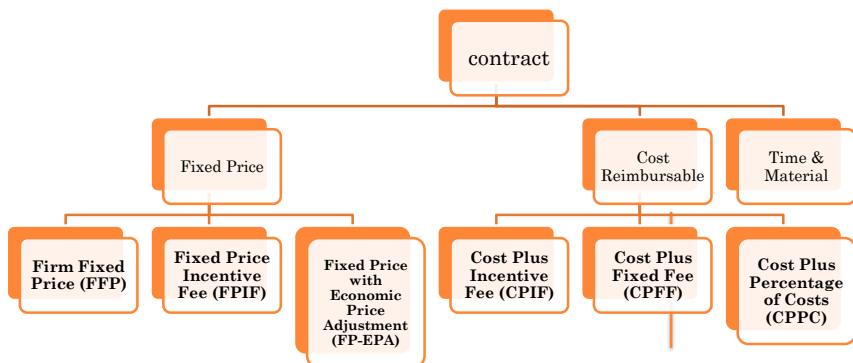
Example (Continued)

Determine a price quote to refurbish a pontoon boat:
Estimated 50 hours of labour
Estimated \$3,600 parts and materials

LAKE HOLIDAY MARINA Time and Material Price Quotation

Job: Marianne Perino, repair of 28-foot pontoon boat	
Labor charges: 50 hours @ \$38.20	\$1,910
Material charges	
Cost of parts and materials	\$3,600
Material loading charge ($43.5\% \times \$3,600$)	<u>1,566</u>
	5,166
Total price of labor and material	<u><u>\$7,076</u></u>

TYPES OF CONTRACT



FIXED PRICE CONTRACTS

- **Firm Fixed Price Contracts (FFP)**
 - The fee is fixed for the products /services. No incentives are given.
- **Fixed Price Incentive Fee Contracts (FPIF)**
 - On top of fixed fee, incentives are given to the seller in case the pre-defined performance targets are met or exceeded.
- **Fixed Price with Economic Price Adjustment Contracts (FP-EPA)**
 - The fixed fee will be adjusted based on the external economic factors, such as inflation rate, currency exchange rate, during the project implementation.

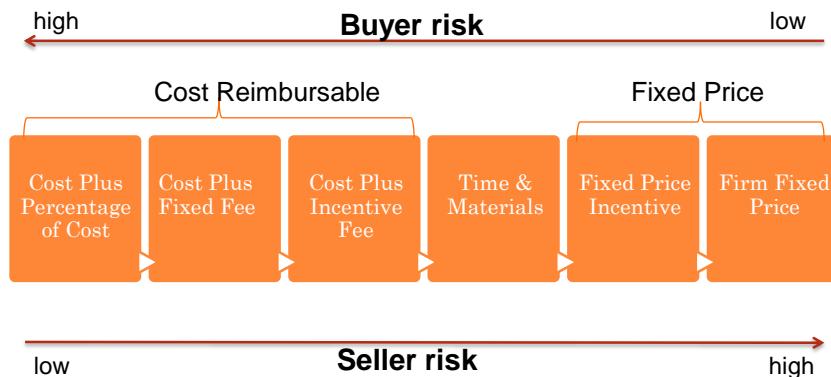
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COST REIMBURSABLE CONTRACTS

- **Cost plus incentive fee (CPIF)**: the buyer pays the supplier for allowable performance costs plus a predetermined fee and an incentive bonus
$$\text{Allowable performance costs} + \text{Predetermined fee (income of contractor)} + \text{Incentive bonus}$$
$$(\text{Incentive bonus} = \text{saved amount} \times \text{shared \%})$$
- **Cost plus fixed fee (CPFF)**: the buyer pays the supplier for allowable performance costs plus a fixed fee payment usually based on a percentage of estimated costs
$$\text{Allowable performance costs} + \text{Fixed fee}$$
- **Cost plus percentage of costs (CPPC)**: the buyer pays the supplier for allowable performance costs plus a predetermined percentage based on total costs
$$\text{Allowable performance costs} + \text{Allowable performance costs} \times \text{predetermined \%}$$

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CONTRACT TYPES VS. RISK



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FIXED PRICE (IN THE VIEWPOINT OF BUYERS)

- Pros
 - Easier to budget
 - Lower risk (higher risk for the sellers)
 - Buyers do not bear the raise of materials and labor costs.
- Cons
 - Rely on the clarity of the scope and requirements
 - Do not allow much change on the planned specifications. (Any change may require the change of contract.)
 - Buyers will not enjoy the benefit of the drop of materials and labor costs.

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COST REIMBURSABLE (IN THE VIEWPOINT OF BUYERS)

- Pros

- More flexible for changing market needs (or when the scope is uncertain)

- Cons

- The seller has no incentive to keep cost low
- More difficult to budget (total cost not known at the start of the project)
- Higher risk (lower risk for the sellers)

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PROCUREMENT MANAGEMENT PLAN

- Describes how the procurement processes will be managed, from developing documentation for making outside purchases or acquisitions to contract closure
- Contents vary based on project needs

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CONTRACT STATEMENT OF WORK (SOW)

- A **Statement Of Work** is a description of the work required for the procurement
- If a SOW is used as part of a contract to describe only the work required for that particular contract, it is called a **contract statement of work**
- A SOW is developed from Scope Baseline (Project Scope Statement, WBS, WBS Dictionary).
- A good SOW gives bidders a better understanding of the buyer's expectations

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FIGURE 12-3. STATEMENT OF WORK (SOW) TEMPLATE

Statement of Work (SOW)	
I.	Scope of Work: Describe the work to be done in detail. Specify the hardware and software involved and the exact nature of the work.
II.	Location of Work: Describe where the work must be performed. Specify the location of hardware and software and where the people must perform the work.
III.	Period of Performance: Specify when the work is expected to start and end, working hours, number of hours that can be billed per week, where the work must be performed, and related schedule information.
IV.	Deliverables Schedule: List specific deliverables, describe them in detail, and specify when they are due.
V.	Applicable Standards: Specify any company or industry-specific standards that are relevant to performing the work.
VI.	Acceptance Criteria: Describe how the buyer organization will determine if the work is acceptable.
VII.	Special Requirements: Specify any special requirements such as hardware or software certifications, minimum degree or experience level of personnel, travel requirements, and so on.

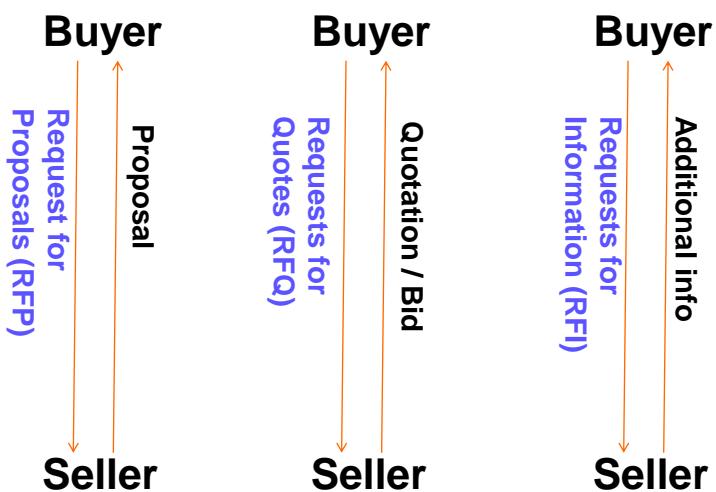
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PROCUREMENT DOCUMENTS

- **Request for Proposals (RFP)**: used to solicit proposals from prospective sellers
 - A **proposal** is a document prepared by a seller when there are different approaches for meeting buyer needs
- **Requests for Quotes (RFQ)**: used to solicit quotes or bids from prospective suppliers
 - A **bid**, also called a tender or quote (short for quotation), is a document prepared by sellers providing pricing for standard items that have been clearly defined by the buyer
- **Requests for Information (RFI)**: used to solicit more information from prospective suppliers
 - RFI is usually followed by a RFQ or RFP

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RFP, RFQ AND RFI



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FIGURE 12-4. REQUEST FOR PROPOSAL (RFP) TEMPLATE

Request for Proposal Template	
I.	Purpose of RFP
II.	Organization's Background
III.	Basic Requirements
IV.	Hardware and Software Environment
V.	Description of RFP Process
VI.	Statement of Work and Schedule Information
VII.	Possible Appendices
	A. Current System Overview
	B. System Requirements
	C. Volume and Size Data
	D. Required Contents of Vendor's Response to RFP
	E. Sample Contract

EVALUATION CRITERIA

- It's important to prepare some form of evaluation criteria, preferably before issuing a formal RFP or RFQ
- Beware of proposals that look good on paper; be sure to evaluate factors, such as past performance and management approach
- Can require a technical presentation as part of a proposal

CONDUCTING PROCUREMENTS

- Sending appropriate documentation to potential sellers
- Obtaining proposals or bids
- Selecting a seller
- Awarding a contract

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APPROACHES FOR PROCUREMENT

- Organizations can advertise to procure goods and services in several ways:
 - Approaching the preferred vendor
 - Approaching several potential vendors
 - Advertising to anyone interested
- Bidders' conference
 - It is a meetings with prospective sellers prior to preparation of a bid or proposal
 - It can help clarify the buyer's expectations to the sellers

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SOURCE SELECTION

- Evaluating proposals or bids from sellers
- Choosing the best one
- Negotiating the contract
- Awarding the contract

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FIGURE 12-5. SAMPLE PROPOSAL EVALUATION SHEET

Criteria	Weight	Proposal 1		Proposal 2		Proposal 3, etc.	
		Rating	Score	Rating	Score	Rating	Score
Technical approach	30%						
Management approach	30%						
Past performance	20%						
Price	20%						
Total score	100%						

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FIGURE 12-5. SAMPLE PROPOSAL EVALUATION SHEET (WITH FIGURES)

Criteria	Weight	Proposal 1		Proposal 2		Proposal 3, etc.	
		Rating	Score	Rating	Score	Rating	Score
Technical approach	30%	80%	24	70%	21	60%	18
Management approach	30%	80%	24	80%	24	70%	21
Past performance	20%	90%	18	80%	16	70%	14
Price	20%	50%	10	80%	16	90%	18
Total score	100%		76		77		71

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SELLER SELECTION

- Organizations often do an initial evaluation of all proposals and bids and then develop a short list of potential sellers for further evaluation
- Sellers on the short list often prepare a best and final offer (BAFO)
- Final output is a contract signed by the buyer and the selected seller

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ADMINISTERING/CONTROLLING PROCUREMENTS

- Ensures that the seller's performance meets contractual requirements
- Contracts are legal relationships, so it is important that legal and contracting professionals be involved in writing and administering contracts

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CLOSING PROCUREMENTS

- Involves completing and settling contracts and resolving any open items
- The project team should:
 - Determine if all work was completed correctly and satisfactorily
 - Update records to reflect final results
 - Archive information for future use
- The contract itself should include requirements for formal acceptance and closure

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