

Revision

COMP6204: Software Project
Management and Secure Development

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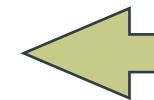
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January 22

Assessment:

- Examination 70%
 - Closed book examination,
 - 2 hours, Section A and Section B
 - Section A - 11 short answer questions
 - Section B - Choose 2 questions from 3 questions
- Coursework 30%
 - Secure Laboratories using PHP
 - No marks for self-paced work, but everyone has to do it.

This was
the case in
previous
years and
it can be
subject to
change
this year.



Definitions & Terms

- What is Software Engineering?
 - The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.
- **Software** Project Management vs other areas of project management
 - Invisibility
 - Complexity
 - Flexibility
- Software Product Attributes: Maintainability, Dependability, Efficiency

Why do software projects fail?

- People begin programming before they understand the problem
- The team has an **unrealistic** idea about how much work is involved.
- Defects are injected early but discovered late.
- Programmers have poor habits – and they don't feel accountable for their work.
- Managers try to test quality into the software.

Factors that contribute to the success of software projects.

- Make sure all decisions are based on openly shared information – Good stakeholders management
- Don't second-guess your team members' expertise – Effective team management
- Introduce software quality from the very beginning of the project – continues quality management and monitoring
- Accurate work breakdown and effort estimation
- Successful Software Project - Success factors
- Project management triangle - *triple constraint*

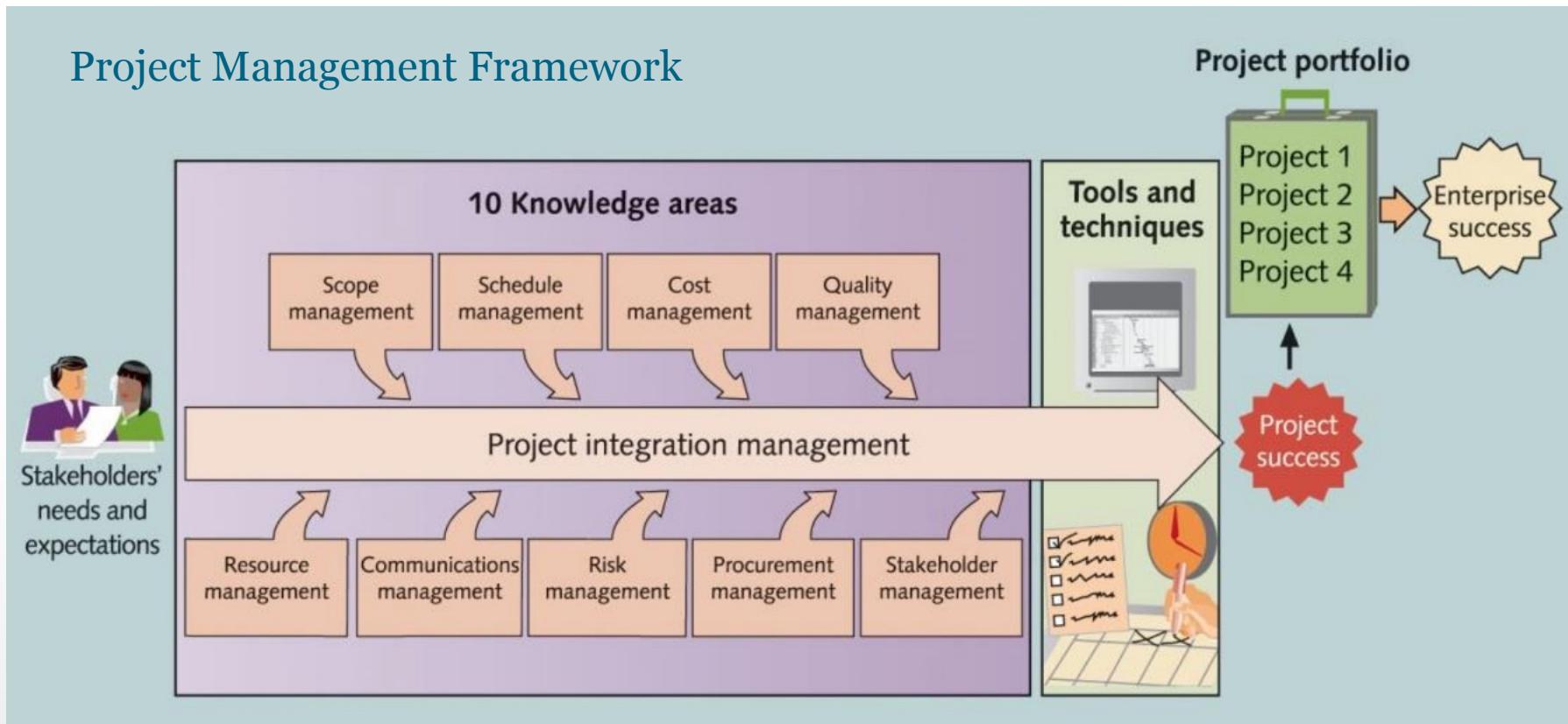
Effective SW project management

- Effective SW project management focuses on 3 P's:
 - people
 - problem
 - process

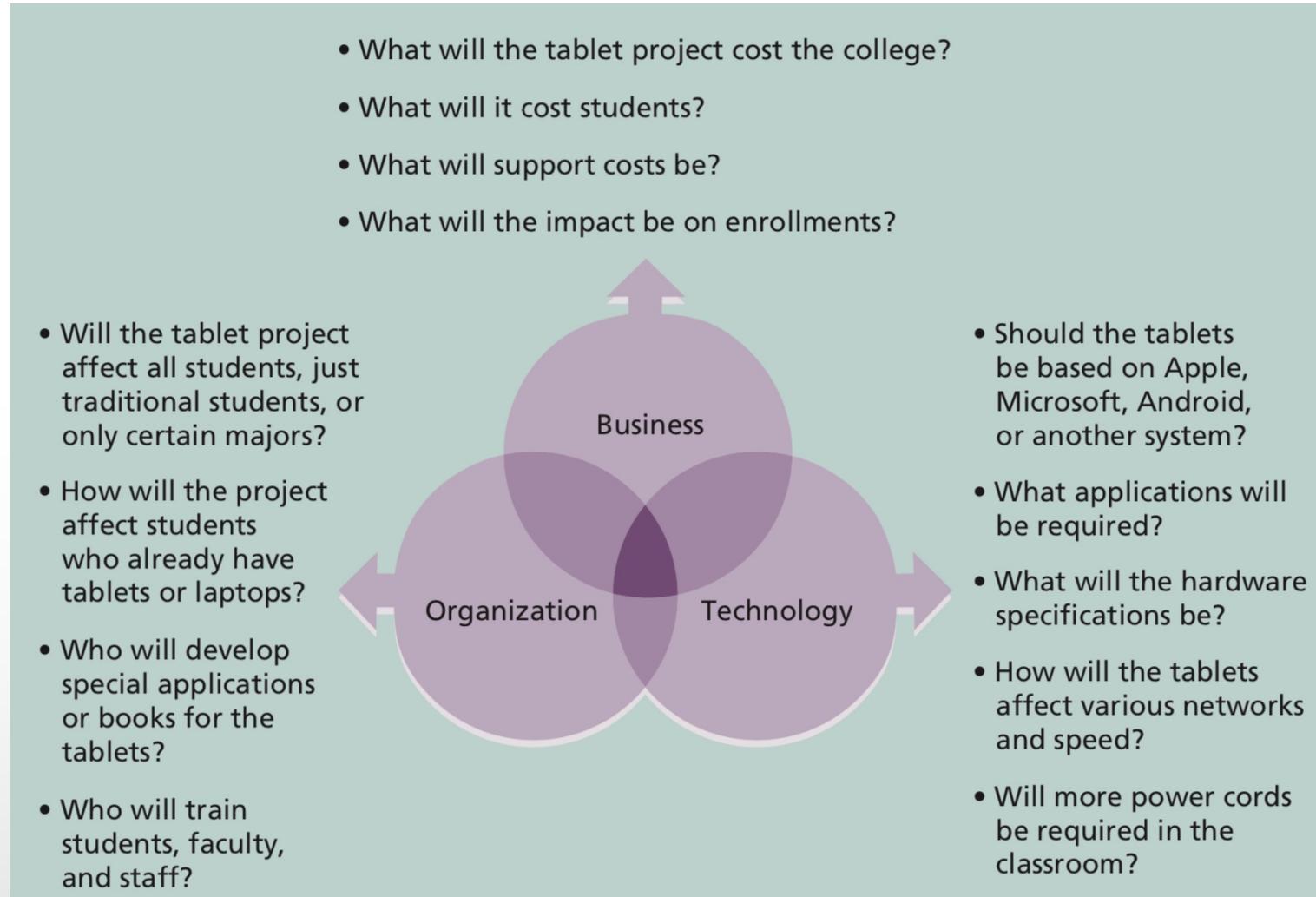
Management activities

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations
- Project Management Institute (PMI) and PMBOK which stands for *Project Management Body of Knowledge*.

What is Project Management?



The Three-Sphere Model for Systems Management



The Four Frames of Organisations

Structural frame: Roles and responsibilities, coordination, and control. Organizational charts help describe this frame.	Human resources frame: Providing harmony between needs of the organization and needs of people.
Political frame: Coalitions composed of varied individuals and interest groups. Conflict and power are key issues.	Symbolic frame: Symbols and meanings related to events. Culture, language, traditions, and image are all parts of this frame.

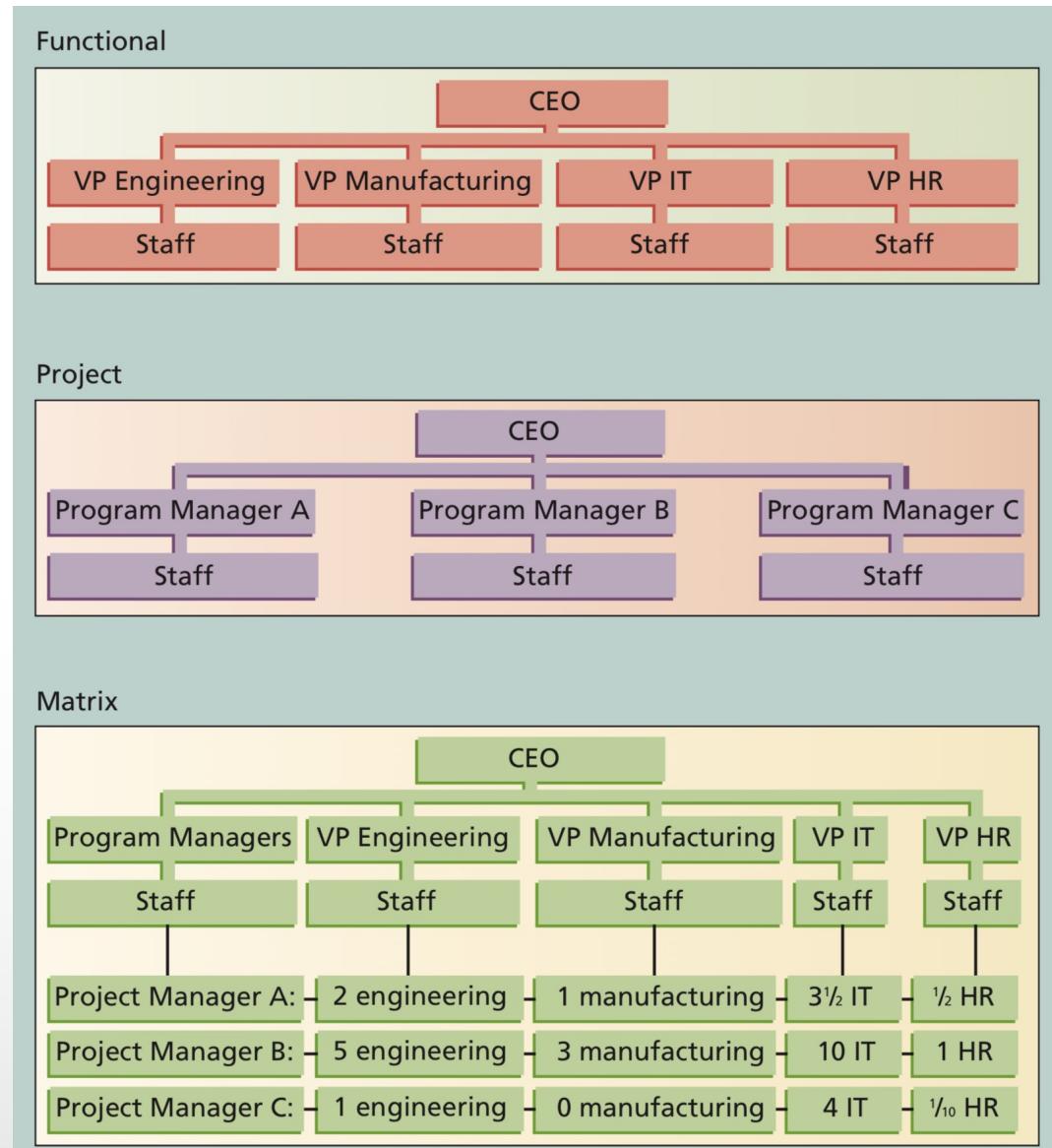
Source: Bolman and Deal.

Organisational Structures

- Three basic organisational structures
 - Functional: functional managers report to the CEO
 - Project: program managers report to the CEO
 - Matrix: middle ground between functional and project structures;
 - personnel often report to two or more bosses; structure can be weak, balanced, or strong matrix

Organisational Structures

Functional, project,
and matrix
organisational
structures



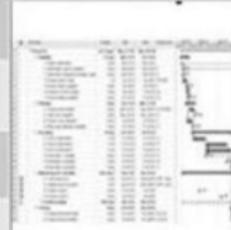
Product Life Cycles

- Products also have life cycles
 - The Systems Development Life Cycle (SDLC) is a framework for describing the phases of developing information systems
 - Systems development projects can follow
 - Predictive life cycle
 - Iterative life cycle
 - Incremental life cycle
 - Adaptive life cycle
 - Hybrid life cycle

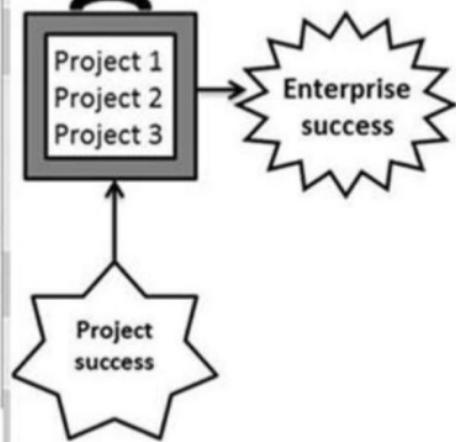
Project Management Framework

**Stakeholder
needs and
expectations**



Process groups	Knowledge areas	Tools and techniques
1. Initiating 2. Planning 3. Executing 4. Monitoring and controlling 5. Closing	1. Integration	
	2. Scope	
	3. Schedule	
	4. Cost	
	5. Quality	
	6. Resource	
	7. Communication	
	8. Risk	
	9. Procurement	
	10. Stakeholder	

**Project
portfolio**

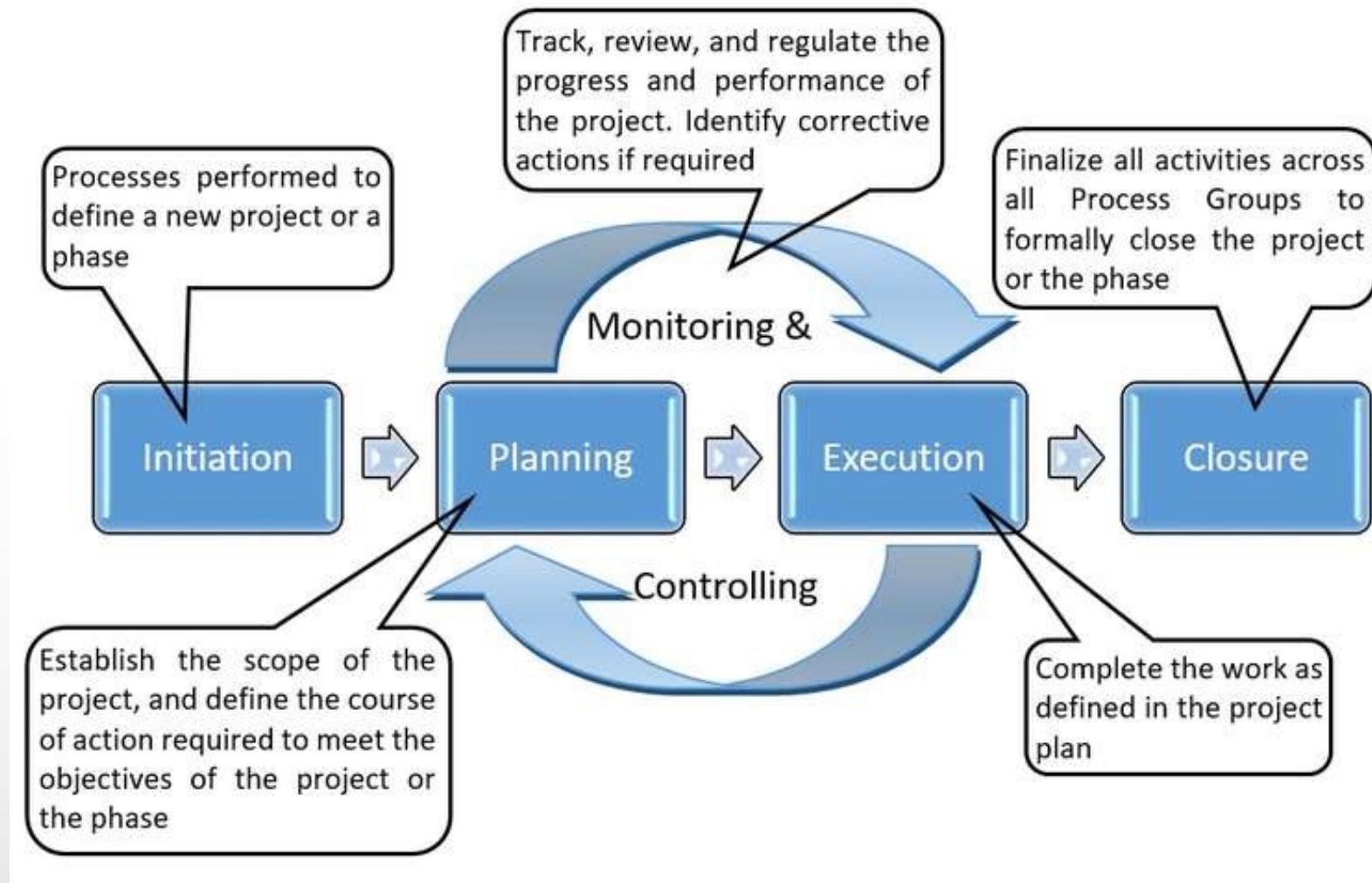


Project Management Process Groups

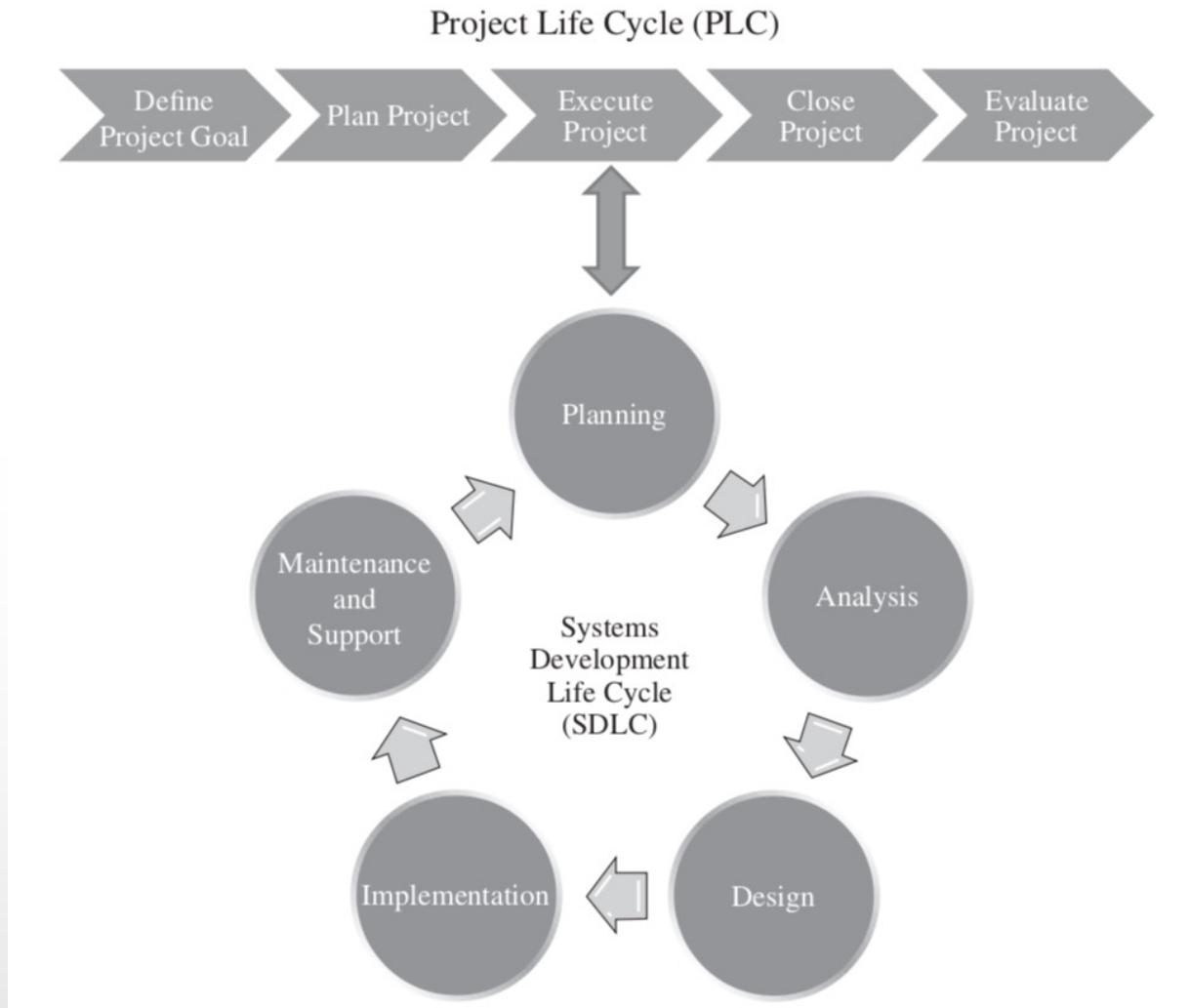
- A *process* is a series of actions directed toward a particular result
 - Project management can be viewed as a number of related processes
- Project management process groups
 - Initiating processes
 - Planning processes
 - Executing processes
 - Monitoring and controlling processes
 - Closing processes



Project Management Process Groups



The Project Life Cycle (PLC) and the Systems Development Life Cycle (SDLC)



Project management process group and knowledge area mapping

Knowledge Area	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
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	

Project management process group and knowledge area mapping

Knowledge Area	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
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 Monitor Stakeholder Engagement	

Source: Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Sixth Edition (2017)*.

Recent Trends Affecting Information Technology Project Management

- Globalisation
- Outsourcing: Outsourcing is when an organisation acquires goods and/or sources from an outside source.
 - Offshoring is sometimes used to describe outsourcing from another country
- Virtual teams: A virtual team is a group of individuals who work across time and space using communication technologies
- Agile project management

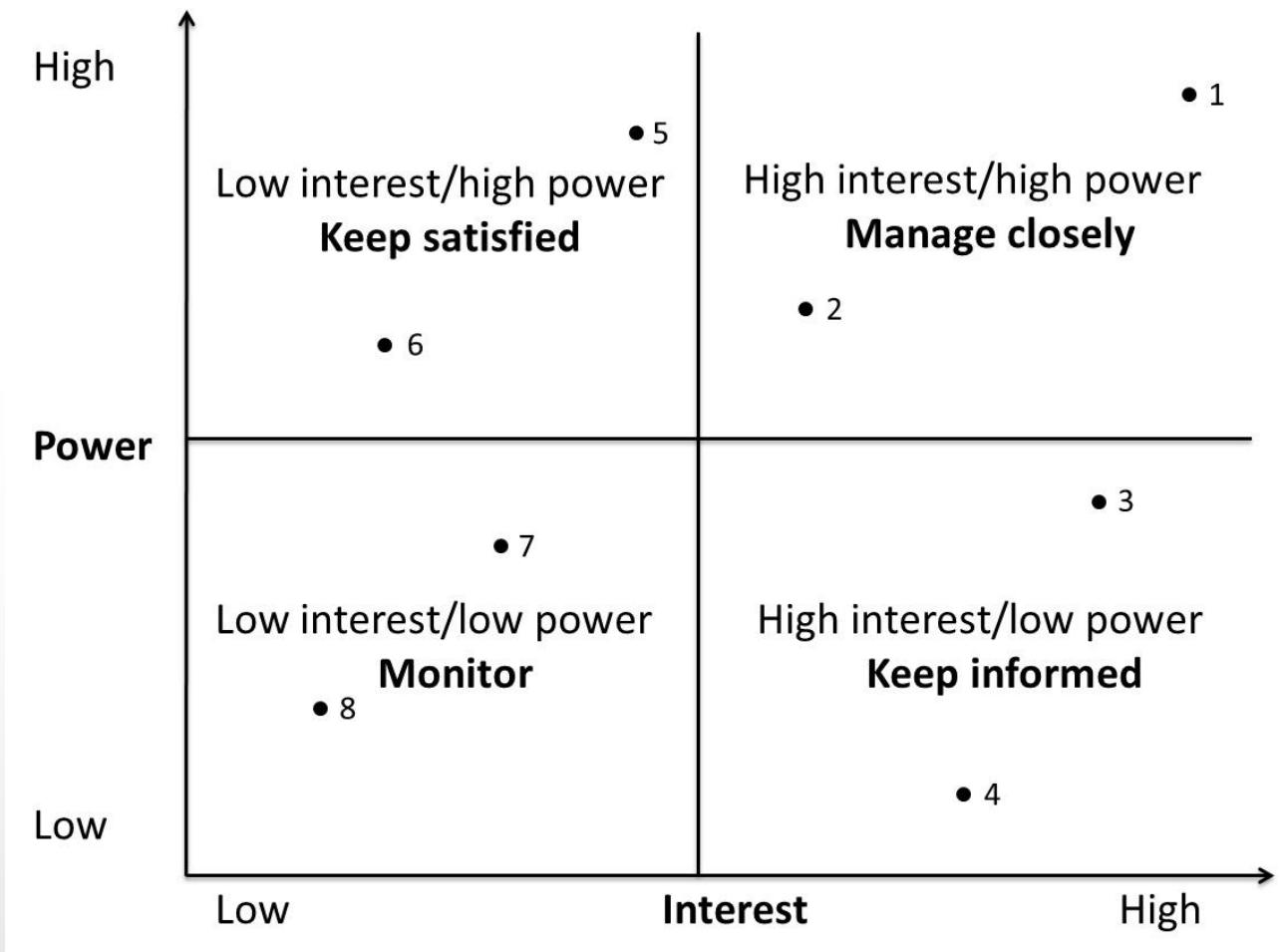
Initiating Processes and Outputs

Knowledge area	Initiating process	Outputs
Project integration management	Develop project charter	Project charter Assumption log
Project stakeholder management	Identify stakeholders	Stakeholder register Change requests Project management plan updates Project documents updates

Stakeholder Register and Stakeholder Analysis

- A **stakeholder register** is a document that includes details related to the identified project stakeholders -usually available to many people, so it should not include sensitive information
- A **stakeholder analysis** is a technique for analyzing information to determine which stakeholders' interests to focus on and how to increase stakeholder support throughout the project

Sample Stakeholder Analysis Power/Interest Grid



Creating a Project Charter

- A *project charter* is a document that formally recognises the existence of a project and provides a **summary** of the project's **objectives** and management
- It *authorises* the project manager to use organisational **resources** to complete the project
- Ideally, the project manager will play a major role in developing the project charter
- Instead of project charters, some organisations initiate projects using a simple **letter of agreement** or **formal contracts**
- *A crucial part of the project charter is the sign-off section*

Project Management Plan and Project Documents

Project Management Plan	Project Documents
1. Scope management plan 2. Requirements management plan 3. Schedule management plan 4. Cost management plan 5. Quality management plan 6. Resource management plan 7. Communications management plan 8. Risk management plan 9. Procurement management plan 10. Stakeholder engagement plan 11. Change management plan 12. Configuration management plan 13. Scope baseline 14. Schedule baseline 15. Cost baseline 16. Performance measurement baseline 17. Project life cycle description 18. Development approach	1. Activity attributes 2. Activity list 3. Assumption log 4. Basis of estimates 5. Change log 6. Cost estimates 7. Cost forecasts 8. Duration estimates 9. Issue log 10. Lessons learned register 11. Milestone list 12. Physical resource assignments 13. Project calendars 14. Project communications 15. Project schedule 16. Project schedule network diagram 17. Project scope statement 18. Quality control measurements 19. Quality metrics

Source: Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – Sixth Edition (2017).

Planning Processes and Outputs for Project Integration and Scope Management

Knowledge area	Planning process	Outputs
Project integration management	Develop project management plan	Project management plan
Project scope management	Plan scope management Collect requirements Define scope Create WBS	Scope management plan Requirements management plan Requirements documentation Requirements traceability matrix Project scope statement Project documents updates Scope baseline Project documents updates

Planning Processes and Outputs for Project Schedule and Cost Management

Knowledge area	Planning process	Outputs
Project schedule management	Plan schedule management Define activities Sequence activities Estimate activity durations Develop schedule	Schedule management plan Activity list Activity attributes Milestone list Change requests Project management plan updates Project schedule network diagrams Project documents updates Activity duration estimates Basis of estimates Project documents updates Schedule baseline Project schedule Schedule data Project calendars Project management plan updates Project documents updates
Project cost management	Plan cost management Estimate costs Determine budget	Cost management plan Cost estimates Basis of estimates Project documents updates Cost baseline Project funding requirements Project documents updates

Defining Activities

- An *activity* is a distinct, scheduled portion of work performed during the course of a project.
- The goal of the defining activities process is to ensure that project team members have a complete understanding of all the work they must do as part of the project scope so that they can start scheduling the work.
- For example, how can you estimate how long it will take or what resources you need to prepare a report if you don't have more detailed information on the report?

Creating the Activity List and Attributes

- The *activity list* is a tabulation of activities to be included on a project schedule
- It should include the activity name, an activity identifier or number, and a brief description of the activity
- The *activity attributes* provide schedule-related information about each activity, such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity
 - Both should be in agreement with the WBS and WBS dictionary and be reviewed by key project stakeholders

Creating a Milestone List

- A *milestone* is a significant point or event in a project
- It often takes **several activities** and a lot of work to complete a **milestone**, but the milestone itself is like a marker to help identify necessary activities
- There is usually **no cost** or **duration** for a milestone
- Project sponsors and senior managers often focus on major milestones when reviewing projects
- Sample milestones for many projects include:
 - Sign-off of key documents
 - Completion of specific products
 - Completion of important process-related work, such as awarding a contract to a supplier

Milestones List – Best Practice

- The **SMART** criteria suggest that **milestones** should be:
 - **S**pecific
 - **M**easurable
 - **A**ssignable
 - **R**ealistic
 - **T**ime-framed

Milestones List – Best Practice

- You can also use milestones to help reduce schedule risk by following these best practices:
 - Define milestones early in the project and include them in the Gantt chart to provide a visual guide
 - Keep milestones small and frequent
 - The set of milestones must be all-encompassing
 - Each milestone must be binary, meaning it is either complete or incomplete
 - Carefully monitor the milestones on the critical path

Sequencing Activities

- *Sequencing activities* involves reviewing the activity list and attributes, project scope statement, and milestone list to determine the relationships or dependencies between activities
- A **dependency** or **relationship** relates to the sequencing of project activities or tasks
 - For example, does a certain activity have to be finished before another one can start?
 - Can the project team do several activities in parallel?
 - Can some overlap?
- Sequencing activities has a significant impact on developing and managing a project schedule

Network Diagrams

- Network diagrams are the preferred technique for showing activity sequencing
- A **network diagram** is a schematic display of the logical relationships among, or sequencing of, project activities
 - In the **activity-on-arrow (AOA)** approach, or the **arrow diagramming method (ADM)**, activities are represented by arrows and connected at points called **nodes** (starting and ending point of an activity) to illustrate the sequence of activities; only show finish-to-start dependencies (most common type of dependency)
 - The **precedence diagramming method (PDM)** (also called **activity on node, or AON**) is a network diagramming technique in which boxes represent activities These are more widely used as they can show all dependency types

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Activity Duration Estimating – Effort vs Duration vs Elapsed Time

- During the “*Estimate Activity Durations*” process, the **effort**, **duration**, and **elapsed time** are determined for the schedule activities.
- **Effort** is the number of **work units** required to complete the activity.
- **Effort** may also be referred to as **staff-hours**, **days**, or **weeks**.
- In order to determine the **activity duration**, the **effort** required to complete the activity must be determined first.

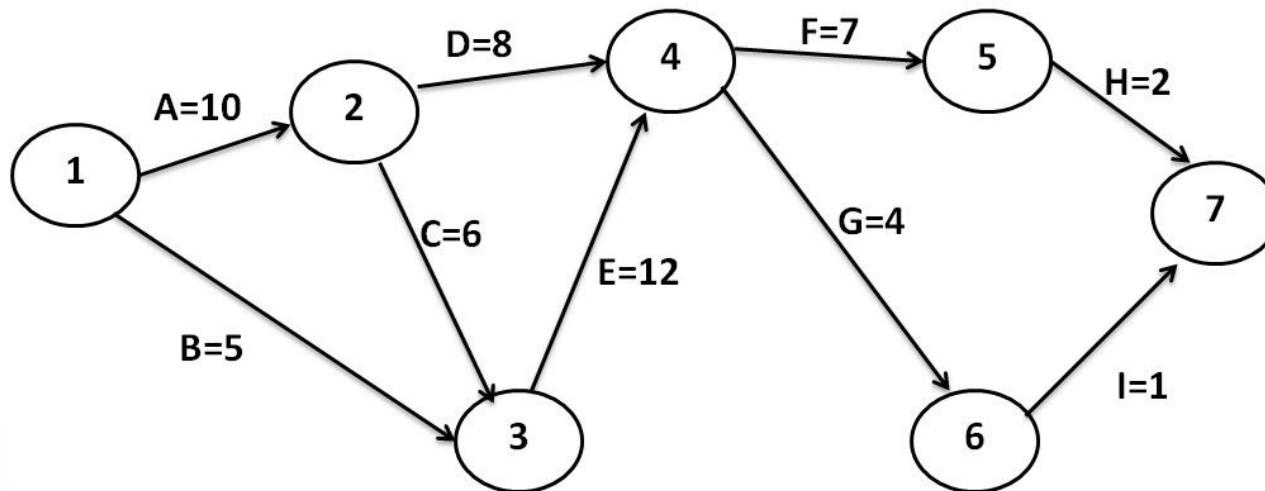
Activity Duration Estimating – Effort vs Duration vs Elapsed Time

- Duration is the total time to complete the activities based on the resources available to the project.
 - Duration does not include holidays or non-working days and may be referred to workdays or weeks.
- *Elapsed time* is the calendar time or span required to complete the activities based on the resources available.
 - Elapsed time does include holidays and non-working days.
- Duration is used to determine the schedule; effort is used to determine labor costs.

Critical Path Analysis

- Critical path method (CPM)—also called critical path analysis—is a network diagramming technique used to predict total project duration
- A critical path for a project is the series of activities that determine the *earliest* time by which the project can be completed. It is the *longest* path through the network diagram and has the least amount of slack or float
 - Slack or float is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date
- The longest path or the path containing the critical tasks is what is driving the completion date for the project

Critical Path Calculation for Project X



Note: Assume all durations are in days.

Path 1: A-D-F-H Length = $10+8+7+2 = 27$

Path 2: A-D-G-I Length = $10+8+4+1=23$

Path 3: A-C-E-F-H Length = $10+6+12+7+2=37$

Path 4: A-C-E-G-I Length = $10+6+12+4+1 = 33$

Path 5: B-E-F-H Length = $5+12+7+2=26$

Path 6: B-E-G-I Length = $5+12+4+1=22$

Critical Chain Scheduling

- Critical chain scheduling is a method of scheduling that considers **limited resources** when creating a project schedule and includes **buffers** to protect the project completion date.
 - Critical chain takes CPM a step further by adding **time buffers** to account for limited resources.
- It uses the **Theory of Constraints (TOC)**, a management philosophy developed by Eliyahu M. Goldratt and introduced in his book “*The Goal and Critical Chain*”
- It attempts to minimize **multitasking**, which occurs when a resource works on more than one task at a time

Project Cost Management

- Project **cost management** includes the processes required to ensure that a project team completes a project within an approved budget
- The main planning tasks are planning cost management, estimating costs, and determining the budget
- The main documents produced include a **cost management plan**, a **cost estimate**, and a **cost performance baseline**

Cost Estimating Techniques

- **Analogous estimates**, also called **top-down estimates**, use the actual cost of a previous, similar project as the basis for estimating the cost of the current project. This technique requires a good deal of expert judgment and is generally less costly than others are, but it can also be less accurate
- **Bottom-up estimates** involve estimating individual activities and summing them to get a project total. This approach can **increase the accuracy** of the cost estimate, but it can also be **time intensive** and, therefore, expensive to develop
- **Parametric modeling** uses project characteristics (parameters) in a **mathematical model** to estimate project costs

Cost Estimating Process

- See the detailed steps, ground rules, and assumptions that Kristin's team used for developing their cost estimate
- Summary information was documented in a cost model
- Just as projects are unique, so are cost estimates
- Consult with internal and external experts and organizations for assistance

Planning Processes and Outputs for Project Quality, Human Resource, Communications, Risk, Procurement, and Stakeholder Management

Knowledge area	Planning process	Outputs
Project quality management	Plan quality management	Quality management plan Quality metrics Project management plan updates Project documents updates
Project resource management	Plan resource management Estimate activity resources	Resource management plan Team charter Project document updates Resource requirements Basis of estimates Resource breakdown structure Project documents updates
Project communications management	Plan communications management	Communications management plan Project management plan updates Project documents updates
Project risk management	Plan risk management Identify risks Perform qualitative risk analysis Perform quantitative risk analysis Plan risk responses	Risk management plan Risk register Risk report Project documents updates Project documents updates Change requests Project management plan updates Project documents updates
Project procurement management	Plan procurement management	Procurement management plan Procurement strategy Bid documents Procurement statement of work Source selection criteria Make or buy decisions Independent cost estimates Change requests Project documents updates Organizational process assets updates
Project stakeholder management	Plan stakeholder engagement	Stakeholder engagement plan

Project Quality Management

- Project quality management ensures that the project will satisfy the stated or implied needs for which it was undertaken
- Key outputs produced as part of project quality management include a *quality management plan*, *quality metrics*, and updates to the project management plan and project documents

What Is Quality?

- The International Organization for Standardization (ISO) defines *quality* as “*the degree to which a set of inherent characteristics fulfill requirements*” (ISO9000:2000)
- Other experts define quality based on *conformance* to *requirements* and *fitness* for use.
 - Conformance to requirements means that the project’s processes and products meet written specifications
 - Fitness for use means that a product can be used as it was intended
- The *customer* ultimately decides that the quality level is acceptable

Quality Metrics

- A *metric* is a standard of measurement
- Metrics allow organizations to measure their performance in certain areas and to compare them over time or with other organizations
- Examples of common metrics used by organizations include failure rates of products produced, availability of goods and services, and customer satisfaction ratings

Sample Quality Metrics

- The Just-In-Time Training project's *success criteria*, as documented in the *scope statement*, included metrics based on:
 - *Time*: Completing the project within **one year**
 - *Customer satisfaction*: Achieving an average course evaluation of at least **3.0** on a **5.0 scale**
 - *Cost reduction*: Recouping the cost of the project in reduced training costs within **two years** after project completion
- Many organizations use **charts** to keep track of **metrics**, such as a **project dashboard**—a graphical screen summarizing key project metrics

Project Resource Management

- Many corporate executives have said, “*People are our most important asset.*” People determine the *success* and *failure* of organizations and projects
- Project resource management is concerned with making effective use of the people involved with a project as well as physical resources (materials, facilities, equipment, and infrastructure)
- The main outputs produced as part of project resource management planning are:
 - Project resource management plan (can be separated into a team management plan and a physical resource management plan)
 - Team charter

Team Management Plan

- Key components include:
 - Project organizational chart
 - Responsibility assignment matrix
 - Resource histogram
 - Staffing management plan

Responsibility Assignment Matrices

- A **responsibility assignment matrix (RAM)** is a matrix that maps the work of the project as described in the **work breakdown structure (WBS)** to the **people responsible for performing the work**
- For smaller projects, it is best to assign **WBS activities to individuals**; for larger projects, it is more effective to assign the work to **organizational units or teams**
- **RACI charts** are a type of RAM that show **Responsible** (who does the task), **Accountable** (who signs off on the task or has authority for it), **Consulted** (who has information necessary to complete the task), and **Informed** (who needs to be notified of task status/results) roles for project stakeholders

Project Risk Management

- PMI defines a project *risk* as an **uncertainty** that can have a *negative or positive* effect on meeting project objectives
- Note that some people only **view** risks as negative and call positive risks **opportunities**
- The main planning processes are planning risk management, **identifying** risks, performing **qualitative risk analysis**, performing **quantitative risk analysis**, and **planning risk responses**
- You can also plan to reduce procurement-related risks by making risk-related contract decisions

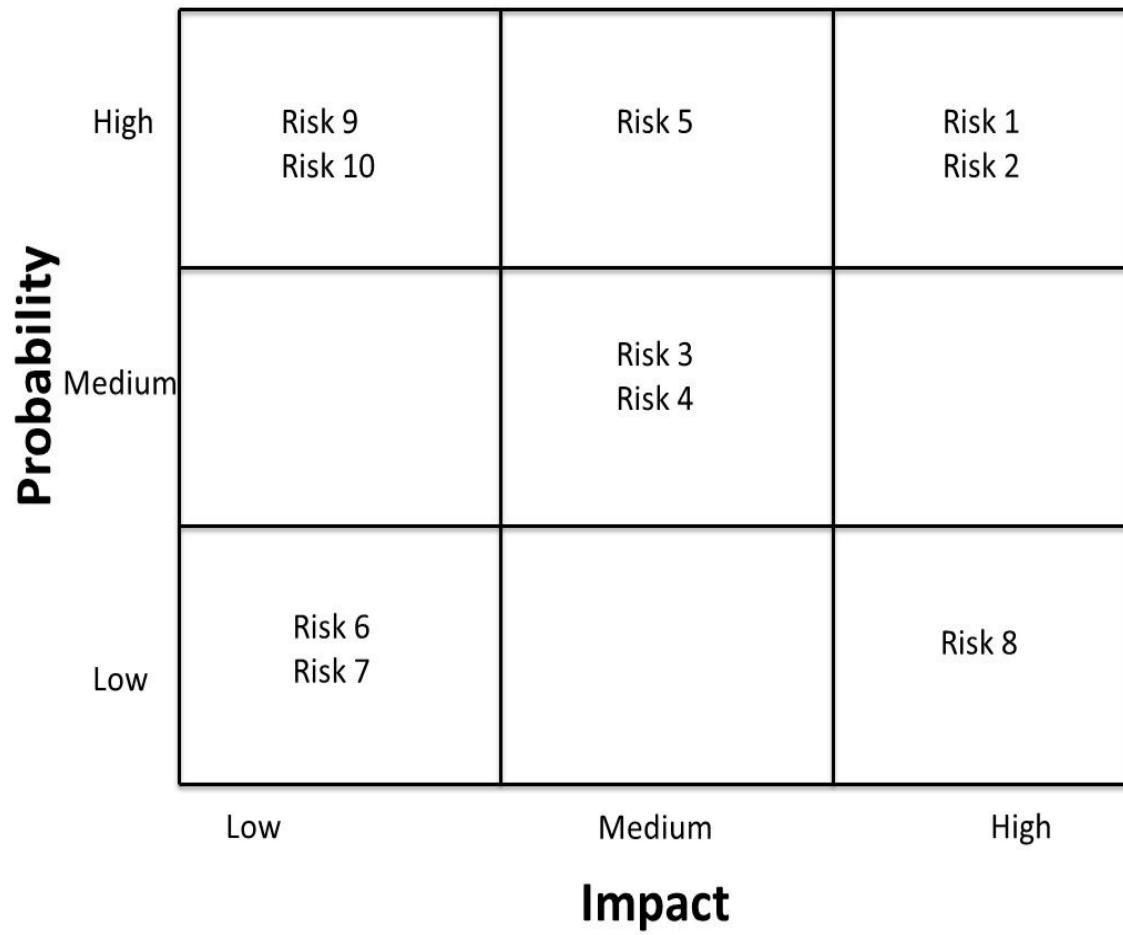
Project Risk Management

- A *risk management plan* documents the procedures for managing risk *throughout the life of a project*
- The general topics that a risk management plan should address include the **methodology** for risk management, **roles** and **responsibilities**, **budget** and **schedule estimates** for risk-related activities, **risk categories**, **probability** and **impact matrices**, and **risk documentation**

Performing Qualitative Risk Analysis

- Results in prioritizing risks as high, medium, or low
- A probability/impact matrix is a good technique to help decide which risks are most important on a project

Sample Probability/Impact Matrix



Performing Quantitative Risk Analysis

- Large, complex projects involving leading-edge technologies often require extensive **quantitative** risk analysis
- Data gathering often involves **interviewing** experts and collecting **probability distribution** information
- Quantitative risk analysis and modeling techniques include **decision tree analysis**, **simulation**, **influence diagrams**, and **sensitivity analysis**. The most commonly used simulation tool is **Monte Carlo** analysis

Planning Risk Responses

- There are several strategies that teams can plan for responding to risks.
- The five basic response strategies for negative and positive risks are:
 - Negative risk responses
 - Escalation of the risk
 - Risk avoidance
 - Risk acceptance
 - Risk transference
 - Risk mitigation
 - Positive risk responses
 - Escalation of the risk
 - Risk exploitation
 - Risk sharing
 - Risk enhancement
 - Risk acceptance

Risk Registers

- A **risk register** is a document that contains the results of various risk management processes and is often displayed in a table or spreadsheet format
- It is a tool for documenting potential risk events and related information.

Risk Registers - Content

- An identification number for each risk event
- A rank for each risk event (usually high, medium, or low)
- The name of the risk event
- A description of the risk event
- The category under which the risk event falls
- The **root cause**: The real or underlying reason a problem occurs
- **Triggers**: Indicators or symptoms of actual risk events
- Potential responses to each risk event
- The risk owner, or person who will own or take responsibility
- The probability of the risk event occurring
- The impact to the project if the risk event occurs
- The status of the risk event

Processes in Planning Process Group (24 Processes)

- The Planning Process Group has processes from each knowledge area.

1. Develop Project Management Plan ⇒ **Project Integration Management**
2. Plan Scope Management ⇒ **Project Scope Management**
3. Collect Requirements ⇒ Project Scope Management
4. Define Scope ⇒ Project Scope Management
5. Create WBS ⇒ Project Scope Management
6. Plan Schedule Management ⇒ **Project Schedule Management**
7. Define Activities ⇒ Project Schedule Management
8. Sequence Activities ⇒ Project Schedule Management
9. Estimate Activity Durations ⇒ Project Schedule Management
10. Develop Schedule ⇒ Project Schedule Management
11. Plan Cost Management ⇒ **Project Cost Management**
12. Estimate Costs ⇒ Project Cost Management

Processes in Planning Process Group - Cont.

- The Planning Process Group has processes from each knowledge area.

13. Determine Budget ⇒ Project Cost Management

14. Plan Quality Management ⇒ **Project Quality Management**

15. Plan Resource Management ⇒ **Project Resource Management**

16. Estimate Activity Resources ⇒ Project Resource Management

17. Plan Communications Management ⇒ **Project Communication Management**

18. Plan Risk Management ⇒ **Project Risk Management**

19. Identify Risks ⇒ Project Risk Management

20. Perform Qualitative Risk Analysis ⇒ Project Risk Management

21. Perform Quantitative Risk Analysis ⇒ Project Risk Management

22. Plan Risk Responses ⇒ Project Risk Management

23. Plan Procurement Management ⇒ **Project Procurement Management**

24. Plan Stakeholder Engagement ⇒ **Project Stakeholder Management**

Processes in Planning Process Group (24 Processes)

13. Determine Budget ⇒ Project Cost Management
14. Plan Quality Management ⇒ Project Quality Management
15. Plan Resource Management ⇒ Project Resource Management
16. Estimate Activity Resources ⇒ Project Resource Management
17. Plan Communications Management ⇒ Project Communication Management
18. Plan Risk Management ⇒ Project Risk Management
19. Identify Risks ⇒ Project Risk Management
20. Perform Qualitative Risk Analysis ⇒ Project Risk Management
21. Perform Quantitative Risk Analysis ⇒ Project Risk Management
22. Plan Risk Responses ⇒ Project Risk Management
23. Plan Procurement Management ⇒ Project Procurement Management
24. Plan Stakeholder Engagement ⇒ Project Stakeholder Management

Executing Processes and Outputs (continued)

KNOWLEDGE AREA	EXECUTING PROCESS	OUTPUTS
Project communications management	Manage communications	Project communications Project management plan updates Project documents updates Organizational process assets updates
Project risk management	Implement risk responses	Change requests Project documents updates
Project procurement management	Conduct procurements	Selected sellers Agreements Change requests Project management plan updates Project documents updates Organizational process assets updates
Project stakeholder management	Manage stakeholder engagement	Change requests Project management plan updates Project documents updates Organizational process assets updates

Issue Logs

- An *issue log* helps to **document**, **monitor**, and **track** issues that need to be **resolved** for effective work to take place.
- An *issue* is a matter under question or dispute that could impede project success.
- Issues can hurt team performance, so it is important to take action to resolve them.
- A **critical issue** is anything that prevents progress on scheduled activities.
 - If the activity is on the **critical path**, resolution is **urgent**. There should be an **issue escalation process** that ensures issue resolution action.

Change Requests

- Often, a number of **requests for changes** emerge during project execution
- Recall that a **process for handling changes** should be defined during **project planning** as part of the project management plan
- It is important during project execution to formally and informally request appropriate changes

Conflict Handling Modes

- Competing is *assertive* and *uncooperative*, when people pursue their own concerns at other people's expense.
- Accommodating is *unassertive* and *cooperative*, when people neglect their own concerns to satisfy the concerns of other people.
- Avoiding is *unassertive* and *uncooperative*, when people neither pursues their own concerns nor those of others by simply not dealing with the conflict.
- Collaborating is both *assertive* and *cooperative*, when people attempt to work with others to find some solution that fully satisfies their concerns.
- Compromising is *moderate* in both *assertiveness* and *cooperativeness*, where the objective is to find a mutually acceptable solution that partially satisfies both parties.

Managing Quality

- Quality assurance includes all the activities related to satisfying the relevant quality standards for a project
- Another goal of quality assurance is continual quality improvement
- Key outputs of managing quality include a quality report, test and evaluation documents, change requests, project management plan updates, and project documents updates

Quality Improvement Tools and Techniques

1. Benchmarking generates ideas for quality improvements by *comparing* specific project practices or product characteristics to those of other projects or products within or outside of the organization itself (for example, *training costs per employee* and *course ratings* are benchmarks)
2. A quality audit is a structured review of specific quality management activities that helps identify *lessons learned*, which could *improve performance* on current or future projects

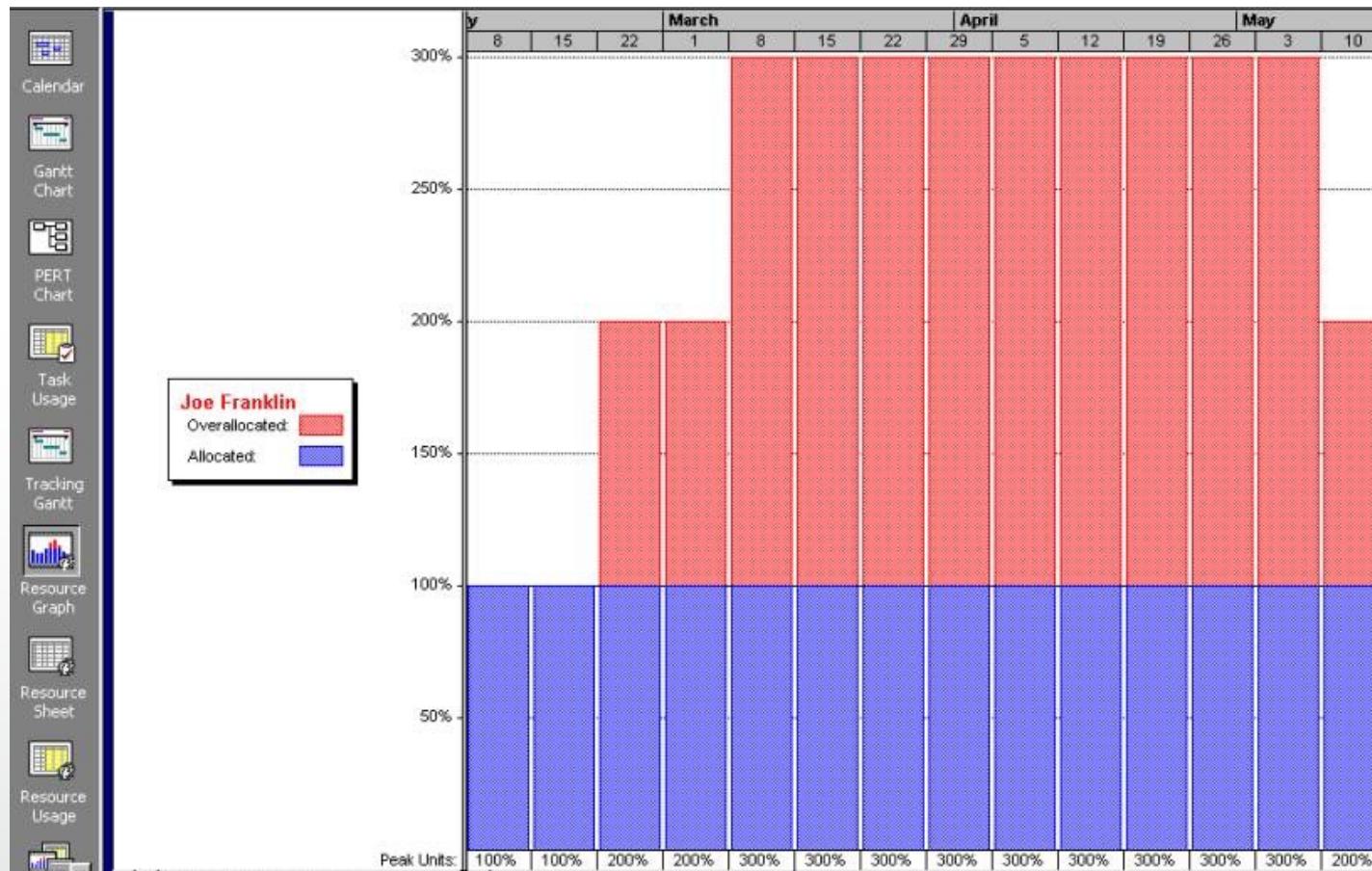
Quality Improvement Tools and Techniques

3. Process analysis involves analyzing how a process operates and determining improvements.
 - You can use a simple task board or kanban board to visually display work in columns labeled To Do, In Progress, and Done.
 - Cause-and-effect diagrams—also called *fishbone* diagrams (because their structure resembles a fishbone) or Ishikawa diagrams (named after their founder)—can assist in ensuring and improving quality by finding the root causes of quality problems

Resource Loading

- Resource loading refers to the amount of individual resources an existing schedule requires during specific time periods
- Helps project managers to develop a general understanding of the demands a project will make on the organization's resources and individual people's schedules
- Overallocation means more resources than what are available assigned to tasks
- Project managers often use resource histograms, as described in Chapter 6

Sample Resource Histogram Showing an Overallocated Individual



Resource Leveling

- Resource leveling is a technique for resolving resource conflicts by delaying tasks
- The main purpose of resource leveling is to create a smoother distribution of resource usage and reduce overallocation

Project Stakeholder Management

- The process of **managing stakeholder engagement** involves working with various project stakeholders to meet their **needs** and **expectations**, addressing stakeholder issues as they occur, and **fostering engagement** in project decisions and activities
- The key benefit of managing stakeholder engagement, if done well, is that it allows the project manager to increase support and minimize resistance from stakeholders, significantly increasing the chances to achieve project success

Knowledge area	Monitoring and controlling process	Outputs
Project quality management	Control quality	Quality control measurements Verified deliverables Work performance information Change requests Project management plan updates Project documents updates
Project resource management	Control resources	Work performance information Change requests Project management plan updates Project documents updates
Project communications management	Monitor communications	Work performance information Change requests Project management plan updates Project documents updates
Project stakeholder management	Monitor stakeholder engagement	Work performance information Change requests Project management plan updates Project documents updates
Project risk management	Monitor risks	Work performance information Change requests Project management plan updates Project documents updates Organizational process assets updates
Project procurement management	Control procurements	Closed procurements Work performance information Procurement documentation updates Change requests Project management plan updates Project documents updates Organizational process assets updates

Forecasting With Earned Value Management

- Earned value management (EVM) is a project *performance measurement* technique that integrates **scope**, **time**, and **cost** data
- Given a *baseline*, project managers and their teams can determine how well the project is meeting scope, time, and cost goals by entering actual information and then comparing it to the *baseline*
- The baseline information includes:
 - Scope data (WBS tasks)
 - Time data (start and finish estimates for each task)
 - Cost data (cost estimates for each task)
- Note that you can use earned value management at either a detailed or a summary level

Gather Work Performance Information

- Effective earned value management requires the compilation of several pieces of information from the project.
- None of these are difficult; the four pieces of information that the project manager must gather for each task are:
 - Budget at Completion (BAC)
 - It represents the original project budget. It is determined during project planning and readily available.
 - Planned Value (PV)
 - Earned Value (EV)
 - Actual Cost (AC)

Determine Schedule Status

- Using the calculation so far we have determined whether we are
 1. *ahead* or *behind* our schedule
 2. *under* or *above* the *estimated cost*.
- It's time to determine *how far ahead* or *behind* schedule
- Or how much *under* or *above* the *estimated cost*.
- To do this, we will calculate another four values from the initial four we *gathered* from the project data.

Variance Analysis

- At this point, the project manager wants to know how far off we are from the project *baseline*.
- This can be determined through
 - Schedule Status
 - Schedule Variance (SV)
 - Schedule Performance Index (SPI)
 - Cost Status
 - Cost Variance (CV)
 - Cost Performance Index (CPI)

Schedule Performance Index (SPI)

- Another way of looking at project performance, apart from variance, is through *indexes*.
- *Schedule Performance Index (SPI)* gives a sense of project performance from a schedule perspective.

$$SPI = EV/PV$$

- SPI > 1 indicates the project is ahead of schedule and SPI < 1 indicates the project is behind schedule. The SPI, *greater than 1.0 is good*.
- In our example, SPI = $\$7,500/\$10,000 = 0.75$, indicating the project is only going 75% as per the original plan or it's 25% behind schedule.

Cost Performance Index (CPI)

- *Cost Performance Index (CPI)* gives a sense of project performance from a **cost perspective**.
$$\text{CPI} = \text{EV}/\text{AC}$$
 - CPI > 1 indicates the project is under budget and CPI < 1 indicates the project is **over budget**.
- In our example, CPI = $\$7,500/\$15,000 = 0.5$
 - CPI = 0.5 means the project has spent *twice* amount that it should have at this point.
 - CPI = 1.0 means the project is on schedule.
 - CPI = 2.0 means the project has spent half the amount that it should have at this point.

Interpreting Earned Value Numbers

- In general, *negative numbers for cost and schedule variance indicate problems in those areas*
- Negative numbers mean the project is *costing more than planned* or *taking longer* than planned
- Likewise, *CPI and SPI less than one or less than 100 percent indicate problems*

Earned Value Forecasting

- Earned Value Management contains **four calculations** which give the project manager a *forecast* into future performance of the project:
 1. Estimate to Complete (ETC)
 2. Estimate at Completion (EAC)
 3. Variance at Completion (VAC)
 4. To Complete Performance Index (TCPI)
- Each of these are, in essence, an extrapolation from the **previous calculation** which was used to determine the status of the project right now.

Project Quality Management

- Key outputs of *quality control* include quality-control measurements, verified deliverables, work performance information, change requests, project management plan updates, and project documents updates
- Outcomes are acceptance decisions, rework, and process adjustments
- What is quality?
 - Quality, simplistically, means that a product should meet its specification.

Challenges of Software Quality

- There is a tension between customer quality requirements (*efficiency*, *reliability*, etc.) and developer quality requirements (*Maintainability*, *reusability*, etc.).
- Some quality requirements are *difficult* to specify in an *unambiguous* way.
- Software specifications are usually *incomplete* and often *inconsistent*.
- Therefore with the previous definition:
 - “Quality, simplistically, means that a product should meet its specification.”

We face a difficult dilemma

Seven Basic Tools of Quality (ASQ*)

1. **Cause-and-effect diagrams:** Help you find the root cause of quality problems
2. **Check sheets:** A Check Sheet is a tool to collect both qualitative and quantitative facts about quality problems.
 - When it is used to collect quantitative data, then known as tally sheet
3. **Control charts:** Illustrate the results of a process over time and show if a process is in control
4. **Histograms:** Show a bar graph of a distribution of variables

* *American Society for Quality (ASQ)*

Seven Basic Tools of Quality (ASQ)

5. **Pareto charts:** Help you identify and prioritize problem areas
6. **Scatter diagrams:** Show if there is a relationship between two variables
7. **Stratification:** A technique used to separate data to see patterns in data.
 - A **run chart** displays the history and pattern of variation of a process over time.
 - A **flow chart** is a graphical display of the logic and flow of processes that help you analyze how problems occur and how processes can be improved

Summary of Project Closing Outputs

Knowledge area	Closing process	Outputs
Project integration management	Close project or phase	Project documents updates Final product, service, or result transition Final report Organizational process assets updates

Closing Outputs

- **Project documents updates:** All project documents should be reviewed and marked as final versions, and the lessons learned register should include lessons learned during the closing process
- **Final product, service, or result transition:** Project sponsors are usually most interested in making sure that the final products, services, or results are delivered and transitioned to the appropriate part of the organization.
- A final project report and presentation are also commonly created during project closing
- **Updates to organizational process assets:** Recall that organizational process assets help people understand, follow, and improve business processes. Examples include plans, processes, policies, procedures, and knowledge bases, such as templates and lessons-learned reports. During closing, the project team should update appropriate process assets, especially the lessons learned repository

What Is PRINCE2?

- PRINCE stands for: PRojects IN Controlled Environments , While 2 stands for the version.
- PRINCE2 is a structured project management method,
- PRINCE2 emphasises dividing projects into manageable and controllable stages.
 - This method focuses on managing resources and risks by dividing projects into smaller stages, defining clear roles & responsibilities and using seven processes to manage the project life cycle.
- PRINCE2 is mostly used in the UK, Australia and European countries.

Overview

- We'll go over the main components of the PRINCE2 project management methodology, which are:
 - PRINCE2 Principles
 - PRINCE2 Themes
 - PRINCE2 Processes
 - PRINCE2 Roles and Responsibilities
- But before we dive into that, let's define what PRINCE2 is.

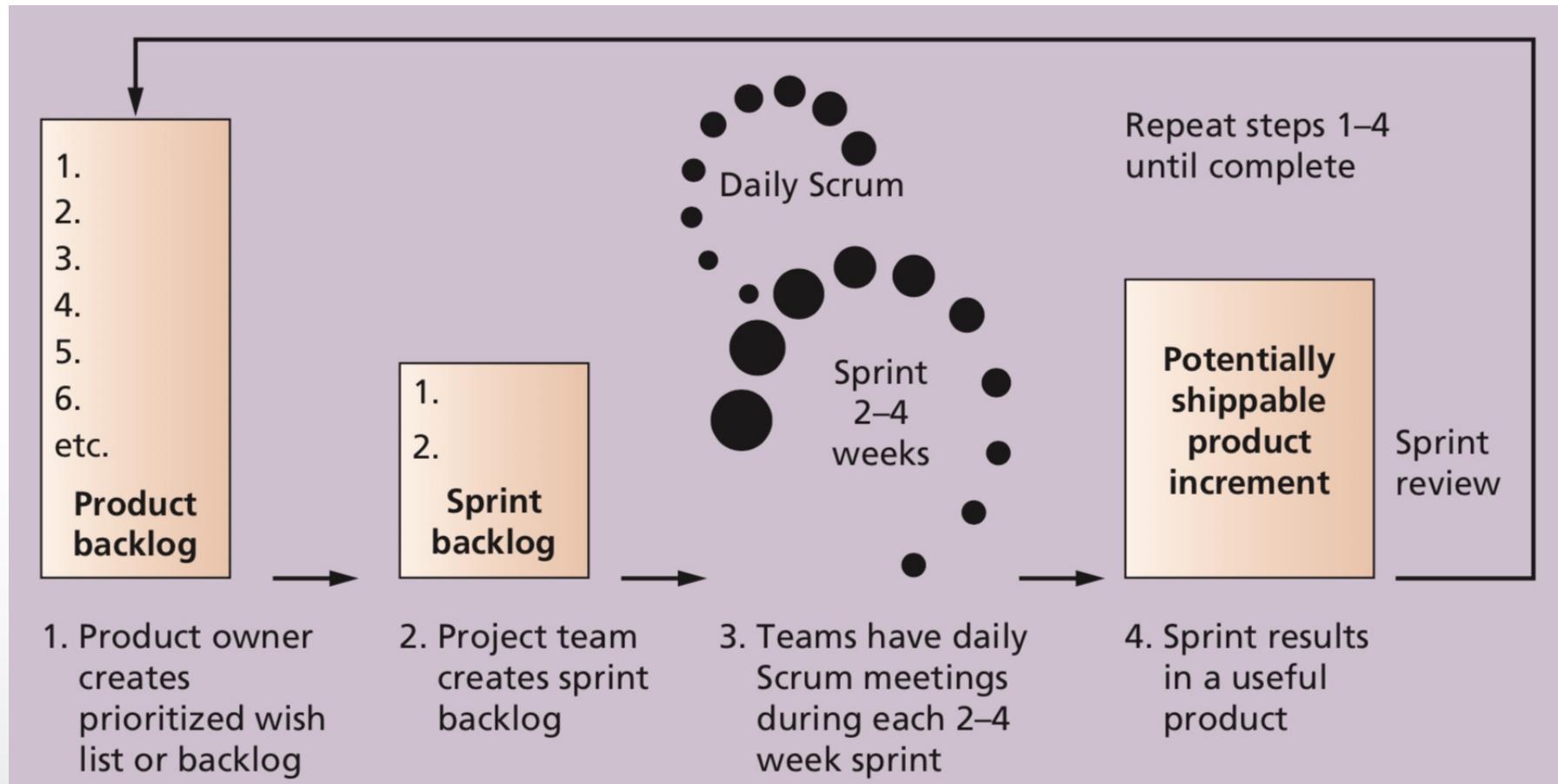
PRINCE2 – The 7 Processes

- These describe a **step-wise progression** through the **project lifecycle**, from getting started to project closure. Each process provides **checklists** of recommended **activities**, **products** and **related responsibilities**. These seven processes are:
 1. Starting up a Project
 2. Directing a Project
 3. Initiating a Project
 4. Controlling a Stage
 5. Managing Product Delivery
 6. Managing a Stage Boundary
 7. Closing a Project

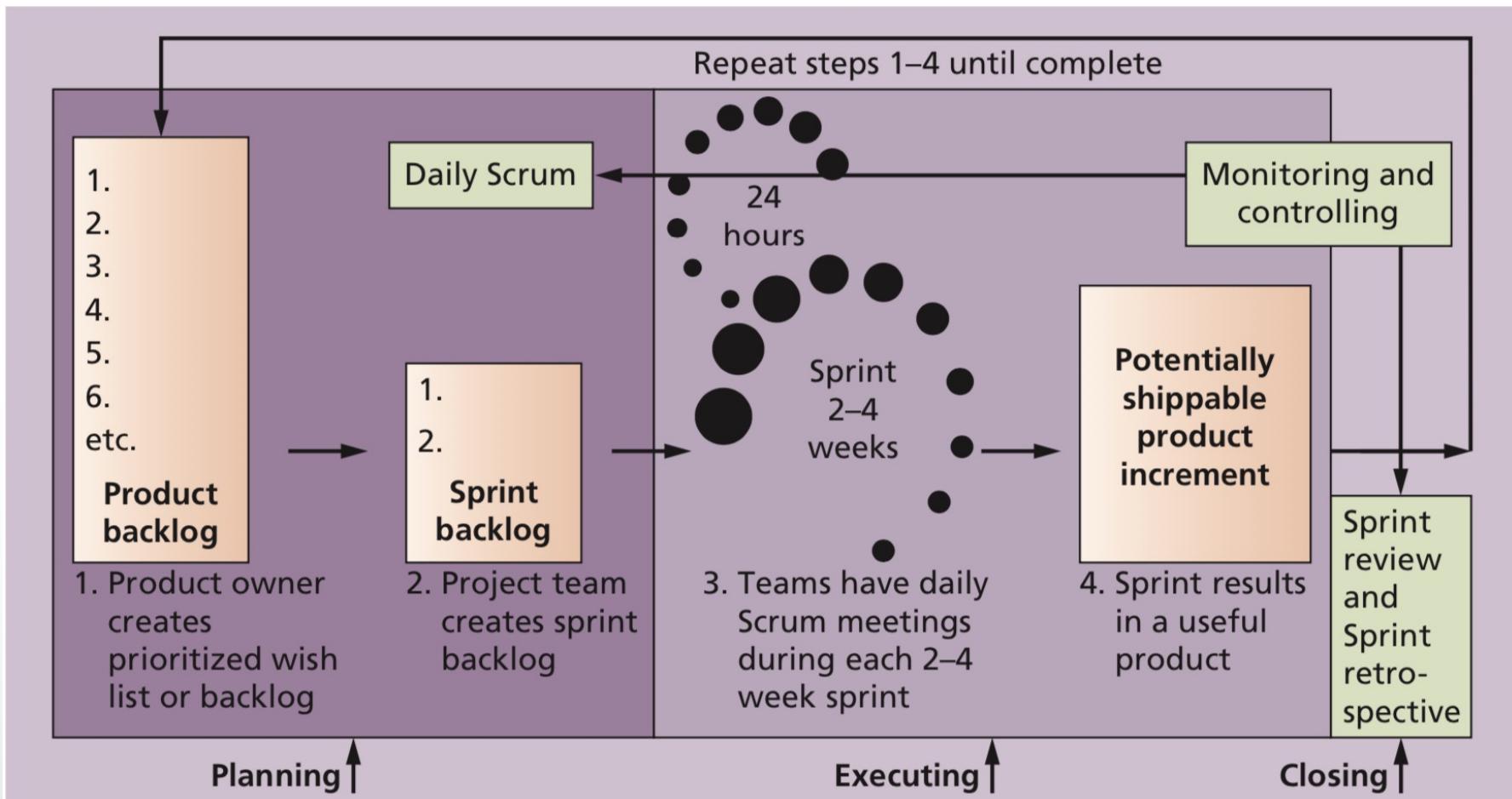
Types of PRINCE2 documentation

- **Business case:** Detailed description of why the project is needed and its expected benefits to users and the business.
- **Risk register:** Lists the probability and potential impacts of risks and opportunities.
- **Quality register:** A running log of quality checks that ensure deliverables meet expectations.
- **Issues register:** A list of problems and concerns from project team members.
- **Lessons log:** Notes on lessons learned to apply to the next work stage and/or future projects.
- **Daily log:** A daily diary written by the project manager that reports activity and progress.

Scrum Framework



Scrum framework and the process group



Scrum – Roles

- **Product owner:** person responsible for the business value of the project and for deciding what work to do and in what order, as documented in the product backlog
- **Scrum Master:** person who ensures that the team is productive, facilitates the daily Scrum, enables close cooperation across all roles and functions, and removes barriers that prevent the team from being effective
- **Scrum team or development team:** cross-functional team of five to nine people who organise themselves and the work to produce the desired results for each sprint, which normally lasts two to four weeks

Scrum – Artifacts

- **Product backlog:** list of features prioritised by business value
- **Sprint backlog:** highest-priority items from the product backlog to be completed within a sprint
- **Burndown chart:** shows the cumulative work remaining in a sprint on a day-by-day basis

Scrum – Ceremonies

- **Sprint planning session:** meeting with the team to select a set of work from the product backlog to deliver during a sprint
- **Daily Scrum:** short meeting for the development team to share progress and challenges and plan work for the day
- **Sprint reviews:** meeting in which the team demonstrates to the product owner what it has completed during the sprint
- **Sprint retrospectives:** meeting in which the team looks for ways to improve the product and the process based on a review of the actual performance of the development team

Themes, Initiatives, Epics and Story Cards

- In agile projects, instead of WBS we can have:
 - *Themes* are *large focus areas* that span the organisation.
 - *Initiatives* are collections of *epics* that drive toward a common goal.
 - *Epics* are large bodies of work that can be broken down into a number of smaller tasks (called *stories*).
 - *Stories*, also called ‘user stories,’ are short requirements or requests written from the *perspective* of an *end user*.

MoSCoW Prioritisation Method

In Agile, it is important to prioritise requirements as well.



Must have: Non-negotiable product needs that are mandatory for the team.



Should have: Important items that add significant value.



Could have: Nice to have items that will have a small impact if not provided.



Will not have: Items that are not a priority for this specific time frame.

Story Cards

- *Story cards* contain information about **user stories** written on an **index card** or typed in software to facilitate planning and discussion.
- Stories should use the INVEST rule and be:
 - **Independent**: Can be completed on its own
 - **Negotiable**: One or two sentences long. Details can be worked out through discussion
 - **Valuable**: Provide value to the customer
 - **Estimable**: A good approximation
 - **Small**: Can be completed within one iteration
 - **Testable**: Know when it is complete

Cost Planning for an Agile/Hybrid Project

- Unlike predictive projects, therefore, there is no *total project budget* or *detailed cost estimate* for the entire project for agile project.
- There is some estimating involved when using an agile approach, but instead of using *hours* or *dollars*, most estimates are done in a *relative* fashion.
- Relative estimates are created by comparing work or grouping it by equivalent difficulty based on factors like risk, complexity, and required labor.

Agile Estimating Methods

- **T-shirt sizing:** S, M, L, XL, XXL
- **Planning poker:** Each team member estimates user stories with numbered cards (1, 2, 3, 5, 8, 13, 21)
- **The bucket system:** Extension of planning poker when there are many user stories, and the team is large
- **Affinity estimates:** Three steps:
 1. Silent relative estimates (Sticky note “small” on the left and “large” on the right)
 2. Editing the wall (discussion done by group)
 3. Placing items into more specific sizes (S, M, L, XL, XXL)

QUALITY, RESOURCE, COMMUNICATIONS, STAKEHOLDER, RISK, AND PROCUREMENT MANAGEMENT PLANNING FOR AN AGILE/HYBRID PROJECT

- Agile/hybrid teams can use any of the predictive project planning processes, tools, or techniques mentioned earlier.
- For example, an agile project, like a predictive project, can include surveys and evaluations for examples.
 - They could use similar metrics for both kinds of projects.
- The following section focuses on planning approaches more specific to agile teams

Agile Quality Planning

- **Definition of Done:** a list of **criteria** which must be met before a product increment '*often a user story*' is considered 'done'.
- Big **visible charts** of **information radiators**, the generic term for any of a number of handwritten, drawn, printed or electronic displays which a team places in a highly visible location, so that all team members as well as passers-by can see the latest information at a glance.

Agile Resource Planning

- One of the biggest differences in resource planning between **predictive** and *agile* projects is that instead of having a project manager assign people to tasks, agile teams self-manage, meaning they decide who will work on tasks themselves.
- The team should have all the skills and authority to complete the work in the product backlog. This makes selecting the team very important.
- Creating resource histograms and cross-training employees can help agile organizations ensure they have adequate and skilled workers.

Agile Stakeholder Planning

- The **sprint review meetings** allow **key stakeholders** to inspect the **outcomes** of each sprint and **determine** future adaptations.
- The **Scrum master** or **project manager** works with the appropriate people to remove the **impediments**.
- Key stakeholders determine the **Definition of Done** for each increment.
- The **information radiators** provide **visibility** into work progress for all interested stakeholders.

Agile Risk Planning

- Emphasizing *value* to the customer, prioritizing work, and **collaborating** as a team *focused* on *one sprint goal at a time* helps to address potential risks.
- Teams should openly discuss *impediments* as part of their daily Scrum meetings, and the Scrum master or project manager should work hard to **remove impediments** so the teams can focus on accomplish meaningful work.
- Many agile teams also use *risk registers*, as described earlier in this chapter.

Monitoring And Controlling Agile/Hybrid Projects

- The **daily Scrum** and **sprint review** meetings assist in monitoring and controlling agile projects
- **Burn charts** show project team velocity. **Velocity** measures the **productivity** rate at which the deliverables are produced, validated, and accepted within a predefined interval.
- You can create the following types of burn charts:
 - **Burndown charts** show the amount of work (number of tasks) remaining compared to the plan. They are often used for each sprint and discussed during sprint retrospectives.
 - **Burnup charts** show the amount of work (tasks) completed compared to the plan. They can be used during each sprint, and they can also show progress for several sprints.
 - **Combined burn charts** show how much work has been completed and how much remains.

Closing Agile/Hybrid Projects

- Just like predictive projects, **agile and hybrid** projects should be closed.
 - Hybrid projects can use any of the project closing processes listed earlier.
- A strength of the Scrum events, if used on agile projects, is an intentional moment of closure, as follows:
 - **Daily Scrum:** You can think of these meetings as providing closure for the day before.
 - **Sprint reviews:** Sprint reviews provide closure for sprints, and sometimes entire projects.
 - **Sprint retrospectives:** This event is similar to a lessons-learned, but it only focuses on a particular sprint. When a project ends, teams should hold a **final retrospective** to focus on all lessons learned.
- Teams should still hold a **close-out** meeting and celebrate!