Murdoch
UNIVERSITY

Project planning and management

Topic 11

ICT284 Systems Analysis and Design

About this topic

In the final two topics of the unit, we change the focus from the activities involved in the SDLC to *managing the systems development process itself*. This involves consideration of project management activities and the choice of development methodology.

In Topic 1 we introduced the core processes involved in developing a system, and discussed them in terms of the SDLC. In this topic we look at core processes 1 and 2 again, but this time from the perspective of **project management**, and describe how a project can be identified and approved, and planned and monitored.

Murdoch UNIVERSITY

Unit learning outcomes addressed in this topic

1. Explain how information systems are used within organisations to fulfil organisational needs
2. Describe the phases and activities typically involved in the systems development life cycle
3. **Describe the professional roles, skills and ethical issues involved in systems analysis and design work**
4. Use a variety of techniques for analysing and defining business problems and opportunities and determining system requirements
5. Model system requirements using UML, including use case diagrams and descriptions, activity diagrams and domain model class diagrams
6. Explain the activities involved in systems design, including designing the system environment, application components, user interfaces, database and software
7. Represent early system design using UML, including sequence diagrams, architectural diagrams and design class diagrams
8. **Describe tools and techniques for planning, managing and evaluating systems development projects**
9. Describe the key features of several different systems development methodologies
10. Present systems analysis and design documentation in an appropriate, consistent and professional manner

Murdoch UNIVERSITY

Topic learning outcomes

After completing this topic you should be able to:

- Discuss the factors that cause a software development project to *succeed* or *fail*
- Describe the *responsibilities* of a project manager
- Define the *PMBOK* and briefly outline its *knowledge areas*
- Describe the *Agile* approach to project management knowledge areas
- Explain the *activities* required to get a project *approved*
- Explain the *activities* required to *plan* and *monitor* a project
- Apply different *cost/benefit analysis* techniques

Murdoch UNIVERSITY

Resources for this topic

READING

- Satzinger, Jackson & Burd, Chapter 11
- Online Chapter C on My Unit Readings:
    - PMBOK (you don't need all the detail here)
    - more detail on cost-benefit analysis techniques and project scheduling

Except where otherwise referenced, all images in these slides are from those provided with the textbook:

Satzinger, J., Jackson, R. and Burd, S. (2016) *Systems Analysis and Design in a Changing World*, 7th edition, Course Technology, Cengage Learning: Boston. ISBN-13 9781305117204

Murdoch UNIVERSITY

Topic outline

- Introduction to project management
- Role of the project manager
- The Project Management Body of Knowledge (PMBOK)
    - The Agile approach to PMBOK knowledge areas
- Project management activities of Core Process 1
- Project management activities of Core Process 2
- Cost-benefit analysis

Murdoch UNIVERSITY

Introduction to project management

Murdoch UNIVERSITY

Overview

In Topic 1 we introduced the core processes involved in developing a system. These were discussed in terms of the SDLC.

In this topic we look at Core Process 1 & 2 again, but this time from the perspective of *project management*, and describe how a project can be identified and approved, and planned and monitored

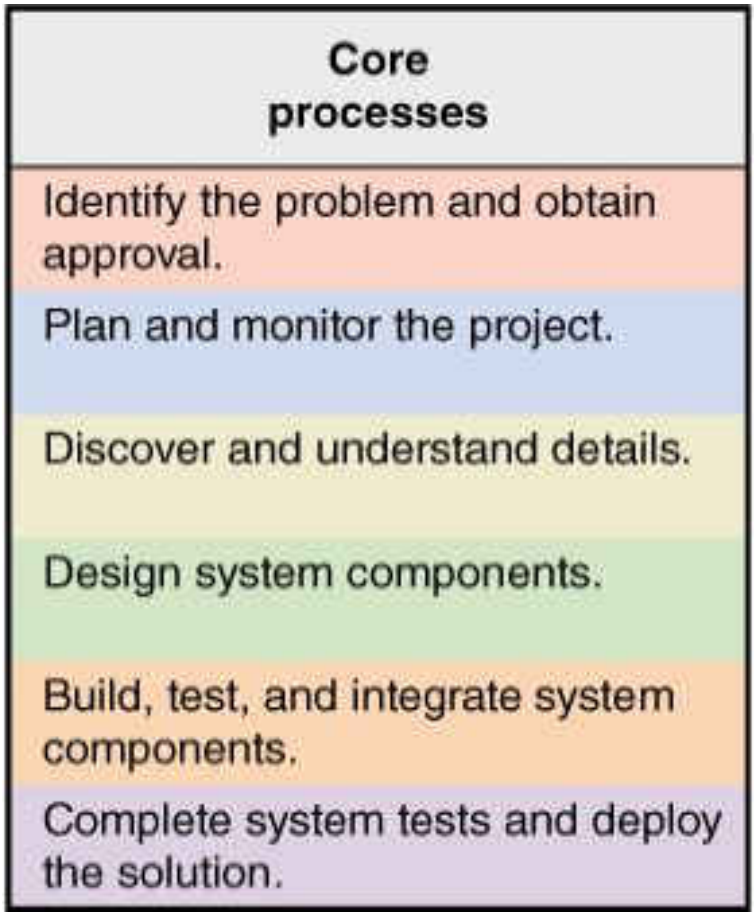


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Projects and Project Management

A **project** is a planned undertaking, with a beginning and end, which produces a predetermined result and is usually constrained by a schedule and resources

A project:

- Has a unique purpose
- Is temporary
- Requires resources
- Involves uncertainty/risk
- Has a deliverable

Projects and Project Management

Project management is the application of knowledge, skills, tools and techniques to project activities and processes to improve project outcomes – i.e. within **time** constraints, within **budget**, and **according to specification**

The purpose of **project management** is:

- to *coordinate* the activities involved
- to *determine* the order they should occur in
- to *assign* tasks to appropriate team members
- … and *monitor* progress to ensure the project is successfully completed

The need for Project Management

A number of organisations study the outcome of projects to identify why they succeed or fail.

Success is usually measured in terms of

- Time
- Budget
- Specifications (the needs expressed in the problem definition)

Measures of project success

Project success = project management success + project product success

Project management success includes

- The system was delivered “on time.”
- The system was delivered “within budget.”
- The system was delivered “according to requirements”.
- The resulting information system is “acceptable to the customer”.
- The system development process had a minimal impact on ongoing business operations.

Project product success includes

- Product has added value to the organisation.

Research on project success

- Many system development projects fail. Standish Group (2015) report that:
  - 29% of IT projects succeed (on time, on budget, all features)
  - 52% are challenged (project operational but either over budget, or over time, or reduced features)
  - 19% fail (cancelled before completion)
  - Ref: http://www.infoq.com/articles/standish-chaos-2015
- Some examples of project failures: http://www.computerworlduk.com/galleries/infrastructure/top-10-software-failures-3599618

Some evidence that good project management can reduce the chance of failure

Examples of failed projects (Australia)

- The Commonwealth of Australia's child support project was a $104million project which aimed to support the payment of 3.2 billion dollars per year. In January 2017, the system failed due to unsuccessful meeting of milestones and functional requirements, costing taxpayers $100,100 per day plus more than 80 technicians, mostly contractors costing $200 a day to work and fix the current system technical gaps
- In December 2016, the Australian Taxation Office's (ATO) system went down after a major failure of the upgraded storage network. An independent review estimated that the crash would cost the taxpayers at least $340,000
- The 2016 Australian Bureau of Statistics (ABS) Census project is considered an IT catastrophe, with insufficient security protection against a minor cyber-attack that led to 40 hours outage of the system. It is estimated that the census failure will cost the taxpayer at least $30million
- In 2011 Victoria's MYKI transport ticketing system was reported to be $350m over budget and at least four years behind schedule. This was one of a series of projects examined in the report, which estimated the projects it had reviewed were collectively $1.44bn over budget

Examples of failed projects (international)

Murdoch UNIVERSITY

- In 2016 the Royal Bank of Scotland was fined £56million when customers experienced an outage due to issues with batch scheduling software
- The Obama administration has spent roughly $840million on *HealthCare.gov*, including more than $150 million just in cost overruns for the version that failed so badly when it launched in 2013
- In 2011 the UKP 12.7bn ($20.4bn) National Health Service IT Scheme was cancelled after the Major Projects Authority had reviewed it and decided it was not fit to provide services to the NHS

Chaos Reports 2011-2015

Murdoch UNIVERSITY

MODERN RESOLUTION FOR ALL PROJECTS

	2011	2012	2013	2014	2015
SUCCESSFUL	29%	27%	31%	28%	29%
CHALLENGED	49%	56%	50%	55%	52%
FAILED	22%	17%	19%	17%	19%

The Modern Resolution (OnTime, OnBudget, with a satisfactory result) of all software projects from FY2011-2015 within the new CHAOS database. Please note that for the rest of this report CHAOS Resolution will refer to the Modern Resolution definition not the Traditional Resolution definition.

https://www.infoq.com/articles/standish-chaos-2015

Project success based on development paradigms

Survey of success Nov 2013

Paradigm	Successful	Challenged	Failed
Lean	72%	21%	7%
Agile	64%	30%	6%
Iterative	65%	28%	7%
Ad hoc	50%	35%	15%
Traditional	49%	32%	18%

Adaptive

Chaotic

Predictive

http://www.drdobbs.com/architecture-and-design/the-non-existent-software-crisis-debunki/240165910

Reasons for IT project failure

Many studies identify the reasons for failure:

- *Undefined project management practices*
- *Poor IT management and procedures*
- Inadequate executive support for the project
- *Inexperienced project managers*
- Unclear business needs and project objectives
- Inadequate user involvement

Why can these issues lead to project failure?

Key to project success

Project management approaches have been studied, and are identified and described in a very comprehensive body of knowledge. Project management information is not hard to find:

- Therefore ,the problem appears to be down to the *application* of that knowledge… and may be preventable
- Case studies show that professionals with experience and skills were not leading them
- A lack of management skills underlies many of the reasons for project failure

Summing up…

- Project **success** is usually measured in terms of time, budget, specifications, and acceptability to the user
- Many projects **fail** – they are over time, over budget, or don't meet specifications; or even cancelled before completion
- A lack of management skills underlies many of the reasons for project failure
- **Project management** is the application of knowledge, skills, tools and techniques to project activities and processes to achieve a planned result within budget and on schedule

Murdoch UNIVERSITY

Role of the project manager

Murdoch UNIVERSITY

Role of the Project Manager

- Project management – organising and directing people to achieve a planned result within budget and on schedule
- Success or failure of project depends on skills of the project manager
    - Beginning of project – plan and organise
    - During project – monitor and control
- Responsibilities are both **internal** and **external**

Internal responsibilities

Project manager responsibilities inside the project include managing people and resources. These include:

- Develop the project schedule
- Recruit and train team members
- Assign team members to tasks
- Assess project risks
- Monitor and control project deliverables and milestones

The PM serves as a locus of control for the project team and all it activities.

External responsibilities

Project manager responsibilities associated with other stakeholders include:

- Report the project's status and progress
- Work directly with the client (the project's sponsor) and other stakeholders
- Identify resource needs and obtain resources
- Establish good working relationships with those who identify the needed system requirements (the people who will use the system)

The PM is the main contact for the project, and represents the team to the outside world.

Role of the Project Manager – interaction with stakeholders

The PM must interact with:

- Client/customer
- Oversight/steering committee
- Users

as well as with the project team

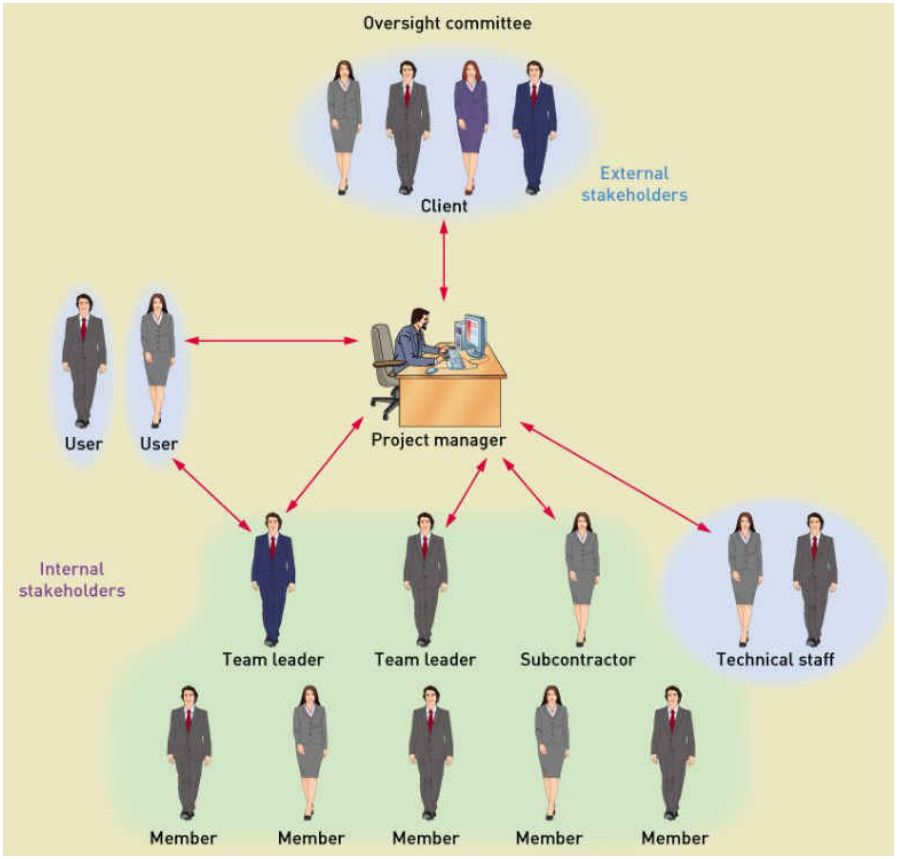


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Role of the Project Manager – ceremony (how formal should the PM be?)

The:

- amount of documentation
- traceability of specifications, and
- the formality of the decision-making process

determine the *level of ceremony* of a project

Usually large, complex projects are executed with high ceremony

Smaller or more adaptive projects may often have less ceremony

Summing up…

Success or failure of a project depends on the skills of the **project manager**

- Beginning of project – focus is on planning and organising
- During project – monitoring and controlling

Responsibilities are both *internal* and *external*:

- **Internal** to the project include managing people and resources of the development team
- **External** responsibilities include managing interactions with all stakeholders, including client, steering committee and users

Murdoch UNIVERSITY

The Project Management Body of Knowledge (PMBOK)

Murdoch UNIVERSITY

The Project Management Body of Knowledge (PMBOK)

- The Project Management Institute (PMI) is a professional society involved in education and certification of project managers. They created the **Project Management Body of Knowledge (PMBOK)**

- PMBOK provides a solid base of standards, procedures and practices for managing all types of projects and is used by many organisations to apply project management principles to projects

PMBOK mindmap

https://www.pinterest.co.uk/pin/134896951316720047

PMBOK Knowledge Areas

PMBOK covers the following 10 *knowledge areas*:

- **Integration management** – focusing on the tasks that ensure the project is coordinated, executed, monitored and controlled successfully
- **Scope management** – defining and controlling the functions included in the system and the scope of work done by the team
- **Time management** - building a detailed schedule of all project tasks and monitoring progress of project against milestones

PMBOK Knowledge Areas (continued)

- **Cost management** - calculating cost/benefit analysis and monitoring expenses
- **Quality management** – establishing a quality plan and quality control activities for each project phase
- **Human resource management** - recruiting and hiring project team members
- **Communications management** - including the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval and ultimate disposition of project information

PMBOK Knowledge Areas (continued)

- **Risk management** - identifying and reviewing risks for failure and developing plans to reduce these risks
- **Procurement management -** developing requests for proposals (RFPs); evaluating bids, writing contracts, monitoring vendor performance
- **Stakeholder management** – identify stakeholders and manage stakeholder expectations

Summing up…

- The Project Management Body of Knowledge (**PMBOK**) provides a solid base for managing all types of projects
- It covers **10 knowledge areas**, addressing the management of:

  integration, scope, time, cost, quality, human resources, communications, risk, procurement, stakeholders

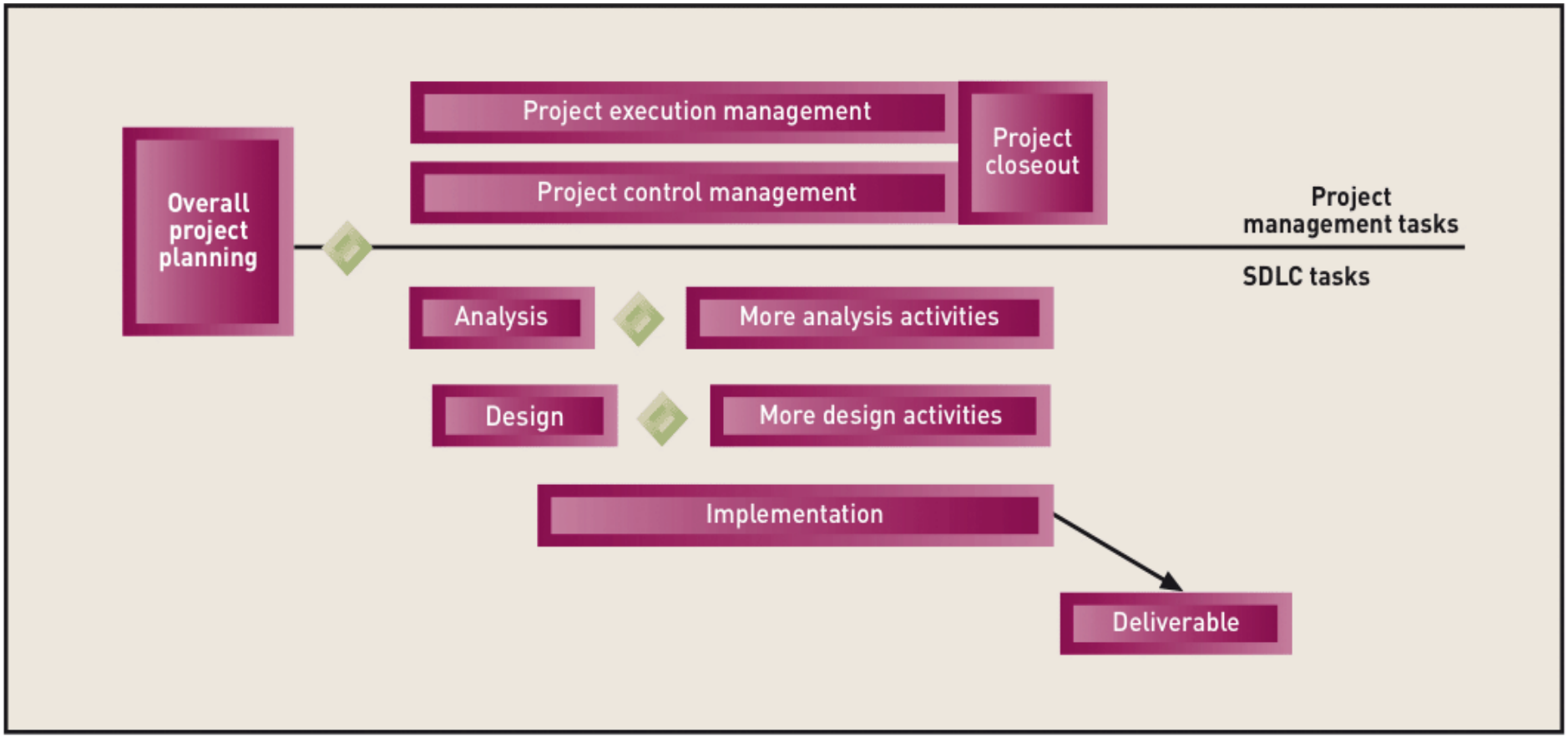
- PMBOK is used by many organisations to apply project management principles to projects

Murdoch UNIVERSITY

The Agile approach to project management

Murdoch UNIVERSITY

Project Management and SDLC tasks for a *predictive* project

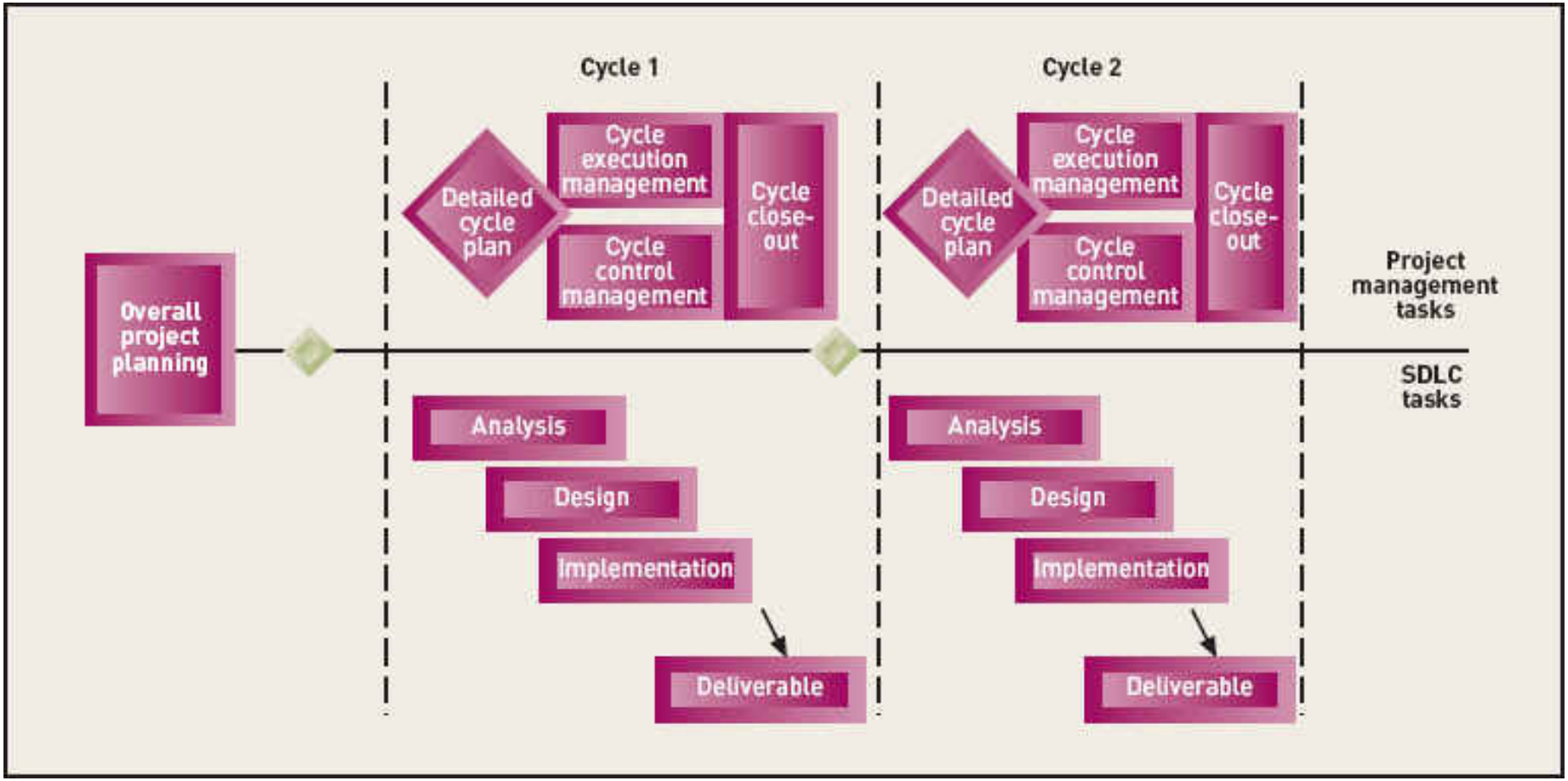


http://images.slideplayer.info/11/3205189/slides/slide_14.jpg

Image from Satzinger, J. Jackson, R. & Burd, S. (2007) Systems Analysis and Design in a Changing World, 4th edition. Course Technology, Thomson Learning. Figure 3.3

Project Management and SDLC tasks for an *adaptive* project

Murdoch UNIVERSITY



http://images.slideplayer.info/11/3205189/slides/slide_15.jpg

Image from Satzinger, J. Jackson, R. & Burd, S. (2007) Systems Analysis and Design in a Changing World, 4th edition. Course Technology, Thomson Learning. Figure 3.4

Agile development

Murdoch UNIVERSITY

- Complements Adaptive SDLCs and Methodologies that support it
- A guiding philosophy and set of guidelines for developing information systems in an unknown, rapidly changing environment
- Takes adaptive and makes sure developers are fast on their feet to respond to changes

More on Agile approaches in Topic 12

Agile PM

Murdoch UNIVERSITY

One of the major challenges of Agile Project Management is how best to manage the flexibility and chaos of an agile team with the order and control needed for a project

Issues with Agile PM in 5 of the 10 knowledge areas:

- Scope management
- Time management
- Cost management
- Risk management
- Quality management

are discussed next as examples

Agile Scope Management

The PM must have a process, and mechanisms in place to control the scope of a project, even when it is accepted that scope is not well understood and there will be changes, updates and refinements to the requirements as the project progresses

Prioritising the requirements is one approach. Criteria can include importance, complexity, size

Since high priority items are delivered first, the client can shut down the project when s/he considers it complete

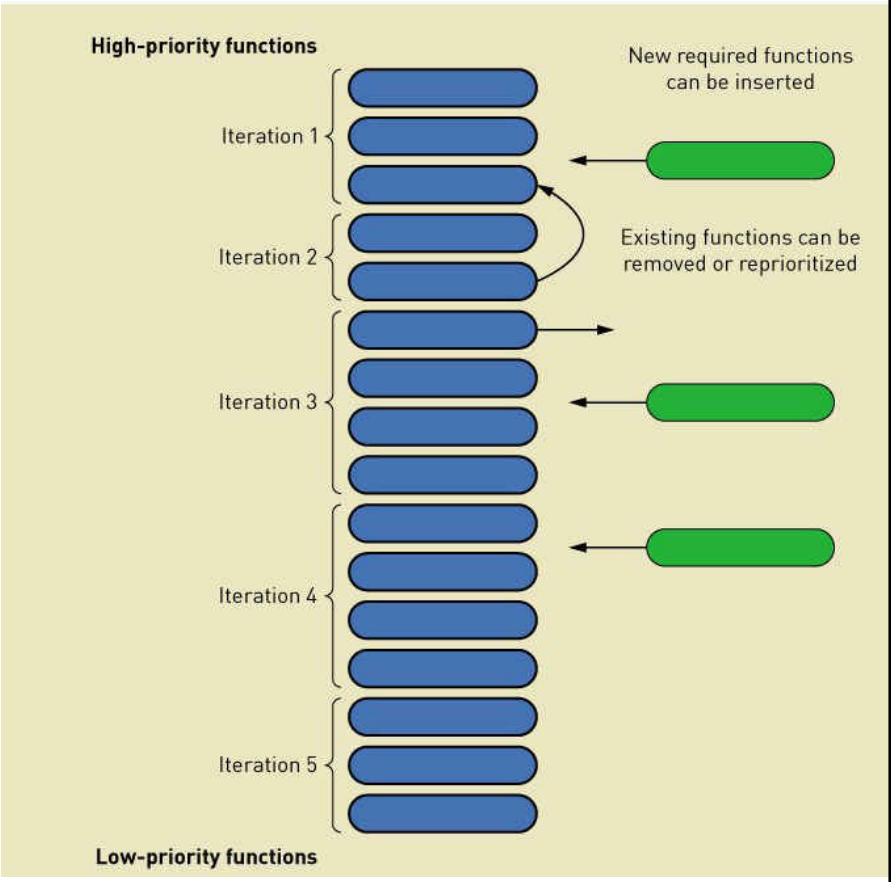


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Agile Time Management

Murdoch UNIVERSITY

Because Agile requirements are always changing it can be difficult to develop a meaningful project schedule across the project

- Preliminary Agile scheduling identifies *iterations* and assigns requirements to these
- Within an iteration, a more detailed schedule can be developed, by the *project team* (not just PM)
- The tasks within an iteration are identified, estimates developed and tasks assigned to team members, who soon become proficient at estimating and scheduling

Agile Cost Management

- As requirements are often expected to change throughout the lifetime of the project it is more difficult to estimate costs
- More important for the PM to *control* the costs during the life of the project
- Where agile projects have strict budgets, the scope and time are adjusted to remain within cost constraints

Image source: https://www.quora.com/Given-tech-improvements-is-project-management-without-time-as-a-static-factor-theoretically-possible

Agile Risk Management

Murdoch UNIVERSITY

Iterative projects are often *risk-driven*:

- Early iterations focus on addressing most critical risks so high risk portions of the new system are developed first
- Requirements are regularly updated and reprioritised based on an improved understanding of current risk exposure
- In predictive projects it is more difficult to integrate risk-reducing activities in the project schedule

Agile Quality Management

Murdoch UNIVERSITY

- Consider the quality of the *process* as well as the *product* (ie the system)
- Quality Management in a predictive project tends to focus on the end phase – when it's difficult and expensive to make changes
- In an Agile project the quality of each new iteration deliverable is considered individually as well as it integrates to the rest of the system, with input from users, so:

  Testing and quality control are spread across the project for a more robust delivered system

In summary – Agile PM

Murdoch UNIVERSITY

Agile Areas of Project Management

- Agile Scope Management
  - Scope is defined broadly and controlled
- Agile Time Management
  - Schedule is flexible
- Agile Cost Management
  - Costs are estimated after iterations
- Agile Risk Management
  - Higher risk aspects are completed first
- Agile Quality Management
  - Quality is assessed after iterations

Source: http://www.slideshare.net/dcsunu/agile-project-management-54493426

Summing up…

- Project management principles can be applied to *predictive* and *adaptive* projects in different ways
- We used the example of Agile to demonstrate how several of the PM areas apply in an Agile project
- One of the major challenges of Agile project management is how best to manage the flexibility and chaos of an agile team with the order and control needed for a project

Murdoch UNIVERSITY

Project management activities of Core Process 1 – Identify the problem and obtain approval

Murdoch UNIVERSITY

Project Management activities of Core Process 1

Core Process 1 is critical for project success, and involves four activities:

1. Identify the problem
2. Quantify project approval factors
3. Perform risk and feasibility analysis
4. Review with client and obtain approvals

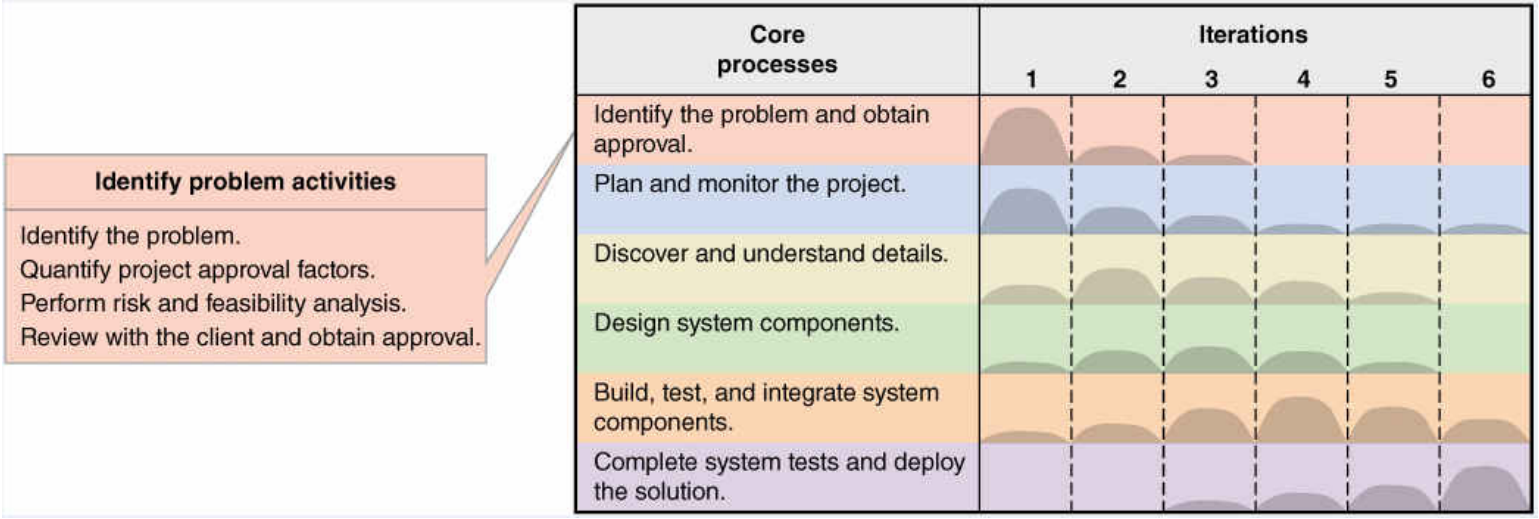


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Activity 1.1: identify the problem

Murdoch UNIVERSITY

Driving forces to start project:

Respond to **opportunity**

Resolve **problem**

Conform to **directive**

Project initiation comes from:

- Long-term IS strategic plan (top-down)
- Department managers or process managers (bottom-up)
- Response to outside forces (e.g. new legislative requirements)

Activity 1.1:identify the problem

Murdoch UNIVERSITY

Need to ensure the new system meets the business need, by defining the 'target'

A System Vision Document:

- Describes the *problem*
- Identifies business *benefits* (cost/benefits)
- Describes system *capabilities* (in terms of the requirements for the IS to achieve business benefits)

System Vision Document

Problem Description

Sales and marketing on the Web has changed drastically since the CSS was built. Customers are more sophisticated, and they are used to catalog and sales systems that are easy to use and provide many services, such as one-click ordering, deferred-purchase tracking, simplified searches, and comparison shopping. In addition, research has shown that sales increase dramatically when social media marketing tools are combined with basic sales functionality. Hence, the new CSMS is needed not only to respond to today's competition but also to launch RMO into today's world of social media and mobile computing. The longer RMO delays in starting this project, the more opportunities it misses.

System Capabilities

This document identifies the required system capabilities at a high level. Later documents will specify the detailed requirements. These capabilities are required:

- Provide a shopping cart capability.
  - Support customer sales with high automation (one-click, etc.).
  - Recommend related product purchases and comparison shopping.
  - Allow customer ratings and recommendations.
  - Include "friend" network capability.
- Include comprehensive order fulfillment.
  - Support multiple and split-order shipping and tracking.
  - Support back-ordering and tracking.
  - Allow customer comments and feedback.
- Provide customer account and billing capability.
  - Provide individualized customer accounting.
  - Support electronic billing and many electronic payment methods.
  - Accumulate customer "points" and allow transfer and sharing.
- Include marketing functions for promotions and specials.
  - Provide flexible promotions and sales.
  - Accumulate and track "points" from suppliers directly to customers.
  - Interface with social marketing media for advertising and social marketing activities.
  - Support mobile devices for social marketing and sales.

Business Benefits

The primary business benefit of these capabilities will be to increase sales by connecting with customers and improving the customer experience. The specific benefits include:

- Increasing the size of customer purchases
- Increasing the frequency of customer purchases
- Increasing customer satisfaction
- Increasing product recommendations from customers to friends
- Attracting new customers through recommendations and social marketing
- Building customer loyalty with recommendations and service
- Increasing speed of product availability
- Eliminating shipping delays and outages

Activity 1.2: quantify project approval factors

Project team, with users, defines the scope and impact of the project

Sufficient justification to obtain funding

May require complete cost/benefit analysis

Criteria usually considered:

a. Estimated project completion time
b. Estimated cost for project and system
c. Anticipated benefits from deployment

These estimates are only rough – stakeholders realise requirements are unknown at this stage

Activity 1.2a – estimated time

The major inputs to estimating project completion date are scoping statement (from Vision document) and effort required to develop the requirements identified

This helps identify:

- number of iterations
- size and number of teams working on various subsystems

Time Estimate for the New CSMS Project			
Subsystem	**Functional requirements**	**Iterations required**	**Estimated time**
Sales subsystem*	15	5	20 weeks
Order Fulfillment subsystem*	12	5	20 weeks
Customer Account subsystem**	10	4	15 weeks
Marketing subsystem**	6	3	13 weeks
Reporting subsystem**	7	3	12 weeks
Total development time (2 teams)			40 weeks
Final hardening and acceptance testing		2	8 weeks
Total project time			48 weeks

*Assigned to Tiger team
**Assigned to Cougar team

Activity 1.2b – estimated cost

Includes project and system

Should also consider the costs involved in deploying the system (e.g. training) as well as ongoing maintenance costs

Summary of Development Costs for CSMS	
Expense category	**Amount**
Salaries/wages (includes benefits costs) (1 PM, 8 analysts, 1 support)	$936,000.00
Equipment/installation	$308,000.00
Training	$78,000.00
Facilities	$57,000.00
Utilities	$97,000.00
Travel/miscellaneous	$87,000.00
Licenses	$18,000.00
Total	**$1,581,000.00**

Activity 1.2c – anticipated benefits

An analysis of identified benefits and provide an estimate of value to the business

The value becomes part of the decision criteria, and is estimated by the client, with assistance from the PM

Estimated Annual Benefits for CSMS	
Benefit or cost saving	**Amount**
Recapture/prevention of lost sales	$200,000.00
Increase sales to existing customers	$300,000.00
Sales to new customers	$350,000.00**
Increased efficiency in order processing	$50,000.00
Reduction of data center and equipment costs because of hosting	$146,000.00
Total	**$1,046,000.00**

**plus 8% annual growth

Activity 1.2c – anticipating benefits

If a comparison is needed between estimated costs and anticipated benefits, a *cost/benefit analysis* is undertaken

Where the organisation can estimate a dollar value of a benefit (or cost), this is a **tangible benefit** (or cost)

Where dollar value cannot be estimated, **intangible benefits**/costs may exist, e.g.

- Benefits - increased level of service or customer satisfaction
- Cost – reduced employee morale

More on cost/benefit analysis later

Activity 1.3 – determine risk & feasibility

This activity verifies whether the project can be started and completed successfully:

a. Determine **organisational** risk & feasibility
   (in terms of organisational culture and norms)

b. Evaluate **technological** risk & feasibility
   (including expertise required)

c. Assess **resource** risk & feasibility
   (including team skills and availability as well as computer & physical resources)

d. Identify **schedule** risk & feasibility
   (identifying milestones and iterations allows PM to assess risk and implement contingency plans)

Feasibility covered in Topic 6

Activity 1.4 – review with client & obtain approvals

It is good practice to get approval and support from the whole organisation

Resources can then be assigned, and the organisation informed that a major activity has commenced, with support and request for co operation from management

Summing up…

- Core Process 1 is about **project initiation**
- Core Process 1 is critical for project success, and involves four main activities:
    - Identify the problem
    - Quantify project approval factors
    - Perform risk and feasibility analysis
    - Review with client and obtain approvals

Murdoch UNIVERSITY

Project management activities of Core Process 2 – Plan and monitor the project

Murdoch UNIVERSITY

Project Management activities of Core Process 2

Planning & monitoring lasts throughout the project

- Major planning effort after approval
- Ongoing planning and monitoring during all project iterations –
  - Each iteration planned as it commences
  - Progress continually monitored and corrective action applied as required

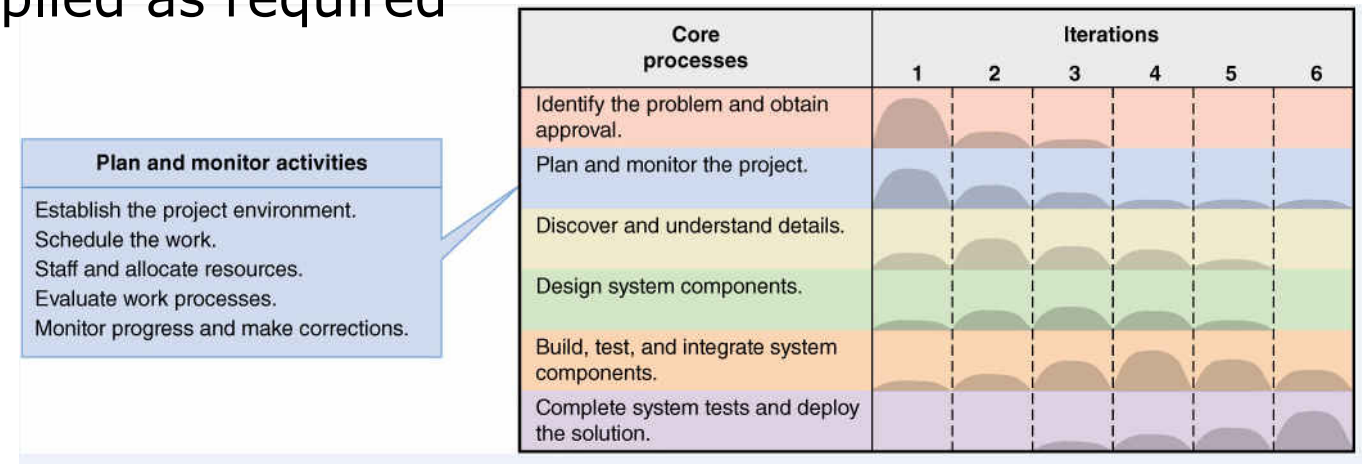


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Activity 2.1 – establish project environment

All the elements to allow the project to proceed without blocks must be put into place. These include:

- Methodology (predictive/adaptive)
- Communication process for stakeholders (internal/external) & recording of decisions
- Work & team environment (facilities, tools, support)
- Processes and procedures (standard organisational or special for project (e.g. type of programming – single/pair))

Activity 2.2 – schedule the work

For adaptive systems scheduling occurs throughout the project

- At initial planning – user cases/stories are developed for each subsystem and assigned to iterations. This is the **project iteration schedule**
- As each iteration starts, a **detailed work schedule** is developed to identify all task and work to be completed within the iteration
- At the completion of an iteration, the project iteration schedule may be reviewed (by team leaders & key users)and reworked to include changes and new requirements

Activity 2.2 – schedule the work…

Developing a detailed work schedule for an iteration involves:

a. Developing a **work breakdown structure**
b. Estimating effort and identifying dependencies
c. Creating a schedule

Activity 2.2a - Work Breakdown Structure

A **work breakdown structure** (WBS) is list of all the required individual activities and tasks for the project. Various approaches exist for creating the WBS – by deliverable within an iteration:

Project Iteration Schedule for the CSMS Sales Subsystem		
Iteration	**Time estimate**	**Use cases assigned to iteration**
1	4 weeks	1. Search for item. 2. View detailed descriptions. 3. View rotating (3-D) images. 4. Compare item characteristics.
2	4 weeks	5. View comments and ratings. 6. Search comments and ratings for friends. 7. View accessory combinations (images). 8. Save item + accessories as "combo."
3	5 weeks	9. Add item (or combo) to shopping cart. 10. Remove item (or combo) from shopping cart. 11. Add item (or combo) to "on reserve" cart. 12. Remove item (or combo) from "on reserve" cart.
4	4 weeks	13. Check out active cart. 14. Create and process store sale. 15. Create and process phone sale.
5	3 weeks	16. Clean up, final test, harden site, tune database, etc.
Total	20 weeks	

or by timeline:

1 Phase 1 of the project …
2 Phase 2 of the project …
- **2.1 Activity 1 of Phase 2 …**
- **2.2 Activity 2 of Phase 2**
  - **2.2.1 Task 1 of Activity 2.2 in Phase 2**
  - **2.2.2 Task 2 of Activity 2.2 in Phase 2**
  - **2.2.3 Task 3 of Activity 2.2 in Phase 2**
- **2.3 Activity 3 of Phase 2 …**

3 Phase 3 of the project …

Activity 2.2a - WBS guidelines

When developing a WBS:

- There should be a way to recognise when the task is completed
- The definition of the task should be detailed enough to estimate effort required
- The effort should be around 1-5 working days

Activity 2.2b – determine dependency and effort

Murdoch UNIVERSITY

Considering the order of tasks to be completed, task dependencies can be identified (the start or completion of individual tasks may depend on the start or completion of other tasks)

There are 4 types of intertask dependencies:

- Finish-to-start (FS)—The finish of one task triggers the start of another task (default)
- Start-to-start (SS)—The start of one task triggers the start of another task.
- Finish-to-finish (FF)—Two tasks must finish at the same time.
- Start-to-finish (SF)—The start of one task signifies the finish of another task

Effort can be estimated based on the actual amount of work required to complete the task

Activity 2.2c – create schedule

A **Gantt chart** is a simple horizontal bar chart that depicts project tasks against a calendar. Each bar represents a named project task. The tasks are listed vertically in the left-hand column. The horizontal axis is a calendar timeline

A **PERT chart** is a graphical network model that depicts a project's tasks and the relationships between those tasks. It often identifies when the earliest and latest time a task can commence and finish as well as duration

[**Gantt** a type of bar chart devised by Henry **Gantt** in the 1910s]

[**PERT** *Program Evaluation Review Technique* developed in the 1950s]

Activity 2.2c – create schedule… Gantt

Murdoch UNIVERSITY

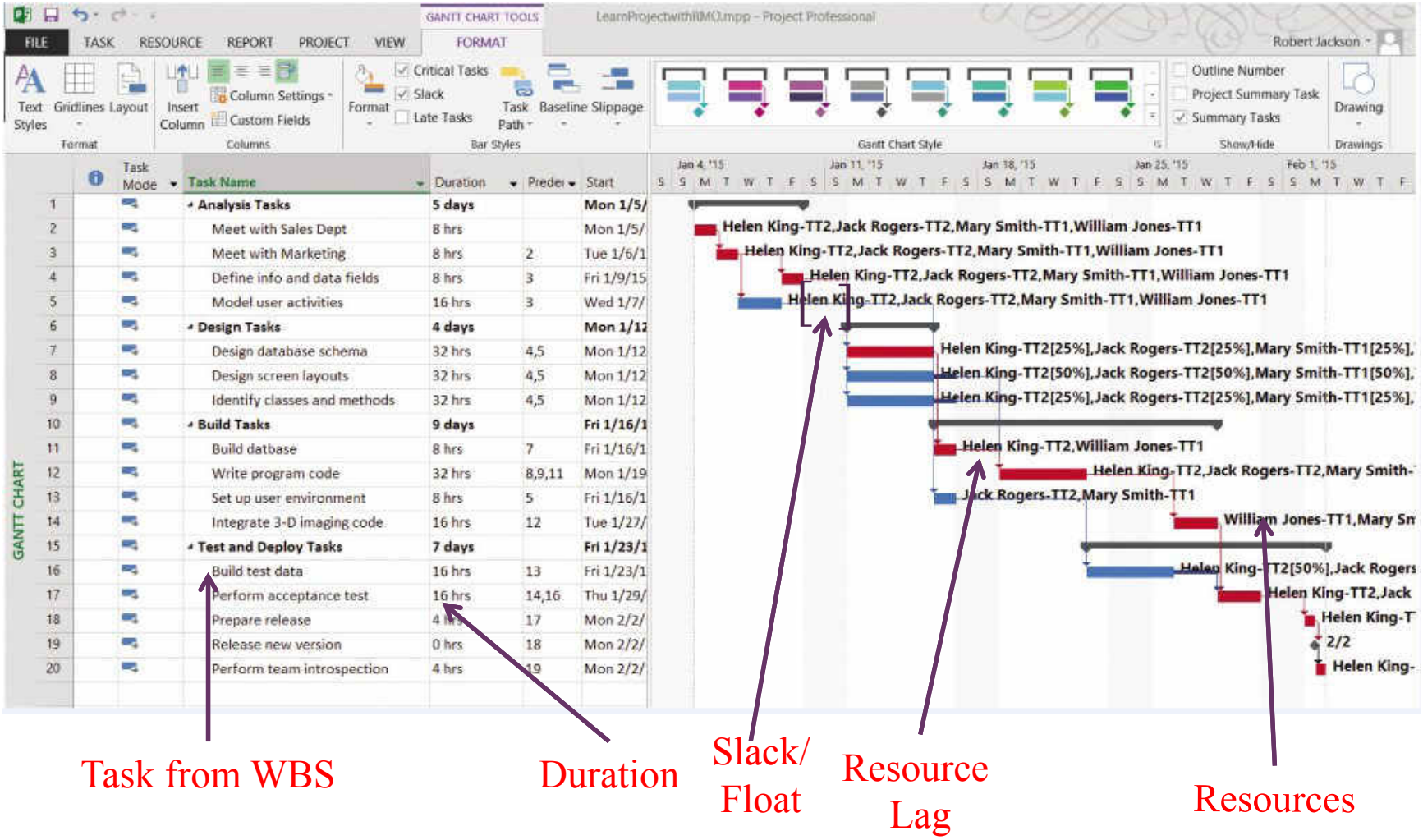


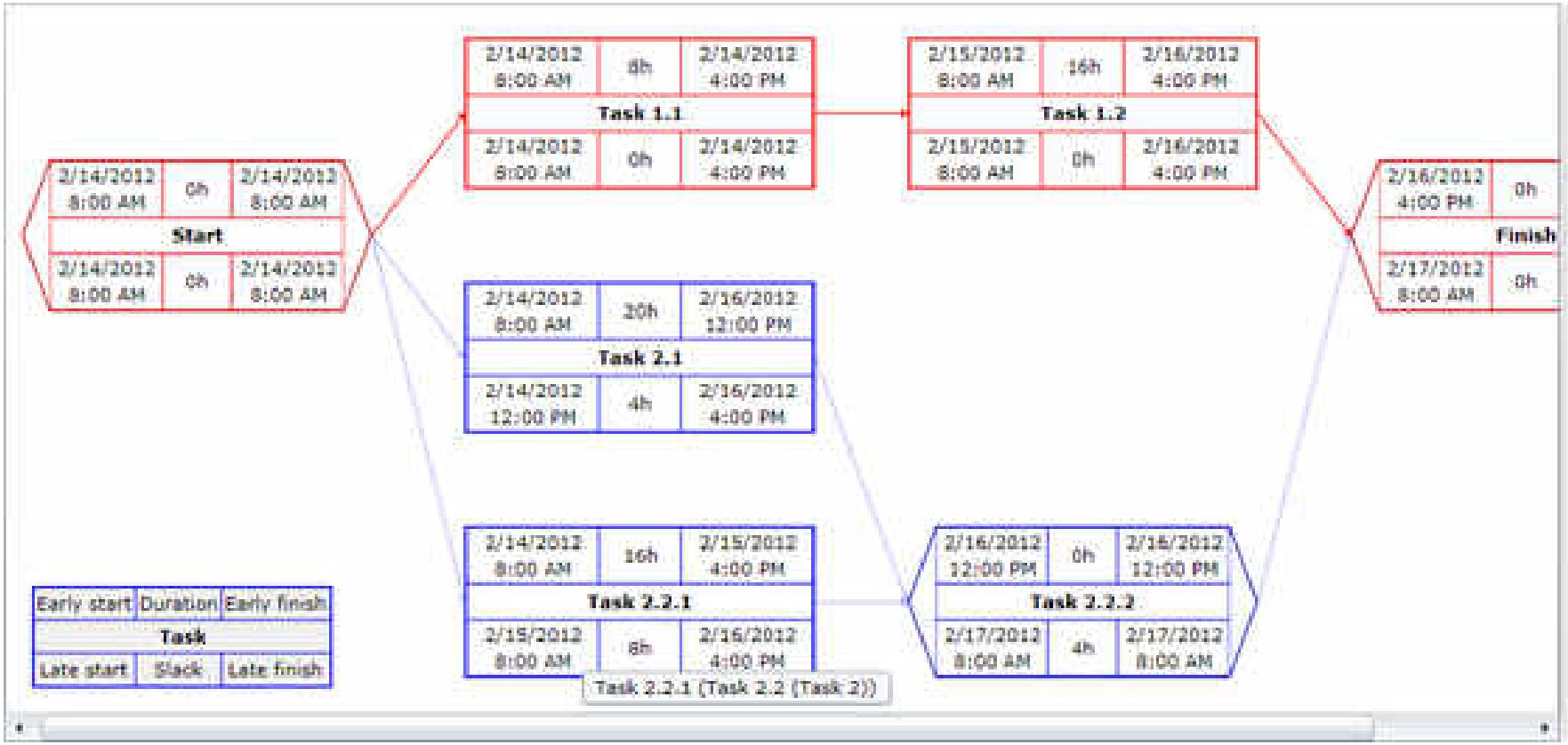
Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Activity 2.2c – create schedule… Gantt

- **Resource Lag** is the time a resource (in this case a team member) is not assigned a WBS task (Helen King)
- **Slack** or **float** is the amount of time an activity can be delayed without delaying a succeeding activity or the project finish date. This means the slack is attached to WBS tasks NOT on the Critical Path (From the end of Task *Define info and data fields* to commencement of Task *Design database schema*)

http://dlhsoft.com/ProjectManager/

Activity 2.2c – create schedule… PERT



Critical path is shown in red – the sequence of tasks that can't be delayed without delaying the whole project

Activity 2.3 – staff and allocate resources

The PM identifies what expertise is needed for the project and gets those people assigned. The staffing activity includes:

a. Developing a resources plan
b. Identifying and acquiring specific technical staff
c. Identifying and requesting specific user staff
d. Organising the project team
e. Conducting preliminary training & team-building

Activity 2.3 – staff and allocate resources...

The availability of resources can significantly alter a project schedule.

Need to assign:

- **People**—including system owners, users, analysts, designers, builders, external agents, and clerical help that will be involved in the project in any way
- **Services**—a service such as a quality review that may be charged on a per use basis
- **Facilities and equipment**—including all rooms and technology that will be needed to complete the project
- **Supplies and materials**—everything from pencils, paper, notebooks, toner cartridges, etc
- **Money**—A translation of all of the above into the language of accounting—budgeted dollars!

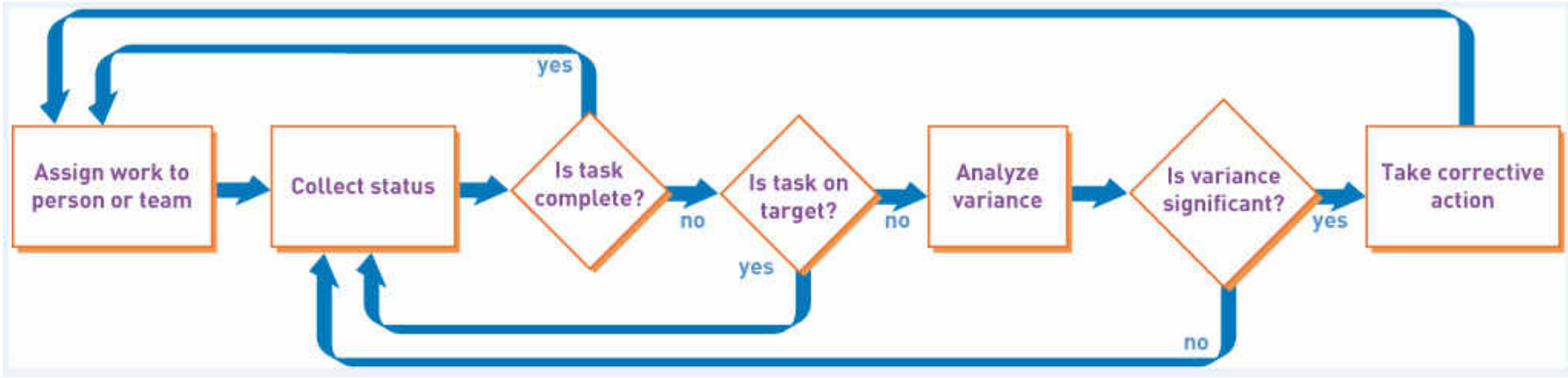
Activity 2.4 – evaluate work processes

An 'end of iteration' review can determine how well the team works together – this may be called a retrospective. Issues identified can include:

- Are communications procedures adequate? How can they be improved?
- Are working relationships with users effective?
- Were deadlines met? Why/why not?
- What went well/what didn't?

Activity 2.5 – monitor project process & make corrections

Each development project includes a basic process for monitoring & controlling a project:



The monitoring & control of risk and issues is often based on tracking logs, available to team members.

Summing up…

- Core Process 2 is about **planning and monitoring** the project
- Planning and monitoring lasts *throughout* the project:
  - Major planning effort after approval
  - Ongoing planning and monitoring during all project iterations:
  - Each iteration is planned as it commences, progress is continually monitored and corrective action applied as required
- Tools such as **Work Breakdown Structures**, **Gantt charts** and **PERT charts** are used to schedule tasks, allocate resources, plan and track project progress
- Good project management practice ensures any issues are resolved quickly and the project moves forward rapidly

Murdoch UNIVERSITY

Cost/benefit analysis

Murdoch UNIVERSITY

Cost/Benefit Analysis

Organisations like to compare the estimated costs with the anticipated benefits to assess economic feasibility

This process is called **cost/benefit analysis**, which uses a variety of techniques

Anticipating benefits

The business benefits of the system need to be identified

The value to the organisation is then estimated

Benefits:

- **Tangible** benefits are those that can be easily quantified. In dollar terms, for example
  - increased revenue
  - cost reduction
- **Intangible** benefits are those benefits believed to be difficult or impossible to quantify
  - increased levels of service (in ways that can't be measured in dollars)
  - increased customer satisfaction (not measurable in dollars)
  - survival—need to do it to compete
  - need to develop in-house expertise (such as a pilot program with new technology)

Categorising costs

Murdoch UNIVERSITY

Costs:

- **Development costs** are one time costs that will not recur after the project has been completed
- **Operating costs** are costs that tend to recur throughout the lifetime of the system. Such costs can be classified as:
  - **Fixed costs** — occur at regular intervals but at relatively fixed rates
  - **Variable costs** — occur in proportion to some usage factor

Example of costs

DEVELOPMENT COSTS

Personnel:

2	Systems Analysts (400 hours/ea $50.00/hr)	$40,000
4	Programmer/Analysts (250 hours/ea $35.00/hr)	$35,000
1	GUI Designer (200 hours/ea $40.00/hr)	$8,000
1	Telecommunications Specialist (50 hours/ea $50.00/hr)	$2,500
1	System Architect (100 hours/ea $50.00/hr)	$5,000
1	Database Specialist (15 hours/ea $45.00/hr)	$675
1	System Librarian (250 hours/ea $15.00/hr)	$3,750

Expenses:

4	Smalltalk training registration ($3,500.00/student)	$14,000

New Hardware & Software:

1	Development Server	$18,700
1	Server software (operating system, misc.)	$1,500
1	DBMS server software	$7,500
7	DBMS client software ($950.00 per client)	$6,650

Total Development Costs: $143,275

PROJECTED ANNUAL OPERATING COSTS

Personnel:

2	Programmer/Analysts (125 hours/ea $35.00/hr)	$8,750
1	System Librarian (20 hours/ea $15.00/hr)	$300

Expenses:

1	Maintenance Agreement for server	$995
1	Maintenance Agreement for server DBMS software	$525
	Preprinted forms (15,000/year @ .22/form)	$3,300

Total Projected Annual Costs: **$13,870**

Image from Whitten, J.L., Bentley, L.D. & Dittman, K.C., (2004), Systems Analysis and Design Methods, 6th Edition, McGraw-Hill. Figure 10.2

Three popular cost/benefit analysis techniques

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

The **Time Value of Money** is a concept that should be applied to each technique. The time value of money recognises that a dollar today is worth more than a dollar one year from now

Calculating financial returns

- The two basic concepts of **net present value** are
  - that all benefits and costs are calculated in terms of today's dollars (that is, **present** value)
  - that benefits and costs are combined to give a **net** value—*net present value*
- *Discount rate* **–** the annual percentage rate that an amount of money is discounted to bring it to a present value
- *Discount factor* **–** the accumulation of yearly discounts based on the discount rate

Present Value formula

$$PV_n = FV/(1 + i)^n$$

Where:

- PV is the present value of the investment - the value in today's dollars
- FV is the future value of the investment - the amount in the future
- i is the discount rate - discount rate is similar to interest rate
- n is the number of time periods – usually years

It is possible to rearrange the formula to get this

$$PV_n = FV * (1/(1 + i)^n)$$

The red highlighted part is called the *discount factor*, and we can pre-calculate these and keep them in a table to make it easier when we need to calculate future values….

PV table

Murdoch UNIVERSITY

PRESENT VALUE OF $1

Periods	RATE PER PERIOD																
	0.25%	0.50%	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%	4.00%	5.00%	6.00%	7.00%	8.00%	9.00%	10.00%	11.00%	12.00%
1	0.99751	0.99502	0.99256	0.99010	0.98522	0.98039	0.97561	0.97087	0.96154	0.95238	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286
2	0.99502	0.99007	0.98517	0.98030	0.97066	0.96117	0.95181	0.94260	0.92456	0.90703	0.89000	0.87344	0.85734	0.84168	0.82645	0.81162	0.79719
3	0.99254	0.98515	0.97783	0.97059	0.95632	0.94232	0.92860	0.91514	0.88900	0.86384	0.83962	0.81630	0.79383	0.77218	0.75131	0.73119	0.71178
4	0.99006	0.98025	0.97055	0.96098	0.94218	0.92385	0.90595	0.88849	0.85480	0.82270	0.79209	0.76290	0.73503	0.70843	0.68301	0.65873	0.63552
5	0.98759	0.97537	0.96333	0.95147	0.92826	0.90573	0.88385	0.86261	0.82193	0.78353	0.74726	0.71299	0.68058	0.64993	0.62092	0.59345	0.56743
6	0.98513	0.97052	0.95616	0.94205	0.91454	0.88797	0.86230	0.83748	0.79031	0.74622	0.70496	0.66634	0.63017	0.59627	0.56447	0.53464	0.50663
7	0.98267	0.96569	0.94904	0.93272	0.90103	0.87056	0.84127	0.81309	0.75992	0.71068	0.66506	0.62275	0.58349	0.54703	0.51316	0.48166	0.45235
8	0.98022	0.96089	0.94198	0.92348	0.88771	0.85349	0.82075	0.78941	0.73069	0.67684	0.62741	0.58201	0.54027	0.50187	0.46651	0.43393	0.40388
9	0.97778	0.95610	0.93496	0.91434	0.87459	0.83676	0.80073	0.76642	0.70259	0.64461	0.59190	0.54393	0.50025	0.46043	0.42410	0.39092	0.36061
10	0.97534	0.95135	0.92800	0.90529	0.86167	0.82035	0.78120	0.74409	0.67556	0.61391	0.55839	0.50835	0.46319	0.42241	0.38554	0.35218	0.32197
11	0.97291	0.94661	0.92109	0.89632	0.84893	0.80426	0.76214	0.72242	0.64958	0.58468	0.52679	0.47509	0.42888	0.38753	0.35049	0.31728	0.28748
12	0.97048	0.94191	0.91424	0.88745	0.83639	0.78849	0.74356	0.70138	0.62460	0.55684	0.49697	0.44401	0.39711	0.35553	0.31863	0.28584	0.25668
13	0.96806	0.93722	0.90743	0.87866	0.82403	0.77303	0.72542	0.68095	0.60057	0.53032	0.46884	0.41496	0.36770	0.32618	0.28966	0.25751	0.22917
14	0.96565	0.93256	0.90068	0.86996	0.81185	0.75788	0.70773	0.66112	0.57748	0.50507	0.44230	0.38782	0.34046	0.29925	0.26333	0.23199	0.20462
15	0.96324	0.92792	0.89397	0.86135	0.79985	0.74301	0.69047	0.64186	0.55526	0.48102	0.41727	0.36245	0.31524	0.27454	0.23939	0.20900	0.18270
16	0.96084	0.92330	0.88732	0.85282	0.78803	0.72845	0.67362	0.62317	0.53391	0.45811	0.39365	0.33873	0.29189	0.25187	0.21763	0.18829	0.16312
17	0.95844	0.91871	0.88071	0.84438	0.77639	0.71416	0.65720	0.60502	0.51337	0.43630	0.37136	0.31657	0.27027	0.23107	0.19784	0.16963	0.14564
18	0.95605	0.91414	0.87416	0.83602	0.76491	0.70016	0.64117	0.58739	0.49363	0.41552	0.35034	0.29586	0.25025	0.21199	0.17986	0.15282	0.13004
19	0.95367	0.90959	0.86765	0.82774	0.75361	0.68643	0.62553	0.57029	0.47464	0.39573	0.33051	0.27651	0.23171	0.19449	0.16351	0.13768	0.11611
20	0.95129	0.90506	0.86119	0.81954	0.74247	0.67297	0.61027	0.55368	0.45639	0.37689	0.31180	0.25842	0.21455	0.17843	0.14864	0.12403	0.10367
21	0.94892	0.90056	0.85478	0.81143	0.73150	0.65978	0.59539	0.53755	0.43883	0.35894	0.29416	0.24151	0.19866	0.16370	0.13513	0.11174	0.09256
22	0.94655	0.89608	0.84842	0.80340	0.72069	0.64684	0.58086	0.52189	0.42196	0.34185	0.27751	0.22571	0.18394	0.15018	0.12285	0.10067	0.08264
23	0.94419	0.89162	0.84210	0.79544	0.71004	0.63416	0.56670	0.50669	0.40573	0.32557	0.26180	0.21095	0.17032	0.13778	0.11168	0.09069	0.07379
24	0.94184	0.88719	0.83583	0.78757	0.69954	0.62172	0.55288	0.49193	0.39012	0.31007	0.24698	0.19715	0.15770	0.12640	0.10153	0.08170	0.06588
25	0.93949	0.88277	0.82961	0.77977	0.68921	0.60953	0.53939	0.47761	0.37512	0.29530	0.23300	0.18425	0.14602	0.11597	0.09230	0.07361	0.05882
30	0.92783	0.86103	0.79919	0.74192	0.63976	0.55207	0.47674	0.41199	0.30832	0.23138	0.17411	0.13137	0.09938	0.07537	0.05731	0.04368	0.03338
35	0.91632	0.83982	0.76988	0.70591	0.59387	0.50003	0.42137	0.35538	0.25342	0.18129	0.13011	0.09366	0.06763	0.04899	0.03558	0.02592	0.01894
40	0.90495	0.81914	0.74165	0.67165	0.55126	0.45289	0.37243	0.30656	0.20829	0.14205	0.09722	0.06678	0.04603	0.03184	0.02209	0.01538	0.01075
50	0.88263	0.77929	0.68825	0.60804	0.47500	0.37153	0.29094	0.22811	0.14071	0.08720	0.05429	0.03395	0.02132	0.01345	0.00852	0.00542	0.00346

Source: http://www.principlesofaccounting.com/ART/fv.pv.tables/pvof1.htm

An example

What is the current value of $15,000 received in 4 years time if the discount rate is 8%?

PV = FV * discount factor [$(1/(1 + i)^n)$ *[taken from table]*

PV = $15,000 * 0.735

= $11,025

Payback analysis

Payback analysis is a simple and popular method for determining if and when an investment will pay for itself

The payback period is the period of time that will lapse before accrued benefits overtake accrued and continuing costs

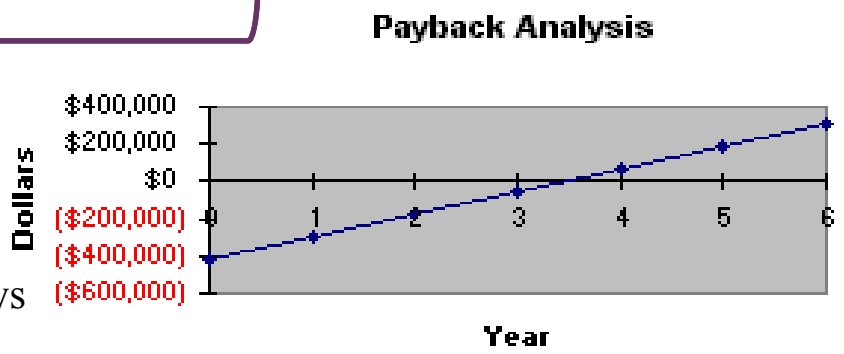
- The point at which this happens is the **break-even point**
- The time before the break-even point is the **pay-back period**

Payback analysis for a project

	A	B	C	D	E	F		
4	Cash flow description	Year 0	Year 1	Year 2	Year 3	Year 4	Ye	Year 6
5	Development cost:	($418,040)						
6	Operation & maintenance cost:		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)
7	Discount factors for 12%:	1.000	0.893	0.797	0.712	0.636	0.567	0.507
8	Time-adjusted costs (adjusted to present value):	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)
9	Cumulative time-adjusted costs over lifetime:	($418,040)	($431,475)	($444,227)	($456,331)	($467,779)	($478,552)	($488,692)
10								
11	Benefits derived from operation of new system:	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000
12	Discount factors for 12%:	1.000	$0.893	$0.797	$0.712	$0.636	$0.567	$0.507
13	Time-adjusted benefits (current of present value):	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750
14	Cumulative time-adjusted benefits over lifetime:	$0	$133,950	$269,440	$404,720	$538,280	$668,690	$795,440
15		0	1	2	3	4	5	6
16	Cumulative lifetime time-adjusted costs + benefits:	($418,040)	($297,525)	($174,787)	($51,611)	$70,501	$190,138	$306,748

Break-even point

Pay-back period



Payback period is calculated as:
3 years + 51,611/(51,611+70,501)*365 = 3 years 154 days

Image from Whitten, J.L., Bentley, L.D. & Dittman, K.C., (2004), Systems Analysis and Design Methods, 6th Edition, McGraw-Hill. Figure 10.3

Net Present Value

NPV = Lifetime benefits - Lifetime costs

where all benefits and costs are in PV form

If NPV is positive the investment is good, if it is negative the investment is bad

When comparing alternative proposals the one with the highest *net present value* is the best investment (even if they have different lifetimes)

Many people consider net present value to be the best cost benefit technique.

NPV analysis

Murdoch UNIVERSITY

	A	B	C	D	E	F	G	H	I	J
1	Net Present Value Analysis for Client-Server System Alternative									
2	(Numbers rounded to nearest $1)									
3										
4	**Cash flow description**	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Total**	
5	**Development cost:**	($418,040)								
6	**Operation & maintenance cost:**		($15,045)	($16,000)	($17,000)	($18,000)	($19,000)	($20,000)		
7	**Discount factors for 12%:**	1.000	0.893	0.797	0.712	0.636	0.567	0.507		
8	**Present value of annual costs:**	($418,040)	($13,435)	($12,752)	($12,104)	($11,448)	($10,773)	($10,140)		
9	**Total present value of lifetime costs:**								($488,692)	←
10										
11	**Benefits derived from operation of new**	$0	$150,000	$170,000	$190,000	$210,000	$230,000	$250,000		
12	**Discount factors for 12%:**	1.000	$0.893	$0.797	$0.712	$0.636	$0.567	$0.507		
13	**Present value of annual benefits:**	$0	$133,950	$135,490	$135,280	$133,560	$130,410	$126,750		
14	**Total present value of lifetime benefits:**								$795,440	←
15										
16	**NET PRESENT VALUE OF THIS ALTERNATIVE:**								$306,748	
17										

Image from Whitten, J.L., Bentley, L.D. & Dittman, K.C., (2004), Systems Analysis and Design Methods, 6th Edition, McGraw-Hill. Figure 10.5

Return-on-Investment analysis (ROI)

Return-on-Investment compares the lifetime profitability of alternative solutions or projects

The ROI for a solution or project is a percentage return (like an interest rate) that measures the relationship between the amount the business gets back from an investment and the amount invested

ROI formulae

Lifetime ROI = $\dfrac{(\text{lifetime benefits} - \text{lifetime costs})}{\text{lifetime costs}}$

example $\dfrac{795{,}440 - 488{,}692}{488{,}692} = 62.7\%$

Annual ROI = $\dfrac{\text{lifetime ROI}}{\text{lifetime of the system}}$

Summing up…

- **Cost/benefit analysis** is a way of comparing the projected lifetime costs of a project with the lifetime benefits
- Used to evaluate *economic feasibility*
- Popular cost/benefit analysis techniques include **Payback Analysis**, **Return On Investment** (ROI) and **Net Present Value** (NPV)
- All techniques involve the concept of the *time value of money* – the fact that a dollar in the today is worth more than a dollar a year from now

Murdoch UNIVERSITY

Topic learning outcomes revisited

After completing this topic you should be able to:

- Discuss the factors that cause a software development project to succeed or fail
- Describe the responsibilities of a project manager
- Define the PMBOK and briefly outline its knowledge areas
- Describe the Agile approach to project management knowledge areas
- Explain the activities required to get a project approved
- Explain the activities required to plan and monitor a project
- Apply different cost/benefit analysis techniques

Murdoch UNIVERSITY

What’s next?

In the final topic, we’ll look at alternatives for the systems development process itself, by considering different broad approaches and some specific methodologies.

Murdoch UNIVERSITY