



SWEN90016

Software Processes & Project Management

Marion Zalk

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The University of Melbourne

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2021 – Semester 1
Lecture 1

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Your Subject Support Staff

Lecturer: [Marion Zalk](#)
(Subject Coordinator)



Tutors



*Esther
Rotimi*



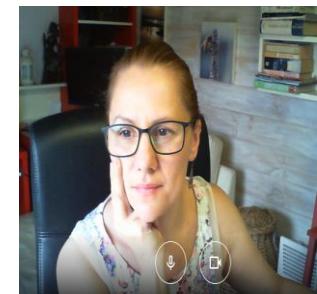
*Rajesh
Sundaram*



*Doc
Wallace*



*Eileen
O'Callaghan*



*Renata
Romila*

Marion Zalk – Subject Coordinator

Academic – Melbourne lecturer



Professional Experience

- Senior Programmer/Analyst
 - Financial and wealth management organizations (Citigroup in London, UBS & ComputerShare in Melbourne, MCubed); Consultant
- 8 Years experience
 - Waterfall, agile, hybrid
- PhD (University of Melbourne)



Where's Everyone?





Poll - Tutors and You



AIM

The aim of this subject is to introduce students to the software engineering principles, processes, tools and techniques for analysing and managing complex software projects.

INTENDED LEARNING OUTCOMES

- Select appropriate software engineering processes and practices projects
- Manage team dynamics and professional communication
- Plan and manage projects
- Identify risks and modify project activities to mitigate these risks
- Manage software project activities to ensure a quality product
- Describe human and organisational implications of change and explain the organisational change process.

GENERIC SKILLS

- In-depth knowledge project management areas of knowledge
- Reach a high level of achievement in writing, research or project activities problem-solving and communication through the writing of project analyses
- Ability to function effectively as an individual and in a multidisciplinary and multi-cultural team as a leader, manager or effective team-member
- Understand and respect ethics and intellectual integrity
- Writing and communication skills.



LECTURES

- attend
- available via LMS

**Tutorials Start
Friday
Week 1**

TUTORIALS / WORKSHOPS

- Students are expected to attend one one-hour workshop/tutorial each week.
- Workshops are intended to take concepts and principles discussed in lectures and to apply them to realistic examples.
- Students are expected to actively engage in workshops and show initiative, ask questions, conduct workshop exercises and engage in the discussions

PLAGIARISM AND COLLUSION

- Submissions must be own independent work or group project work.
- Faculty policy: mechanisms for establishing contributions of individuals to group work
- University policy: see <http://academichonesty.unimelb.edu.au/policy.html>
- If plagiarism or collusion is detected, harsh penalties must and will be applied

Communication

How to Contact Us

- General inquiries: Discussion forum on LMS
- We encourage all students to join in discussions – answering other students' questions is one of the best ways to improve your own understanding
- Please do not post sections of your assignments- if you must include these, private-message the instructors
- Personal/private concerns: Email the lecturer
- If you email us about a general inquiry, we may ask you to re-post your question in the forum
- Please include SWEN90016 in email subject



Due dates are available in LMS- Assignments, Quizzes (3 for marks, week 5, 9, 11) and other quizzes for review.

I'll be discussing Assignments in more detail next

Zoom

Please update your computer to the latest version to make use of the features

Cameras- I am recording each live lecture for lecture capture



Poll- Face to face workshop

Feedback has been mostly positive, a few suggestions for improvement.

1. General

- Would like to thank all teaching staff in delivery of quality content in a tough period! The presenters both lecturing and tutoring were great.
- Make it an elective, not core.
- Having mid-term break on week 9 is really a bad idea,
- I found my two units (SWEN90016 and xx) to be engaging and impactful - especially being my first semester in post-graduate study.
- The harder, more complex topics were given equal time as the more simple topics, an extra week or workshop reviewing them (project scheduling and cost estimation)
- High interaction based learning with integrated quizzes within the lectures and group discussion based learning in tutorials
- The material was laid out very well, and all of the teaching staff did their best to engage all of the students and make sure nobody was left behind conceptually
- X's mic makes it slightly hard to follow.
- Person's accent difficult to follow for international students.
- Practical learning

Feedback has been mostly positive, a few suggestions for improvement.

2. Lectures

- For online learning I also prefer shorter 1 hour lectures. 2 hour zoom lectures are too long, especially in the evening it is very easy to lose focus.
- The lectures are not engaging and interactive. Too much talking on concepts instead of how to apply them in real life.
- The lecturers and tutors are working hard for presenting a subject with good quality.
- The lecture slides are clear on knowledge of the topic.
- The online learning experience was just fabulous. Particularly the lecture recordings and the study materials provided by the teaching staff was highly effective and did me to a great extend.
- Staff represent project management in the slowest changing sectors, government, health and banking.
- I can see that the materials is constantly being updated and also the teaching team try to keep it relevant to the current working conditions.
- Knowledge in lecture

3. Exam revision

Feedback has been mostly positive, a few suggestions for improvement.

4. Assignments

- Assignments were interesting
- Create open sessions for us to discuss assignment and ask broad questions
- Clear assignment requirements
- The assignment's requirements should be clearer. And it would be really helpful for us to get some examples of the assignments. Since the students have various academic background, some may be familiar with what the assignment is talking about, others probably even have no idea to do a draft. Although we did researches, investigation and asked in discussion board, an example would be more useful. The example can give us a direction to do a correct thing.
- Learned more about how to plan and manage the development process.
- Teamwork in writing group project.

Feedback has been mostly positive, a few suggestions for improvement.

5. Tutor and tutorials

- Tutor X doesn't seem to enjoy teaching and rush through everything
- I felt the tutorials were run fairly interactively and there was a reasonable amount of practice and hands on learning that worked well with the subject material.

6. Discussion boards

- Thank you Marion for putting efforts into building such an efficient and helpful discussion board for students
- The subject coordinator would reply very soon and willing to answer our questions.

7. Quizzes

- I liked the quizzes during the semester, as they helped me to stay up to date with the content and make the current exam preparation much easier.
- Intermittent tests were a great way of keeping up to date with the content. I wish more subjects had this



Weeks 5, 9, 11

- 15 minutes in a 30 minute window;
- Discuss the solutions
- During the lecture time (open 15 minutes before and then first 15 minutes of the lecture)
- Lecture will start 6:40pm (week 5, 9, 11)



Assignment 1 - Learning Outcomes:

Analysis of an IT project case study that will demonstrate the ability to:

- identify the goals of the project;
- identify the key characteristics for the project;
- identify the risks in the project as identified at the start of the project; and
- justify the choice of a suitable software development lifecycle (SDLC) model to manage the project.



Assignment 1:

- Assignment specification will be given out by the end of week 2 – due week 5
- You are expected to spend ~30 hours
- You will answer a set of questions related to a given case study
- Will be based on the material covered in weeks 1-4



Assignment 2 - Learning Outcomes:

A web-based IT system development project that will demonstrate the ability to:

- develop a Project Management Plan (PMP) for a given project brief;
- plan the activities involved in the chosen process;
- execute, monitor and control processes to achieve an outcome; and
- work effectively in a team.



Assignment 2

- Teams:
 - We will organise teams of 4-5 members during week 2
 - Week 2 workshop attendance is mandatory as we will be selecting teams
 - Each student is expected to spend 30-40 hours on the project
 - If you have not done the foundation subjects in your degree (or have received credit for them) please consider doing this subject next semester, after you complete the foundation subjects

Assignment 2:

- Assignment specification will be given out by the end of week 2 – due week 7, 11 and a presentation in week 12
- You are expected to spend ~30 hours
- Will be based on all the material



Class rep

If you are interested in becoming class representative

Please email me

mzalk@unimelb.edu.au



Poll- Assignments

Lecture 1 – Intended Learning Objectives

Module 1: Subject Introduction

Module 2: Introduction to Projects

Module 3: Projects



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Lecture 1

Lecture 1 – Intended Learning Objectives

Module 1: Subject Introduction

1. ~~Get to know your teaching staff, subject learning objectives, subject content and semester structure.~~

Module 2: Introduction to Projects

1. Understand key elements of a Project and why organisations use them.
2. Understand the foundational components of Project Management.
3. Understand key skills and responsibilities / activities of a Project Manager.

Module 2.1 – What is a Project

A temporary endeavour to create a unique product, service or outcome.

Key characteristics:

- Introduce **CHANGE** to the organisation
- **TEMPORARY**, it has a defined beginning and end
- **CROSS-FUNCTIONAL**, cuts across organisational boundaries
- Deals with the **UNKNOWN**
- **UNIQUE**
- They all vary in **SIZE** –  /  , \$'s and 

Module 2.1 – Why do organisations use Projects

- Provides strategic alignment of key activities and visibility at the appropriate levels
- Mechanism to prioritise activities (Benefits, Regulatory, HW Refresh)
- Allows organisations to deliver change in a structured and formal manner outside of BAU
- Effective and efficient management of organisations limited resources (people & \$'s)
- Establish ownership and accountability – Process and the Benefits
- Provide clarity, buy-in and agreement across what will be done, when, who, why and the outcomes

www.pmi.org/about/learn-about-pmi/what-is-project-management



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Module 2.2 – What is Project Management

Project Management is the planning, delegating, monitoring and controlling of all aspects of a project, and motivating those involved to achieve the project objectives within the expected targets for time, costs, quality, scope, benefits and risks.

Value lies in:

- Organising and structuring scarce resources
- Managing risk
- Identifying and clearing issues
- Managing and implementing change
- Retaining and re-using knowledge
- Organisational wide learning from past success and failures



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Module 2.3 – Project Manager Skills / Attributes

Project managers are highly skilled knowledge workers and change agents. They take accountability, make project goals their own and use their skills and expertise to inspire a sense of shared purpose across the project team. They enjoy the organised adrenaline of new challenges and the responsibility of driving business results.

Core Skills / Attributes:

- Work well under pressure
- Comfortable with change and complexity in changing environments
- Use / have the right people skills
- Adapt, resolve issues and deal with problems
- Effective communicators regardless of hierarchy
- Action orientated and leave nothing for tomorrow
- Command & Control
- ***Good ones are in demand, hard to find and get paid a lot***

www.pmi.org/about/learn-about-pmi/who-are-project-managers

Module 2.3 – Project Manager Key Activities (traditional)

Planning

- Define and clarify project scope
- Develop the project management plan
- Develop the project schedule
- Develop policies and procedures to support the achievement of the project objectives

Leading

- Setting team direction
- Owning & coordinating activities across different organisational functions
- Motivating team members
- Assigning work

Organising

- Determine the project team structure
- Identify roles and responsibilities
- Identify services to be provided by external companies
- Staff all project positions and on-going management

Controlling

- Defining project baselines
- Tracking project progress
- Project status reporting
- Determining and taking corrective actions

Module 2.3 – Agile Scrum Master Key Activities *“a change is occurring”*

Agile is redefining the way we execute projects and the role of the PM.

In pure Agile:

- No defined PM role
- Key activities are spread / shared across team members
 - Key project activities are still undertaken formally with appropriate documentation
- Some alignment between a Scrum Master and a Project Manager
- Move from Command and Control to Servant Leadership
 - Coaches and facilitates teams to deliver
 - Emphasises objectives
 - Is invested in the program's overall performance
 - Asks the teams for answers
 - Allows the teams to self-organise and hit their stride
 - Assists others with fixing issues

www.pmi.org/learning/library/pm-role-lean-agile-world-9350

www.greenleaf.org/what-is-servant-leadership/

<https://www.mountaingoatsoftware.com/agile/agile-project-management>

Module 2.3 – Project Manager Key Activities – *The Market wants it all!*

Project Manager Job Ad - Skills and experience

- Minimum 8+ years of experience as a Project Manager managing large, complex projects with multi-functional teams
- Strong stakeholder and relationship management skills
- Experience in managing multi-vendor teams
- Experience and qualifications in Prince2
- Can deal with complexity with very solid Project Management technical skills such as ability to develop and manage schedules, financial workbooks
- Strong stakeholder partnership skills, ability to work with teams at varying levels of project experience
- Key requirement is knowledge of multiple models of technical project delivery such as agile and running sprints but equally able to build confidence with the steering committee with formal project management approaches such as setting and achieving deadlines on timing and scope



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Lecture 1 – Intended Learning Objectives

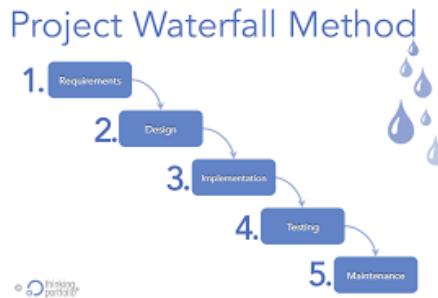
Module 3: Projects

1. An initial look at (some) Project Management Methodologies / Standards.
2. Explore the key drivers of why projects fail / succeed.
3. Understand how organisations select the best / right projects (Project Screening).
4. Understand the Project Initialization process, Business Case structure and why organisations use them.
5. Explore various investment techniques and financial models.
6. Understand what a Project Charter is and how it is used.

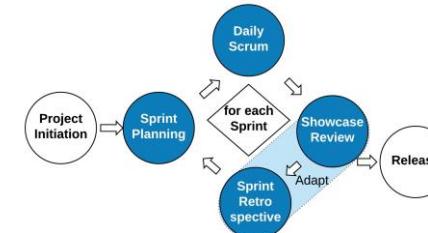


Module 3.1 – PM Methodologies / Standards

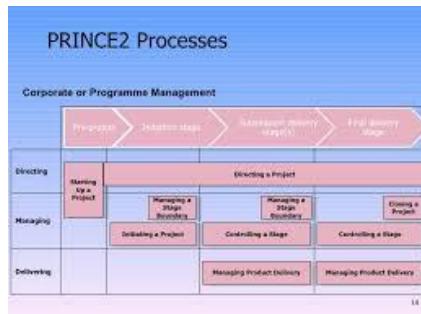
Waterfall



SCRUM



Prince2



Agile

12 Agile Principles





Module 3.1 – Key Elements of Project Management Methodologies / Standards

Waterfall

- Traditional approach used for over 40 years
- Requirements must be defined at the start
- Little / no alternations
- Sequential - Complete 1 task and then the next
- Used in large scale SW development where thorough planning and predictability is required

Pros

- Extensive planning, this thoroughness often results in more accurate timelines and budgets

Cons

- Difficult to apply changes or modify / correct previous steps (water can't run backwards), need to be proactive in anticipating problems

Module 3.1 – Key Elements of Project Management Methodologies / Standards

Agile

- Focuses on adapting to changing situations
- Reliant on constant and regular feedback
- Focuses on iterative outcomes delivering value as quickly as possible & collaboratively
- Small manageable actions and activities
- Involvement & ownership across the team – Team members self select work
- Customer focus over formalised sign-offs

Pros

- Retains flexibility while continually producing outcomes – less rework
- Greater communication & engagement – increased buy in across the team of the end outcome

Cons

- Difficult to do without experience – especially an experienced Scrum Master
- Large projects co-location a problem
- Difficult to contract suppliers

Module 3.1 – Key Elements of Project Management Methodologies / Standards

Structured Project Management Methodologies e.g. PRICNE 2 etc

- Widely used and accepted - Consulting, Private and Government
- Process orientated approach
- Divides projects into multiple stages
- Detailed and thorough
- Must have a clear need, a target customer, realistic benefits, and a thorough cost analysis

Pros

- Extensive documentation is helpful with corporate planning & tracking

Cons

- Difficult and untimely to adapt changes and apply these to all documentation



Module 3.1 – Project Methodologies – Which one is the right one?

- They all have a place and all can be appropriate
- It is like selecting the best recipe – *it all depends on your ingredients*
- Items (ingredients) to consider include:
 - Clarity and stability of scope
 - Timelines
 - Tools to support / drive the process
 - People / knowledge
 - Organisational maturity
 - Stakeholder buy-in
 - Experience in the various approaches

BREAK

Please return promptly as the

Lecture will re-start in *10 mins*



Original estimate

- \$1.2m
- 12 months

Final outcomes

- \$2m (60% increase)
- 18 months (50% longer)

FAILURE ----- SUCCESS



Redefined the market in Tracking, Pricing, Staff Pay, Customer Flexibility and Transparency

Original estimate

- \$1.2m
- 12 months



Final outcomes

- \$2m (60% increase)
- 18 months (50% longer)

‡ Recent News & Activity

↗ Acquisition • Nov 19, 2015

Royal Mail acquired eCourier.co.uk for an undisclosed amount

FAILURE ----- SUCCESS

BREAK

Please return promptly as the

Lecture will re-start in *10 mins*

Lecture 1 – Intended Learning Objectives

Module 3: Projects

1. An initial look at (some) Project Management Methodologies / Standards.
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4. Understand the Project Initialization process, Business Case structure and why organisations use them.
5. Explore various investment techniques and financial models.
6. Understand what a Project Charter is and how it is used.

Module 3.2 – Project Success / Failure – You decide

Failure or Success?

- Original estimate
 - \$1.2m
 - 12 months
- Final outcomes
 - \$2m (60% increase)
 - 18 months (50% longer)

FAILURE-----SUCCESS



Module 3.2 – Project Success / Failure – You decide

Failure or Success?

- Original estimate
 - \$1.2m
 - 12 months
- Final outcomes
 - \$2m (60% increase)
 - 18 months (50% longer)



FAILURE ----- SUCCESS



Module 3.3 – Project Success / Failure – You decide

Failure or Success?

- Original estimate
 - \$7m
 - 6 years
- Final outcomes
 - \$102m (1,357% more)
 - 16 years (10 years longer)

FAILURE-----SUCCESS



Module 3.3 – Project Success / Failure – You decide

Failure or Success?

- Original estimate
 - \$7m
 - 6 years
- Final outcomes
 - \$102m (1,357% more)
 - 16 years (10 years longer)





Module 3.2 – Software Projects

History tells us we have failed.

ALL IT PROJECTS					
	2011	2012	2013	2014	2015
Successful	29%	27%	31%	28%	29%
Challenged	49%	56%	50%	55%	52%
Failed	22%	17%	19%	17%	19%

- **Successful:** project is completed on-time and on-budget, with all features and functions as initially specified.
- **Challenged:** completed and operational but over-budget, over the time estimate or offers fewer features and functions than planned.
- **Failed:** project is cancelled at some point during the development cycle.

Standish Group Chaos Reports: Source: Standish Group 2015 Chaos Report www.projectsmart.co.uk/white-papers/chaos-report.pdf

Module 3.2 – Software Projects - What determines success?

Success Factors	%
1. Executive Sponsorship	15%
2. Emotional Maturity	15%
3. User Involvement	15%
4. Optimisation – Statement of Requirements	15%
5. Skilled Resources	10%
6. Standard Architecture	8%
7. Agile Process	7%
8. Modest Execution	6%
9. Project Management Expertise	5%
10. Clear Business Objectives	4%

- Factors have remained relatively constant
- If we know the reasons why can't we fix / improve it?
- 60% (first 4) are non technical items and difficult to change
- Broader organisational context and system at play

Standish Group Chaos Reports: www.projectsmart.co.uk/white-papers/chaos-report.pdf
www.infoq.com/articles/standish-chaos-2015

Lecture 1 – Intended Learning Objectives

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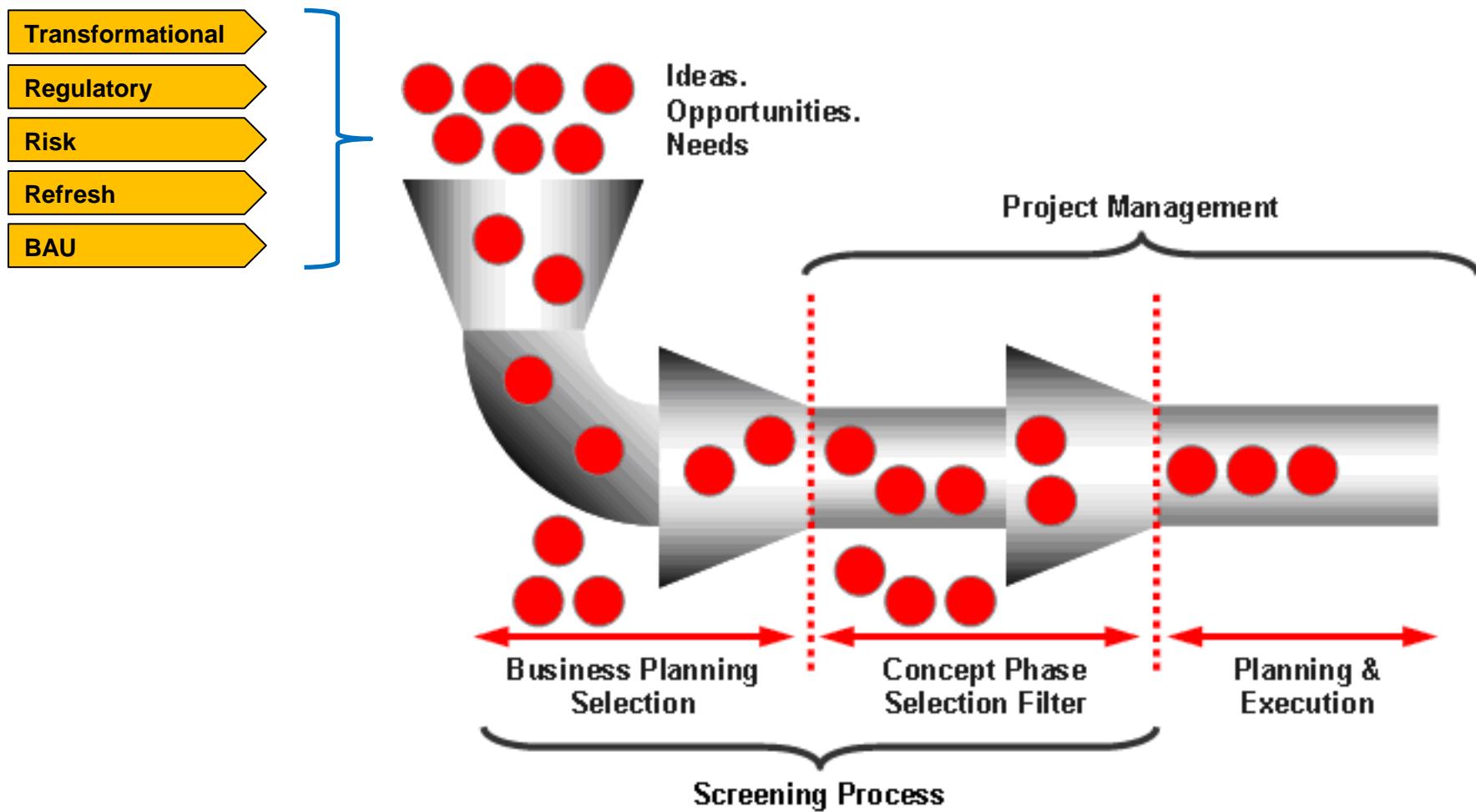
Module 3.3 – Project Screening and where to start

“If you don’t know where you’re going any road will take you there”. Any Road by George Harrison – The Beatles

- The place to start is at the beginning!
- Organisations need a formal, structured approach to:
 - Select;
 - Prioritise;
 - Have oversight; and
 - Drive accountability across all projects.



Module 3.3 – Project Screening and where to start



Lecture 1 – Intended Learning Objectives

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Module 3.4 – Project Initialization

There are many approaches and methodologies that are widely used across industry with organisations favoring standard industry ones (PRINCE2, PMBOK, Agile etc) or usually a modified version of these they make their own.

They all have Pro's & Con's.

Software PM Activities

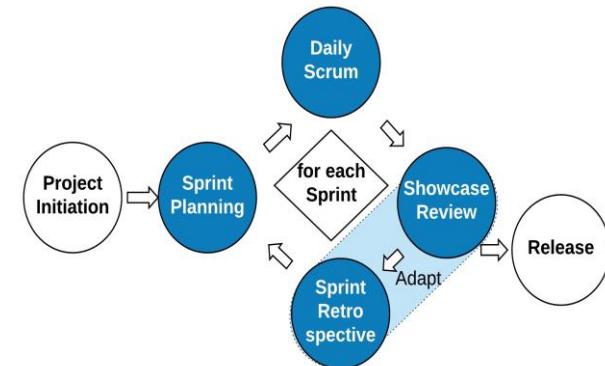


<http://blog.zilicus.com/software-project-management-activities-roles/>

Prince2



AGILE



Module 3.4 – Setting up a project for success. A Business Case is the key.

The purpose of the Business Case is to establish mechanisms to judge whether the project is (and remains) desirable, viable and achievable as a means to support decision making in its initial and continued investment.

- Provides a factual base for key decisions makers to decide if the project should be undertaken
- Demonstrates how the project adds value to the organisation
- Has a set of pre-defined standard organisational characteristics (costs, benefits, risk, etc.)
- It is not all about size - size depends on the cost / benefit
- It is a living document throughout the project that should be reviewed and signed off at key stages

Module 3.4 – Setting up a project for success. The Business case is key

Business case contains:

- Executive summary
- Reasons / explanation of why it is required
- Business options
- Expected benefits
- Expected dis-benefits
- Timescale
- Costs
- Investment appraisal
- Major risks

Source: www.prince2.com

Module 3.4 - Business Case. Who's is responsible for what?

Role	Responsibilities
Corporate	<ul style="list-style-type: none"> 1. Provides Mandate / The go ahead. 2. Holds Senior Users accountable for benefits realisation. 3. Responsible for conducting post projects benefits validation.
Executive / Sponsor	<ul style="list-style-type: none"> 1. Owns the Business Case. 2. Responsible for reviewing the benefits throughout the project.
Senior Users	<ul style="list-style-type: none"> 1. Responsible for accepting the benefits and delivering them. 2. Responsible for ensuring the delivered products are to the appropriate quality standard. 3. Provides on-going actual V forecasted benefit realisation.
Project Manager	<ul style="list-style-type: none"> 1. Prepares the Business Case. 2. Conducts Risk assessment and impact analysis. 3. Assess and updates the Business Case at each defined stage.
Project Assurance / QA	<ul style="list-style-type: none"> 1. Assists in developing the Business Case. 2. Ensure value for money and risks are continuously managed. 3. Monitors change to the Business Case and validates it.
Project Support	<ul style="list-style-type: none"> 1. Responsible for capturing data and preparing management reports. 2. Key support point for all project stakeholders – schedules, cost analysis, minutes, actions, supplier liaison etc.

Lecture 1 – Intended Learning Objectives

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5. Explore various investment techniques and financial models.
6. Understand what a Project Charter is and how it is used.

Module 3.5 – It is all about the money!

- For non mandatory projects, the primary benefit is financial
- Multiple investment techniques are used to analyse the investment required / financial benefit
- Some (there are many more) techniques include:
 - Return On Investment
 - Net Present Value
 - Payback period
 - Rough Order of Magnitude
- However, it is not always about the best return – organisations need to invest in all parts of their business

Module 3.5 – Investment Techniques – Return On Investment (ROI)

- ROI is income divided by investment
 - $\text{ROI} = (\text{total discounted benefits} - \text{total discounted costs}) / \text{total discounted costs}$
- The higher the ROI % or higher the ratio of benefits to costs, the better it is
- Many organisations have a required rate of return or minimum acceptable rate of return on investment for projects (11% to 14%)

Module 3.5 – Investment Techniques – Net Present Value (NPV)

- NPV is one of the most often used quantitative/financial models for project selection
- NPV is a method of calculating the expected net monetary gain or loss from an investment (project) by discounting all future costs and benefits to the present time
- Projects with a positive NPV should be considered if financial value is a key criterion
- Generally, the higher the NPV, the more favourable a project is

Module 3.5 – Investment Techniques – Payback period

- The payback period is the amount of time it takes a project before the accrued benefits surpass accrued costs or how much time an investment takes to recover its initial cost
- Based on tracking the net cash flow across each year to determine the year that net benefits overtake net costs (not discounted cash flows)
- Many organizations want IT projects to have a fairly short payback period (< 1 year) due to the changing nature of technology

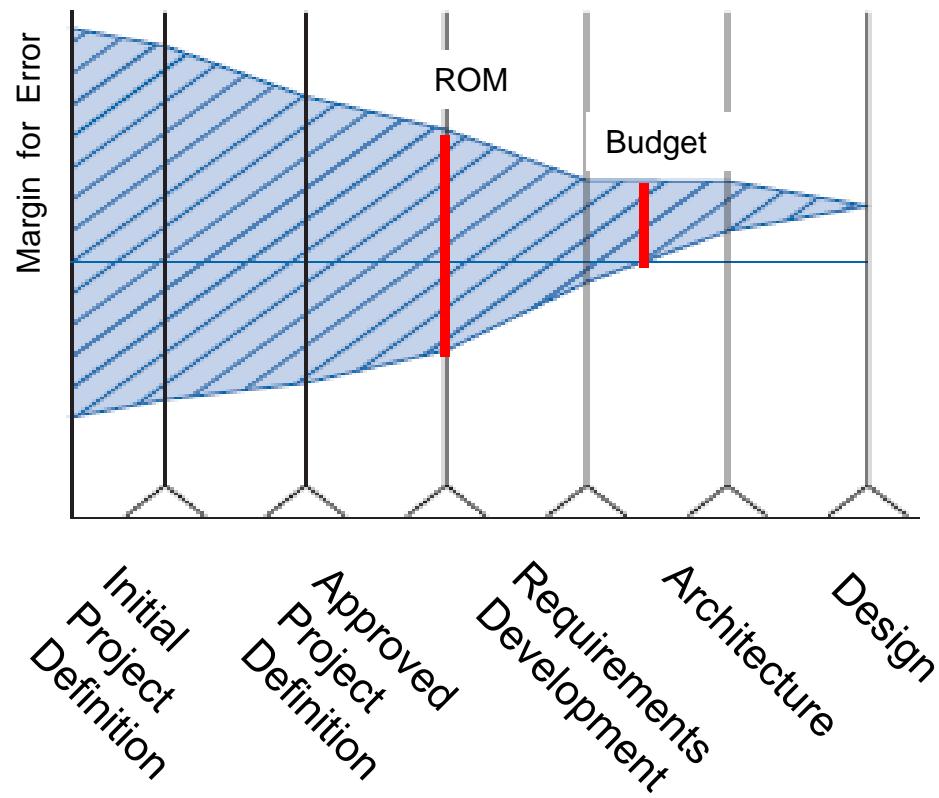


Module 3.5 – Investment Techniques – Project Estimation Rough Order of Magnitude (ROM)

The **Cone of Uncertainty** for cost estimates

Limited accuracy:

- ROM: -25% ... +75%
- Budget: -10% ... +25%



Reference: Kathy Schwalbe, Information Technology Project Management, pg 280

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Module 3.6 – It all begins with a Project Charter



|

<http://blog.zilicus.com/software-project-management-activities-roles/>



Project Name

Target Date: [Date]

Project Description

Write out the project description here. Write out the project description here.

Costs	Item	Quantity	Rate	Total
	Resources			
	Equipment			
	Budget			
	Total			

Gains	Item	Quantity	Rate	Total
	Cost Savings			
	Time Savings			
	Revenue Gain			
	Net Total			

Project Team

- Person 1 – Project Manager
- Person 2 – Team Lead
- Person 3 – Analyst
- Person 4 – Developer
- Person 5 – Quality
- Person 6 – Trainer
- Person 7 – Other
- Person 8 – Other
- Person 9 – Other
- Person 10 – Other

Milestone 1

[Date]

[Description of what will be accomplished on this milestone]

Milestone 2

[Date]

[Description of what will be accomplished on this milestone]

Milestone 3

[Date]

[Description of what will be accomplished on this milestone]



Revision Poll

Lecture 1 – Intended Learning Objectives

Module 3: Projects

1. An initial look at (some) Project Management Methodologies / Standards.
2. Explore the key drivers of why projects fail / succeed.
3. Understand how organisations select the best / right projects (Project Screening).
4. Understand the Project Initialization process, Business Case structure and why organisations use them.
5. Explore various investment techniques and financial models.
6. Understand what a Project Charter is and how it is used.



SWEN90016

Software Processes & Project Management

Marion Zalk

Department of Computing and Information Systems

The University of Melbourne

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2021 – Semester 1
Lecture 2



Lecture 1 – Recap

- ✓ Understand Assignments and our expectations
- ✓ Understand key elements of a Project and why organisations use them
- ✓ Understand the foundational components of Project Management
- ✓ Understand key skills, responsibilities & activities of a Project Manager
- ✓ Understand key elements of how to manage Projects
- ✓ Exposure to some Project Management Methodologies



Lecture 1 – Recap

- ✓ Explore key drivers in why projects fail / succeed
- ✓ Understand how organisations select the best / right projects
- ✓ Understand the Project Initialization process, Business Case structure and why organisations use them
- ✓ Explore various Investment techniques and financial models
- ✓ Understand responsibilities associated with building a Business Case and the accountable group / individual
- ✓ Understand what a Project Charter is and how it is used



L1 - Recap



Intended Learning Objectives

Module 4 – Process & Project Management Plan.

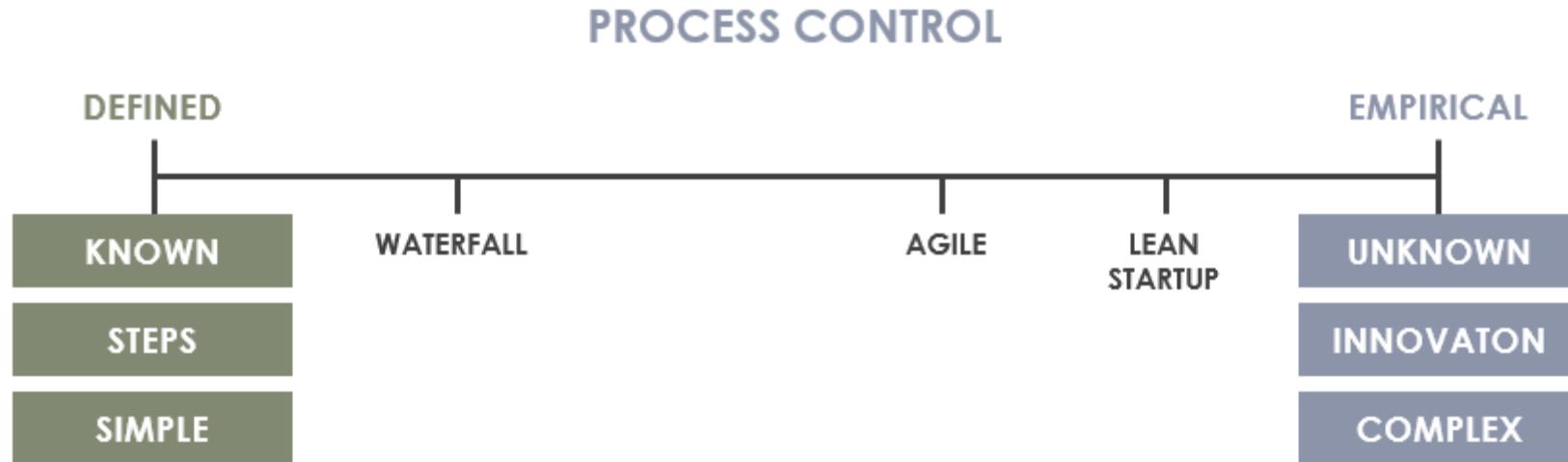
Module 5 – Stakeholder Management.

Module 6 – Communication Management.



Module 4.1 – Empirical and Defined Process

Empirical process control expects the unexpected, while defined process control expect every piece of work to be completely understood in upfront.

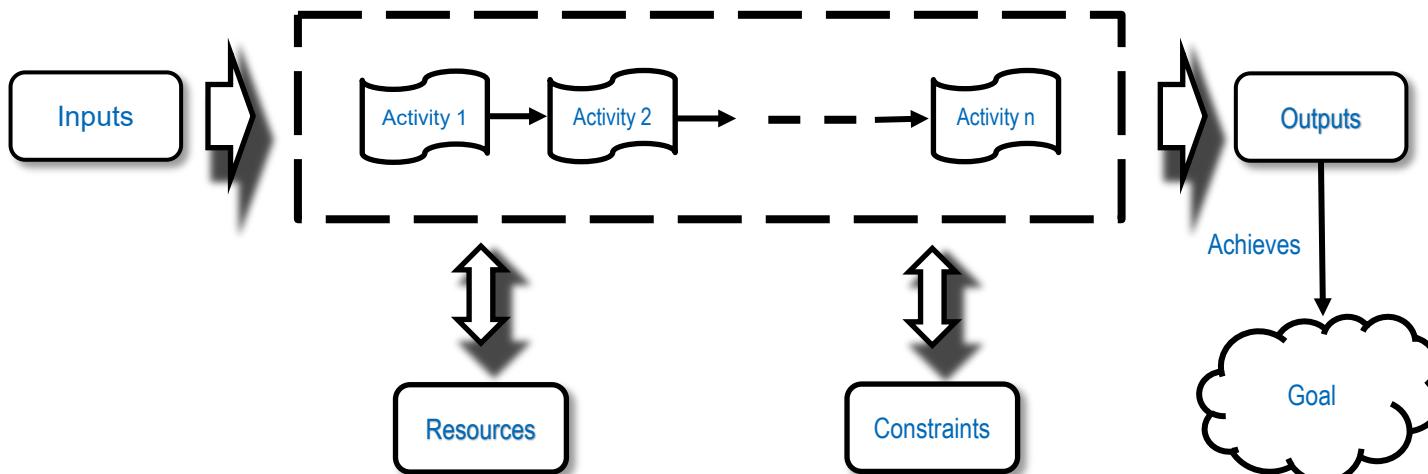




Module 4.1 – Defined Process Control

A process with a well-defined set of steps. Given the same inputs, a defined process should produce the same output every time.

Great when in an environment with relatively low volatility that can be easily predicted; given the same inputs, a defined process should produce the same output every time based on its repeatability and predictability nature.



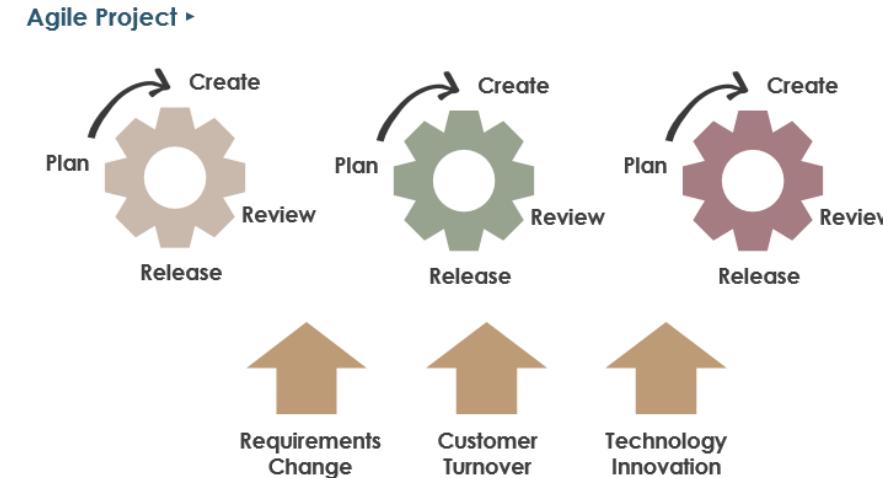
www.visual-paradigm.com/scrum/empirical-vs-defined-process-control



Module 4.1 – Empirical Process Control

In empirical process control, you expect the unexpected. Empirical process control has the following characteristics:

- Learn as we progress
- Expect and embrace change
- Inspect and adapt using short development cycles
- Estimates are indicative only and may not be accurate





WELCOME TO THE

Module 4.1 – Defined v Empirical



Defined / Repeatable Process

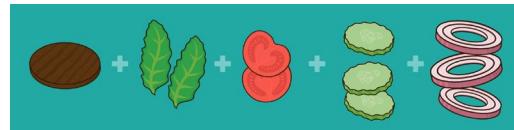


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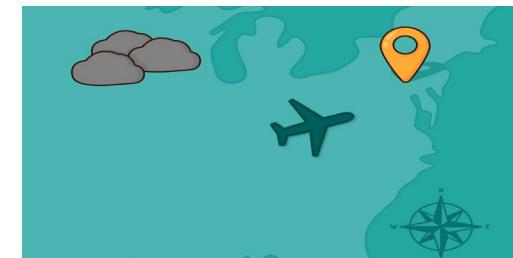
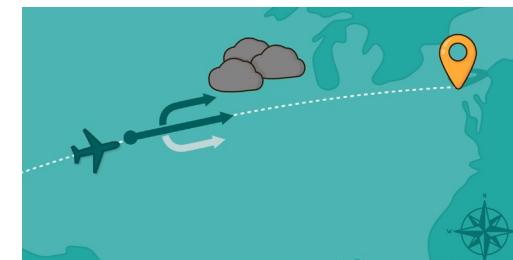


WILLIAM GOLDBECK

Module 4.1 – Defined v Empirical



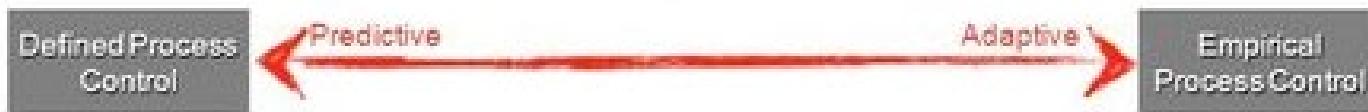
Defined / Repeatable Process



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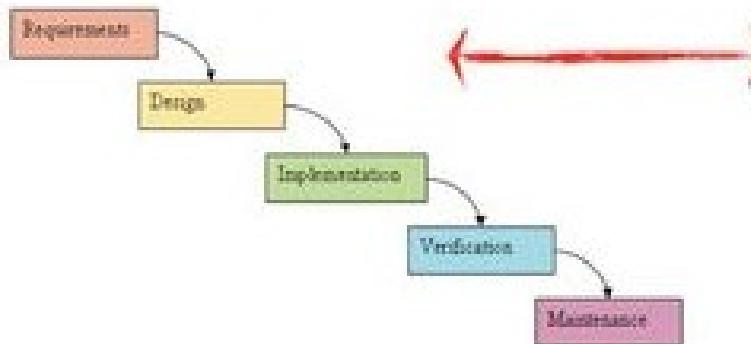
Module 4.1 – Defined v Empirical



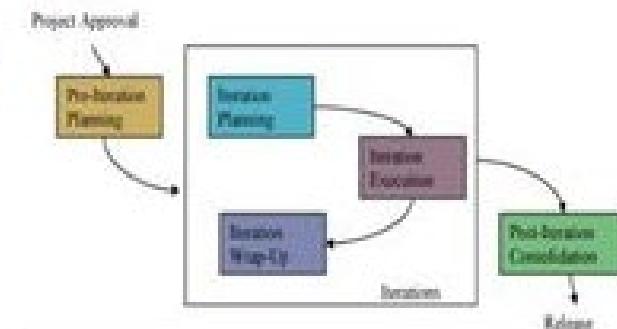
Requires that *every piece of work be completely understood*. Given a well-defined set of inputs, the same outputs are generated every time. A defined process can be started and allowed to run until completion, with the same results every time.

Provides and exercises control through transparency, frequent inspection and adaptation for processes that are *imperfectly defined* and generate unpredictable and unrepeatable outputs.

Waterfall



Agile



Module 4.1 – What does a Process have to do with Project Management and Software Engineering?

1. Project Management is a process as it defines a series of tasks (Planning, Executing and Controlling) to deliver a specific / an agreed set of outcomes.
2. System Development Lifecycle (SDLC) is a term used in Software Engineering. It describes a process for planning, creating, testing, and deploying an information system. SDLC can be composed of hardware only, software only, or a combination of both.

WILLIAM DUNN

Module 4.1 – Project Management Plan (Formal)

Almost every organisations will have it's own “*version*” of a Project Management Plan (PMP), however the reasons they have and use them are the same.

A PMP is a formal approved document that defines how the project is executed, monitored and controlled. It may be a summary or a detailed document.

It is a document that is owned, controlled and populated by the Project Manager and is used throughout the project.

A good PMP provides the required level of detail across key project components and is the one source of truth for all parties involved across the project.



Module 4.1 – Project Charter V Project Management Plan

A Project Charter is a summary project proposal to secure approval for the project goals and terms (useful as part of Business Case).

A PMP is an approved document showing how to achieve the approved project goals / benefits and provides the details on how to execute and manage the project (used as part of mobilisation and on-going management of the project).

Simple Project Charter

Project Name: [Project Name]

Target Date: [Date]

Project Description: Write out the project description here. Write out the project description here.

Item	Quantity	Rate	Total
Costs			
Resources			
Equipment			
Budget			
Total			

Item	Quantity	Rate	Total
Gains			
Cost Savings			
Time Savings			
Revenue Gain			
Net Total			

Project Team:

- Person 1 – Project Manager
- Person 2 – Team Lead
- Person 3 – Analyst
- Person 4 – Developer
- Person 5 – Quality
- Person 6 – Trainer
- Person 7 – Other
- Person 8 – Other
- Person 9 – Other
- Person 10 – Other

Milestone 1 [date] [Description of what will be accomplished on this milestone]

Milestone 2 [date] [Description of what will be accomplished on this milestone]

Milestone 3 [date] [Description of what will be accomplished on this milestone]

SWEN90016 Software Processes and Project Management -33- IT ALL STARTS HERE

Primary Use: Summary (few pages) of key information used to communicate, engage, gain buy-in and obtain approvals.

Project Management Plan - Template			
Section 1 - Introduction			
1. Title Page	1 day	MA	Mon 10/07
2. Executive Summary	2 days	MA	Mon 11/07
3. Table of Contents	2 days	MA	Mon 12/07
4. Introduction	1 day	MA	Tue 13/07
5. Project Scope	1 day	MA	Wed 14/07
6. Project Plan	2 days	MA	Thu 15/07
7. Project Resources	1 day	MA	Fri 16/07
8. Initiations	2 days	MA	Sat 17/07
9. Complete Project Charter	1 day	MA	Sun 18/07
10. Change Request System	2 days	MA	Mon 19/07
11. Step Gate Review Completed	2 days	MA	Tue 20/07
12. Stakeholder Analysis Completed	2 days	MA	Wed 21/07
13. Requirements Gathering	2 days	MA	Thu 22/07
14. Requirements Analysis	2 days	MA	Fri 23/07
15. Requirements Documentation	2 days	MA	Sat 24/07
16. Requirements Verification	2 days	MA	Sun 25/07
17. Requirements Audit	2 days	MA	Mon 26/07
18. Requirements Analysis	2 days	MA	Tue 27/07
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23. Requirements Documentation	2 days	MA	Sun 01/08
24. Requirements Verification	2 days	MA	Mon 02/08
25. Requirements Audit	2 days	MA	Tue 03/08
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271. Requirements Documentation	2 days	MA	Mon 13/05
272. Requirements Verification	2 days	MA	Tue 14/05
27			

Module 4.1 – Project Management Plan (Formal)

A typical PMP consists of all / or most of the following categories.

- *Project Information*
 - Executive Summary
 - Financial Authority to proceed
 - Key Stakeholders
 - Scope
 - Delivery approach / SDLC - Waterfall or Agile
 - Resources / People
 - Key Milestones
 - Project Budget
 - Lessons learned applied to this project
 - Constraints



WELCOME TO THE UNIVERSITY OF MELBOURNE

Module 4.1 – Project Management Plan (Formal)

And.....

- *Project Governance*
 - Roles and Responsibilities
 - Mandatory Project Planning / Key Additional Activities
 - Schedule
 - Risk Management
 - Cost Estimation
 - Quality Assurance
 - Configuration Management (Change Management)

The PMP is a large multi-page document that takes time to prepare, review and complete. Multiple people (subject experts) are involved and prepare the specific details. The Project Manager coordinates all items and has ultimate accountability for the quality and final outcome.



SWEN90016

Software Processes & Project Management

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2021 – Semester 1
Lecture 2



Intended Learning Objectives

Module 4 – Process & Project Management Plan.

Module 5 – Stakeholder Management.

Module 6 – Communication Management.



Intended Learning Objectives

Module 5 – Stakeholder Management.

1. Stakeholders & the Stakeholder Register.
2. Stakeholder Engagement and Planning.



Module 5. 1 - Identifying Stakeholders & the Stakeholder Register

Internal Stakeholders	External Stakeholders
Shareholders	End Users / Customers
Employees	Suppliers
Board Members	Governments
Sponsor / Business Managers	Unions
Project Manager	Local Communities / General Public
Management	Other Related Institutions
Project Team	Competitors



Module 5. 1 - Identifying Stakeholders & the Stakeholder Register

Name	Position	Internal/External	Project Role	Contact Information
Stephen	VP of Operations	Internal	Project Sponsor	stephen@globaloil.com
Betsy	CFO	Internal	Senior Manager. Approves Funds	betsy@globaloil.com
Chien	CIO	Internal	Senior Manager. PM's Boss	chien@globaloil.com
Ryan	IT Analyst	Internal	Team Member	ryan@globaloil.com
Lori	Director Accounting	Internal	Senior Manager	lori@globaloil.com
Sanjay	Director Refineries	Internal	Senior Manager of Largest Refinery	sanjay@globaloil.com
Debra	Consultant	External	Project Manager	debra@globaloil.com
Suppliers	Suppliers	External	Software Supplier	suppliers@gmail.com



Intended Learning Objectives

Module 5 – Stakeholder Management.

1. ~~Stakeholders & the Stakeholder Register.~~
2. Stakeholder Engagement and Planning.

Module 5. 2 – Understanding Stakeholder Engagement and Planning

Levels of Stakeholder Engagement

- *Unaware*: Unaware of the project and its potential impacts on them
- *Resistant*: Aware of the project yet resistant to change
- *Neutral*: Aware of the project yet neither supportive nor resistant
- *Supportive*: Aware of the project and supportive of change
- *Champion / Leading*: Aware of the project and drives change

Module 5. 2 – Understanding Stakeholder Engagement and Planning

The stakeholder management plan can include:

- Current and desired engagement levels
- Interrelationships between stakeholders
- Communication requirements
- Potential management strategies for each stakeholder
- Methods for updating the stakeholder management plan

Note: Because a stakeholder management plan often includes sensitive information, it may not be part of the official project documents, which are normally available for all stakeholders to review.

In many cases, only project managers and a few other team members should prepare the stakeholder management plan. Parts of the stakeholder management plan may not be written down, and if they are, distribution is limited.

Module 5. 2 – Understanding Stakeholder Engagement and Planning

Stakeholder Analysis includes:

- Names and Organisations of Key Stakeholders
- Their Role on the Project
- Unique Facts about Each Stakeholder
- Level of Interest in the Project
- Influence on the Project
- Suggestions and Strategies for Managing Relationships with each Stakeholder



Module 5. 2 – Understanding Stakeholder Engagement and Planning

Stakeholder Analysis example:

Name	Power / Influence	Current Engagement	Potential Management Strategies
Brian	High/High	Champion / Leading	Brian can seem intimidating due to his physical stature and deep voice, but he has a great personality and sense of humour. He previously led a similar software upgrade project at another company and knows what he wants. Manage closely and ask for his advice as required. He likes to be kept in touch with short, frequent updates in person.
Mary	High/Medium	Resistant	Mary is very organised yet hardhead. She has been pushing corporate IT standards, and the system the PM and sponsors like best goes against those standards, even though it's the best solution for this project and the company as a whole. Need to convince her that it is ok and that people still respect her work and position.
Finance Team	Medium/High	Resistant	The Finance Team is resistant to the Project. They believe the funds can be better used elsewhere in the organisations. They also believe the Benefits are not achievable in the defined pay back period. Key stakeholder as they control the funding which the project is dependant on. Need to convince them of the costs & benefits and ensure they understand the detail. Get them involved in a detailed review of all \$'s.
Jessica	High/Low	Neutral	Very professional, logical person. Gets along with Mary. She has supported Brian in approving past projects with strong business cases. Provide detailed financial justification for the suggested solution to keep her satisfied. Also ask her to talk to Mary on Brian's behalf.



SWEN90016

Software Processes & Project Management

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2021 – Semester 1
Lecture 2



Intended Learning Objectives

Module 4 – Process & Project Management Plan.

Module 5 – Stakeholder Management.

Module 6 – Communication Management.

Intended Learning Objectives

Module 6 – Communication Management.

1. The communication challenge.
2. The importance of listening.
3. Communication key skills & importance.
4. Communication plans.
5. Virtual teams & communication.
6. Key communication considerations.



Module 6. 1 – Communication Challenges



Individual



Team

- Semantics [meaning]
- Perception [interpretation]
- Communication Channel
- Feedback
- Anxiety
- Culture

- Status
- Silos
- Information Overload
- Lack of Communication
- Protocol [rules]

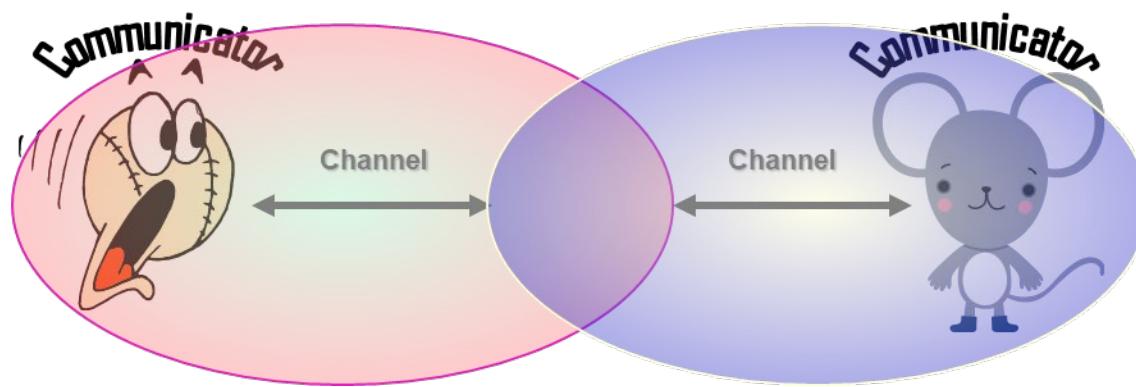


Module 6. 1 – Communication Challenges



The Communication Model

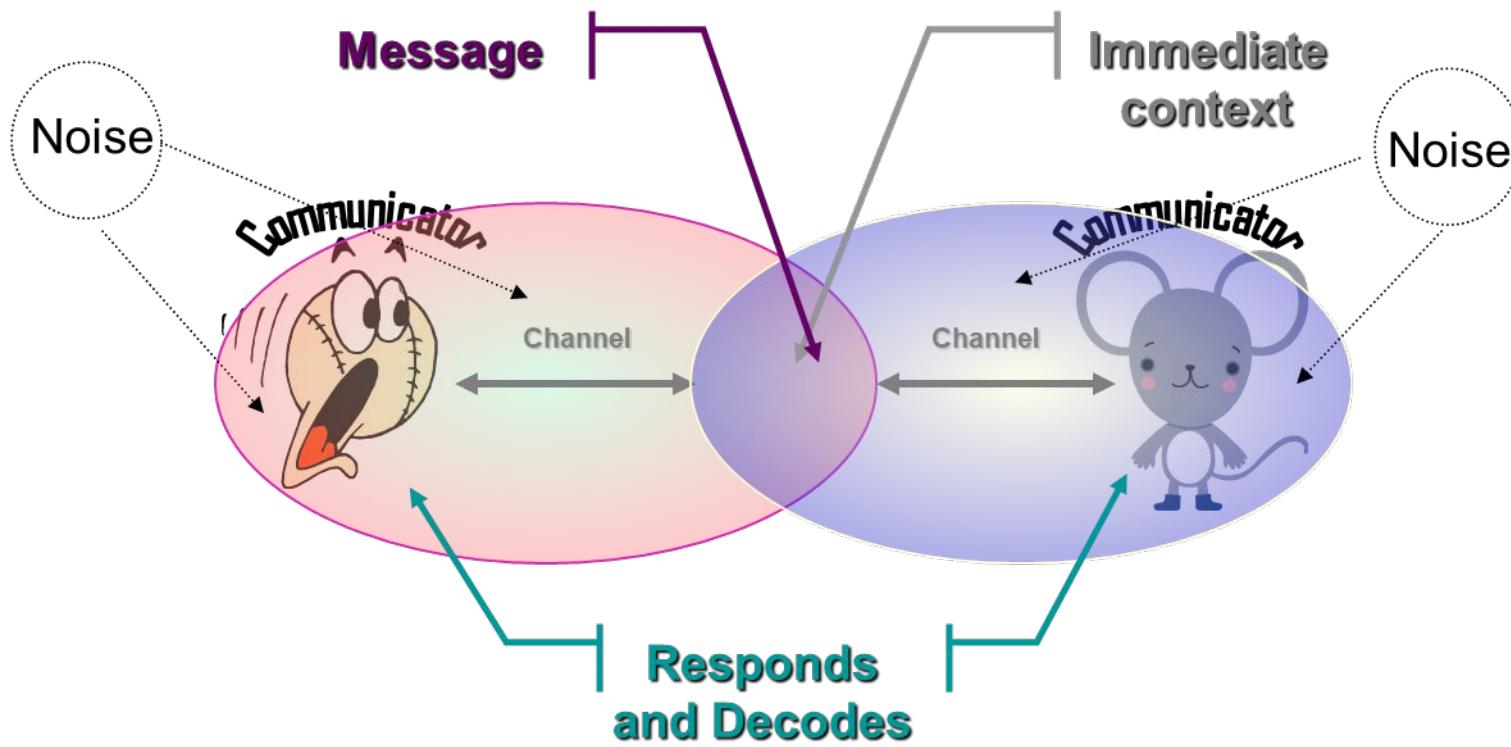
Module 6. 1 – Communication Challenges



The Communication Model



Module 6. 1 – Communication Challenges



The Communication Model

Intended Learning Objectives

Module 6 – Communication Management.

1. ~~The communication challenge.~~
2. **The importance of listening.**
3. Communication key skills & importance.
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Module 6. 2 – The importance of Listening

Hearing is the act of perceiving sound by the ear.

Listening requires concentration and is the process of taking in what you hear and mentally organising it so it makes sense.

The Act of Listening
Demands Real Effort

Listening is An
Essential Life Skill



Truly Effective
Listeners are Rare

Few People Practice
Listening and Even Fewer
Have Been Trained to Listen



WEEK 6: LISTENING

Module 6. 2 – The importance of Listening

Why Do We Listen?

- Promotes problem-solving abilities
- Demonstrates acceptance of others
- Builds and retains trust in relationships
- Increases speaker's receptiveness to thoughts and ideas of others
- Increases self-esteem of the speaker helps you evaluate messages
- Helps you understand and retain information
- Allows you to help others

Module 6. 2 – The importance of Listening

The Process of Listening

- Predicting [some expected outcome]
- Receiving
- Assigning meaning
- Assess / Validate
- Remembering



Module 6. 2 – The importance of Listening

- Types of Listening
 - Passive Listening – *Lectures*
 - Taking in the information without processing or reacting
 - Active or Empathetic Listening – *Tutorials*
 - Show interest
 - Asks questions
 - Avoid distractions
 - Use direct eye contact
 - Do not interrupt
 - Read both verbal and nonverbal messages



Module 6. 2 – The importance of Listening

Challenges to Listening

- Physiological limitations
- Inadequate background information
- Selective memory or expectations
- Fear of being influenced / persuaded
- Bias and being judgemental
- Boredom or interference from emotions
- Partial listening and distractions e.g. mobile phones / background noise
- Physical barrier e.g. environment, lighting, uncomfortable seating
- Cultural differences [understanding the spoken words]
- Past experiences
- Jargon & Acronyms

Module 6. 2 – The importance of Listening

The Importance of Active Listening

- Shows the speaker you are concerned or interested
- Leads to getting better information
- Encourages further communication
- Has the potential to enhance relationships
- Can calm down someone who is upset
- Invites others to listen to you
- Leads to better co-operation and problem solving

Module 6. 2 – The importance of Listening

TED Talk: [5 ways to listen better](#)

Julian Treasure

7 min video

Intended Learning Objectives

Module 6 – Communication Management.

1. ~~The communication challenge.~~
2. ~~The importance of listening.~~
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WILLIAM MORRIS

Module 6. 3 – Communication key skills & importance

Communication Skills are critical in Project Management

- Conveying your point of view
- Motivating and influencing others
- Delegating
- Recognising, defining and solving problems
- Delivering presentations / updates
- Setting goals & articulating a vision
- Managing conflict
- Networking
- Negotiating

L3.1 – Teams, Individuals and Motivation

So why is this important to Project Management?

L3.2 – Project Manager Key Activities "a change is occurring"

Ajile is redefining the way we execute projects and the role of the PM. In Ajile:

- No defined PM role
- Many roles and tasks are shared across team members
- Key project activities are self-understanding formal and appropriate documentation
- Some alignment to activities of a Scrum Master
- Major focus on communication and collaboration between team members
- Includes an emphasis on learning
 - Is involved in continuous improvement performance
 - Allows the team to self-organise and self-manage
 - Allows the team to self-organise and self-manage
 - Assists others with key issues

www.pmi.org/pmi-project-management-best-practices.aspx

www.pmi.org/pmi-project-management-best-practices.aspx

www.pmi.org/pmi-project-management-best-practices.aspx

www.pmi.org/pmi-project-management-best-practices.aspx



Module 6. 3 – Communication key skills & importance

Why Is This Important?

Because successful Project Managers MUST have the ability to:

- Read / understand the client
- Run a meeting
- Communicate (written & orally) thoughts accurately
- Manage the team
- Influence your environment
- Ensure alignment and buy-in to the purpose / outcome



Intended Learning Objectives

Module 6 – Communication Management.

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Module 6. 4 – Communication Plan

- A large proportion of a Project Managers time is spent on communication
- Project Managers often use a Communications Plan to assist in managing and coordinating key communication messages
- A good project Communication Plan:
 - Ensures communications is effective and efficient
 - Allows the Project Manager to be pro-active
 - Sets a common understand of what will be done and when
 - Clarifies who is responsible for key items, what will be delivered and by who

<http://www.projectmanagementdocs.com/project-planning-templates/communications-management-plan.html#ixzz5A9VcGljd>



Module 6. 4 – Communication Plan

A Communications Plan defines:

- What information will be communicated - detail and format
- Communication Channel - meetings, email, telephone, web portal, etc.
- When information will be distributed – frequency of formal and informal comms
- Who is responsible
- Communication needs of stakeholders
- Resources the project will allocate for communication
- How sensitive or confidential information will be communicated & who will authorise this
- The flow of project communications
- Any constraints (internal or external) which affect project communications
- Any standard templates, formats, or documents the project must use
- Escalation process for resolving any communication-based conflicts or issues



Module 6.4 – Communication Plan

Example

Is underpinned by a Communications Matrix

Stakeholder	Communication Objective	Format	Frequency	Owner	Importance
Sponsor	Provide updates on project progress, key issues, success and support required	Regular Meeting - face to face Formal Report	Weekly Monthly	Project Manager	High
Business Expert	Gather requirements, sign-off all scope, approve prototype and final acceptance	Formal Report / documentation	Fortnightly	Project Manager	High
Finance	Future funding approval	Project Finances	Bi-monthly	Finance rep	High
Human Resources	Identify staff required for project and deal with all staff related items	Resource plans	Monthly	Project Support	Medium
Risk Department	Identify risks and mitigation strategies and ensure they are being followed	Risk Management Plan	Monthly	Project Support	Medium
Internal IT Staff	Identify resources for all phases including Design, Requirements Gathering, Development and Production Implementation	Regular Meeting - face to face Formal Report	Weekly Monthly	Project Manager	High
External IT Staff / Supplier	To ensure they can execute on their Testing Services contract	Formal Report	Monthly	Project Manager	Low



Intended Learning Objectives

Module 6 – Communication Management.

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Module 6. 5 – Virtual Teams & Communication

What is a virtual team?

- A virtual team (also known as a geographically dispersed team, distributed team, or remote team) usually refers to a group of individuals who work together from different geographic locations and rely on communication technology. (Wikipedia)

Module 6. 5 – Virtual Teams & Communication

In 2014 survey 1,700 knowledge workers, 79% reported working always or frequently in dispersed teams. Armed with laptops, Wi-Fi, and mobile phones, i.e. technology most professionals can do their jobs from anywhere.

Why does it appeal to employees?

- Employees can be more flexible with work and home commitments

Why does it appeal to organisations?

- Organisations can access the best GLOBAL talent
- Save on real estate costs

Module 6. 5 – Virtual Teams & Communication

What does this mean for communication

- Communication is less rich and less frequent than face-to-face interaction

Why?

- Less visual and behavioural cues
- Less or no informal interactions

BUT not all bad

- Those less inclined to speak in groups, may feel more comfortable
- Less importance on interpersonal skills and physical appearance may benefit certain members of the team
- Still need to be mindful of unconscious bias (virtual unconscious bias)

Module 6. 5 – Virtual Teams & Communication

Create a Communication charter.

- Discipline about how the team should communicate
- Norms of behaviour when participating in virtual meetings (background noise, side conversations, talking clearly and at a reasonable pace, listening attentively, not dominating the conversation)
- Guidelines on communication modes - in which circumstances, which mode should be used e.g. email should be used for formal correspondence, a WhatsApp group for chatting informally, documents

Module 6. 5 – Virtual Teams & Communication

Leverage communication technologies

- How can you use technology to function effectively as a team?
- Who has access to which technologies - bandwidth, free vs cost.

Team building

- Virtual water cooler
- Formal and informal team building activities
- For instance we have a random channel in our slack group where we post funny jokes, memes, celebrations e.g. birthdays, milestones. An intentional place to strengthen the group
- Think of how you can use social networking tools and features to create a connected team.

Module 6. 5 – Virtual Teams & Communication

Factors that contribute to a good virtual team

- Good communication skills
- High emotional intelligence
- Ability to work independently
- Resilience
- Awareness and sensitivity to other cultures is important especially in global groups

Guess what – They are very similar to factors that contribute to any successful team!

References:

<https://hbr.org/2013/06/making-virtual-teams-work-ten>

<https://hbr.org/2014/12/getting-virtual-teams-right>

<https://hbr.org/2018/02/how-to-collaborate-effectively-if-your-team-is-remote>



Intended Learning Objectives

Module 6 – Communication Management.

1. ~~The communication challenge.~~
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Module 6. 6 – Key Communication Consideration

Importance of Face to Face meetings

- 58% of communication is through body language
- 35% of communication is through how the words are said
- 7% of communication is through content or words that are spoken
- Pay attention to more than just the actual words
- A person's tone or voice and body language can say a lot about how they really feel
- Non verbal comms govern how other people feel about us and also how we feel about ourselves

Body Language - Spend some time looking at Ted Talk https://www.youtube.com/watch?v=Ks-_Mh1QhMc



Module 6. 6 – Key Communication Consideration

Items to remember

- Rarely does the receiver interpret a message exactly as the sender intended
- Geographical location and cultural background affect the complexity of communications
 - Different working hours
 - Language barriers
 - Different cultural norms
- Communication helps manage conflicts effectively
- Spend time developing communication skills – *practice & feedback*
- Choose the channel appropriately



Module 6. 6 – Key Communication Consideration Communication Channels – some examples

Choose carefully as it will make a difference

How well medium is Suited to:	Hard Copy	Telephone Call	Voice Mail	eMail	Meeting / f2f	Web Site
Confirming commitments	1	3	3	1	2	1
Building consensus	3	2	3	3	1	3
Mediating conflict	3	2	3	3	1	3
Resolving misunderstanding	3	1	3	3	1	3
Addressing negative behaviour	3	2	3	2	1	3
Expressing support / appreciation	1	1	2	1	1	1
Encouraging creative thinking	2	3	3	2	1	3

1 = Most suited, 2 = Less suited and 3 = Least Suited

Module 6. 6 – Key Communication Consideration Conflict

Conflict is the single most undermanaged activity in projects and if left unresolved will destroy a project. Key causes include:

- Schedule
- Intellectual disagreements
- Personalities
- Project Priorities
- Manpower
- Technical
- Administration
- Personality
- Cost



Module 6. 6 – Key Communication Consideration Conflict

Deal with it quickly and succinctly and
BEFORE it becomes a major issue





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2021 – Semester 1
Lecture 3

Lecture 3 – Intended Learning Objectives

**Module 7 – Software Development
Lifecycles - Formal.**

**Module 8 – Software Development
Lifecycles - Agile.**

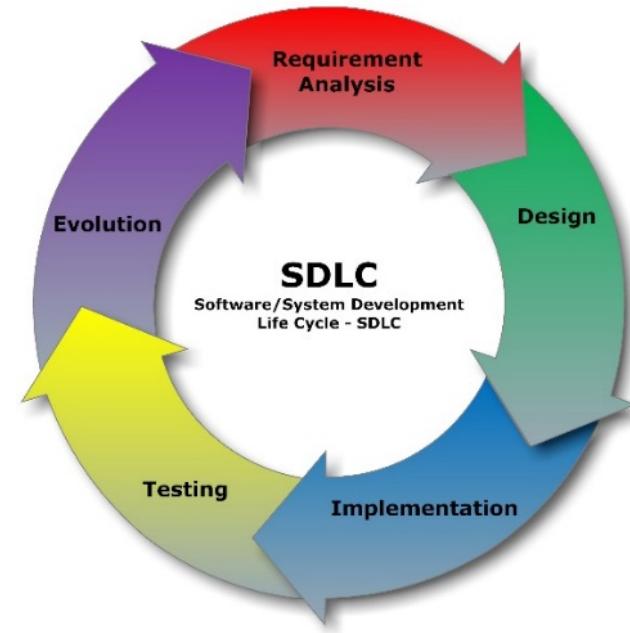


Module 7.1 – Software Development Life Cycle (SDLC)

The systems development life cycle (SDLC), also referred to as the application development life-cycle, is a term used in systems engineering, information systems and software engineering to describe a **process** for planning, creating, testing and deploying an information system.

Activities in SDLC:

- Requirements gathering
- Systems / Architectural Design
- Implementation / coding / Integration
- Testing
- Evolution:
 - Delivery and Release - Deployment
 - Maintenance





Module 7.1 – SDLCs

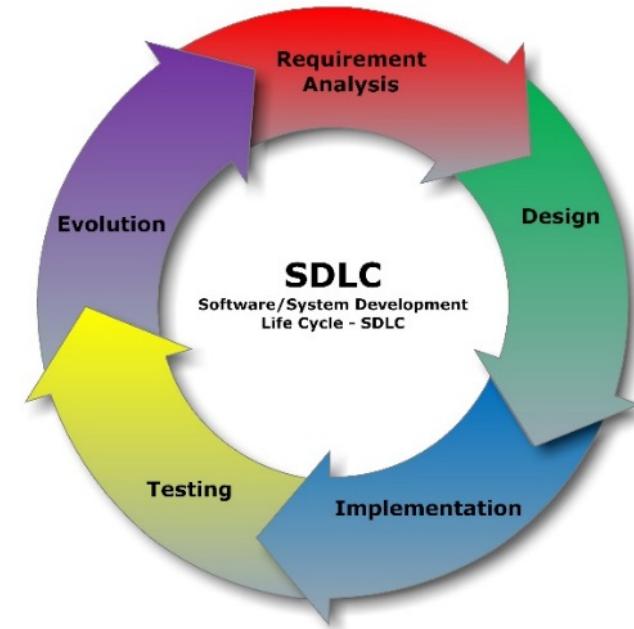
There are many SDLCs around with organisations typically favouring a blend of Formal and Agile approaches.

1. Formal

- Waterfall
- Incremental
- V-Model

2. Agile

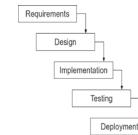
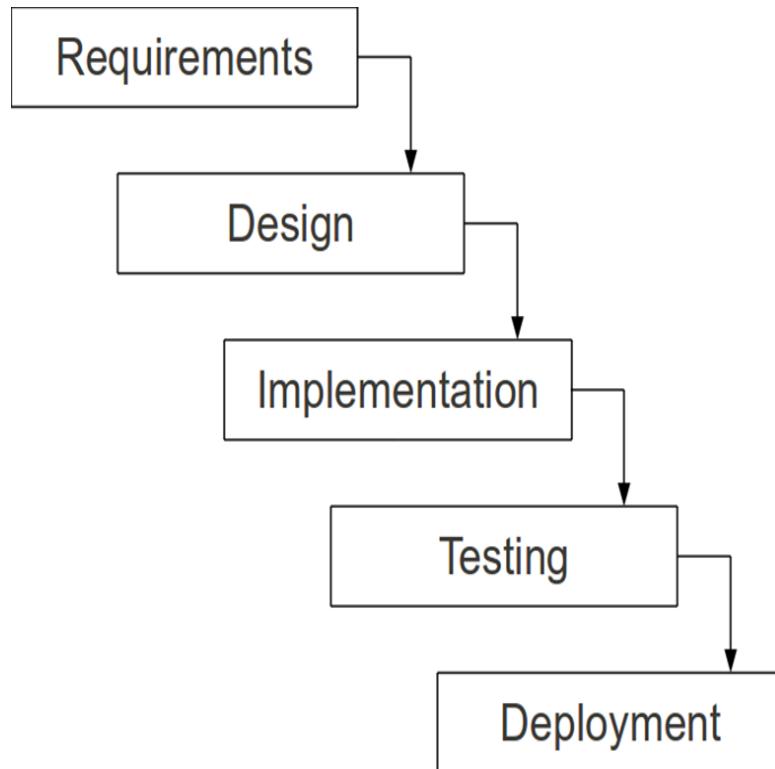
- Scrum
- Kanban
- Extreme Programming





WATERFALL

Module 7.1 – Waterfall



Advantages

- Simple and easy to understand and use
- Easy to manage due to the rigidity of the model
- Phases are processed and completed one at a time
- Documentation available at the end of each phase
- Works well for projects where requirements are very well understood and remain stable

Disadvantages

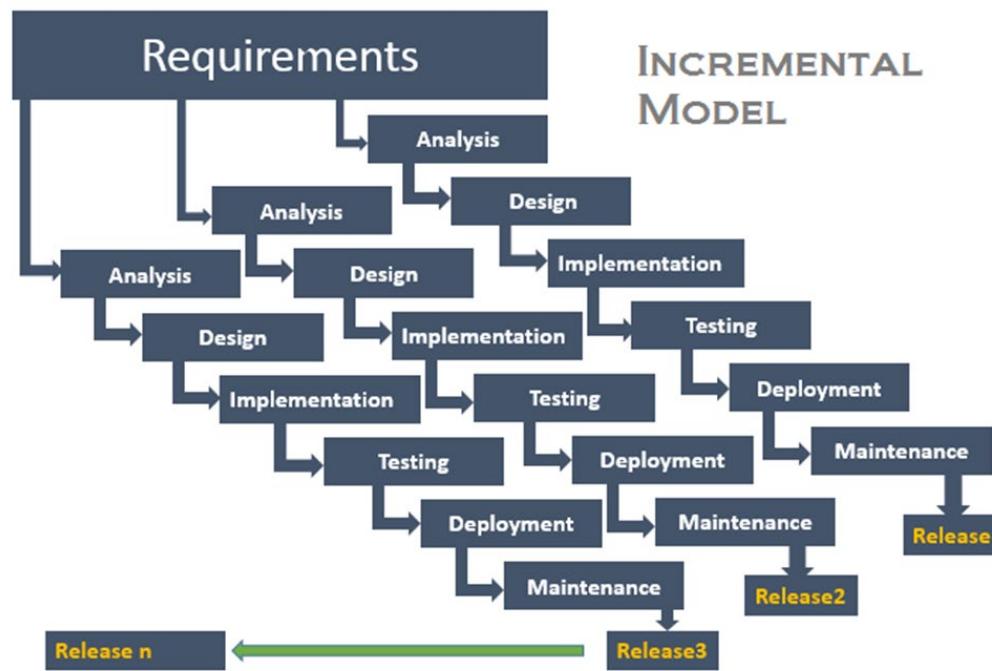
- Difficult to accommodate change after the process is underway
- One phase must be completed before moving on to the next
- Unclear requirements lead to confusion
- Client approval is in the final stage
- Difficult to integrate risk management due to uncertainty



Module 7.1 – Incremental Model



In incremental model the **whole requirement** is divided into various releases. Multiple cycles take place, making the life cycle a **multi-waterfall** cycle. Cycles are divided up into smaller, more easily managed modules.





Module 7.1 – Incremental Model



Advantages – compared to standard waterfall

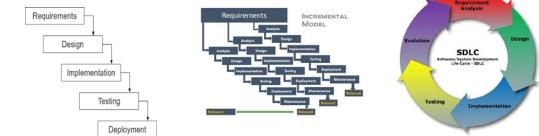
- Each release delivers an operational product
- Less costly to change the scope/requirements
- Customers can respond to each build
- Initial product delivery is faster
- Customers get important functionality early
- Easier to test and debug during smaller iterations

Disadvantages – compared to standard waterfall

- More resources may be required
- More management attention is required
- Defining / partitioning the increments is difficult and often not clear
- Each phase of an iteration is rigid with no overlaps
- Problems may occur at the time of final integration

Software Process

Module 7.1 – Formal Models



Characteristics where “Formal” Models make sense:

- Projects where the customer has a very clear view of what they want
- Projects that will require little or no change to requirements
- Software requirements are clearly defined and documented
- Software development technologies and tools are well-known
- Large scale applications and systems developments



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Lecture 3



Lecture 3 – Intended Learning Objectives

**Module 7 – Software Development
Lifecycles - Formal.**

**Module 8 – Software Development
Lifecycles - Agile.**

Lecture 3 – Intended Learning Objectives

Module 8 - Software Development Lifecycles

Agile:

1. Understand what Agile is and its origins.
2. Understand the Agile framework.
3. Understand Scrum – Roles, Ceremonies and Artefacts.
4. Understand advantages / disadvantages of Agile.



Module 8.1 – SDLCs

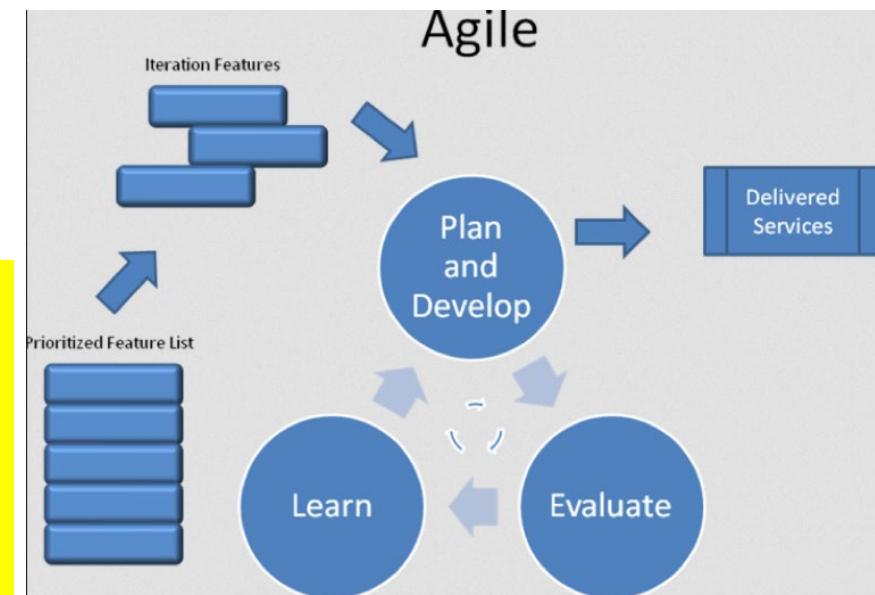
There are many SDLCs around with organisations typically favouring a blend of Formal and Agile approaches.

1. Formal

- Waterfall
- Incremental
- V-Model

2. Agile

- Kanban
- Scrum
- Extreme Programming



Module 8.1 – Why is Agile attractive

- We are in an ever changing global world with the pace of change increasing
- Customer needs and demands are exponentially increasing – products must continually be delivered
- Low Technology cost, ease of use and the global market place has increased competition and reduced entry barriers
- The war for talent is over – and we have lost! Cross functional teams help minimise the potential loss
- Long development cycles are like long lunches – a thing of the past
- Quality is no longer something we do / check later – it must be part of everything we do
- Cross functional groups are more fun!

Module 8.1 – What is Agile

- A framework based on iterative development where requirements and solutions evolve through collaboration between self-organising cross-functional teams
- A disciplined process that encourages frequent inspection and adaptation
- A leadership philosophy that encourages teamwork, self-organisation and accountability
- A set of engineering best practices intended to allow for rapid delivery of high-quality software
- A business approach that aligns development with customer needs and company goals

Module 8.1 – What is Agile

- In software development, we think about methodologies, activities, interactions, results, work products, artefacts and processes to organise the work.

The main tasks of software development remain the same regardless of methodology used, however with Agile, the flow of activities, how they are undertaken and who is involved is extremely different.

Module 8.1 – What is Agile - Origins

- Changes initiated in large US corporates in 1990's
- Software engineers frustrated with
 - long lead times before products were delivered
 - Decisions made early in the project couldn't be changed later
- 17 software engineer thought leaders met first in 2000 to discuss software engineering and different approaches
- Famous meeting in 2001 at the Snowbird ski lodge in Utah where they met to change the way the industry designed, engineered and deployed software
- Brought together by the Agile Manifesto

<https://techbeacon.com/agility-beyond-history%E2%80%94-legacy%E2%80%94-agile-development>



Lecture 3 – Intended Learning Objectives

Module 8 - Software Development Lifecycles

Agile:

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Module 8.2 – Agile Framework

Primary elements of the Agile framework include:

- Manifesto
- 12 Key Principles
- Kanban
- Scrum

Module 8.2 – Agile Framework - *Manifesto*

Agile Manifesto

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- | | | |
|--------------------------------|------|-----------------------------|
| ■ Individuals and interactions | over | processes and tools |
| ■ Working software | over | comprehensive documentation |
| ■ Customer collaboration | over | contract negotiation |
| ■ Responding to change | over | following a plan |

That is, while there is value in the items on the *right*, we value the items on the *left* more.

<http://www.agilealliance.org>



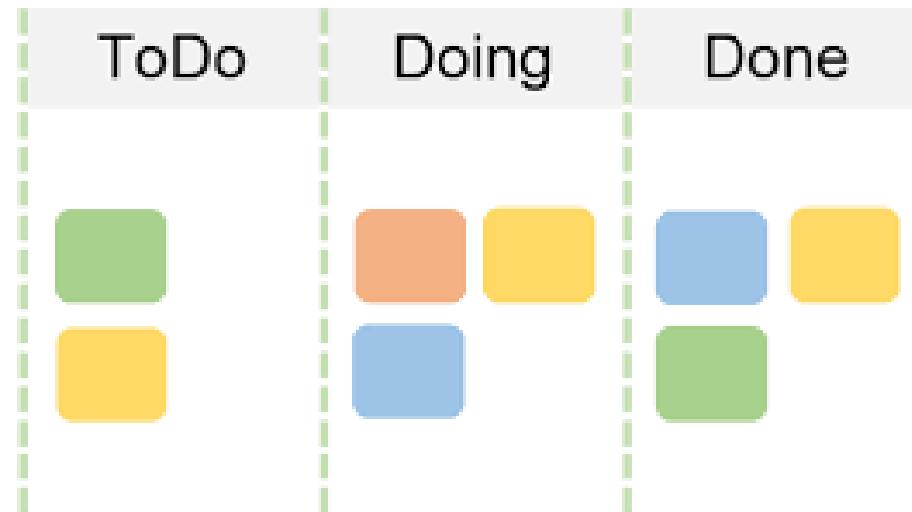
Module 8.2 – Agile Framework – **12 Key Principles**

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, shorter timeframes is the preference.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need and trust them.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity - the art of maximizing the amount of work not done - is essential.
11. The best architectures, requirements, and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.



Module 8.2 – Agile Framework - *Kanban*

- ***Signboard / Billboard:*** Work items are visualised to provide participants a view of progress and process, from start to finish usually via a Kanban board

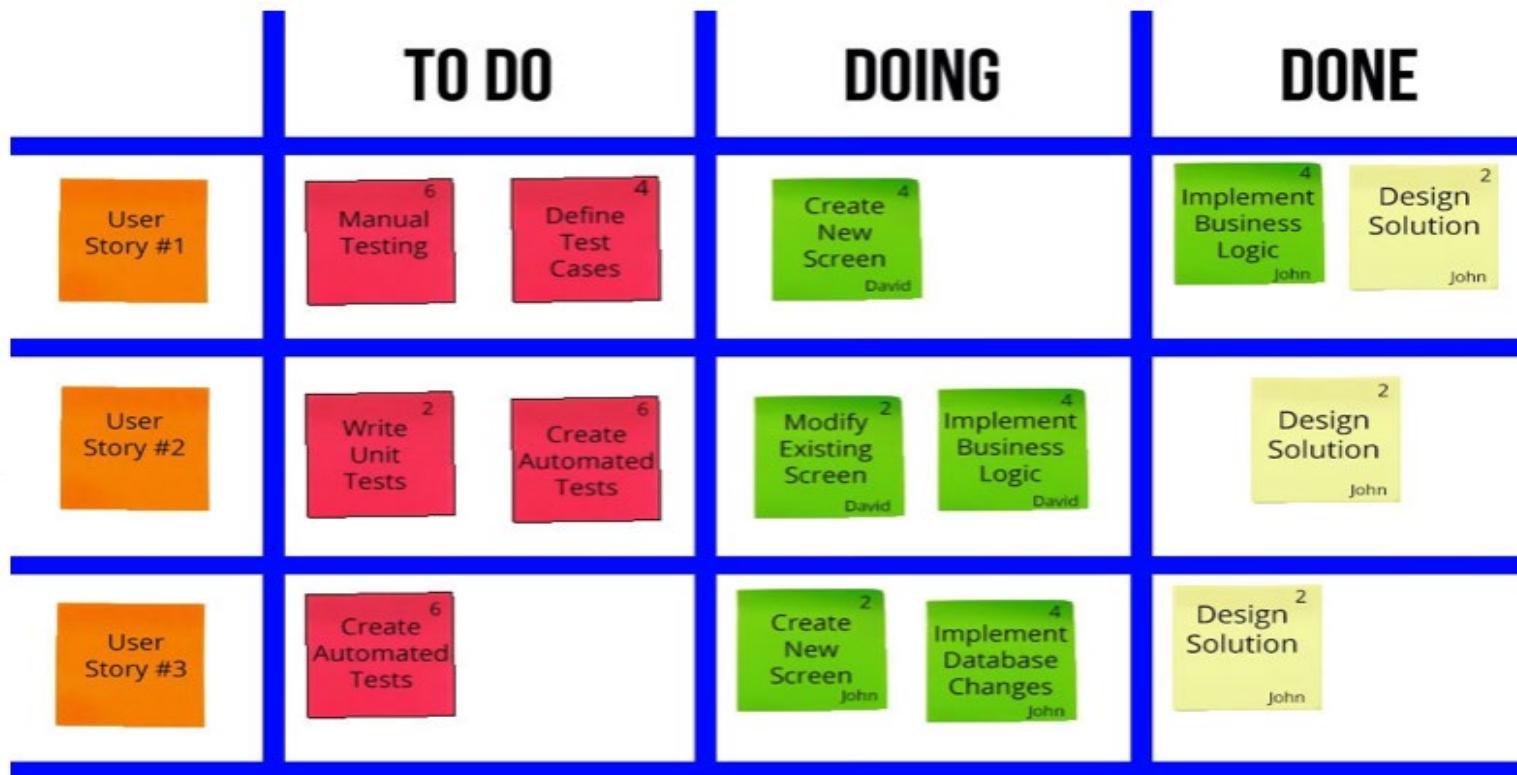




SWIMLANE

Module 8.2 – Agile Framework - *Kanban*

Visual progress gives transparency/accountability for self-organizing teams often referred to as **SWIMLANE** boards



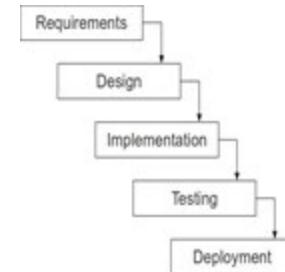


Module 8.2 – Agile Framework - *Scrum*

Scrum is an agile way to manage a project

“The... ‘relay race’ approach to product development...may conflict with the goals of maximum speed and flexibility. Instead a holistic or ‘rugby’ approach—where a team tries to go the distance as a unit, passing the ball back and forth—may better serve today’s competitive requirements.”

Hirotaka Takeuchi and Ikujiro Nonaka, “The New New Product Development Game”, *Harvard Business Review*, January 1986.





Lecture 3 – Intended Learning Objectives

Module 8 - Software Development Lifecycles

Agile:

1. ~~Understand what Agile is and its origins.~~
2. ~~Understand the Agile framework.~~
3. **Understand Scrum – Roles, Ceremonies and Artefacts.**
4. ~~Understand advantages / disadvantages of Agile.~~



Module 8.3 – Scrum

Scrum in 100 words

- Scrum is an agile process that allows us to focus on delivering the highest business value in the shortest time.
- It allows us to rapidly and repeatedly inspect actual working software (every two to four weeks).
- The business sets the priorities. Teams self-organise to determine the best way to deliver the highest priority features.
- Every two to four weeks, you can see real working software and decide to release it as is or continue to enhance it for another sprint.



Module 8.3 – Scrum is used by many organisations

- Microsoft
- Yahoo
- Google
- Electronic Arts
- High Moon Studios
- Lockheed Martin
- Philips
- Siemens
- Nokia
- Capital One
- BBC
- Intuit
- Intuit
- Nielsen Media
- First American Real Estate
- BMC Software
- Ipswitch
- John Deere
- Lexis Nexis
- Sabre
- Salesforce.com
- Time Warner
- Turner Broadcasting
- Oce

Module 8.3 – Scrum is used for all types of projects

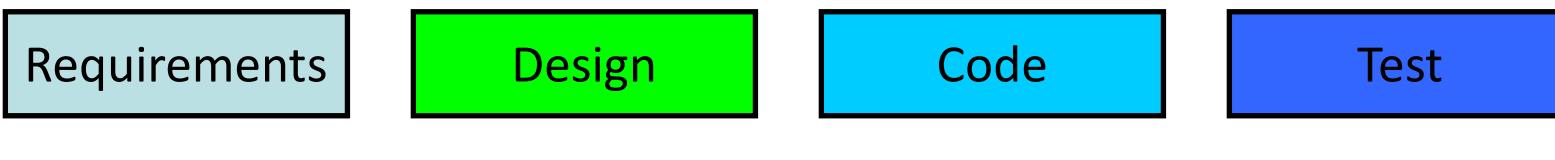
- Commercial software
- In-house development
- Contract development
- Fixed-price projects
- Financial applications
- ISO 9001-certified applications
- Embedded systems
- 24x7 systems with 99.999% uptime requirements
- the Joint Strike Fighter
- Video game development
- FDA-approved, life-critical systems
- Satellite-control software
- Websites
- Handheld software
- Mobile phones
- Network switching applications
- ISV applications
- Some of the largest applications in use

Module 8.3 – Scrum Key Characteristics

- Self-organising teams
- Product progresses in a series of focused sprints
- Requirements are captured as items in a list of product backlog
- Scrum is one of the agile processes – the one most widely used, discussed and debated
- Time frame is contained to a manageable size (weeks or months)



Module 8.3 – Scrum Framework - *Sprints*



Rather than doing one thing at a time...

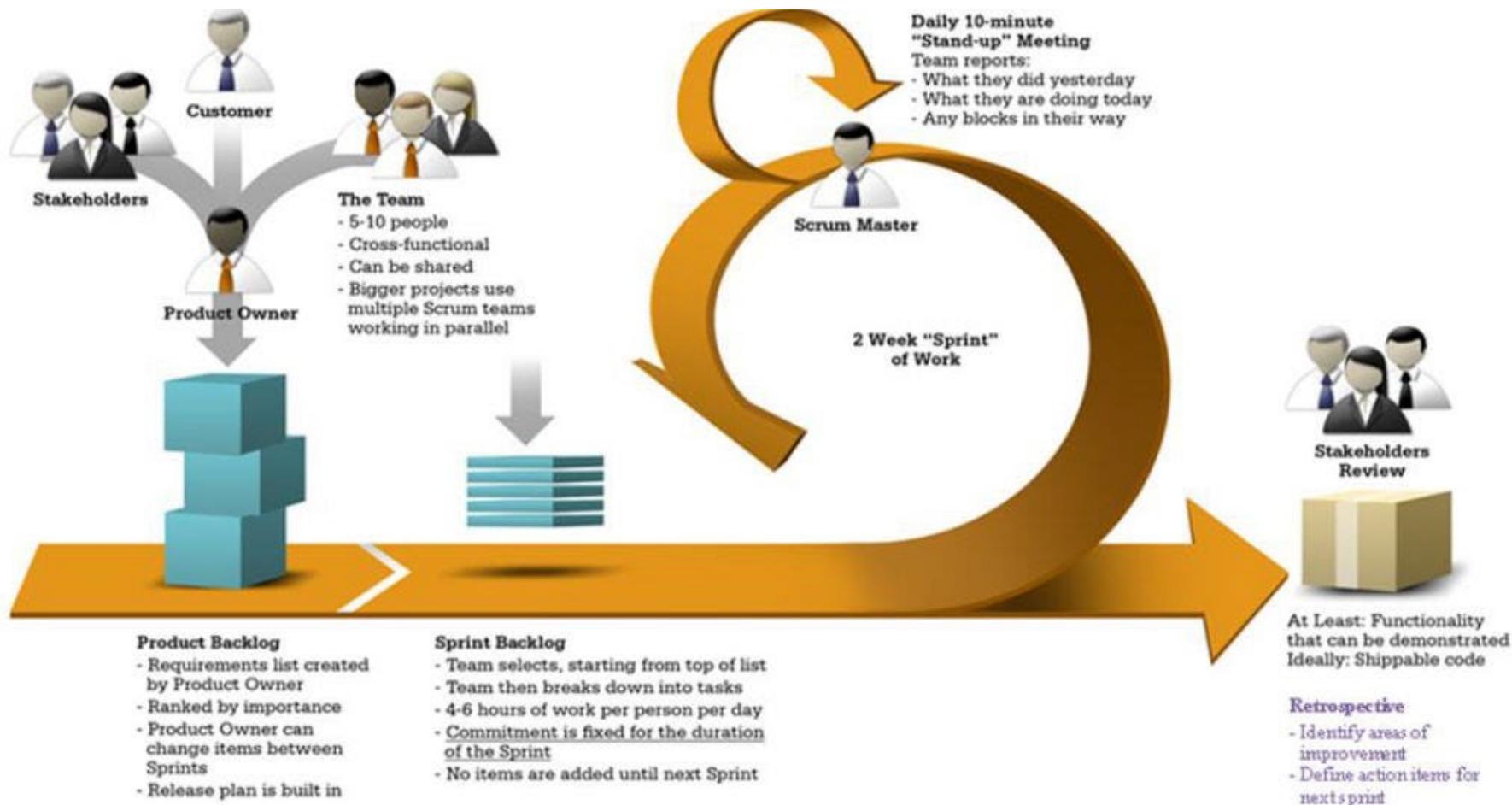
...Scrum teams do a little of everything all the time



Source: "The New New Product Development Game" by Takeuchi and Nonaka. Harvard Business Review, January 1986.



Module 8.3 – Scrum Framework





Module 8.3 – Scrum Framework

Roles

- Product owner
- ScrumMaster
- Team

www.mountaingoatsoftware.com

Ceremonies

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily stand-ups

Artifacts

- Product backlog
- Sprint backlog
- Burndown charts



Module 8.3 – Scrum Roles

Roles

- Product owner
- ScrumMaster
- Team

Ceremonies

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily stand-ups

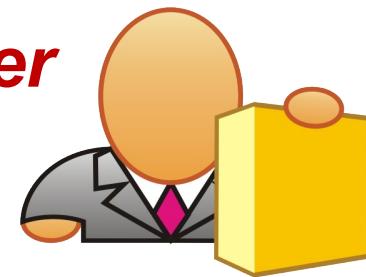
Artifacts

- Product backlog
- Sprint backlog
- Burndown charts



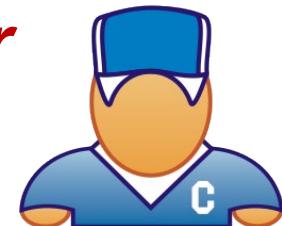
Module 8.3 – Scrum Roles – *Product Owner*

- Defines the features of the product
- Decides on release date and content
- Is responsible for the Benefits / Profitability of the product (ROI)
- Prioritises features according to market value
- Adjusts features and priority every iteration, as needed
- Accepts or rejects work results





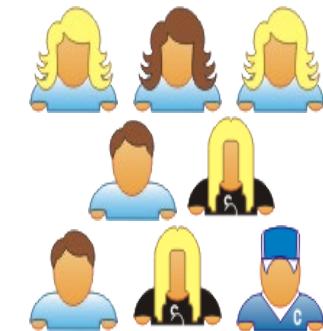
Module 8.3 – Scrum Roles – *Scrum Master*



- Represents management to the project
- Responsible for enacting Scrum values and practices
- Removes impediments / road blocks
- Ensures that the team is fully functional and productive
- Enables close cooperation across all roles
- Shields the team from external interferences
- Is a member & active participant of the Scrum Team



Module 8.3 – Scrum Roles – *The Team*



- Typically 6 - 9 people
- Cross-functional:
 - Programmers, testers, user experience designers, business representatives etc.
- Members should be full-time – some exceptions
- Co-located (physically or virtually)



Module 8.3 – Scrum Ceremonies / Meetings

Roles

- Product owner
- ScrumMaster
- Team

Ceremonies

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily stand-ups

Artifacts

- Product backlog
- Sprint backlog
- Burndown charts



Module 8.3 – Scrum Ceremonies / Meetings

Sprint Planning

- Defines how to achieve sprint goal (design)
- Create sprint backlog (User Stories) from product backlog
- Estimate sprint backlog in team velocity and Story Points
- Product Owner priority guides the work
- Release Plan is created
- High-level design is considered

Module 8.3 – Scrum Ceremonies / Meetings

Sprint Planning Meeting

1st Half of the meeting

- Team defines **what** can be done in this sprint
- Starts by writing down the Sprint goal
- Identify the items from the backlog that can achieve this

2nd Half of the meeting

- Team figures out **how** the work will get done
- Break down each item in the sprint backlog into tasks to capture all the work required
- The tasks form the basis of the sprint plan that is used to track, cost and manage progress

Source: Head First Agile – A Brain-Friendly Guide to Agile Principles, Ideas, and Real-World Practices By [Andrew Stellman, Jennifer Greene](#)



Module 8.3 – Scrum Ceremonies / Meetings

Daily Stand-up

- Parameters
 - Daily
 - 15-minutes and no more than 30 mins
 - Stand-up
- Not for problem solving / Not a status meeting
 - Whole world is invited
 - Only team members, ScrumMaster, product owner, can talk
- Helps avoid other unnecessary meetings
- 3 key questions asked:
 1. What did I do yesterday.
 2. What will I do today.
 3. What is in my way to get my work completed.





WEEK 8: SCRUM

Module 8.3 – Scrum Ceremonies / Meetings

Sprint Reviews - Showcase

- Team presents what it accomplished during the sprint
- Typically takes the form of a demo of new features or underlying architecture
- Informal
- 2-hour prep time rule
- No slides
- Whole team participates
- Invite the world



Module 8.3 – Scrum Ceremonies / Meetings

Sprint Retrospective

- Periodically look at what is and isn't working
- Typically 30 minutes
- Done after every sprint
- Whole team participates:
 - ScrumMaster and Team
- Possibly Product Owner, customers and others
- Discuss what to:
 - Start Doing, Stop Doing and Continue Doing



Module 8.3 – Scrum Artefacts

Roles

- Product owner
- ScrumMaster
- Team

Ceremonies

- Sprint planning
- Sprint review
- Sprint retrospective
- Daily stand-ups

Artifacts

- Product backlog
- Sprint backlog
- Burndown charts

Module 8.3 – Scrum Artefacts – Product Backlog

User Stories

- A User Story is a requirement expressed from the perspective of an end-user / customer of the system
- User stories shift the focus from writing about requirements to talking about them
- User stories are short, simple descriptions of a feature told from the perspective of the customer who wants the new capability of the system. They follow a simple template:
 - *As a < type of user >, I want < some goal > so that < some reason >*



Module 8.3 – Scrum Artefacts – Product Backlog

User Stories

- User stories are written at varying levels of detail.
- They can cover a large amounts of functionality such as this example from a Professional Membership Website:
 - *As a site visitor, I want to get all information associated with my professional membership so that I have access to all information centrally.*
- Because this level of detail is too large for an agile team to complete in one iteration, it is sometimes split into smaller user stories before it is worked on



Module 8.3 – Scrum Artefacts – Product Backlog

Story Points

- Story points are a unit of measure for expressing an estimate of the overall effort that will be required to fully implement a product backlog item or any other piece of work
- Story points help estimate how much work can be done in a sprint
- When estimating with story points, a value is assigned to each item. The raw values are unimportant, what matters are the relative values
- A story that is assigned a 2 should be twice as much as a story that is assigned a 1. It should also be two-thirds that is estimated as a 3 story point.
- Instead of assigning 1, 2 and 3, that team could assign 100, 200 and 300. Or 1 million, 2 million and 3 million. It is the ratios that matter, not the actual numbers



Module 8.3 – Scrum Artefacts – Product Backlog



Product Backlog

- User Story 1
- User Story 2
- User Story 3
- User Story 4
- User Story 5
- User Story nn

- The requirements
- A list of all desired work on the project
- Ideally expressed such that each item has value to the users or customers of the product
- Product Backlog User Stories are selected for a Sprint by Product Owner
- Reprioritised at the start of each sprint



Module 8.3 – Scrum Artefacts – Product Backlog Example - Professional Body Website

Product Backlog

User Story 1

User Story 2

User Story 3

User Story 4

User Story 5

User Story 6

News Section – Sprint 1

- User Story 1 - As a site visitor, I can read current news on the home page so that I stay current on key professional items
- User Story 2 - As a site visitor, I can email news items to the editor so that they can be considered for publication
- User Story 3 - As a site member, I can subscribe to an RSS feed of news so that I can stay current on the news that is of interest to me

Courses and Events – Sprint 2

- User Story 4 - As a site visitor, I can see a sorted list by date of all upcoming “Certification Courses” so that I can choose the best course for me
- User Story 5 - As a site visitor, I can see a list of all upcoming “Other Courses” (non-certification courses) so that I can choose the best course for me
- User Story 6 - As a site visitor, I can see a list of all upcoming “Social/Networking Events.” so that I can select ones I am able to attend

www.mountaingoatsoftware.com/agile/scrum/scrum-tools/product-backlog/example



Module 8.3 – Scrum Artefacts – Product Backlog Example - Professional Body Website

Product Backlog



News Section - Total of 6 Story Points to complete Sprint 1

- User Story 1 - As a site visitor, I can read current news on the home page so that I stay current on key professional items – 1 Story Points
- User Story 2 - As a site visitor, I can email news items to the editor so that they can be considered for publication – 2 Story Points
- User Story 3 - As a site member, I can subscribe to an RSS feed of news so that I can stay current on the news that is of interest to me – 3 Story Points

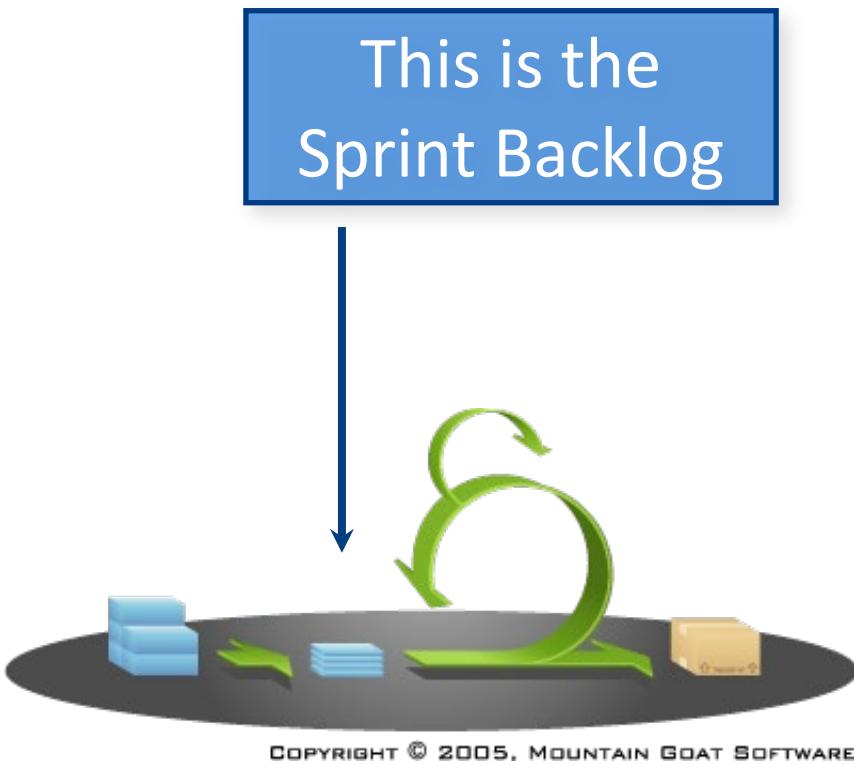
Courses and Events - Total of 8 Story Points to complete Sprint 2

- User Story 4 - As a site visitor, I can see a sorted list by date of all upcoming “Certification Courses” so that I can choose the best course for me – 2 Story Points
- User Story 5 - As a site visitor, I can see a list of all upcoming “Other Courses” (non-certification courses) so that I can choose the best course for me – 5 Story Points
- User Story 6 - As a site visitor, I can see a list of all upcoming “Social/Networking Events.” so that I can select ones I am able to attend – 1 Story Points

To complete this total Product Backlog would take 14 Story Points

www.mountaingoatsoftware.com/agile/scrum/scrum-tools/product-backlog/example

Module 8.3 – Scrum Artefacts – Sprint Backlog / User Story

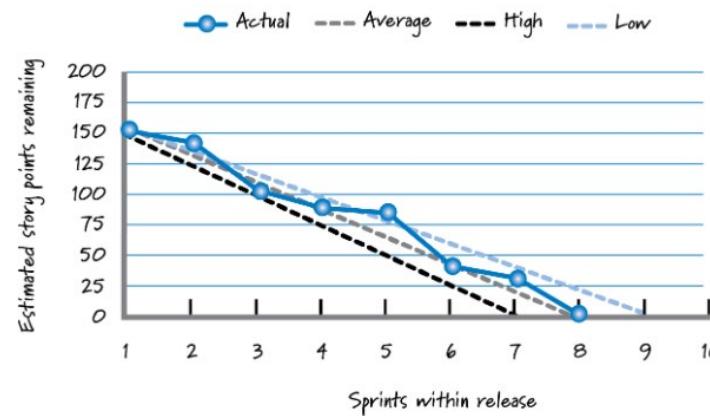


- Scrum team decompose User Stories to Low level User Stories during Sprint Planning
- The User Stories are used for a conversation between the SME and developer. Developer updates the User Stories with the tasks and hours estimates, "Just-In-Time"
- Remaining estimated items are updated daily
- Sprint Backlog is seldom altered
- User stories in the sprint are either completed 100% or not done



Module 8.3 – Scrum Artefacts – Burn Down Chart

- A burn down chart is a graphical representation of work left to do versus time.
- The outstanding work (or backlog of user stories) is often on the vertical axis, with time along the horizontal.
- It is used to predict when all of the work will be completed.





Module 8.3 – Scrum Summary

- Another look at **SCRUM**

<https://www.youtube.com/watch?v=9TycLR0TqFA>

Lecture 3 – Intended Learning Objectives

Module 8 - Software Development Lifecycles

Agile:

1. Understand what Agile is and its origins.
2. Understand the Agile framework.
3. Understand Scrum – Roles, Ceremonies and Artefacts.
4. Understand advantages / disadvantages of Agile.

Module 8.4 – Agile – Advantages & Disadvantages

Advantages

- Customer satisfaction by rapid, continuous delivery of usable software
- People and interactions are emphasised rather than process and tools
- Continuous attention to technical excellence, good design and quality
- Regular adaptation to changing circumstances

Disadvantages

- Difficult to assess the effort required at the beginning
- Can be very demanding (from traditional approaches) on users time
- Harder for new starters to integrate into the team
- Agile is a very different approach – It can be intense for the team
- Requires experienced resources (which are limited in today's market)



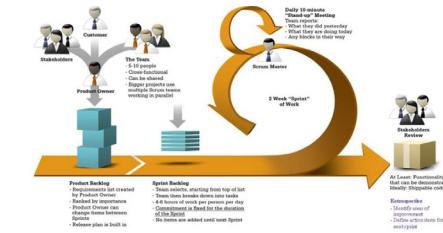
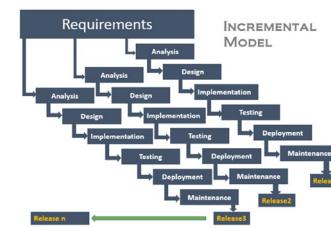
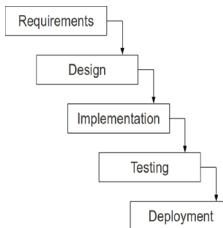
WILLIAM MORRIS

Module 8.4 – Formal or Agile which one Should I use???



There is no one right answer. The following questions can assist deciding:

- How Stable Are the Requirements?
- Do the end users need to collaborate?
- Is the Time Line Aggressive or Conservative
- What Is the Size of the Project
- Where Are the Project Teams Located
- What Are the Critical Resources?





Agile Software

Agile Where to find out more information

- www.agilealliance.org
- www.mountaingoatsoftware.com/scrum
- www.scrumalliance.org
- www.controlchaos.com



SWEN90016
Software Processes & Project Management

Risk Management

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Learning Outcomes

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1. Understand the fundamentals of risk management
2. Understand the Risk Management Process
3. Understand how to:
 - plan risk management activities
 - identify risks
 - analyze and assess risks
 - respond to risks (risk strategies)
 - monitor and control risks



1. Understand the fundamentals of risk management
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What is a risk?

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- A **risk** is a:

Possible future event that has negative results

Hazard; peril; or exposure to loss or injury

- Webster's dictionary

An uncertain event or condition that, if it occurs, has a positive or negative effect on the project objectives

- PMBOK

- The first two definitions above treat risk and always negative, whereas the third definition considers positive as well as negative impacts - **opportunities** (we will stick with the third definition)



- Risk is different to uncertainty although they are related.
- ***Uncertainty:***
 - Lack of complete certainty about an event/outcome
 - The event/outcome has a probability of less than 1
 - E.g. outcome of a sporting event
- ***Risk:***
 - Uncertainty that has an impact
 - E.g. If you have placed a bet on the sporting event, or have some other personal stake in it, then there is risk associated with the outcome of the sporting event

Risk is a result of uncertainty but not every uncertainty is a risk.



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- We deal with risks in our lives every day
 - e.g. Planning to get to the lecture
- Projects have many possible risks, that could have significant impacts on the outcomes:
 - Business risks
 - Project risks
 - Product risks
- A planned Risk Management process is essential
- The goal of project risk management is to:
minimising the impact of potential negative risks while maximising the impact of potential positive risks



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Risk Management Process

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- **Plan**
 - How to approach and plan risk management activities?
- **Identify**
 - Identify the possible risks
- **Analyse and Assess (Qualitative and Quantitative):**
 - Identify the relative priorities of the identified risks
- **Respond (Action):**
 - How can we reduce the likelihood or impact of risks?
- **Monitor and Control:**
 - How can we detect the ongoing status of our risks? How can we control them effectively and efficiently?



Learning Outcomes

MELBOURNE

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- The output of risk management planning is a ***Risk Management Plan (RMP)*** that documents the procedures for managing risks throughout a project
- The project team should review the RMP and understand and implement the organisation's and the sponsor's approaches to risk management
- The level of detail will vary with the needs of the project



- The Risk Management Plan
 - Methodology
 - Roles and Responsibilities
 - Budget and Schedule
 - Risk Categories
 - Risk Probability and Impact
 - Tracking
 - Risk Documentation
 - Contingency Plans
 - Fall-back Plans



Learning Outcomes

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- Determine which events should be considered as risks by analysing the following:
 - Is the *probability* of the event occurring greater than *zero*?
 - What is the *impact* of the event on the project?
 - Do we have some *degree of control* over the event or its outcome?
- Generic Risks:
 - Threats or opportunities common to every software project (e.g. staff turnover, budget and schedule pressures)
- Product-specific Risks:
 - Threats or opportunities specific to the product, and can only be identified by people who have a clear understanding of the product and technology



- **Project risks**
 - Affect the planning of the project
 - e.g. Budget, Schedule, Scope, Personnel, etc.
- **Product risks**
 - Affect the quality or performance of the outcome being developed
 - e.g. Design problems, implementation problems, interface problems, maintenance problems, verification problems
- **Business risks**
 - Affect the economic success of the project
 - e.g. No demand for product, loss of management support, loss of external funding for the project etc.



- **Risk identification**

- Deals with using a systematic approach for identifying and creating a list of threats and opportunities that may impact the project's goals

- **Risk identification techniques**

- Pondering
- Interviewing
- Brainstorming
- Checklists
- Delphi Technique
- SWOT Analysis



- Pondering
 - This simply involves an individual taking the “pencil and paper” approach of risk identification, which involves sitting and thinking about the possible risks that could occur in the project
 - This is one of the initial risk assessment tasks used in many projects
- Interviews/questionnaires
 - Interviewing project stakeholders, or asking them to fill out questionnaires, to harness their knowledge of a domain
 - It is unlikely that a risk manager in a software project will have sufficient knowledge of the methods and tools to be employed to provide a comprehensive view of the risks, so input from stakeholder and domain experts is essential



- Brainstorming
 - The team can use a *risk framework* or the *Work Breakdown Structure (WBS)* to identify threats and opportunities
 - The key is to encourage contributions from everybody
 - The group then discuss and evaluate
- Checklists
 - This involves the use of standard checklists of possible risk drivers that are collated from experience
 - These checklists are used as triggers for experts to think about the possible types of risks in that area



- Delphi Technique
 - A group of experts are asked to identify risks and their impact
 - The responses are then made available to each other anonymously
 - The experts are then asked to update their response based on the responses of others – repeated until consensus is reached
- SWOT Analysis
 - Strengths, Weaknesses, Opportunities and Threats
 - This technique allows finding strengths and weaknesses as well



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- Example: Risk of a third-party software application

Consider the example of using a third-party software application to provide some functionality of a system that is being developed. The third-party application is developed in parallel with the system:
- Risks:
 1. The application could be delivered later than planned, thereby delaying the delivery of the entire system.
 2. Once complete, the third-party application may not be reliable enough to be used, meaning that a new third-party application providing the functionality will need to be sourced or developed.
 3. The third-party application may deliver behaviour that is inconsistent with the expectations of the system developers, meaning that a new third-party application providing the functionality will need to be sourced or developed.



Identified Risks - example

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Risk Source Category	Possible Risk Examples /Risk Factors
Project Size and Complexity	<ul style="list-style-type: none">• Effort Hours• Calendar Time• Estimated Budget• Team and Size (Number of Resources)• Number of Sites• Number of Business Units• Number of Dependencies on other Projects• Degree of Business Change
Requirements	<ul style="list-style-type: none">• Volatile Requirements• Unrealistic Quality Requirements• Complex Requirements
Change Impact	<ul style="list-style-type: none">• Replacement of New System• Impact on Business Policies• Impact on Organisational Structure• Impact on Systems Operations



Identified Risks - example

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Risk Source Category	Possible Risk Examples /Risk Factors
Stakeholders	<ul style="list-style-type: none">• All key stakeholders have not been identified• Missing "Buy-In" from a key stakeholder• Stakeholder needs not completely identified• Key stakeholders not fully engaged
Organization	<ul style="list-style-type: none">• Changes to Project Objectives• Lack of Priorities• Lack of Project Management "Buy-In" and Support• Inadequate Project Funding• Misallocation and Mismanagement of Resources
Scope	<ul style="list-style-type: none">• Grope• Leap• Creep
Schedule	<ul style="list-style-type: none">• Estimated Assumptions are Not Holding True• Scheduled Contingency is Not Adequate• Inadequate or Poor Estimation



Lecture Break

BREAK

Please return promptly as the

Lecture will re-start in *5 mins*



|



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Risk Planning → **Risk Management Plan**

Risk Identification:

Kinds of Risks:

Project
Product
Business

Identification Techniques:

Pondering	Interviewing
Brainstorming	Checklists
Delphi	SWOT Analysis



Learning Outcomes

MELBOURNE

1. Understand the fundamentals of risk management
2. Understand the Risk Management Process
3. Understand how to:
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 - monitor and control risks



- Risk analysis and assessment provide a systematic approach for evaluating the risks
- **Risk analysis**
 - Identify each identified risk's *probability* and *impact*
- **Risk assessment**
 - *Prioritize* risks so that an effective *risk strategy* can be formulated
- Two approaches for analysis and assessment:
 - Qualitative: subjective assessment based on experience/intuition
 - Quantitative: mathematical and statistical techniques



- The important steps of risk analysis are:
 1. Estimating the *risk probability (P)*
 - this is an estimation of the probability that the risk will occur
 - usually done based on expert judgement
 2. Estimating the *risk impact (I)*
 - the impact that the risk will have on the project
 - Usually measured in a scale of 1 – 5 (or 10):
 - (1)no impact; (2) minimal impact; (3) moderate impact; (4) severe impact; and (5) catastrophic impact
 - Impact can be expressed as a monitory value



- The important steps of risk analysis cont..

3. Compute *risk exposure (or P *I Score)*

$$\text{Risk exposure} = P * I$$

4. Identifying the root cause

- It is important that one identifies the root causes of all risks
- If this root cause can be identified, then all of these risks can be controlled by addressing the root cause



- Example: Risk of a third-party software application

Consider the example of using a third-party software application to provide some functionality of a system that is being developed. The third-party application is developed in parallel with the system:
- Risks:
 1. The application could be delivered later than planned, thereby delaying the delivery of the entire system.
 2. Once complete, the third-party application may not be reliable enough to be used, meaning that a new third-party application providing the functionality will need to be sourced or developed.
 3. The third-party application may deliver behaviour that is inconsistent with the expectations of the system developers, meaning that a new third-party application providing the functionality will need to be sourced or developed.



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Risk ID	Risk	Probability (0-1)	Impact	Exposure
1	The application could be delivered later than planned, thereby delaying the delivery of the entire system.	0.15	\$10,000	\$1500
2	Once complete, the third-party application may not be reliable enough to be used, meaning that a new third-party application providing the functionality will need to be sourced or developed	0.05	\$20,000	\$1000
3	The third-party application may deliver behaviour that is inconsistent with the expectations of the system developers, meaning that a new third-party application providing the functionality will need to be sourced or developed	0.2	\$20,000	\$4000

Risk Impact Analysis Table



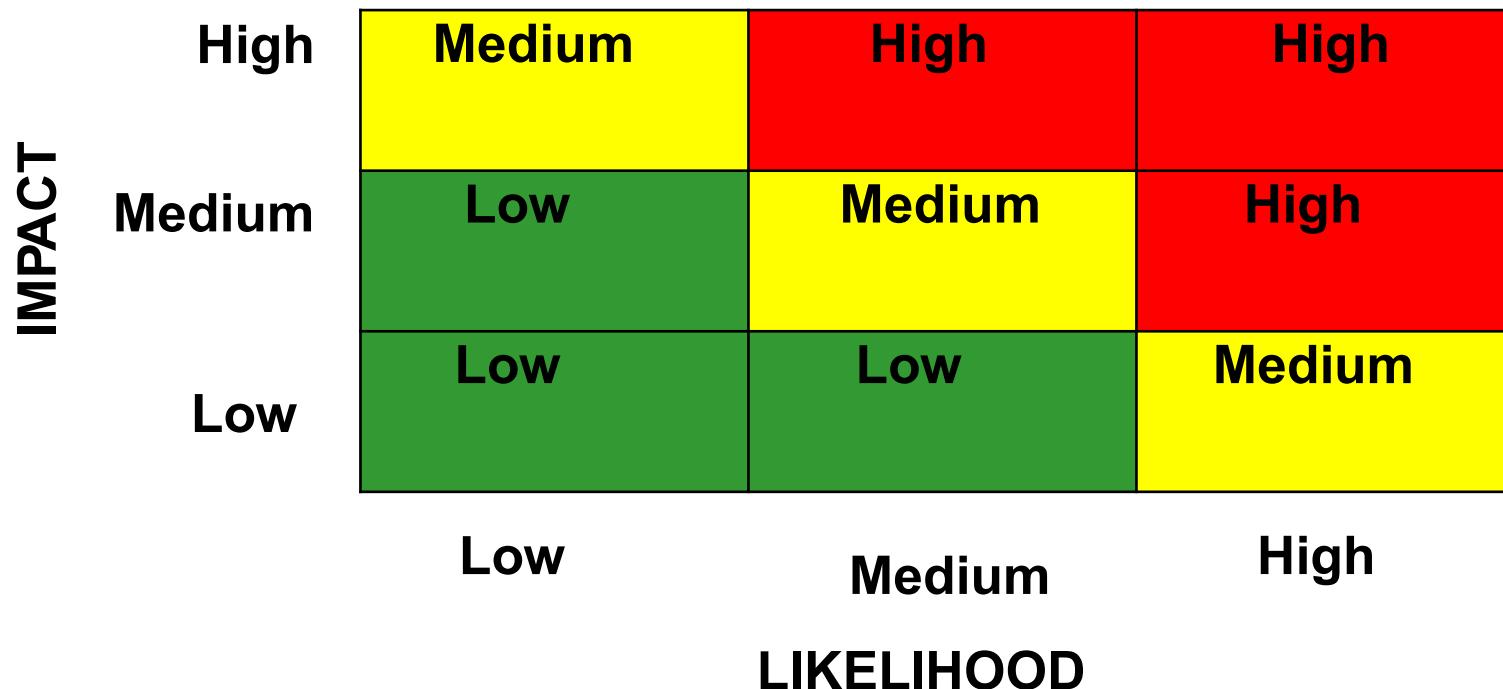
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Risk ID	Risk	Probability (0 – 100%)	Impact (0 – 10)	Exposure	Rank
1	A key member leaving the project	40%	4	1.6	4
2	Client unable to define scope and requirements	50%	6	3.0	3
3	Client experiences financial problems	10%	9	0.9	5
4	Response time not acceptable to the user/client	80%	6	4.8	1
5	Technology does not integrate with existing application	60%	7	4.2	2
6	Financial manager deflects resources away from the project	20%	3	0.6	6
7	Client unable to obtain license agreement	5%	7	0.4	7

Risk Impact Analysis Table



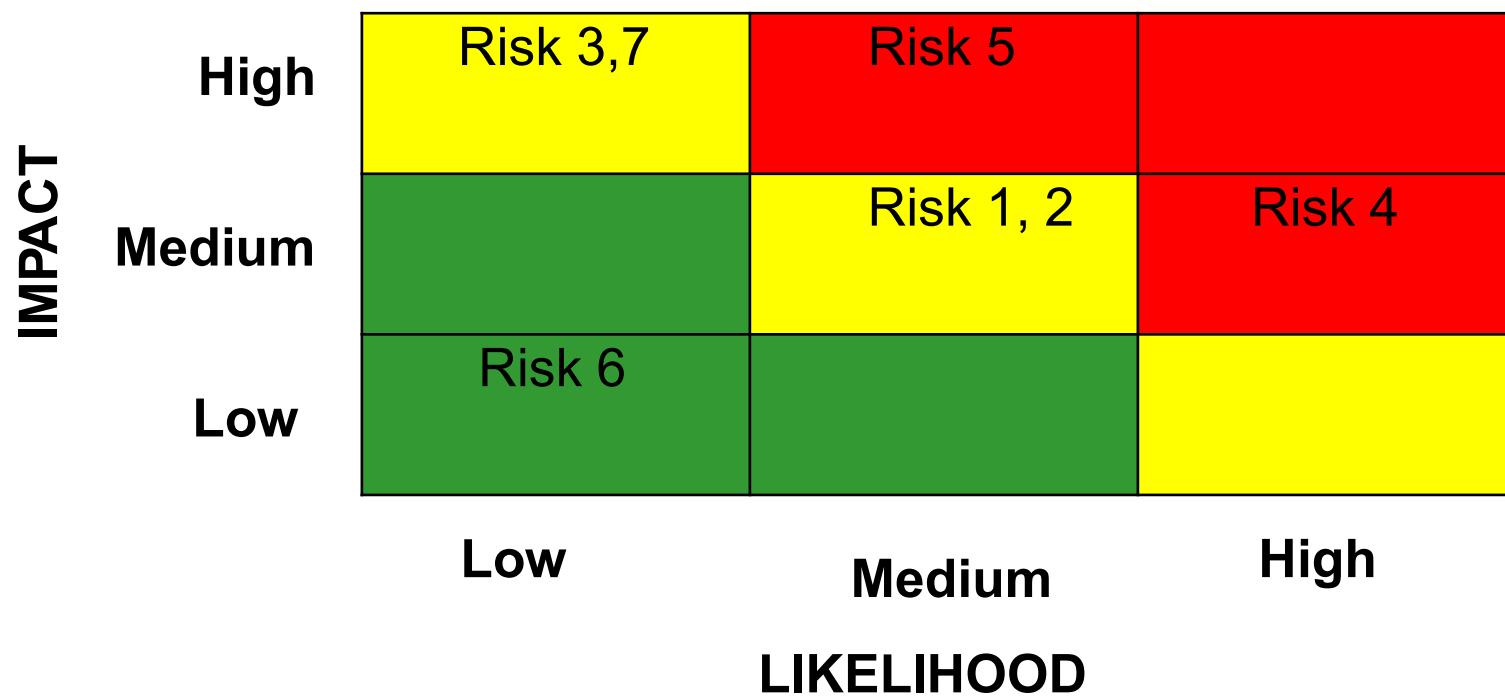
- **Risk matrix** - define the level of risk by considering the probability or likelihood consequence severity.
- A mechanism to increase visibility of risks and assist management decision making.





Risk Matrix - Example

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- Quantitative approaches include mathematical and statistical techniques
- They are based on modelling a particular risk situation - probability distributions of risks are the main consideration
- Common Techniques:
 - Decision Tree Analysis
 - Simulation
 - Sensitivity Analysis
- Quantitative approaches are beyond the scope of this subject



Learning Outcomes

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 - respond to risks (**risk strategies**)
 - monitor and control risks



- Purpose of risk analysis and assessment is to identify what opportunities and threats *should be addressed*
- It is not feasible (or advisable) to respond to every threat or opportunity because this requires *resources*, which are usually diverted from the project, which could have more negative impacts on the project
- Therefore, it is important to select appropriate response strategies



- Four common strategies to handle *threats*:

1. Accept or Ignore

This means that we believe that the risk is of an acceptable exposure, that we hope that the event does not occur, or that the risk exposure is less than the cost of any techniques to avoid, mitigate, or transfer it.

2. Avoid

This means that we completely prevent the risky event from occurring, by either ensuring its probability is 0, or ensuring its impact 0.



- Four common strategies cont..

3. Mitigate

This involves employing techniques to reduce the probability of the risk, or reduce the impact of the risk. This results in a residual risk — that is, a risk consisting of the same event, but with a lower probability/impact, and therefore low exposure. We then must analyse the residual risk as we would our primary risk.

4. Transfer

This involves transferring the burden of the risk to another party. Insurance is one example of risk transfer, in which the impact of the risk is offset by payments from the insurer. Another example is outsourcing a portion of the work to somebody with more knowledge and expertise, which comes at a cost.



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- Example: Risk of a third-party software application

Consider the example of using a third-party software application to provide some functionality of a system that is being developed.

Strategy	Response
Ignore	Do nothing because the vendor is reliable and have delivered quality software in the past.
Avoid	Developing the required functionality in house, rather than buying it or change the requirements so that the functionality is not required at all.
Mitigate	Make the request date well before the required date. We can also reduce the impact of the risk by designing the system such that the third-party application is accessed via a standard interface, and by producing a dummy implementation of that interface that allows development to continue if the third-party application is delivered late.
Transfer	Specifying in the contract that any costs resulting from late delivery of the system will be paid for by the vendor of the third-party application.



- Four common strategies to handle *opportunities*:

1. Exploit:

Add work or change the project to make sure the opportunity occurs

2. Enhance:

Increase the probability and positive impact of risk events

3. Share:

Allocate ownership of opportunity to a third-party

4. Accept

This means that we believe that the cost to exploit or enhance is not justifiable so do nothing about it.



- Once risks and strategies are identified, they can be documented as a part of a risk response plan, also called a Risk Register.
- Template of a simple risk register
 - Risk ID: a unique identification for the risk
 - Trigger: the trigger that flags that the risk has occurred
 - Owner: the person or group responsible for monitoring and responding
 - Response: the strategy for responding
 - Resources: required resources

Risk ID	Trigger	Owner	Response	Resources Required

Risk Register



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 - identify risks
 - analyze and assess risks
 - respond to risks (risk strategies)
 - monitor and control risks



- Once the risk response plan has been created, triggers must be monitored to keep track of various project risks
- New threats and opportunities may arise in the course of the project – they must be identified, analysed and responded to
- Risk monitoring must be part of the overall monitoring and control of the project



- Tools for monitoring and controlling:
 - Risk Audits:
 - external team looks at comprehensiveness of the identification process and ensuring other procedures and processes are in place
 - Risk Reviews:
 - internal reviews of risks periodically that result in status reports generated for PM and those who need-to-know
 - Risk status meetings:
 - risks must be reviewed and discussed in project status meetings, which are periodically held in projects (e.g. weekly meetings)



Risk Management Process

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1. Understand the fundamentals of risk management
2. Understand the Risk Management Process
3. Understand how to:
 - plan risk management activities
 - identify risks
 - analyze and assess risks
 - respond to risks (risk strategies)
 - monitor and control risks



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Software Processes & Project Management

Project Scheduling

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2021 – Semester 1
Lecture 5



1. Understand the role of a project schedule
2. Understand how to develop a project schedule
3. Understand how to use a project schedule to monitor and track project progress
4. Understand agile planning principles



Project Schedule

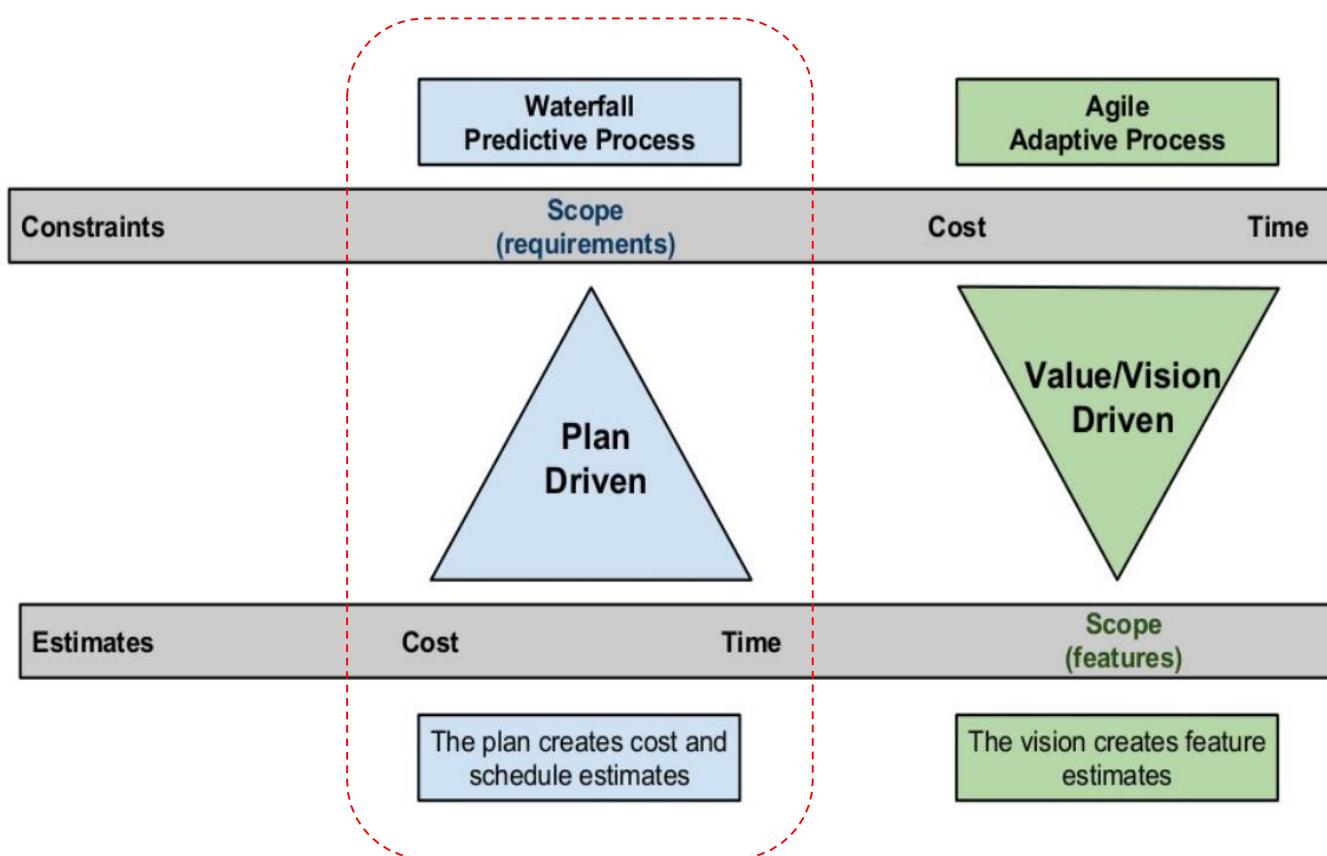
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- **Project Schedule:**
 - One of the important artefacts generated during the project planning phase
 - Is used and maintained throughout the project to monitor and track project progress - is a living document
- **What does the project schedule contain?**
 - Duration and **dependencies** for each task
 - People and **physical resources** required by each task
 - **Milestones** and **deliverables**
 - Project Timeline



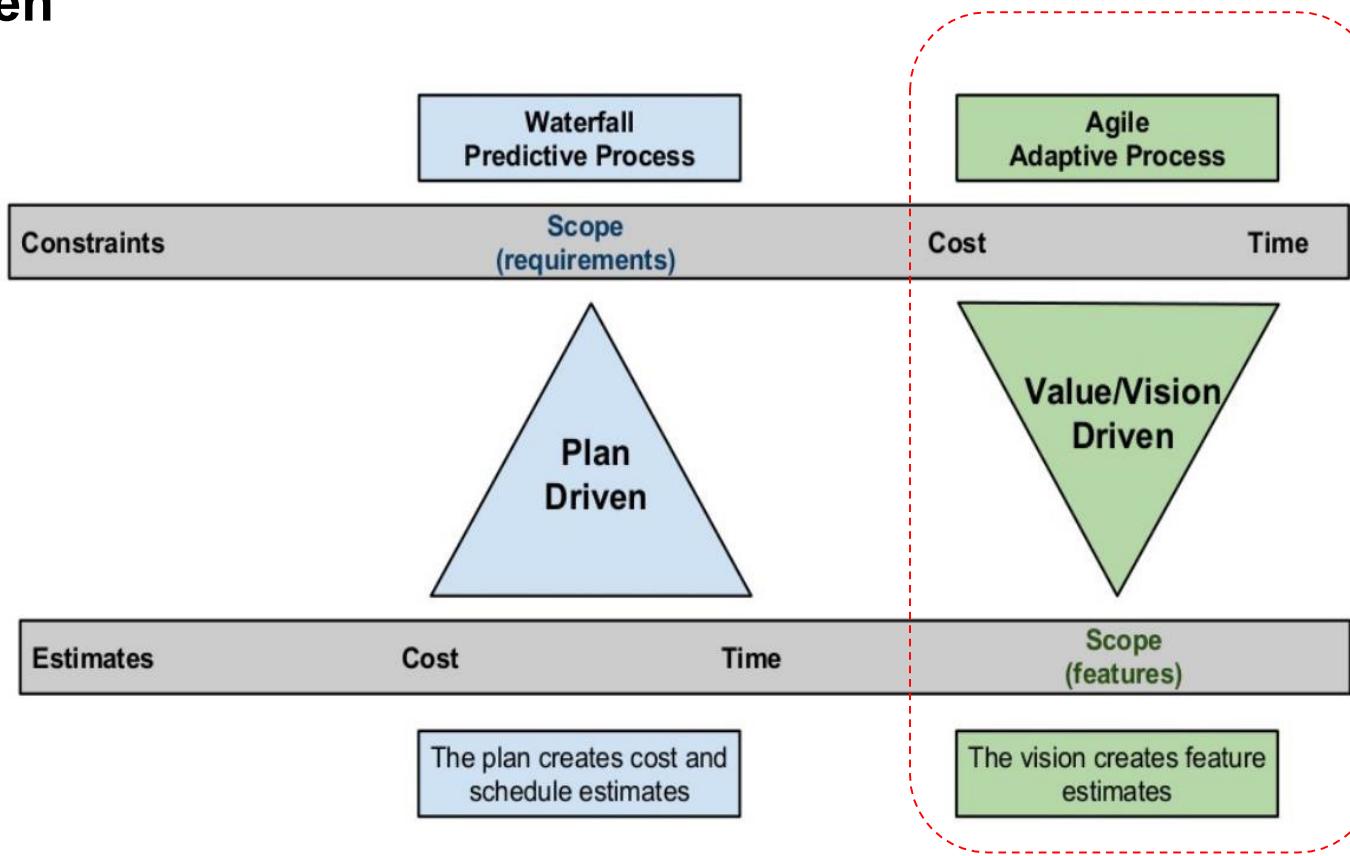
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Project planning and scheduling introduced in this topic apply to formal SDLC processes – Plan Driven





Agile SDLC processes do not use a project schedule - Value/Vision Driven



Anecdotally organizations that use Agile practices also use project schedules for budgeting, contracting and reporting purposes.



1. Understand the role of a project schedule
2. Understand how to develop a project schedule
3. Understand how to use a project schedule to monitor and track project progress
4. Understand agile planning principles



1. Breakdown the task into small chunks you can deal with – **Work Breakdown Structure (WBS)**
2. Identify the **interdependencies** between the broken down tasks and develop a **task network**
3. Estimate the **effort** and the **time allocation** for each task
4. **Allocate resources** for tasks and validate effort
5. Develop the **project schedule**



- Planning and executing large tasks is challenging:
 - Estimating the time and resources
 - Identifying interim goals and deliverable
 - Progress monitoring
- Solution is to break the task down to manageable units:
 - Each task should have a specific outcome or a deliverable
 - Results in a Work Breakdown Structure (WBS)



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Redecorate Room

Prepare materials

- Buy paint
- Buy a ladder
- Buy brushes/rollers
- Buy wallpaper remover

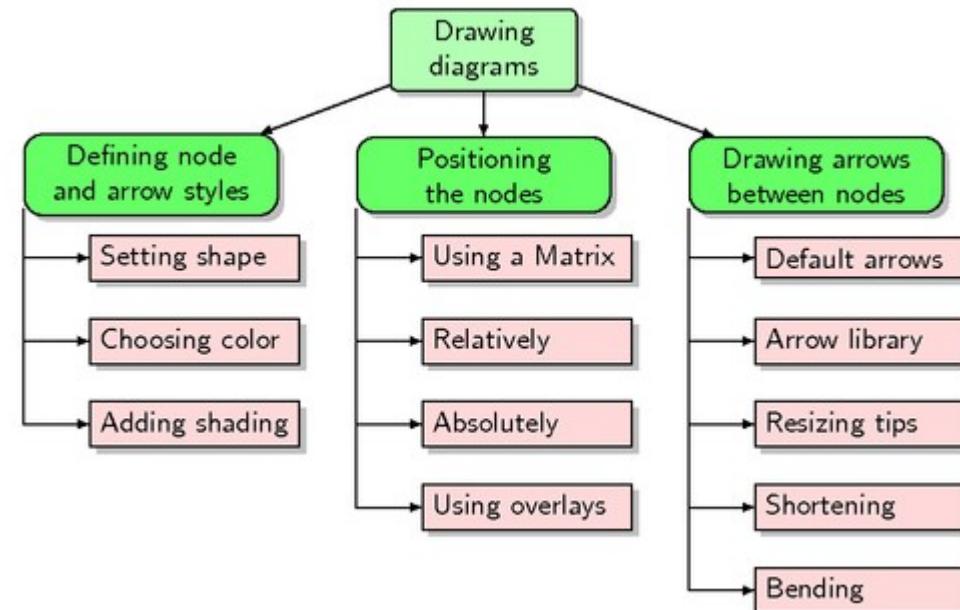
Prepare room

- Remove old wallpaper
- Remove detachable decorations
- Cover floor with old newspapers
- Cover electrical outlets/switches with tape
- Cover furniture with sheets

Paint the room

Clean up the room

- Dispose or store leftover paint
- Clean brushes/rollers
- Dispose of old newspapers
- Remove covers



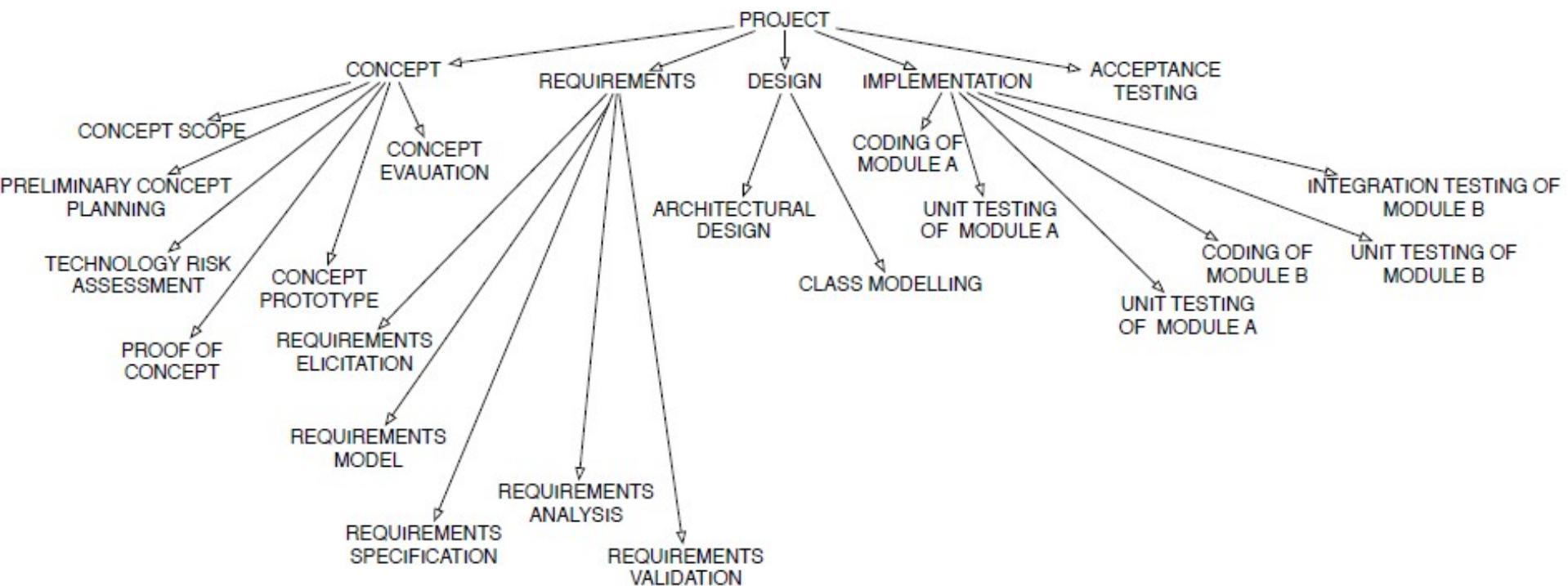
<http://texexample.net/tikz/examples/work-breakdown-structure/>

<http://slideplayer.com/slide/5384158/>



Example – WBS (Software Project)

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1. Breakdown the task into small chunks you can deal with –
Work Breakdown Structure (WBS)

2. Identify the **interdependencies** between the broken down tasks and develop a **task network**

3. Estimate the effort and the time allocation for each task

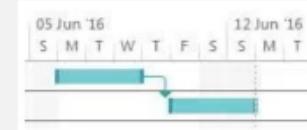
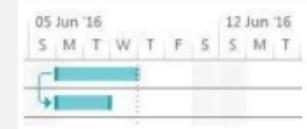
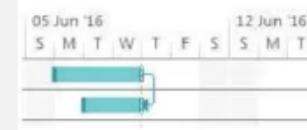
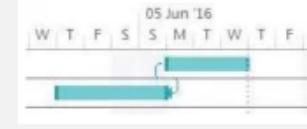
4. Allocate resources for tasks and validate effort

5. Develop a project schedule



- **Tasks can be:**
 - *Unconstrained*: the task can start at any time (buy paint, remove detachable decorations)
 - *Constrained*: depends on another task (cannot remove wall paper until decorations are removed)
 - If task **B** depends on task **A** (**A** → **B**)
 - **B** is a Successor task (S)
 - **A** is a Predecessor task (P)
 - Remove Detachable Decorations (P) → Remove wall paper (S)
- **Dependencies are caused by:**
 - a task needing a work product of another task
 - a task needing resources used by another task

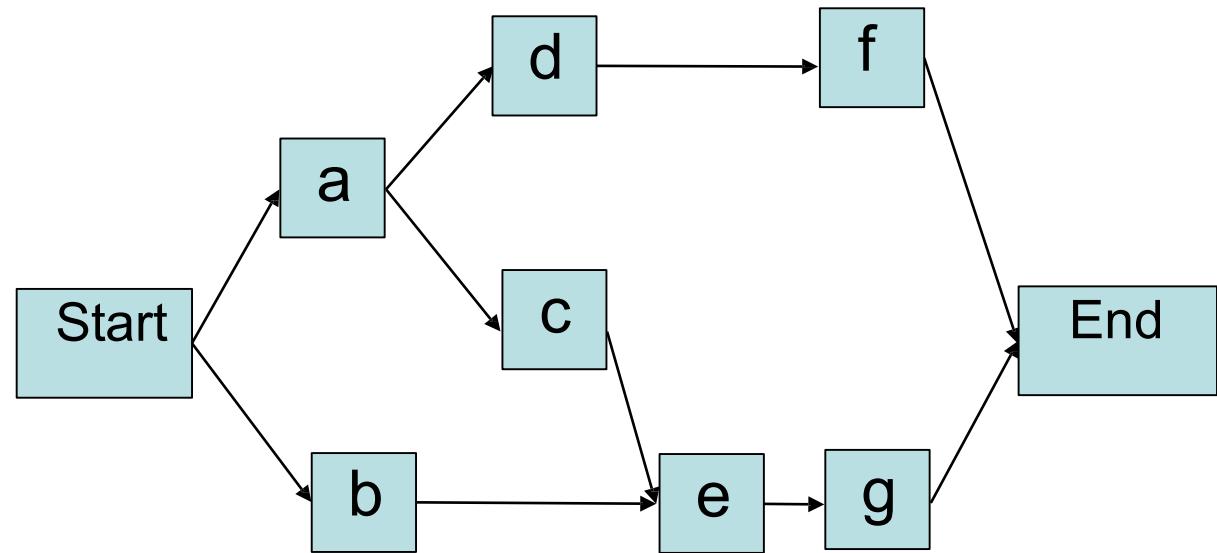


Dependency	Description	Representation
Finish-to-Start	Predecessor must finish before Successor can start	
Start-to-Start	Predecessor must start before Successor can start	
Finish-to-Finish	Predecessor must finish before the Successor can Finish	
Start-to-Finish	Predecessor must start before the Successor can finish	

The most common type of dependency is the finish-to-start dependency



Activity	Predecessor
a	—
b	—
c	a
d	a
e	b, c
f	d
g	e





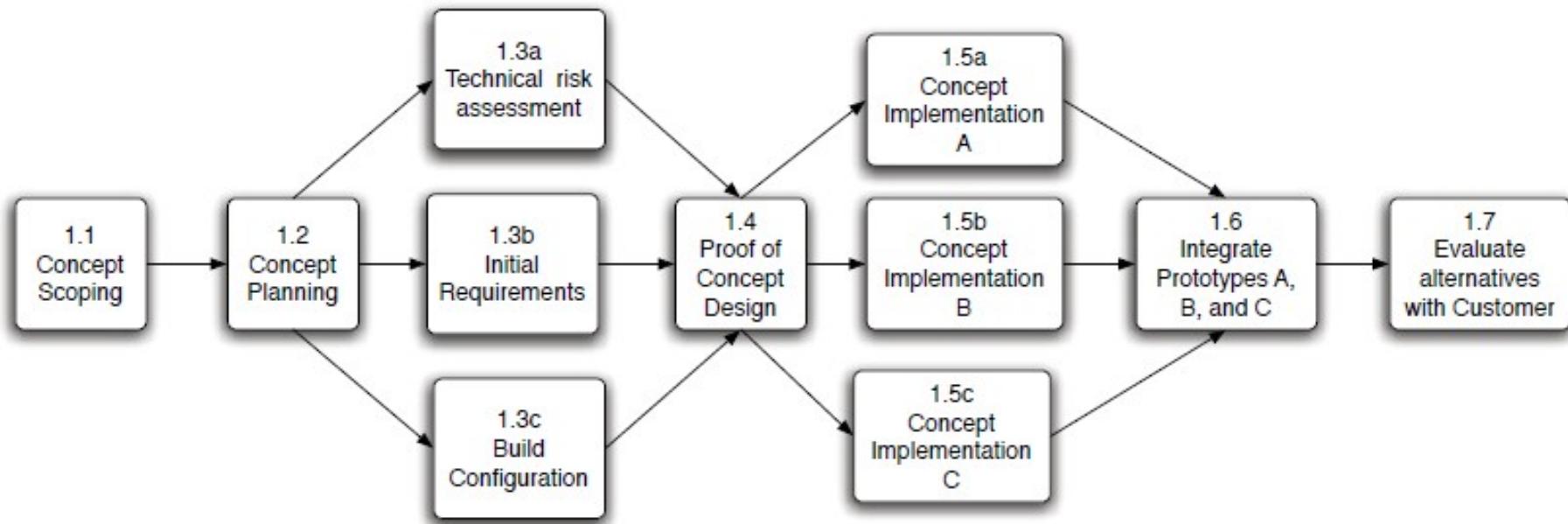
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1. Concept
 1. Concept Scope
 2. Preliminary Concept Planning
 3. Preliminary Analysis
 - 1.3a Technology Risk Assessment
 - 1.3b Initial Requirements
 3. c Build Configuration
 4. Proof of Concept
 5. Concept Prototype
 6. Prototype Integration
 7. Concept Evaluation
2. Requirements
 1. Requirements Elicitation
 2. Requirements Prototype
 3. Requirements Analysis
 4. Requirements Specification
 5. Requirements Validation
3. Design
 1. Software Architecture Design
 2. Class Models
4. Implementation
 1. Coding the Client
 2. Testing the Client
 3. Coding the Server
 4. Testing the Server
 5. Integration Testing of Client with Server
5. Acceptance Testing



Task Network – Software Project

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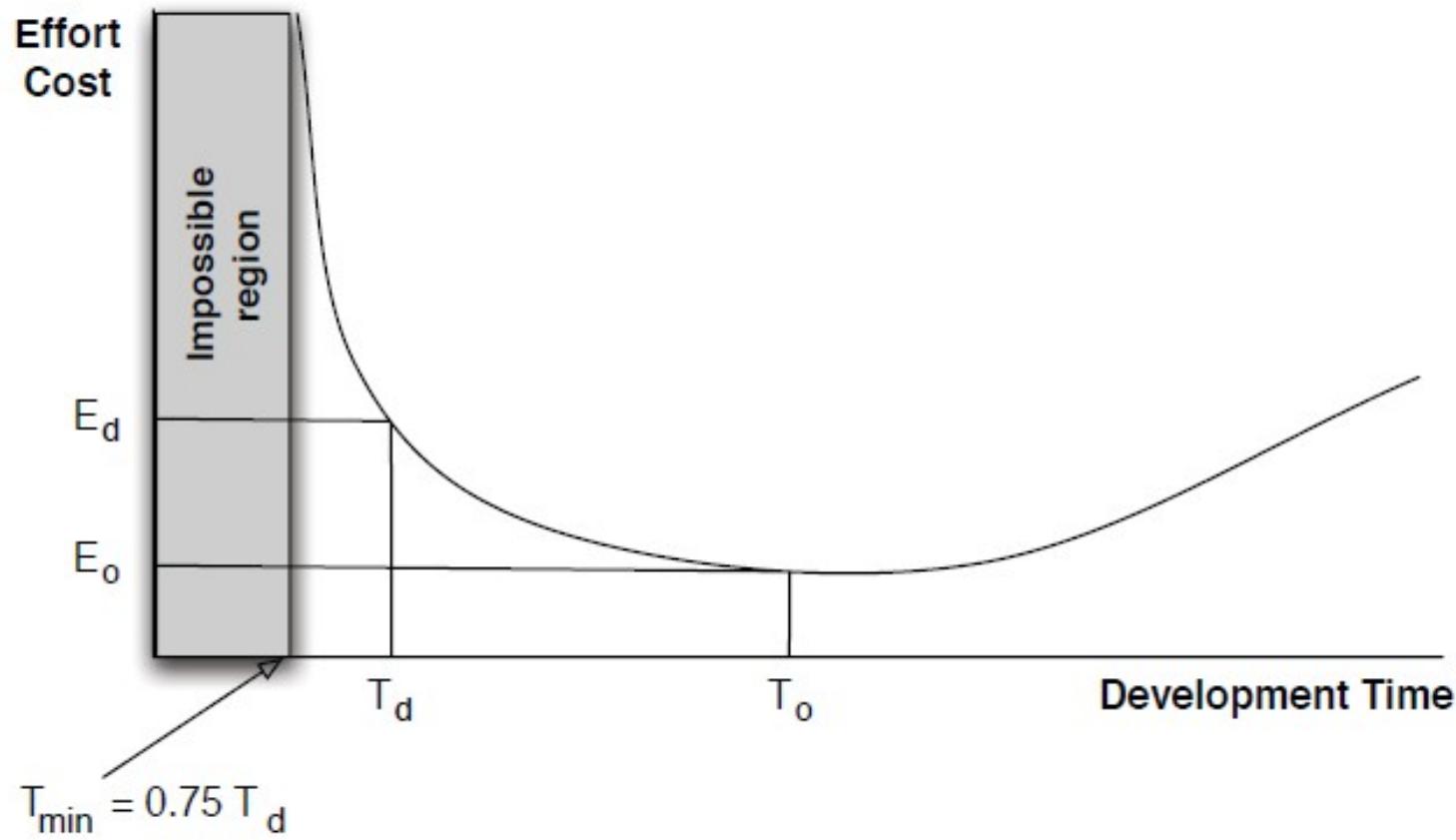




1. Breakdown the task into small chunks you can deal with –
Work Breakdown Structure (WBS)
2. Identify the interdependencies between the broken down tasks and develop a task network
3. Estimate the **effort** and the **time allocation** for each task
4. Allocate resources for tasks and validate effort
5. Develop a project schedule



- A common measure for estimating the effort for software is ***man-months*** (more generally ***person-months***)
 - Effort estimation will be covered in week 7
- **person-months:**
 - the time in months for a single person working full time to complete the task
- **The Mythical Man-Months [Brooks seminal paper]**
 - man-months is a misleading measure to estimate software
 - adding people to a project that is behind schedule could result in more damage than helping it



Putnam-Norden-Rayleigh curve



- **Terminology**

optimistic time - O

pessimistic time - P

most likely time - M

expected time - T_E

$$T_E = (O + 4M + P)/6$$



Time Estimation

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Activity	Predecessor	Time estimates			Expected time (T_E)
		Opt. (O)	Normal (M)	Pess. (P)	
a	—	2	4	6	4.00
b	—	3	5	9	5.33
c	a	4	5	7	5.17
d	a	4	6	10	6.33
e	b, c	4	5	7	5.17
f	d	3	4	8	4.50
g	e	3	5	8	5.17



1. Breakdown the task into small chunks you can deal with –
Work Breakdown Structure (WBS)
2. Identify the interdependencies between the broken down tasks and develop a task network
3. Estimate the effort and the time allocation for each task
4. **Allocate resources for tasks and validate effort**
5. Develop a project schedule



- If the effort (person-months) and the time are known, the number of personnel can be computed as:

$$N = \frac{\text{Effort}}{T}$$

- Assigning people to tasks
 - Although computing the number of personnel required for each task appears simple, resource allocation is complicated task
 - The project manager has to carefully consider the expertise of the people, and the availability of them for tasks, which might require validation and adjustment of the schedule



1. Breakdown the task into small chunks you can deal with –
Work Breakdown Structure (WBS)
2. Identify the interdependencies between the broken down tasks and develop a task network
3. Estimate the effort and the time allocation for each task
4. Allocate resources for tasks and validate effort
5. **Develop a project schedule**



Break- 5 minutes



<https://pmstudycircle.com/2012/04/can-i-take-break-during-my-pmp-certification-exam/>



1. Breakdown the task into small chunks you can deal with –
Work Breakdown Structure (WBS)
2. Identify the interdependencies between the broken down tasks and develop a task network
3. Estimate the effort and the time allocation for each task
4. Allocate resources for tasks and validate effort
5. **Develop a project schedule**



- **Project Schedule will answer two important questions not answered so far:**
 - How long will the system take to develop?
 - How much will it cost?
- **Two widely used graphical notations to represent the Project Schedule**
 - Gantt charts
 - A bar chart that shows the schedule against a calendar
 - PERT (Program Evaluation and Review Technique) charts
 - An activity network that shows the dependencies among tasks and the *critical path*



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Term	Description
Activity (Task)	Is part of a project that requires resources and time
Milestone	Is the completion of an activity that provides evidence of a deliverable completion or end of a phase – is an event that takes zero time
Free float (free slack)	Is the amount of time that a task can be delayed without causing a delay to subsequent tasks
Total float (total slack)	Is the amount of time that a task can be delayed without delaying project completion
Critical path	Is the longest possible continuous path taken from the initial event to the terminal event
Critical activity	Is an activity that has total float equal to zero



- **Milestones**

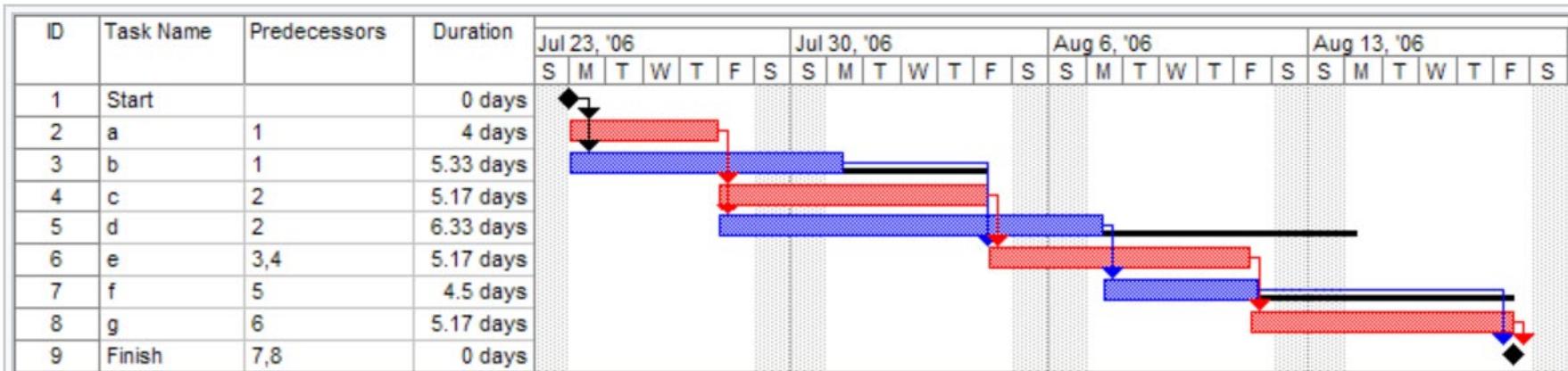
- Mark specific points along a project timeline
- These points may signal anchors such as:
 - a project start and end date
 - a need for external review
 - start and end of a phase
 - a completion of a deliverable

- **Deliverable**

- Specific artefacts that are of interest
- Examples of deliverables include:
 - Project documents such as the Project Management Plan, Requirements Specification, Design Document, Test Plan etc.
 - Prototypes
 - Final application



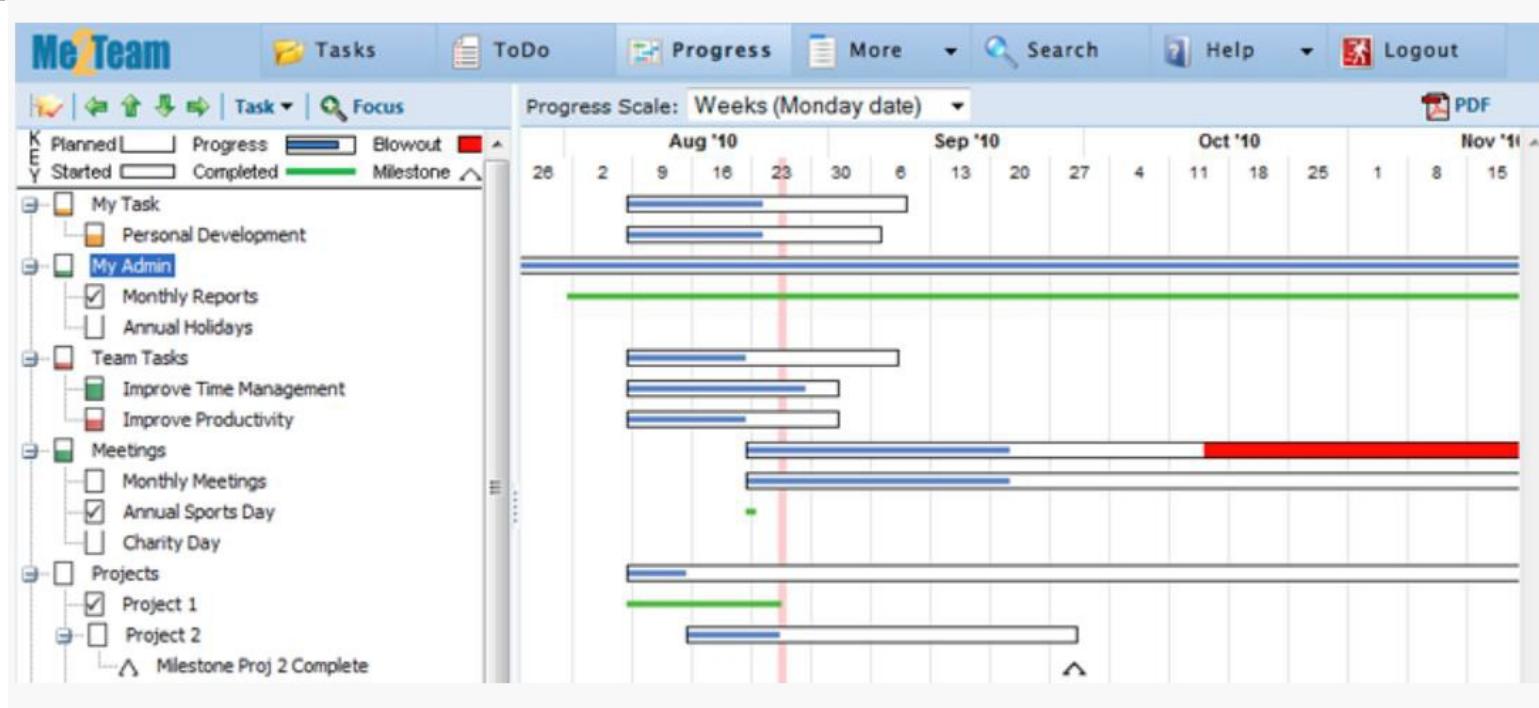
- Was introduced by Henry Gantt in 1910
- Gantt chart is a horizontal bar chart which shows tasks against a timeline – **project schedule**
- Can be used to view planned activities vs progress and therefore is a useful tool for monitoring project progress



A Gantt chart created using Microsoft Project (MSP). Note (1) the critical path is in red, (2) the slack is the black lines connected to non-critical activities, (3) since Saturday and Sunday are not work days and are thus excluded from the schedule, some bars on the Gantt chart are longer if they cut through a weekend.

Linked Gantt charts

- contain lines indicating the dependencies between tasks



Progress Gantt charts

- tasks are shaded in proportion to the degree of their completion
- used for progress tracking – gives a visual representation of the progress



- PERT (Program Evaluation and Review Technique) chart:
 - A task network which shows the dependencies along with time related information and the critical path
- PERT analysis helps:
 - understand the characteristics of the project that will let project managers do scheduling trade-offs
 - perform critical path analysis
 - monitor project progress and re-plan



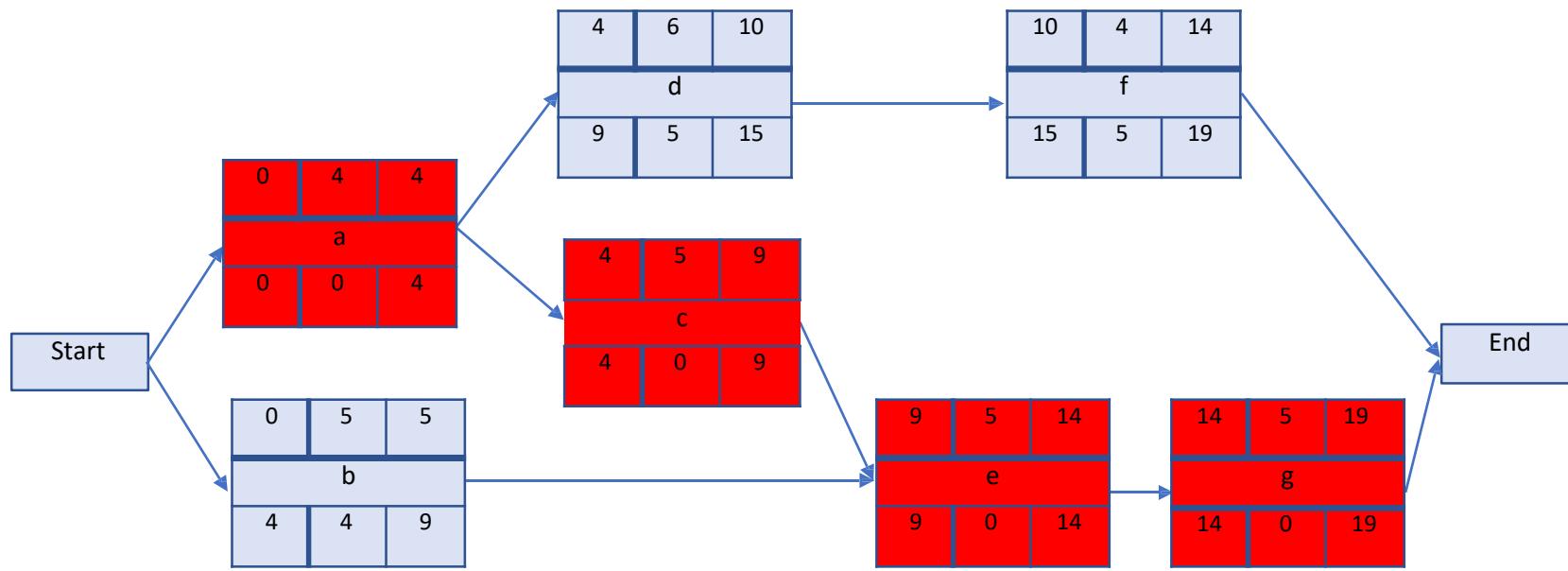
- Involves calculating the following estimates:
 - Earliest start time (ES)
 - Latest start time (LS)
 - Earliest finish time (EF)
 - Latest finish time (LF)
 - Slack time

ES	Duration	EF
Task Name		
LS	Slack	LF



PERT Chart - Example

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Critical Path:
a, c, e, g
Duration:
19 days

Notes:

- Critical path activities have a total free slack of 0
- Two parallel paths could be critical paths
- There can be more than one critical path



PERT Chart Example

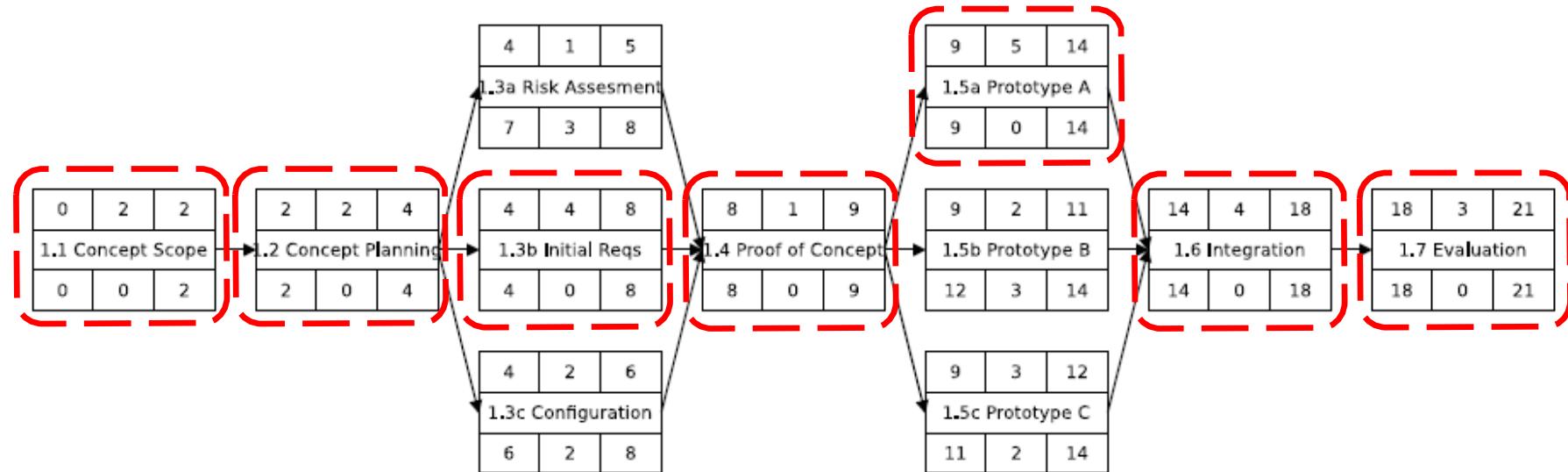
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Task	Dependencies	Most Likely Time
1.1 Concept Scoping		2 days
1.2 Concept Planning	1.1	2 days
1.3a Technology Risk Assessment	1.2	1 day
1.3b Initial Requirements	1.2	4 days
1.3c Configuration	1.2	2 days
1.4 Proof of Concept	1.3a, 1.3b, 1.3c	1 day
1.5a Concept Prototype A	1.4	5 days
1.5a Concept Prototype B	1.4	2 days
1.5a Concept Prototype B	1.4	3 days
1.6 Prototype Integration	1.5a, 1.5b, 1.5c	4 days
1.7 Concept Evaluation	1.6	3 days



PERT Chart Example

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Critical Path: 1.1, 1.2, 1.3b, 1.4, 1.5a, 1.6, 1.7

Duration: 21 days

Note: Critical path activities have a total free slack of 0



- **Critical Path**

- path with the longest duration
- activities on the critical path have a total free slack of 0
- a delay in any of the activities in the critical path will cause the project to delay

- **Crashing the project schedule**

- shortening the total duration of the project by shortening the critical path
 - By removing the dependencies between activities in the critical path; or
 - Shortening the duration of activities in the critical path



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Atlassian (Jira), Microsoft project

Product	Rating	Price	Platforms	Deployments	Business Size	
smartsheet	Smartsheet ★★★★★ (395)	\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
Mavenlink	Mavenlink ★★★★★ (224)	\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
workzone	Workzone ★★★★★ (38)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
inMotion	inMotion ★★★★★ (32)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
Accelo	Accelo ★★★★★ (3)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
monday.com (formerly dapulse)	monday.com ★★★★★ (606)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
workfront	Workfront ★★★★★ (425)	\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
Freshservice	Freshservice ★★★★★ (341)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
Wrike	Wrike ★★★★★ (745)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website
Airtable	Airtable ★★★★★ (162)	\$\$\$\$\$\$	mac, windows, android	cloud, desktop	S M L	Visit Website

<https://www.workzone.com/blog/gantt-chart-software/>



- Understand the role the project schedule
- Understand how to develop a project schedule
- Understand how to use a project schedule to monitor and track project progress
- Understand agile planning principles



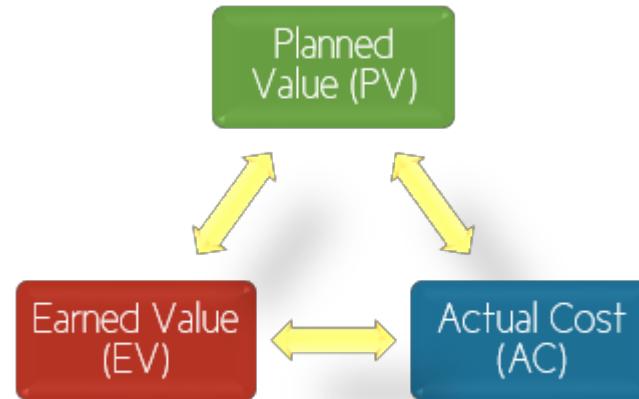
- **How do software projects fall behind schedule?**
One day at a time
 - Fred Brooks, the well-known author of the seminal article *Mythical Man-Months*
- Project scheduling is important, but ***tracking and controlling*** are even more important!



- How to track and control project progress?
 - Periodic meetings where team members report progress
 - Evaluating the results of reviews and audits conducted as part of the software engineering process
 - Tracking formal project milestones
 - Comparing actual start dates with scheduled start dates
 - Meeting engineers and having informal discussions
 - Using a formal method like *earned value analysis*



- EVA can be used to:
 - report current/past project performance
 - predict future project performance based on current/past performance
- Results can be expressed in dollars and/or percentage





- Planned Value (PV)
 - that portion of the approved cost estimate planned to be spent on the given activity during a given period
- The Earned Value (EV)
 - the value of the work actually completed
- Actual Cost (AC)
 - the total of the costs incurred in accomplishing work on the activity in a given period



EVA - Example

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- Consider the following scenario:

You are assigned to manage a project that is planned to finish in 12 months, estimated to cost \$100,000. At the end of the third month, based on the project Gantt chart, 20% of the work had been reported as completed. The finance department has reported the cost of the project to date as \$35,000.

What is the PV?

What is the EV?

What is the AC?



EVA - Example

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- Consider the following scenario:

You are assigned to manage a project that is planned to finish in 12 months, estimated to cost \$100,000. At the end of the third month, based on the project Gantt chart, 20% of the work had been reported as completed. The finance department has reported the cost of the project to date as \$35,000.

$PV = \$100,000 * 3 / 12 = \$25,000$ (assuming equal work distribution over the period, which may not be the case always)

$EV = \$100,000 * 20 / 100 = \$20,000$

$AC = \$35,000$



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- **Schedule Variance Analysis**
 - Uses EV and PV to calculate a variance to the project schedule

- **Schedule Variance: expressed in dollars**

$$\begin{aligned} SV &= EV - PV \\ &= 20,000 - 25,000 \\ &= (5000) \end{aligned}$$

- **Schedule Performance Index: expressed as a fraction**

$$\begin{aligned} SPI &= EV/PV \\ &= 20,000/25,000 \\ &= 0.8 \end{aligned}$$



- **Cost Variance Analysis**
 - Uses EV and AC to calculate a variance to the project schedule

- **Cost Variance: expressed in dollars**

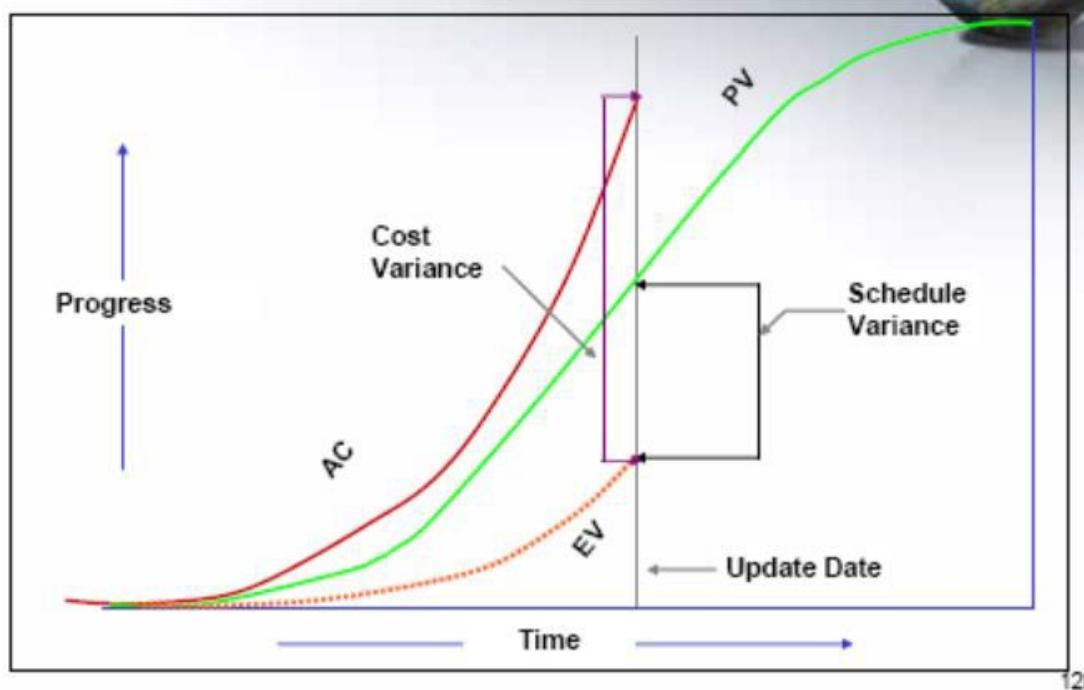
$$\begin{aligned} CV &= EV - AC \\ &= 20,000 - 35,000 \\ &= (15,000) \end{aligned}$$

- **Cost Performance Index: expressed as a fraction**

$$\begin{aligned} CPI &= EV/AC \\ &= 20,000/35,000 \\ &= 0.57 \end{aligned}$$



Graphic Performance Report



128

<https://www.pmi.org/learning/library/earned-value-management-systems-analysis-8026>



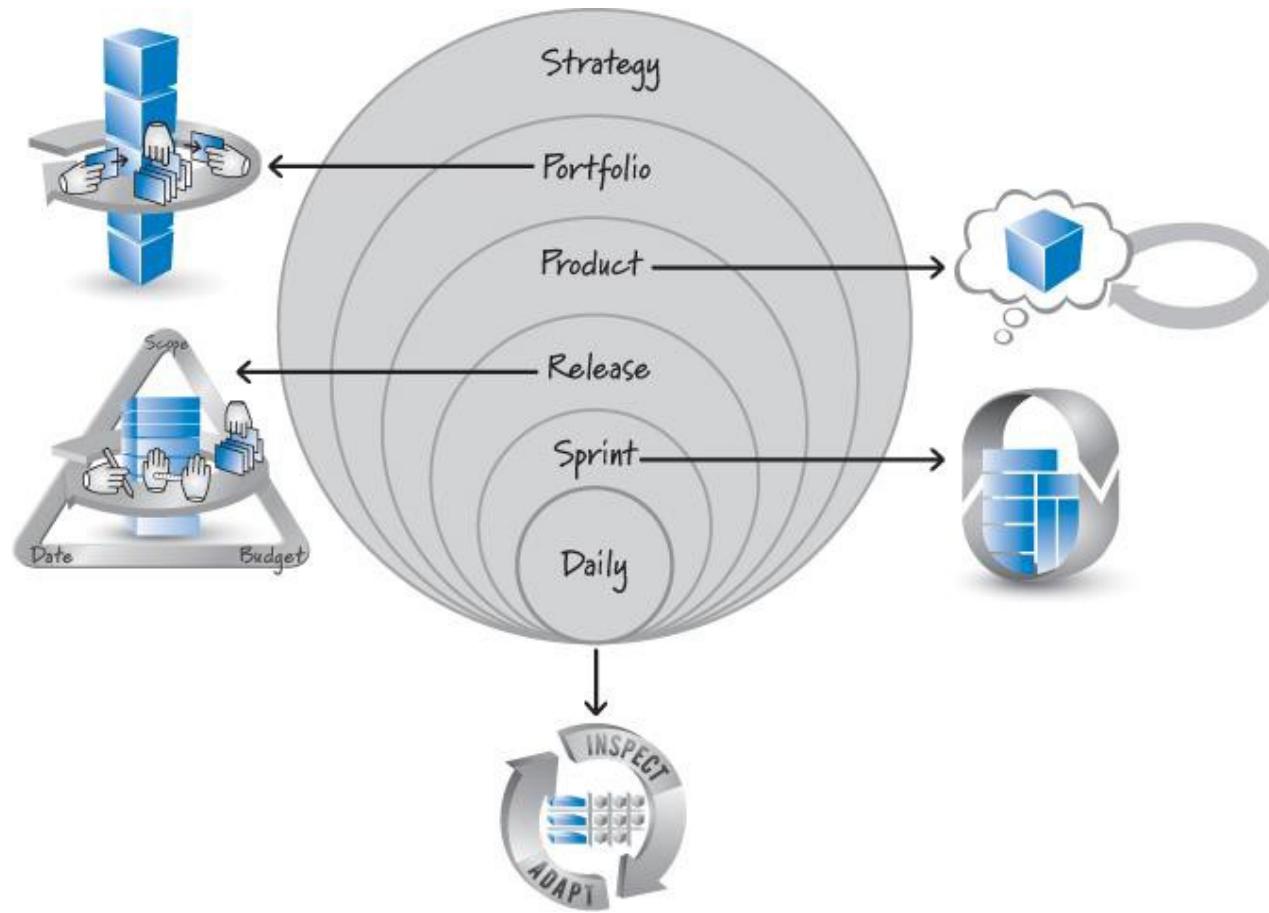
1. Understand the role of a project schedule
2. Understand how to develop a project schedule
3. Understand how to use a project schedule to monitor and track project progress
4. Understand agile planning principles



- Takes a significantly different flavour from traditional approaches
- Detailed planning is deferred until the start of the iteration
 - Designed to handle change
 - An iteration includes all phases (requirements, design and test)
- Planning is based on light weight lists
 - Gantt and PERT charts are considered less useful



- Plan short iterations
- Deliver working software
- Use “Just in time (JIT) planning” – next iteration
- Use the team



Different levels of planning in Scrum



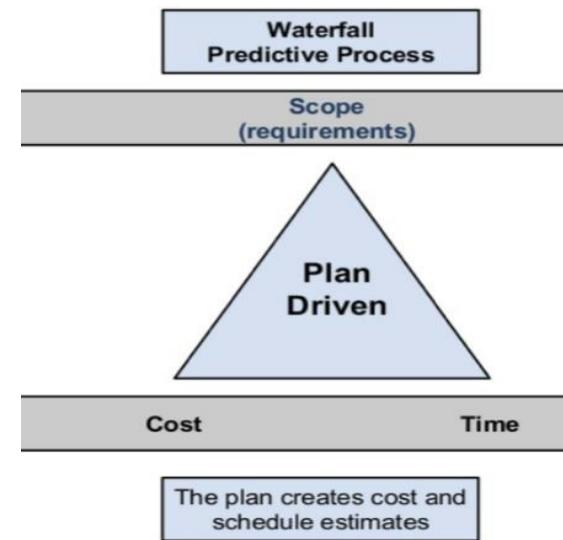
Planning in Scrum

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Level	Horizon	Who	Focus	Deliverables
Portfolio	Possibly a year of more	Stakeholders and product owners	Managing a portfolio of products	Portfolio backlog and collection of in-process products
Product (envisioning)	Up to many months or longer	Product owner, stakeholders	Visions and product evolution over time	Product vision, roadmap, and high-level features
Release	Three (or fewer) to nine months	Entire Scrum Team, Stakeholders	Continuously balance customer value and overall quality against the constraints of scope, schedule and budget	Release Plan
Sprint	Every iteration (one week to one month)	Entire Scrum Team	What features to deliver in the next Sprint	Sprint goals and sprint backlog
Daily	Every day	Scrum Master, development team	How to complete committed features	Inspection of current progress and adaptation



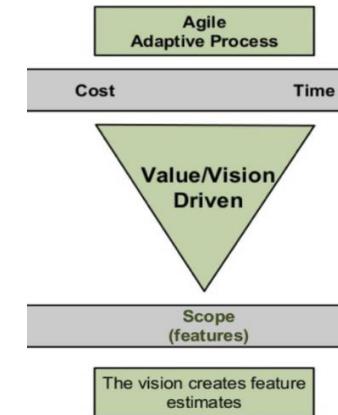
- Assumptions in Formal Planning:
 - Scope fixed – requirements are stable
 - Budget fixed – cost estimations are accurate
 - Schedule fixed - derived based on scope and budget





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- Agile Planning
 - Recognizes that all three factors: scope, budget and time cannot be fixed in reality - not recommended
 - Can we fix scope and date and make the budget flexible?
 - Not really because increasing the budget, hence the resources will not always help to improve speed – not recommended
 - So what are our options?
 - Fix date and budget and have the scope flexible
Fixed-Date release planning



- Fix scope and have the date and budget flexible – *Fixed-Scope release planning*
e.g. <https://www.aoe.com/en/company/agile-teams.html>



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Determine the number of sprints N
 $N = \text{total duration}/\text{length of sprint}$

Groom the product backlog by estimating and prioritizing stories

Measure team velocity range:
 V_{min}, V_{max}

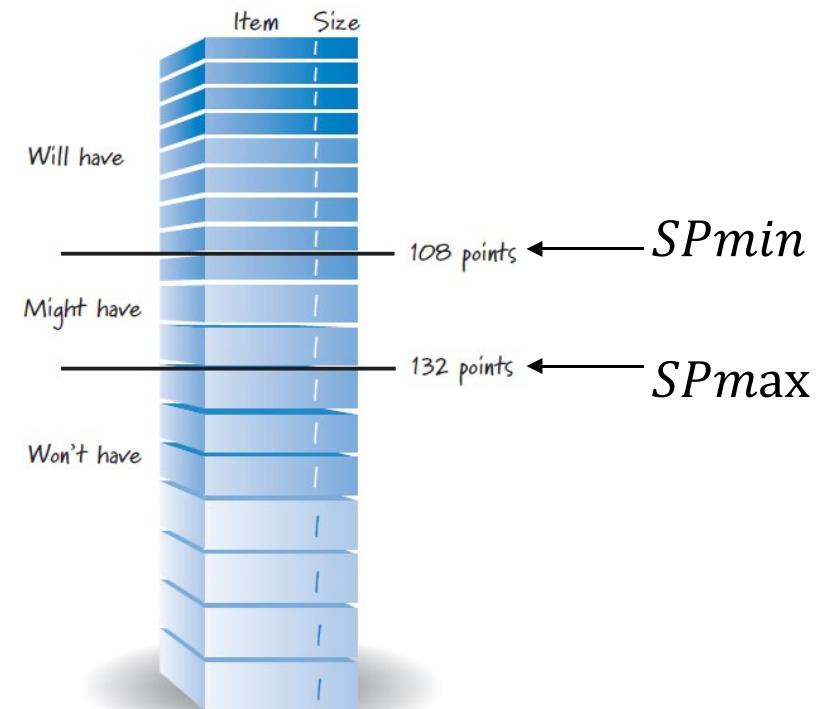
Compute minimum and maximum story points based on velocity

$$SP_{min} = V_{min} \times N,$$

$$SP_{max} = SP_{max} \times N$$

Draw lines through the Product Backlog to show the above

Fixed-Date: used when date is more important





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Groom the product backlog by creating, estimating and prioritizing and identify the must-have stories

Determine the total number of must-have story points (SP_{total})

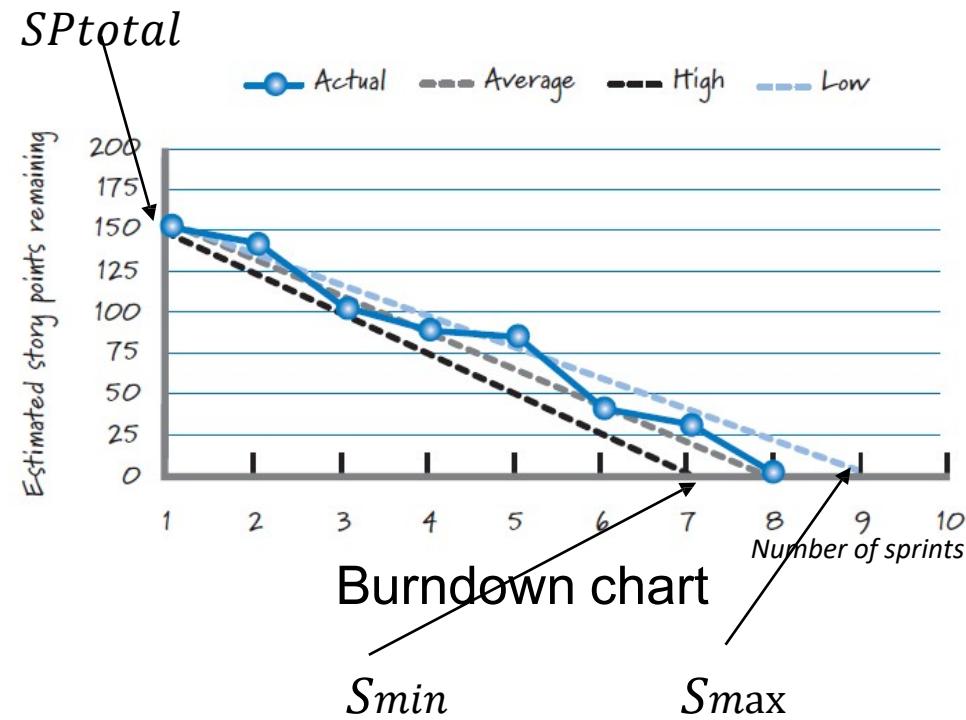
Measure team velocity range:
 V_{min}, V_{max}

Compute minimum and maximum number of sprints

$$S_{min} = SP_{total}/V_{max},$$
$$S_{max} = SP_{total}/V_{min}$$

Show on Burndown Chart

Fixed-Scope: used when scope is more important



May require rounding up to be an integer



1. Understand the role of a project schedule
2. Understand how to develop a project schedule
3. Understand how to use a project schedule to monitor and track project progress
4. Understand agile planning principles



1. F. P. Brooks. *The mythical man-month*. In *Essays on software engineering*. Addison-Wesley, 1995.
2. R. S. Pressman. *Software Engineering: A Practitioner's Approach*. McGraw Hill, seventh edition, 2009.
3. Kenneth S. Rubin. *Essential Scrum – A Practical Guide to the Most Popular Agile Process*. Addison-Wesley, 2013.



SWEN90016

Software Processes & Project Management

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2021 – Semester 1
Lecture 6



Intended Learning Objectives

Module 9 – Individuals, Motivation and Teams.

1. Individuals & motivation.
2. Organisational theory and motivation.
3. Project Management & Leadership.
4. Teams why we use them and their value.
5. Teams forming and performing.
6. Team structures.
7. Advantages & disadvantages of teams.

Module 9.1 – Individuals and Motivation

So why is this important to Project Management?

L1.3 – What is Project Management

Project Management is the planning, delegating, monitoring and controlling of all aspects of the project, and motivating those involved to achieve the project objectives within the expected targets for time, costs, quality, scope, benefits and risks.

Value lies in:

- Organising and structuring scarce resources
- Managing risk
- Identifying and clearing issues
- Managing and implementing change
- Retaining and re-using knowledge
- Organisational wide learning from past success and failures

L1.5b – Project Manager Key Activities “*a change is occurring*”

Agile is redefining the way we execute projects and the role of the PM. In Agile:

- No defined PM role
- Key activities are spread / shared across team members
 - Key project activities are still undertaken formally with appropriate documentation
- Some alignment to activities of a Scrum Master
- Move from Command and Control to Servant Leadership
 - Coaches and facilitates teams to deliver
 - Emphasises objectives
 - Is invested in the program's overall performance
 - Asks the teams for answers
 - Allows the teams to self-organise and hit their stride
 - Assists others with fixing issues

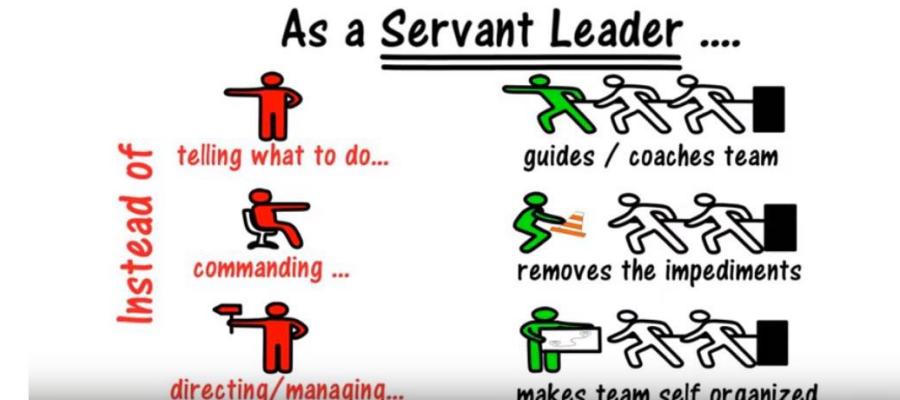
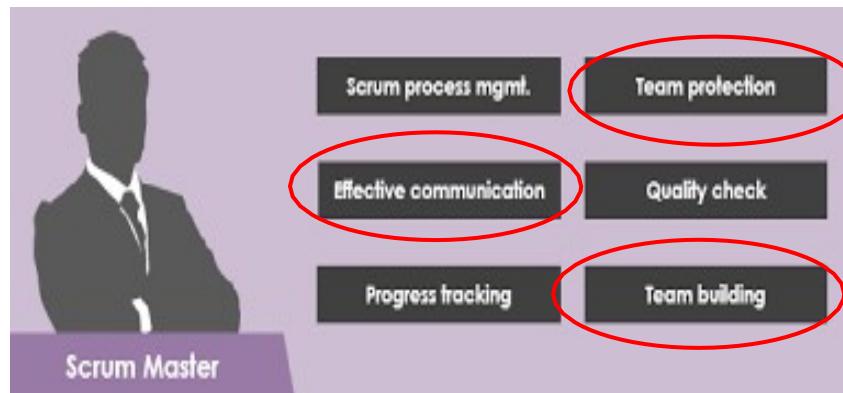


Module 9.1 – Individuals and Motivation

.....and even more critical in an agile world!

A "Scrum Master" represents a pattern known as **Servant Leadership**.

They manage teams not by telling them what to do, but by removing impediments that get in their way and by coaching them in best practices.



www.scrum.org/resources/blog/scrum-master-servant-leader

Module 9.1 – Individuals and Motivation

- Motivation *is derived from the word ‘motive’*
- It is the driving force within individuals that propels them into action

Motivation can inspire, encourage, and stimulate individuals and project teams to achieve great accomplishments. Motivation can also create an environment that fosters teamwork and collective initiatives to reach common goals or objectives.

www.pmi.org/learning/.../motivation-increase-project-team-performance-7234

Module 9.1 – Individuals and Motivation

- Motivation *is derived from the word ‘motive’*
- It is the driving force within individuals that propels them into action

What motivates you?





- Motivation *is derived from the word ‘motive’*
- It is the driving force within individuals that propels them into action

What motivates you?





- Motivation *is derived from the word ‘motive’*
- It is the driving force within individuals that propels them into action

What motivates you?



What motivates you?



Intended Learning Objectives

Module 9 – Individuals, Motivation and Teams.

1. ~~Individuals & motivation.~~
2. **Organisational theory and motivation.**
3. Project Management & Leadership.
4. Teams why we use them and their value.
5. Teams forming and performing.
6. Team structures.
7. Advantages & disadvantages of teams.

Module 9.2 – Organisational Theory & Motivation

Organisational theory consists of approaches to organisational analysis. Organisations are groups of individuals that are structured and managed to meet a need, or to pursue collective goals.

Some well used approaches:

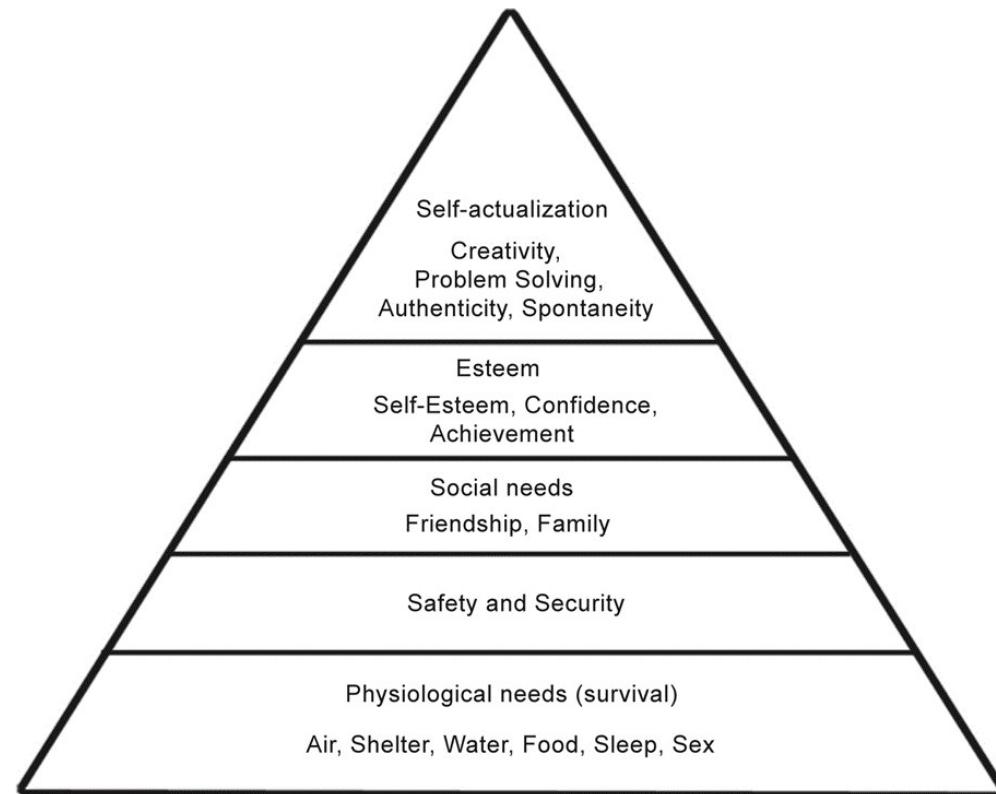
- Maslow Hierarchy of Needs
- Herzberg



Module 9.2 – Organisational Theory & Motivation

Maslow Hierarchy of Needs:

- Proposed by Abraham Maslow in 1943 and still widely used today
- A key tool used by managers in how individuals are motivated
- Focuses on a 5 tier model of human needs
- Describes humans are motivated to achieve certain needs
- Needs take precedence over others and the basic needs must be more or less met before higher needs
- Individual behaviour is multi-motivated and stimulated by more than one need





Module 9.2 – Organisational Theory & Motivation

Hertzberg Two Factor Theory:

- Proposed by Fredrick Hertzberg in 1959 and still widely used today
- Asked people to describe situations when they felt really good and really bad about their jobs
- There are a set of factors in the workplace that cause satisfaction
- And a separate set of factors that cause dissatisfaction
- Remedyng the causes of dissatisfaction will not create satisfaction





Intended Learning Objectives

Module 9 – Individuals, Motivation and Teams.

1. ~~Individuals & motivation.~~
2. ~~Organisational theory and motivation.~~
3. **Project Management & Leadership.**
4. Teams why we use them and their value.
5. Teams forming and performing.
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Module 9.3 – Project Management & Leadership



Project Management & Leadership - motivates and demotivates the team!

- Project Managers must Manage & Lead
- Management is the process where resources are used and decisions made in order to achieve the goal
- Managers set objectives and decide how to achieve them
- Leadership is the ability to influence and direct people to achieve a common goal
- Leaders inspire and motivate people to meet goals

Team Member	Role	Location	Development Goal	Motivation Drivers – Employee wants/needs	How to apply motivational driver
Marion	Technical Expert	Melbourne	Project Management	Formal training and recognition	Sponsor Marion in Melbourne Uni Masters program
Harry	Developer	Gold Coast	Detailed Technical knowledge	Work Life Balance	Allow 4 day per week work in line with Project activity

Module 9.3 – Project Management Common Motivational Mistakes

- Whatever motivates me will motivate others
- People are motivated primarily by money
- Team members love to receive formal awards
- Give them a rally slogan
- The best project leader is a strong cheerleader
- These people are professionals. They don't need motivating
- I'll motivate them when there is a problem
- I'll treat everyone the same. People like that, and it will motivate them

Reference: Flannes, S. W. & Levin, G. (2005). *Essential People Skills for Project Managers*. Vienna, VA: Management Concepts, Inc.

Module 9.3 – Project Management & Leadership Summary

- Individuals are individuals and we are all motivated by different means
- Projects succeed / fail because of people so manage, lead and motivate them to increase success
- Leadership and Management are different. Consciously select the style that is right for the situation
- The biggest impact you can have is by managing yourself take the necessary step to achieve this

Intended Learning Objectives

Module 9 – Individuals, Motivation and Teams.

1. ~~Individuals & motivation.~~
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Moule 9.4 - Teams and Teamwork

We have all experienced this!



Module 9.4 - Teams



Teamwork in the workplace is an **critical** factor for project **success**. As a result, developing an **effective** project team is one of the **primary responsibilities** of a project manager. Teamwork creates human synergy.

I prefer to work.....

By myself /
Alone

As part of a
diverse
team



- An individual is a person with a unique set of skills
- A Group is a collection of people working together who do not necessarily work collectively toward the same goal
- A Team is two or more individuals consciously working together to achieve a common objective
- A Group becomes a Team when members demonstrate a commitment to each other and to the end goal toward which they are working



Module 9.4 – Why Teams



1. **Very few (if any) individuals** possess all the knowledge, skills, and abilities needed to accomplish all tasks.
2. **Complementary teamwork skills** are one of the most commonly **required** skills in the work environment.
3. Substantial **benefits** to the organisation and to the team members.
4. **Shared accountability** increases likelihood of **success**.



Module 9.4 – Why Teams - Benefits

1. **Enhanced Opportunities:** Individuals & organisation.
2. **Greater Productivity:** Leverage the strengths and skills of the collective group.
3. **Increased Ownership & Accountability:** Multiple people collectively owning the activity and the outcome.
4. **More Creativity and Innovation:** Individuals build upon one another's ideas with solutions going beyond one person's vision of what's possible.
5. **Greater Joy and Satisfaction Among Team Members:** A space for people to socialise, connect and be part of something bigger.
6. **Broader Perspective:** Ability to leverage the collective perspective of all team members.
7. **Increased Representation:** Involvement of multiple stakeholders groups and their input.
8. **Increased Equality:** Individuals across all levels can more freely offer their ideas, knowledge and concerns.
9. **More Dialogue:** Teams offer a site where people can voice their feelings, disagreements, opinions and ideas.

Intended Learning Objectives

Module 9 – Individuals, Motivation and Teams.

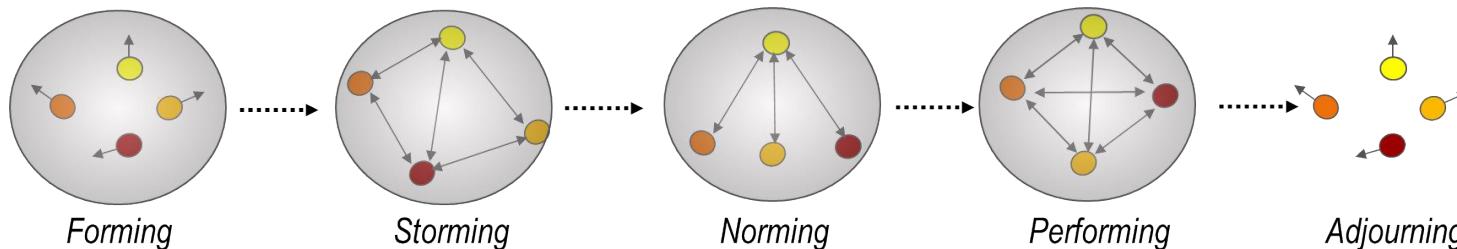
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Tuckman's Team Development Model



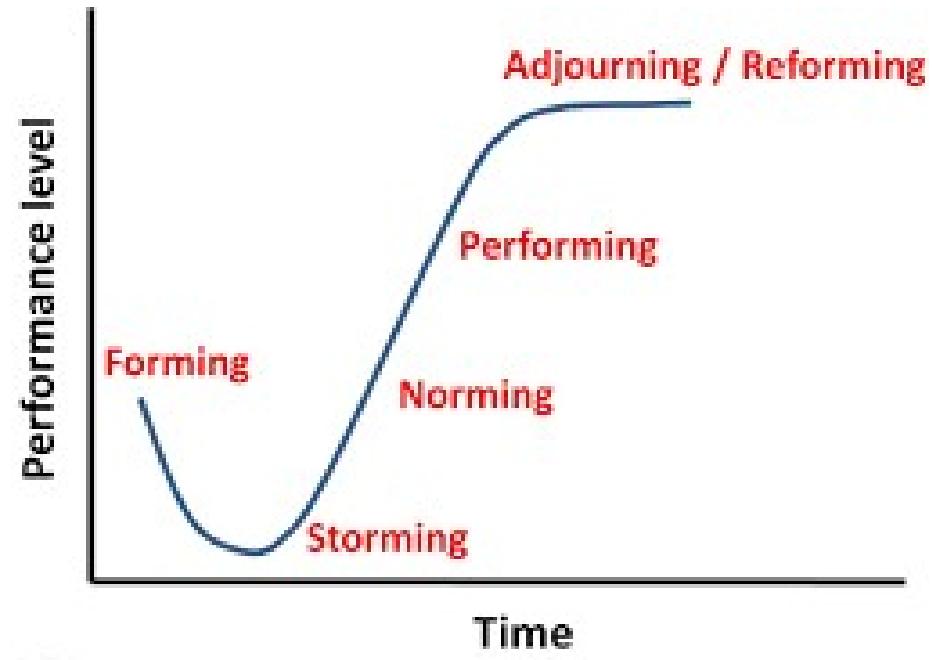
- First proposed by Bruce Tuckman in 1965
- Elegant and simple explanation of team development
- Initial model focused on 4 stages Forming–Storming–Norming- Performing
- Tuckman stated that all phases are necessary and inevitable if a team is to grow, face up to challenges, tackle problems, find solutions, plan work and deliver results
- He found that it was critical for team to go through an Adjourning stage which was added in the 70's





Tuckman's Team Development Model

- As teams develop maturity and ability – leadership styles change and behaviors change
- Tuckman also found that Team Effectiveness changed over time with the team experiencing initial decline in performance after Stage 1 – Forming



<https://project-management.com/the-five-stages-of-project-team-development/>



Module 9.5 – How teams Form & Perform



FORMING

Establishing ground rules and preserving formalities



STORMING

Members communicate, but maintain strict individuality



NORMING

Team bonding and higher acceptance of perspectives



PERFORMING

Less emphasis on hierarchy and more on flexibility



ADJOURNING

Yearly assessment and plan for acknowledging individual contributions



High dependency on the leader

Leader coaches and support

Leader moves to facilitator and enabler

Leader delegates and oversees

Leader acknowledges, recognises and directs



Positive signs

- Clear communication
- Regular brainstorming with all members participating
- Consensus among team members
- Problem solving done by the group
- Commitment to the project outcomes and the other team members
- Regular team meetings are effective and inclusive
- Timely hand off from team members to others or early advise if this won't happen
- Positive, supportive working relationships

Not so Positive signs

- Lack of communication
- No clear roles and responsibilities
- Work is “thrown over the wall”, with lack of concern for timelines or work quality
- Team members work alone, rarely sharing information and offering assistance
- Blame for what goes wrong, no one accepts responsibility
- Lack of support for others
- Frequently absent impacting time and creating additional work for others

<https://www.pmi.org/learning/library/team-building-development-project-management-5707>



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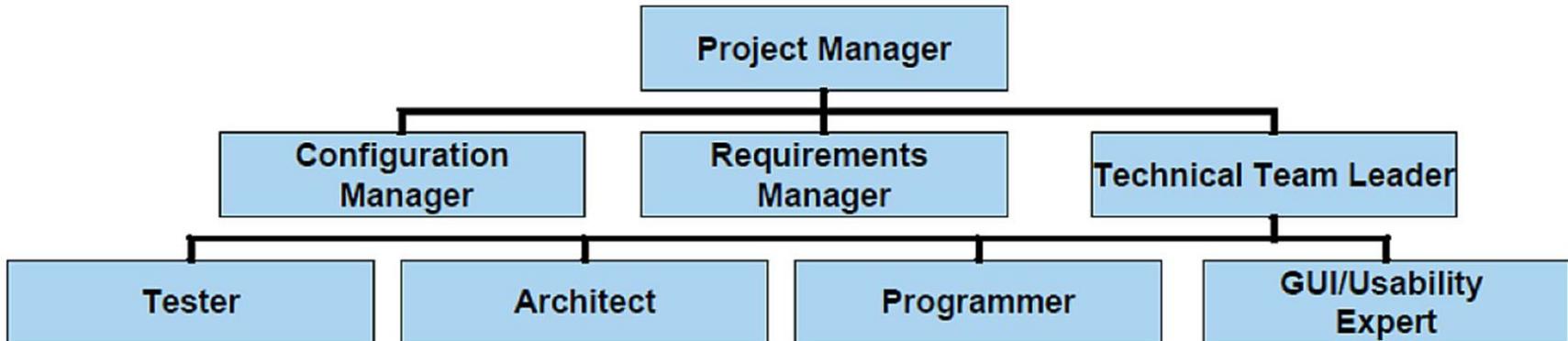


Module 9.6 – Team Structures



Controlled Centralised

- Leader coordinates tasks and directs work
- Communication and Control are vertical
- Sub-teams with leaders to direct and guide sub-groups



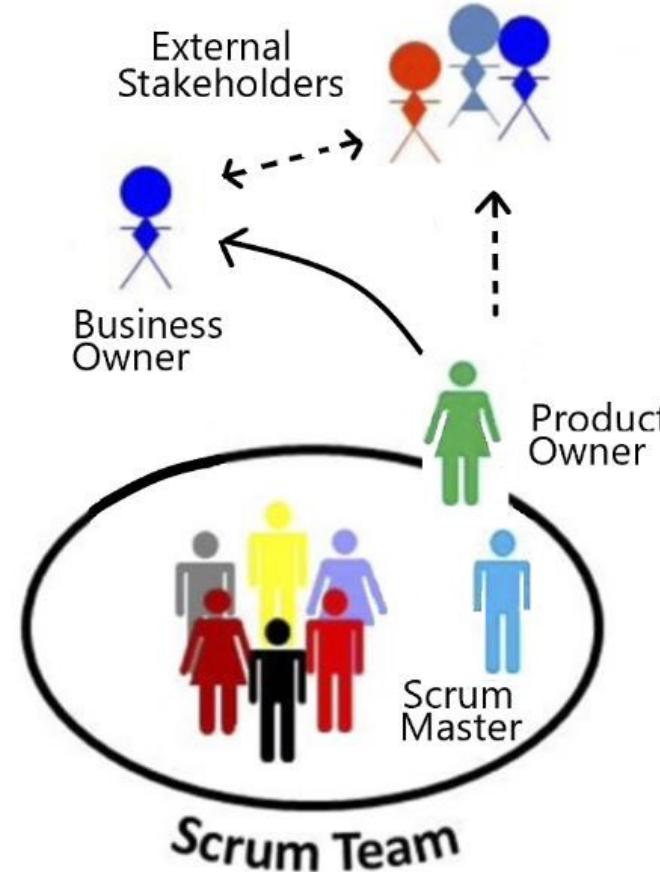


Module 9.6 – Team Structures



Scrum Team

- Used in Agile





Intended Learning Objectives

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6. ~~Team structures.~~
7. **Advantages & disadvantages of teams.**



AVAILABILITY

Module 9.7 – Teams Advantages / Disadvantages

Advantages

- Provides a larger pool of ideas – creative & collective problem solving
- Interaction enhances the knowledge of the whole team
- Individuals working together can stimulate performance, motivation and output
- Provides continuity across the tasks if people leave
- Increased ownership of the overall outcome & not just the individual component

Disadvantages

- It takes time, effort and great skill to effectively manage
- Some individuals find it difficult and may become overshadowed / overwhelmed
- Unequal involvement - Some people may not pull their weight
- One person can demoralise the whole team
- Social loafing
- Group think



Intended Learning Objectives

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7. ~~Advantages and Disadvantages of teams~~



SWEN90016
Software Processes & Project Management

Cost Estimation

Marion Zalk

Department of Computing and Information Systems

The University of Melbourne

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2021– Semester 1
Lecture 7

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Assignment 2

WEEK 10: REPORT

Your Assignment 2 report should include screen shots of your Gantt Chart or Kanban board in section 6.5.

You have an option of also including a link to your online tool, such as Trello, if you think this will aid your marker, as sometimes the screen shots are fuzzy and difficult to read.

If you grant (read) permissions to the generic SWEN90016 tutor email address inside your tool,

swen90016tutors@groups.unimelb.edu.au

then all tutors who click on the link inside your report will have access to read.



|



1. Understand the role of a project schedule
2. Understand how to develop a project schedule
3. Understand how to use a project schedule to monitor and track project progress
4. Understand agile planning principles



Project Breakdown

Redecorate Room

Prepare materials

- Buy paint
- Buy a ladder
- Buy brushes/rollers
- Buy wallpaper remover

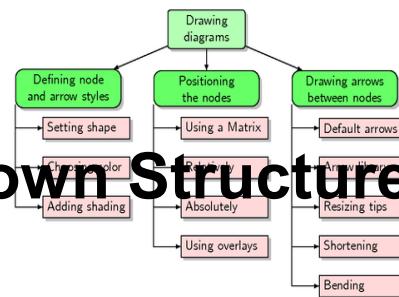
Prepare room

- Remove old wallpaper
- Remove tacks from the floor
- Cover floor with old newspapers
- Cover electrical outlets/switches with tape
- Cover furniture with sheets

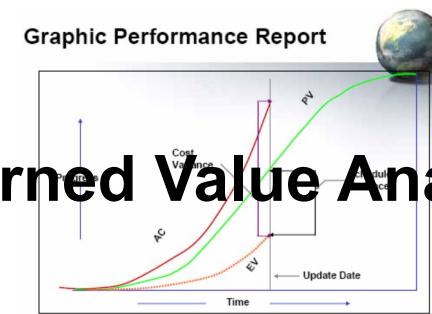
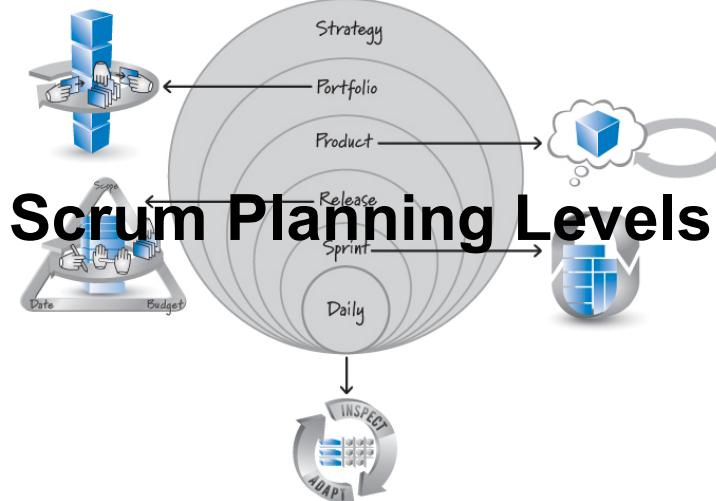
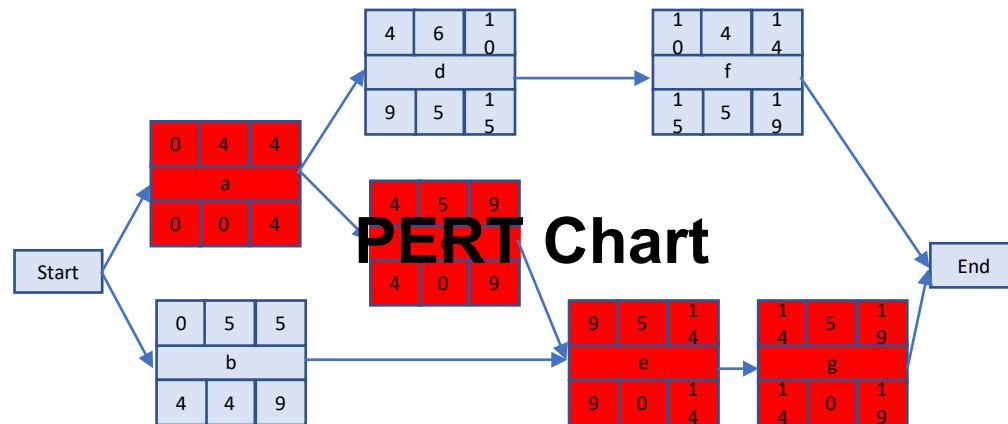
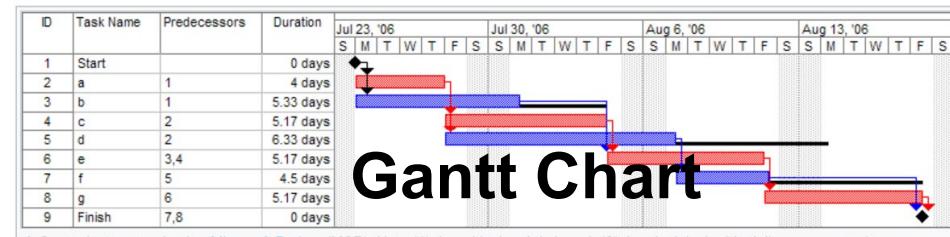
Paint the room

Clean up the room

- Dispose or store leftover paint
- Clean brushes/rollers
- Dispose of old newspapers
- Remove covers



Work Breakdown Structure





Today's lecture

|



Version 0.1

Formal

1. Understand the importance of cost estimation and the challenges involved
2. Understand the techniques used for cost estimation
3. Understand software size estimation techniques
4. Understand the principles of the COCOMO II model for algorithmic cost estimation

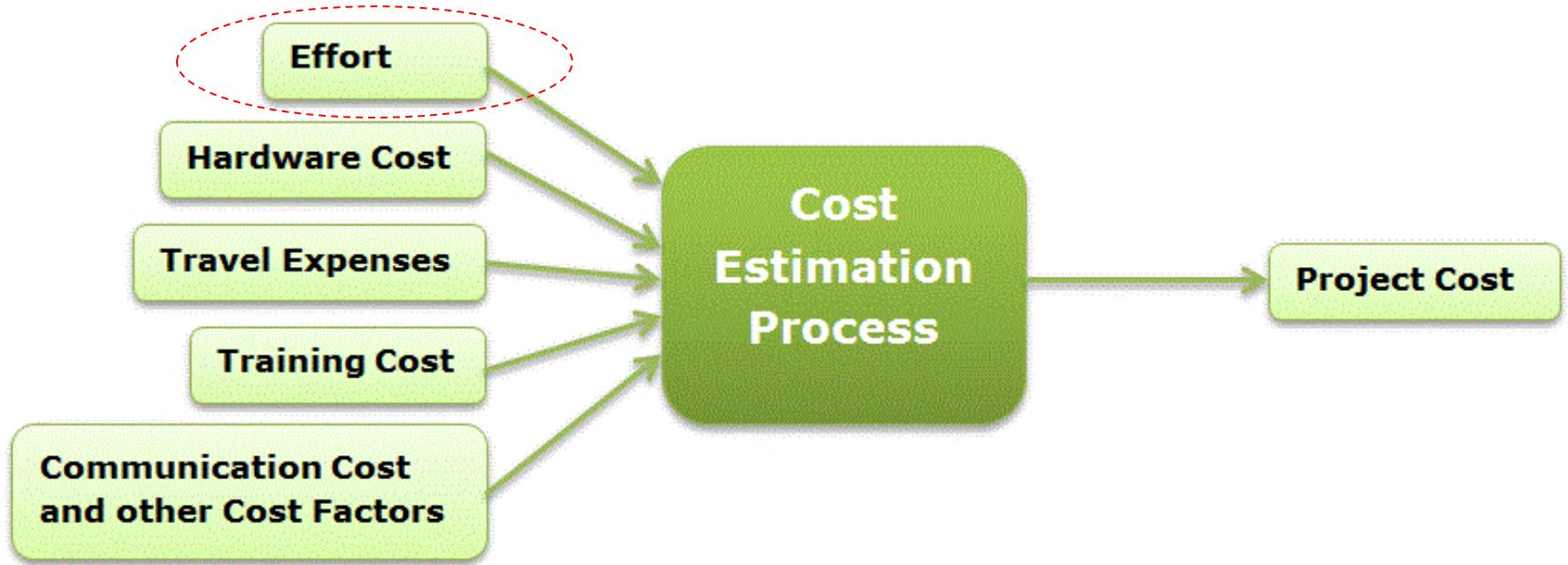
Agile

Understand cost estimation techniques used in Agile software development lifecycles



SWEN90016

1. Understand the importance of cost estimation and the challenges involved
2. Understand the techniques used for cost estimation
3. Understand software size estimation techniques
4. Understand the principles of the COCOMO II model for algorithmic cost estimation



<http://geethanjalisnsce.blogspot.com.au/2015/04/>



- What is estimation?
 - Is the process of finding an estimate, or approximation, which is a value that can be used for some purpose even if *input data may be incomplete, uncertain, or unstable*
- What is *software cost estimation*?
 - Estimation of how much *money, effort, resources, and time* will take to build a specific software based system or product
- Why is it Important?
 - Would you build a house without knowing how much you were about to spend - of course not
 - Since most software systems cost considerably more to build than a large house, it would seem reasonable to develop an estimate before you start creating the software



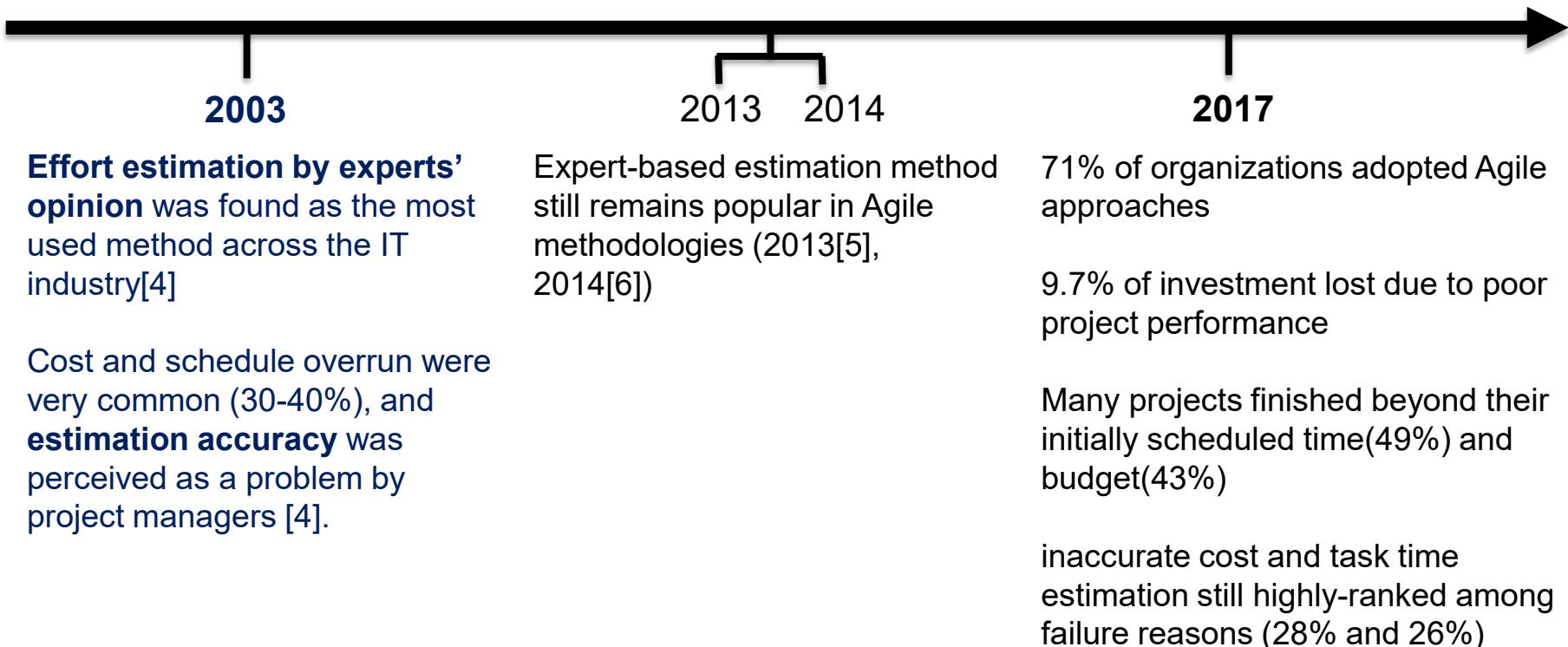
- There is no exact science for cost estimation – it will never be considered as all accurate
- No person can reasonably predict what can go wrong in the project
- Most estimation methods assume things will proceed as expected and simply adds some slack to account for what can go wrong



1. Delay estimation – 100% accuracy at the end of the project but less useful!
2. Base estimation on data from previous projects that have been completed
3. Break the system to smaller parts and generate the estimates for smaller parts, which is easier
4. Use empirically-based estimation methods



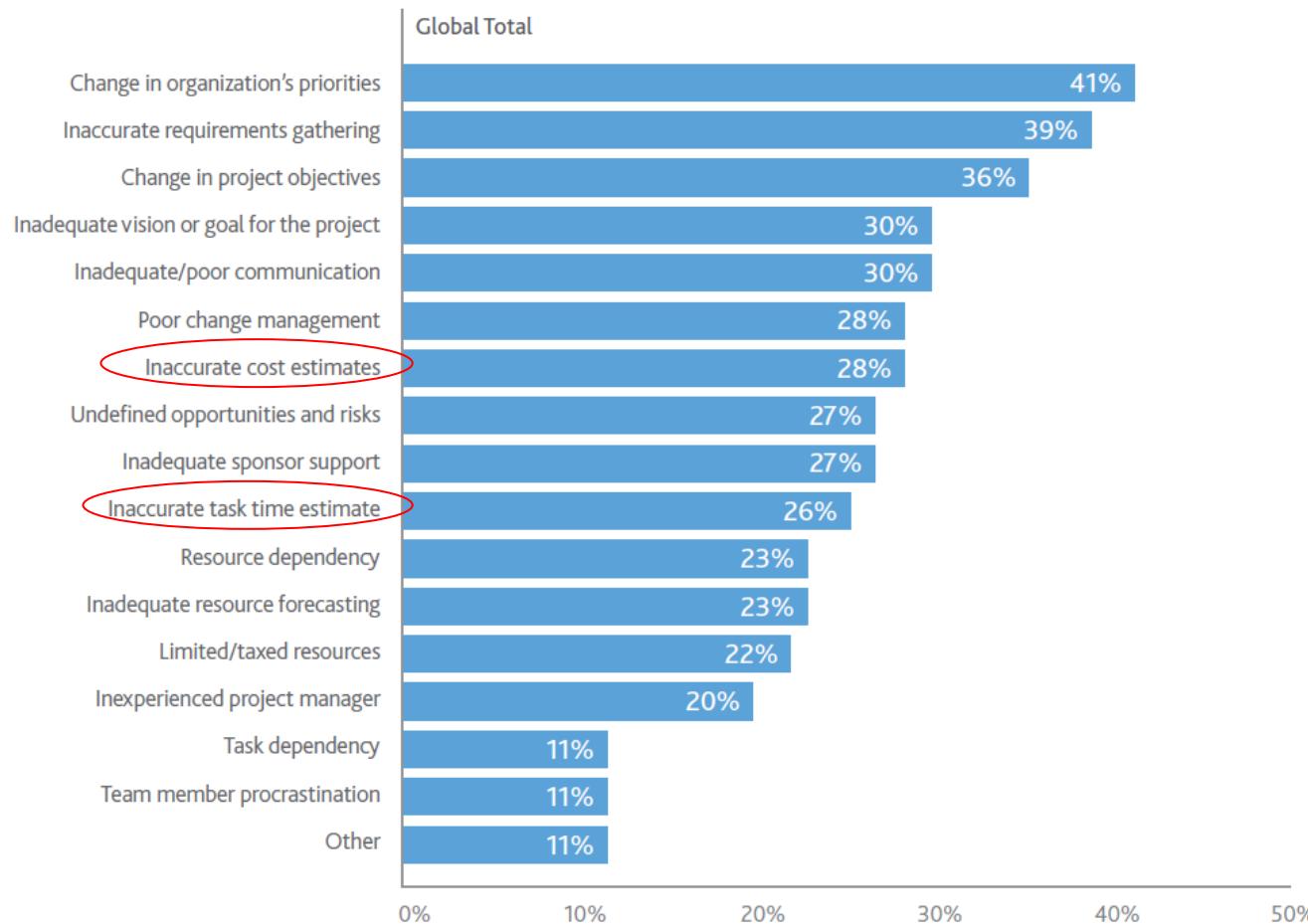
Why do we need to improve effort estimation?



Source: Literature Review PhD Student Jirat Pasuksmit



Q: Of the projects started in your organization in the past 12 months that were deemed failures, what were the primary causes of those failures? (Select up to three.)



PMI's PULSE of the PROFESSION -<https://www.pmi.org/learning/thought-leadership/pulse/pulse-of-the-profession-2017>



Version 0.1 (2018)

1. Understand the importance of cost estimation and the challenges involved
2. Understand the techniques used for cost estimation
3. Understand a range of software size estimation techniques
4. Understand the principles of the COCOMO II model for algorithmic cost estimation



1. Expert judgement

- Several experts on the proposed software development technique and the application domain estimate project cost. These are then discussed, compared and adjusted until consensus is reached
- Some expert judgement techniques involve polling each expert independently, in some cases for three estimates, pessimistic estimate (p), optimistic estimate (o) and the most likely estimate (m), and the expert's estimate is computed as the:

$$e = (p + 4m + o)/6$$

- *Delphi technique*: asks several experts to make an individual judgement of the effort using any method they wish. Then, the average effort is calculated, and presented to all of the experts. Each expert is then given a chance to revise their estimate, in some cases after a discussion between all experts. This continues until no expert wishes to revise their estimate.



SWEN90016

2. Estimation by Analogy

- The cost of a new project is estimated based on similar projects in the same application domain

3. Parkinson's Law

- This law states that the work will expand to fill the time available
- The cost is determined by available resources rather than by objective assessment
- For example, if the software is to be delivered in 12 months, and 3 people are available, the effort is 36 person months

4. Pricing to win

- The cost is estimated to be whatever the customer has available to spend on the project - cost depends on the budget not on the software functionality



5. Algorithmic cost modelling

- A **model** is developed using **historical cost information** based on some **software metric (usually its size)** to the project cost
- When a project effort needs to be estimated, an estimate of the metric is computed
- Using the model, the effort is predicted
- The most general form of an algorithm cost estimate is given by:

$$Effort = A \times Size^B \times M$$

- A** - a constant factor that depends on the organizational practices
- Size** - size of the software estimated in a metric of choice (e.g. lines of code, function point, use case points)
- B** - a value between 1 and 1.5 derived experimentally
- M** - a multiplier made by combining process, product and development attributes such as stability of requirement, experience of the team



5. Algorithmic cost modelling - cont...

$$Effort = A \times \text{Size}^B \times M$$

Basic steps in algorithmic cost estimation

1. Estimate the *size* of the development product
2. Estimate the *effort in person-months* or person-hours
3. Estimate the *schedule in calendar months*
4. Estimate the *project cost in agreed currency*



Version 0.1

1. Understand the importance of cost estimation and the challenges involved
2. Understand the techniques used for cost estimation
3. Understand software size estimation techniques
4. Understand the principles of the COCOMO II model for algorithmic cost estimation



- Commonly used metric for software size estimation
 - Source Lines of Code (SLOC)
 - Based on code
 - Function Points (FP)
 - Based on the Requirements Specification
 - Use-case Points (UCP)
 - Based on Use Cases



SOURCE LINES OF CODE

- There are two types of SLOC:
 - **Physical SLOC:** Count the number of lines excluding comments and blank lines
 - **Logical SLOC:** Measure the number of executable "statements", but their specific definitions are tied to specific computer languages

C	COBOL
<pre># include <stdio.h> int main() { printf("\nHello world\n"); }</pre>	<pre>identification division. program-id. hello . procedure division. display "hello world" goback . end program hello .</pre>
Lines of code: 4 (excluding whitespace)	Lines of code: 6 (excluding whitespace)



- Advantages of SLOC:
 - Scope for Automation of Counting: Since Lines of Code is a physical entity it is easy to count and can be automated using a tool
 - An Intuitive Metric: Lines of Code serves as an intuitive metric for measuring the size of software because it can be seen and the effect of it can be visualized



- Disadvantages of SLOC:

- Variability: Depends on programmer experience, programming language, framework support (auto generated code), reuse, etc.
- It is difficult to estimate the number of lines of code that will be needed to develop a system from information that is available in analysis and design phases
- Lack of a universally accepted definition for exactly what a line of code is



- Is used to express the *amount of functionality* in a software system, as seen by the user
- A *higher number of function points* indicates *more functionality*
 - Empirical evidence demonstrates that there is a *positive correlation between function points and the complexity of the system*
- Typically used to:
 - Estimate the cost and effort required to design, code and test a software system
 - Predict the number of errors
 - Predict the number of components
 - Measure productivity
- Function points are computed from the *Software Requirements Specification (SRS)*



- **Advantages of Function Points**

- Measures the size of the solution instead of the size of the problem
- Requirements are the only thing needed for function points count
- Can be estimated early in analysis and design
- Is independent of technology
- Is independent of programming languages



- **Disadvantages of Function Points**

- A well defined requirements specification is necessary
- Gaining proficiency is not easy, the learning curve is quite long
- Could be quite time-consuming thus could be costly

We will be going through an example



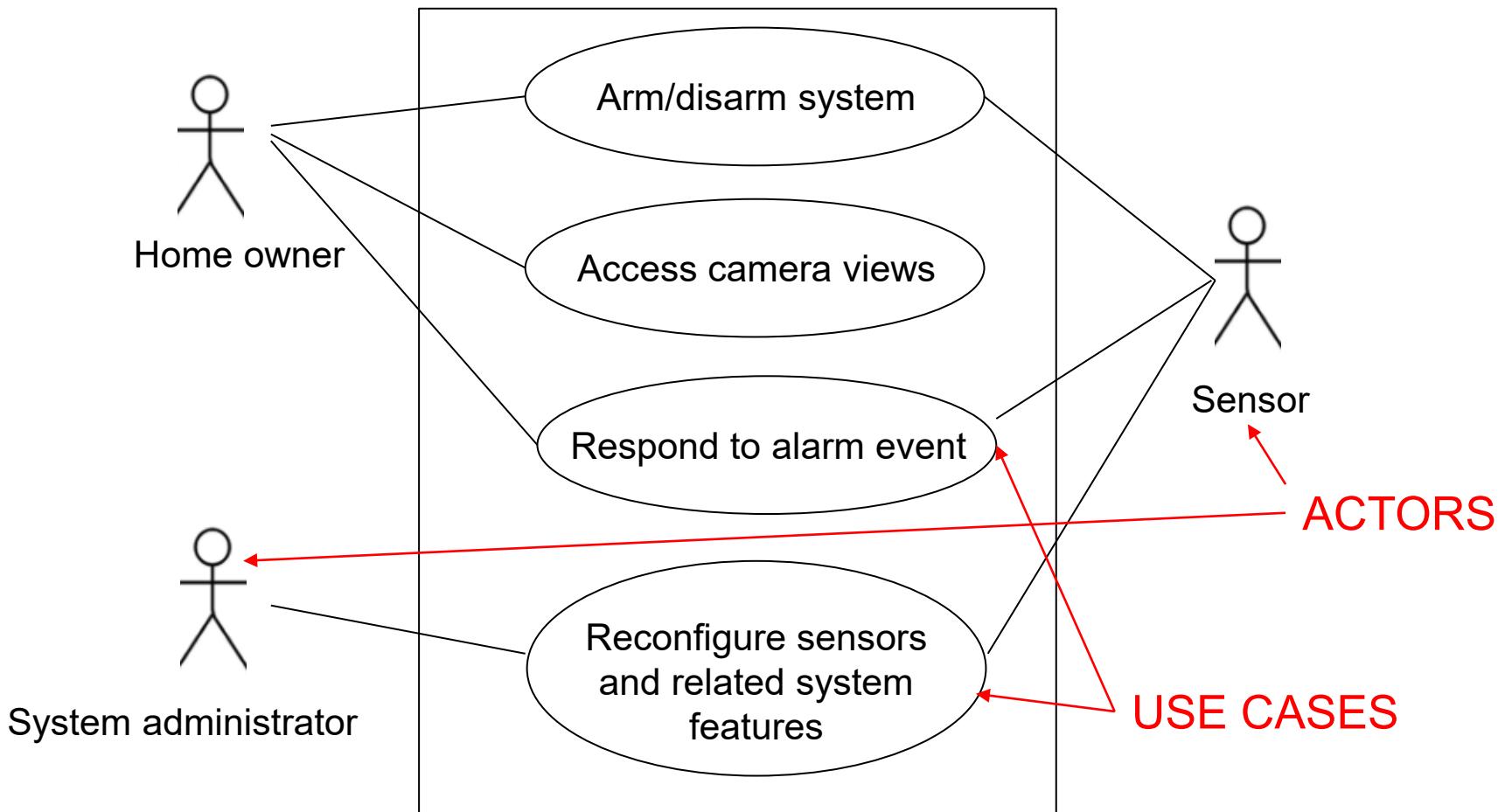
- Is a software estimation technique used to measure the software size with Use Cases
- Developed in 1993 for sizing and estimating projects using OO methodology
 - developed by Gustav Karner of Objectory (now Rational Software)
- The concept of UCP is similar to FPs



- Use cases describe the functionality of the system.
- Use cases model the dialog between the actors and the system.
- Primary purpose is to document functional requirements but also used for testing purposes,



Version 0.0.1



Use Case Diagram for a SafeHome Security System



Version 0.1

Use Case: Access camera views

Description: To view output of cameras from any remote location via the Internet

Primary Actor: Home owner

Preconditions: System must be fully configured; appropriate use-id and password must be available

Trigger: Home owner decides to view the camera output while away.

Scenario:

1. The home owner logs onto the SafeHome system via the Internet.
2. The home owner enters the user ID and password.
3. The system display major function buttons.
4. The home owner selects 'surveillance' from the major function buttons.
5. The home owner selects 'pick a camera' option.
6. The system displays the available cameras on a map.
7. The home owner selects the camera of interest.
8. The home owner selects the 'view' button.
9. The system display the video output on the viewing window.

Extensions:

- 2a. ID or password are incorrect; user is requested to re-enter the password or to validate password.
 - 4a. Surveillance function is not properly configured; system displays an error message and exits.
 - 6a. Map is not properly configured; system request the user to configure the map.
-



1. Compute Unadjusted Use Case Weight (UUCW)
2. Compute Unadjusted Actor Weight (UAW)
3. Compute Technical Complexity Factor (TCF)
4. Compute Environmental Complexity Factor (ECF)
5. Compute the final size estimate



1. Compute Unadjusted Use Case Weight (UUCW)

Count the number of simple average, complex use cases, N_s, N_A, N_C based on the number of transactions as per table below.

- The number of transactions can be computed by counting the number of steps in the scenario

Use Case Classification	Type of Actor	Weight
Simple	1 to 3 transactions	5
Average	4 to 7 transactions	10
Complex	8 or more transactions	15

$$UUCW = N_s \times 5 + N_A \times 10 + N_c \times 15$$



USE CASE POINTS

2. Compute Unadjusted Actor Weight (UAW)

Count the number of simple average, complex actors, N_s, N_A, N_C as per table below.

Actor Classification	Type of Actor	Weight
Simple	External system interacting using a well defined API	1
Average	External system interacting using a standard protocol (e.g. TCP/IP, FTP, HTTP)	2
Complex	Human actor using a GUI	3

$$UAW = N_s \times 1 + N_A \times 2 + N_c \times 3$$



3. Compute Technical Complexity Factor (TCF)

Factor	Description	Weight
T1	Distributed system	2.0
T2	Response time	1.0
T3	End-user efficiency	1.0
T4	Internal processing complexity	1.0
T5	Code reusability	1.0
T6	Easy to install	0.5
T7	Easy to use	0.5
T8	Portability to other platforms	2.0
T9	System maintenance	1.0
T10	Concurrent/parallel processing	1.0
T11	Security features	1.0
T12	Access for third parties	1.0
T13	End user training	1.0

Score each factor between 0 – 5

- 0 - **irrelevant**
- 5 - **essential**

$$TF = \sum_{i=1}^{13} S_i \times W_i$$

S_i - Score for the i -th factor
 W_i - Weight of the i -th factor

$$TCF = 0.6 + TF/100$$



3. Compute Technical Complexity Factor (TCF)

Factor	Description	Weight	Score
T1	Distributed system	2.0	0
T2	Response time	1.0	5
T3	End-user efficiency	1.0	4
T4	Internal processing complexity	1.0	3.0
T5	Code reusability	1.0	0
T6	Easy to install	0.5	1
T7	Easy to use	0.5	2
T8	Portability to other platforms	2.0	1
T9	System maintenance	1.0	3
T10	Concurrent/parallel processing	1.0	4
T11	Security features	1.0	5
T12	Access for third parties	1.0	1
T13	End user training	1.0	3

Score each factor between 0 – 5

- 0 - irrelevant
- 5 - essential

$$TF = \sum_{i=1}^{13} S_i \times W_i$$

S_i - Score for the i -th factor
 W_i - Weight of the i -th factor

$$TCF = 0.6 + TF/100$$



4. Compute Environmental Complexity Factor (ECF)

Factor	Description	Weight
E1	Familiarity with development process used	1.5
E2	Application experience	0.5
E3	Object-oriented experience of team	1.0
E4	Lead analyst capability	0.5
E5	Motivation of the team	1.0
E6	Stability of requirements	2.0
E7	Part-time staff	-1.0
E8	Difficult programming language	-1.0

Score each factor between 0 – 5

- 0 - **irrelevant**
- 5 - **essential**

$$EF = \sum_{i=1}^8 S_i \times W_i$$

S_i - Score for the i -th factor
 W_i - Weight of the i -th factor

$$ECF = 1.4 + (-.03 * EF)$$



UCP = UUCW + UAW

5. Compute the final size estimate

$$UCP = (UUCW + UAW) \times TCF \times ECF$$



- **Advantages of Use Case Points**

- UCPs are based on use cases and can be measured very early in the project life cycle
- UCP based estimates are found to be close to actuals when estimation is performed by experienced people
- UCPs are easy to use and do not call for additional analysis
- Use cases are being used vastly as a method of choice to describe requirements



- **Disadvantages of Use Case Points**
 - UCP can be used only when requirements are written in the form of use cases
 - Dependant on goal-orientated, well written use cases
 - Technical and environmental factors have a high impact on UCP
 - Not as well established as FPs



Lecture Break

BREAK

Please return promptly as the

Lecture will re-start in *5 mins*

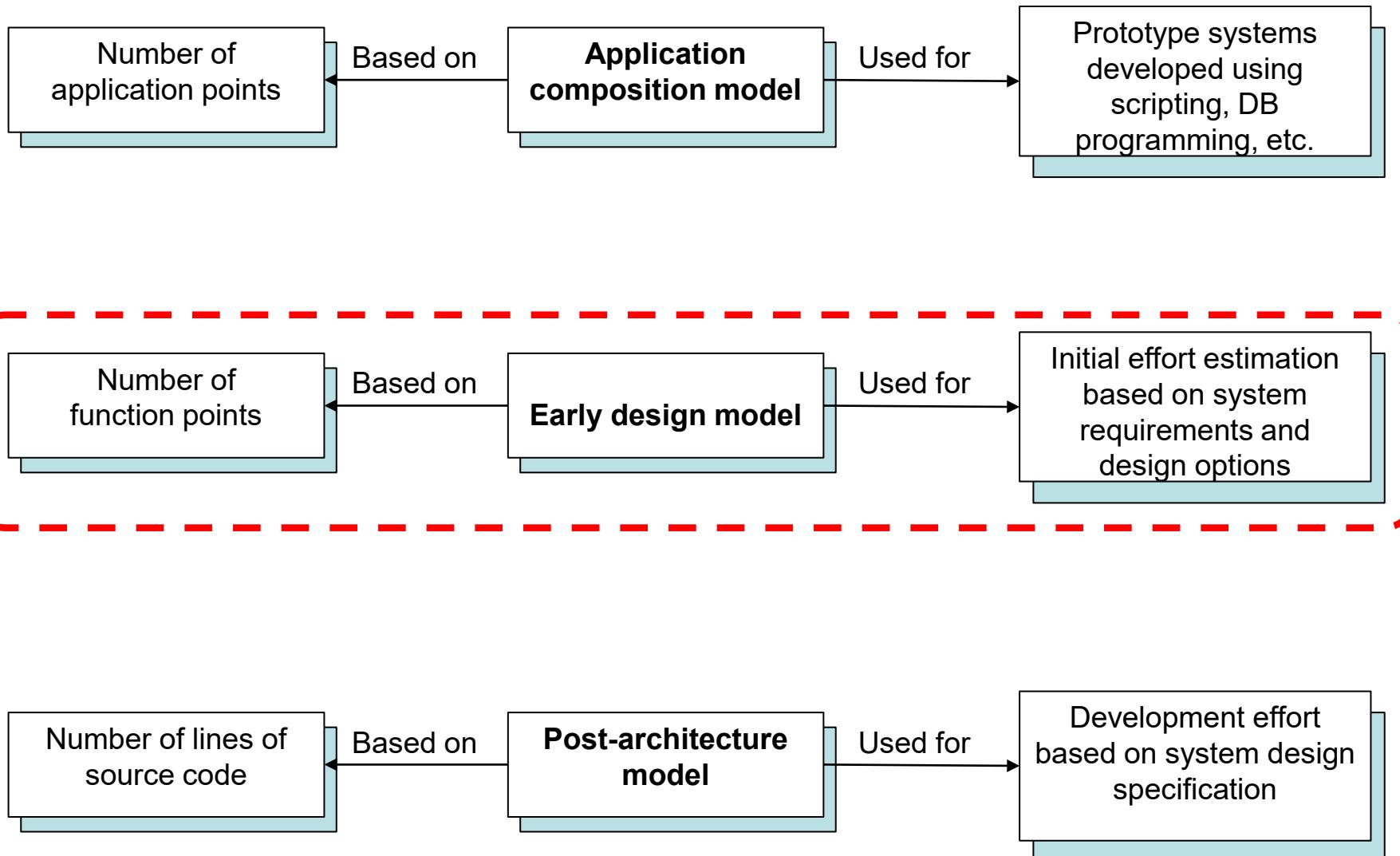


1. Understand the importance of cost estimation and the challenges involved
2. Understand the techniques used for cost estimation
3. Understand software size estimation techniques
4. Understand the principles of the COCOMO II model for algorithmic cost estimation



QUESTION

- Derived from collecting data from a large number of software projects and deriving formulae that best fits the observations
 - *an empirical model*
- It has been widely used and evaluated in a range of organizations
- Well documented, available in the public domain and is well supported by tools
- It has been in use for a long time:
 - first proposed in 1982 (Boehm_1981)
 - most recent version, COCOMO II was published in 2000 (Boehm_2000)





$$\text{Effort} = A \times \text{Size}^B \times M$$

A - a constant factor that depends on the organizational practices

Size - size of the software estimated in a metric of choice

B - a value between 1 and 1.5 derived experimentally

M - a multiplier made by combining process, product and development attributes such as stability of requirement, experience of team

Effort - total effort measured in person-months

In the COCOMO II early design model:

Parameter	Value	Notes
A	2.94	Estimated empirically
Size	KSLOC (thousands of lines of code)	Computed from FPs
B	1.01 – 1.26	Explained later
M	Computed based on project and process characteristic	Explained later



Software Engineering

COCOMO II: Estimating *Size* in KSLOC ($Effort = A \times Size^B \times M$)

- Size is estimated based on logical lines of code
- Can be estimated based on FPs using the table below

Language	Average	Median	Low	High
Ada	154	-	104	205
Assembler	209	203	91	320
C	148	107	22	704
C++	59	53	20	178
C#	58	59	51	66
Fortran	90	118	35	-
Java	55	53	9	214
Perl	57	57	45	60
Visual Basic	50	52	14	276

Number of logical lines of code per FP

e.g. 200 FPs: in C = $29.6 \text{ (} 200 \times 148 / 1000 \text{)} \text{ KSLOC}$; in Java = $11 \text{ (} 200 \times 55 / 1000 \text{)} \text{ KSLOC}$
(per 1000 lines of code)

COCOMO II: Estimating parameter B ($Effort = A \times Size^B \times M$)

$$B = 1.01 + .01 \sum_{i=1}^5 W_i$$

W_i - a scaling factor value ranging from 0-5 as per table below.

Precedentedness	Familiarity of the application domain: 0 (thoroughly familiar) to 5 (completely unprecedented).
Development flexibility	The level of flexibility in development process, methods, and tools, ranging from 0 (general goals) to 5 (rigorous).
Architecture completed and risks eliminated	20%: 5; 40%: 4; 60%: 3; 80%: 2; 90%: 1; 100%: 0
Team cohesion	The level of interaction within the team. Ranging from 0 (seamless interactions) to 5 (very difficult interactions).
Process maturity	A ranking use the Software Engineering Institute's Capability Maturity Model, ranging from 0 (chaotic, following no processes) to 5 (actively measuring and optimising processes) (Quality Management)



COCOMO II: Estimating M ($Effort = A \times Size^B \times M$)

- the cost drivers consist of seven different factors
- each factor is rated on a six point scale; *very low* to *extra high*

$$M = RCPX \times RUSE \times PDIF \times PREX \times PERS \times SCED \times FCIL$$



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RCPX	The expected complexity of the internal processes, and the level of reliability required for the system.
RUSE	The level of reuse that this code developed in this system is expected to offer to future systems.
PDIF	The level of platform difficulty. This refers to the constraints placed on the system by the platform on which it runs, such as the amount of processor time and storage available.
PREX	The experience of the personnel on the project. Ranging from less than 2 months (very low) to more than 6 years (very high).
PERS	The capability of the personnel on the project. Ranging from the 15th percentile (very low) to the 90 percentile (very high).
SCED	The constraints placed upon the project schedule, rated as a percentage of the “stretch-out” of the schedule. Schedules that are highly compressed (not stretched-out), require more effort than the optimal to complete the project on time. A rating of very low is a schedule that is 75% the length of the nominal project. A rating of very high is a project schedule that is 160%+ of the nominal. Empirical evidence suggests that compressing the schedule, and therefore expending less effort, results in lower quality software.
FCIL	The team support facilities.



Cost Driver	Rating					
	Very Low	Low	Nominal	High	Very High	Extra High
RCPX	0.75	0.88	1.00	1.15	1.30	1.66
RUSE		0.91	1.00	1.14	1.29	1.49
PDIF		0.87	1.00	1.11	1.27	1.62
PREX	1.23	1.11	1.00	0.89	0.82	
PERS	1.37	1.16	1.00	0.87	0.75	
SCED	1.29	1.10	1.00	1.00	1.00	1.00
FCIL	1.24	1.11	1.00	0.89	0.79	0.78

Cost driver ratings for the COCOMO II early-design phase model.



COCOMO II: Estimating Effort

- Based on the computed parameter values the effort can be estimated:

$$Effort = A \times Size^B \times M$$

COCOMO II: Estimating Time (T) and Number of Personnel (N)

- Formula for estimating the nominal delivery time:

$$T = 2.5 \times Effort^{(0.33+0.2(B-1.01))}$$

$$N = \frac{Effort}{T}$$



SWEN90016

1. Understand the importance of cost estimation and the challenges involved
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4. Understand the principles of the COCOMO II model for algorithmic cost estimation
5. Understand cost estimation techniques used in Agile software development lifecycles



Two key concepts that are used to effort estimation:

Story points: a story point is a relative measure of the size of a user story (recall that the requirements of the system are documented using user stories)

Velocity: velocity is a measure of productivity of team, which is represented by the number of story points delivered in a specified time period



1. Develop user stories for the system.
2. Estimate the number of story points for each story, basing the estimate on the number of story points from previous stories, using a chosen technique (discussed later).
3. Use the team's velocity from previous experience to estimate the delivery time of the project - in the case of fixed-scope release planning develop a release burn-down chart.
4. During development, measure the actual velocity of the team.
5. Using this velocity, re-estimate the time it will take to deliver the product.



- **Estimate by analogy**
 - There are no units for story points, always base our measures on other stories. If story A is about the same size as story B, they should have the same number of story points.
- **Decompose a story**
 - By decomposing a story into the tasks that are required to complete the story, we can find measures that we know about the tasks, and combine them to provide a total measure.
- **Use the right units**
 - The relative units should not be too fine grained. A pattern-based scale is used. For example, measures can only be 1, 2, 4, 8, or 12 or numbers in the Fibonacci sequence.
- **Use group-based estimations**
 - For a story that is to be implemented by a team, the whole team should provide estimates. Techniques such as the Delphi method or its adaptations can be used to reach consensus.



- Agile Estimation Techniques:

- Planning Poker
- Bucket System
- Relative Mass Valuation
- T-Shirt Sizes
- Affinity Estimation
- Dot Voting



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1. Customer reads story.



Development team asks questions

2. Team estimates.
This includes testing.



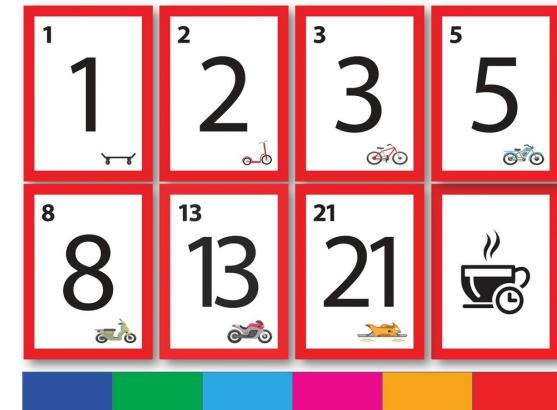
Discussion ...



3. Team discusses.



4. Team estimates again.
Repeat until consensus reached.



<https://www.sitepoint.com/3-powerful-estimation-techniques-for-agile-teams/>



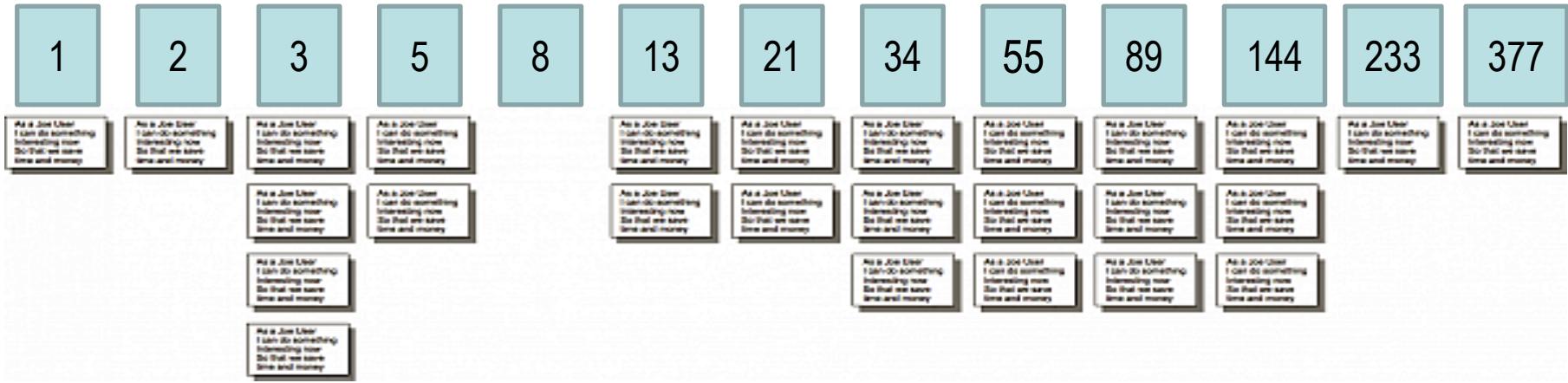
Agile Estimation



<http://www.agileadvice.com/2013/07/30/referenceinformation/agile-estimation-with-the-bucket-system/>



BUCKET SYSTEM



- The team sitting at a table picks a user story card randomly and places it in bucket 8
- The next few cards are randomly picked one at a time, discussed agreed on, and placed in a bucket relative to the previous ones
- Then each person is allocated a set of cards and they are placed in a appropriate bucket, based on individual judgement (Divide and conquer)
- Finally the team reviews the placements and reach agreement



WILLIAM MORRIS

1. Set up a large table so the stories can be moved around easily relative to each other.
2. Pick any story to start, team estimates whether they think that it is relatively: Large, Medium, Small.
3. Large story one end on the table. Medium story in the middle and Small story the other end
4. Continue through steps 2 & 3
5. The next step is to assign points values based on the position of the stories on the table. Start with the easiest story that is worth assigning points to, and call it a 1.
6. Then move up the list of cards, assigning a value of 1 to every story until you get to one that seems at least twice as difficult as the first one. That story gets a 2.

<http://www.flowless.eu/relative-mass-valuation/>



$$V = \frac{SP}{T_i}$$

V - velocity

SP - number of story points completed

T_i - time period over which they were completed

Common methods for measuring velocity:

- Using historical data
- Using data from previous iterations



$$T = \frac{\sum_{i=1}^n SP_i}{V}$$

T - estimate delivery time

V - velocity

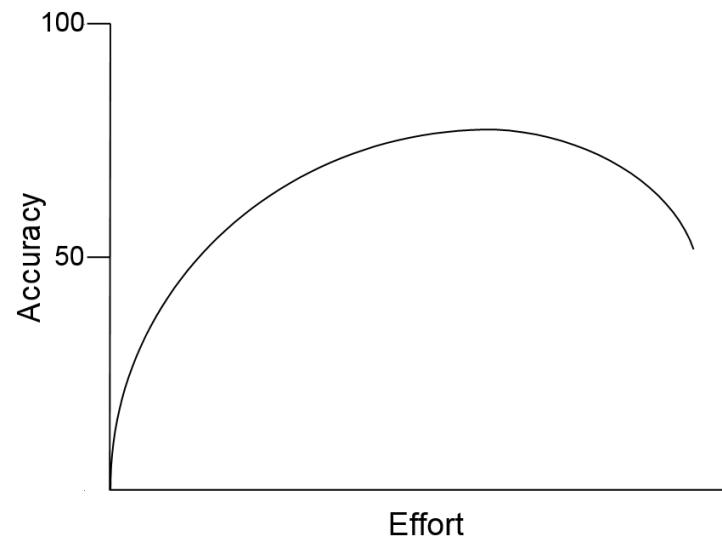
SP_i - number of story points in the i -th user story

n - total number of user stories



Final comments

- Allow enough time to do a proper project estimate - rushed estimates are inaccurate, high-risk estimates
- There is diminishing return on time spent estimating



- Agile teams choose to be closer to the left
- Know that you cannot eliminate uncertainty from estimates but small efforts are rewarded with big gains



1. Understand the importance of cost estimation and the challenges involved
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5. Understand cost estimation techniques used in Agile software development lifecycles

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cont...



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4. A Review of Surveys on Software Effort Estimation
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Function points (in depth example)

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- Is used to express the *amount of functionality* in a software system, as seen by the user
- A *higher number of function points* indicates *more functionality*
 - Empirical evidence demonstrates that there is a *positive correlation between function points and the complexity of the system*
- Typically used to:
 - Estimate the cost and effort required to design, code and test a software system
 - Predict the number of errors
 - Predict the number of components
 - Measure productivity
- Function points are computed from the *Software Requirements Specification (SRS)*

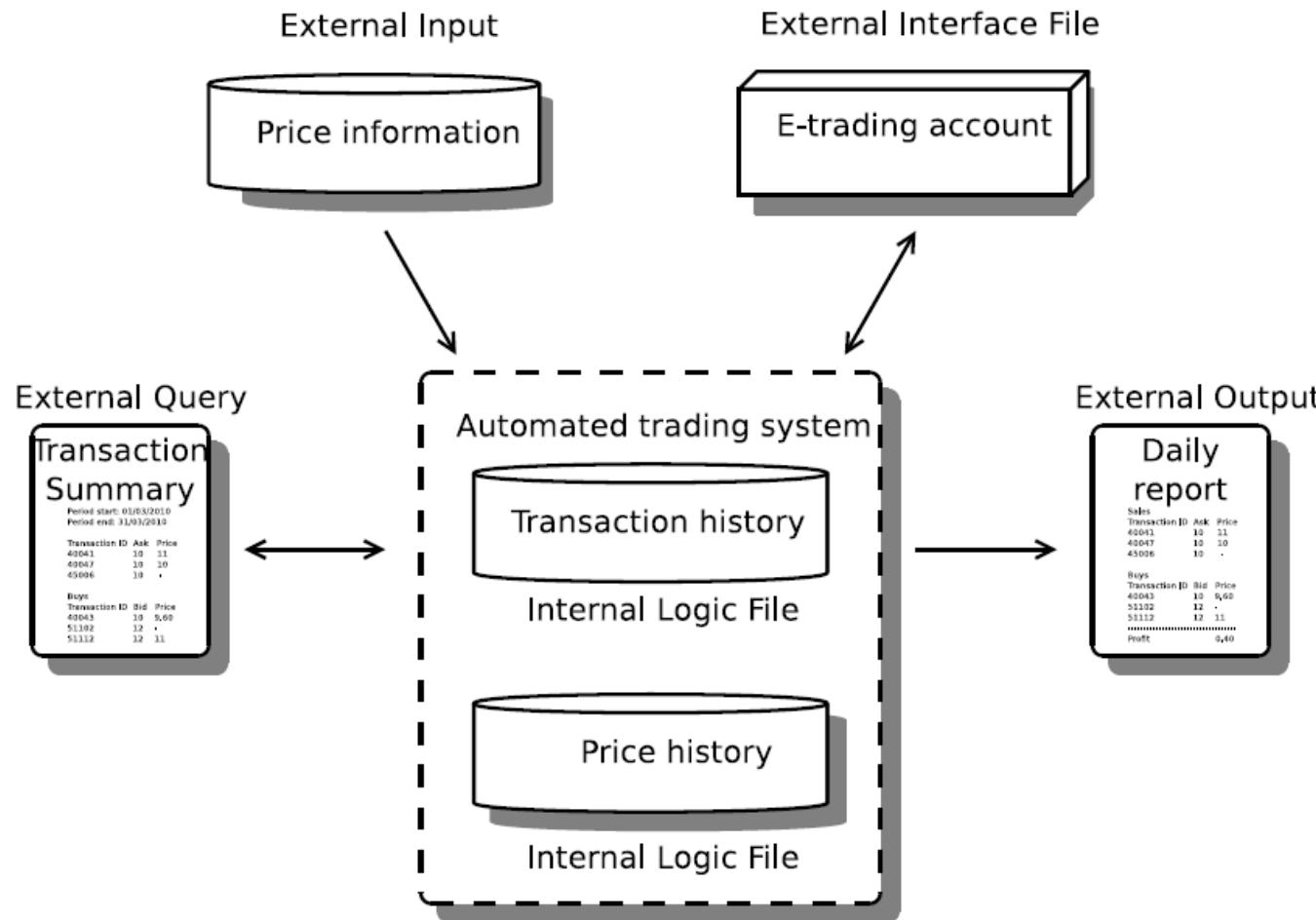


- **Software Requirements Specification (SRS)**
 - A document that specifies what is expected of a software system; referred to as the requirements of the system
 - It contains:
 - Functional Requirements:
 - Specify the functions that are required in the system
 - Non-functional Requirements:
 - Specify requirements that are not directly functions, such as performance, reliability, scalability etc. (quality requirements)



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Automated Trading System





MELBOURNE

Automated Trading System: Functional Requirements

R.1	Read the previous day's trading information (high price, low price, opening price, closing price) from a third-party-server.
R.2	Save a complete “price history” in a database.
R.3	Based on the trends in prices for commodities, decide which commodities to bid for, and which to try to sell.
R.4	Send information to an external e-trading account which places the bid/ask for each commodity.
R.5	When the bid/ask is either accepted or expires, record the result in a “transaction history” database.
R.6	At the end of the day, produce a report that summarizes the transactions of the day along with the following information: profit/loss for the day; number of trades of each commodity; average market price of all commodities; account summary.
R.7	At anytime the user can request a transaction history for a period which gives: transaction IDs; commodity type; bid/ask; price.



Software Process

1. Categorize requirements



2. Estimate a *complexity value* for each category or function



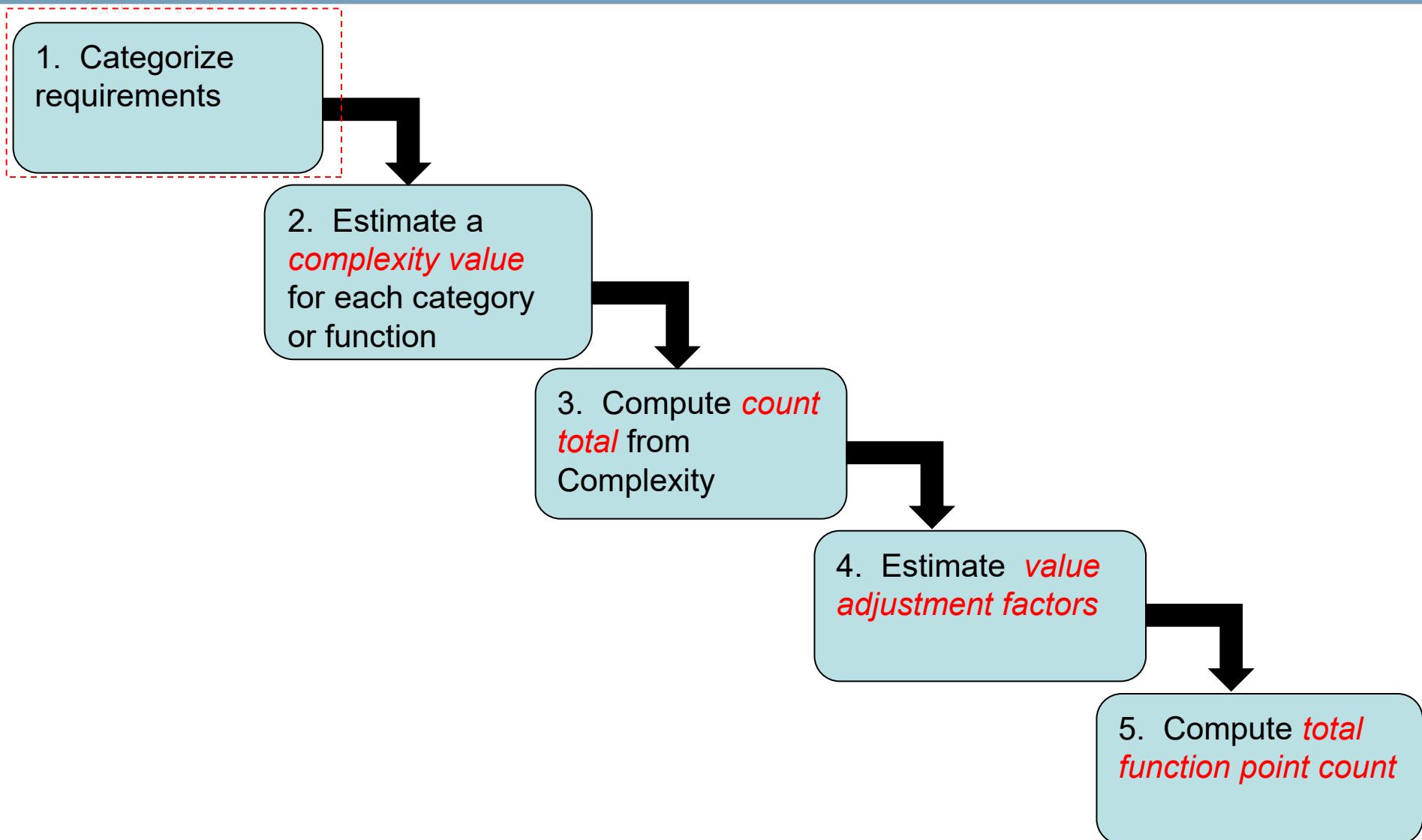
3. Compute *count total* from Complexity



4. Estimate *value adjustment factors*



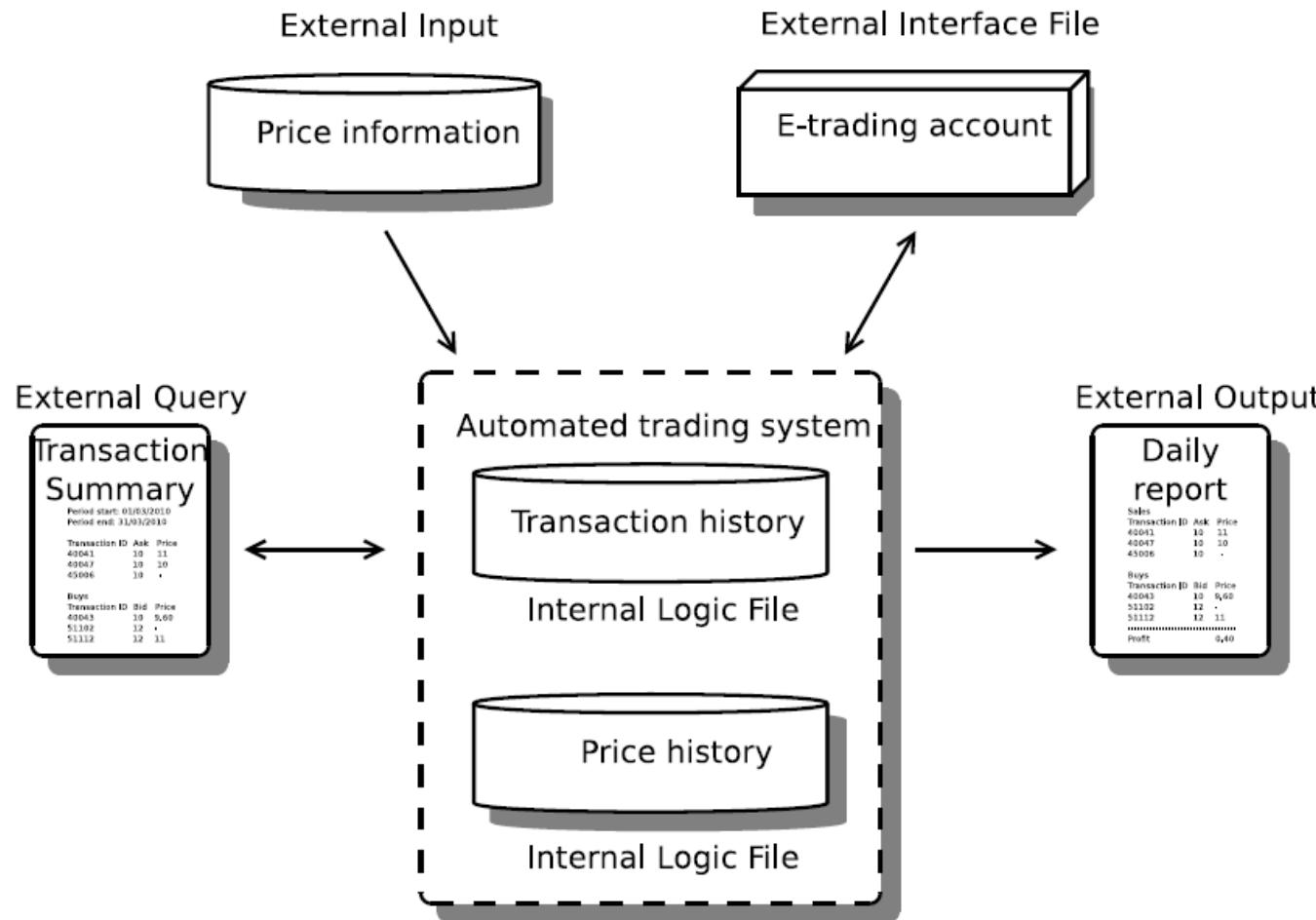
5. Compute *total function point count*

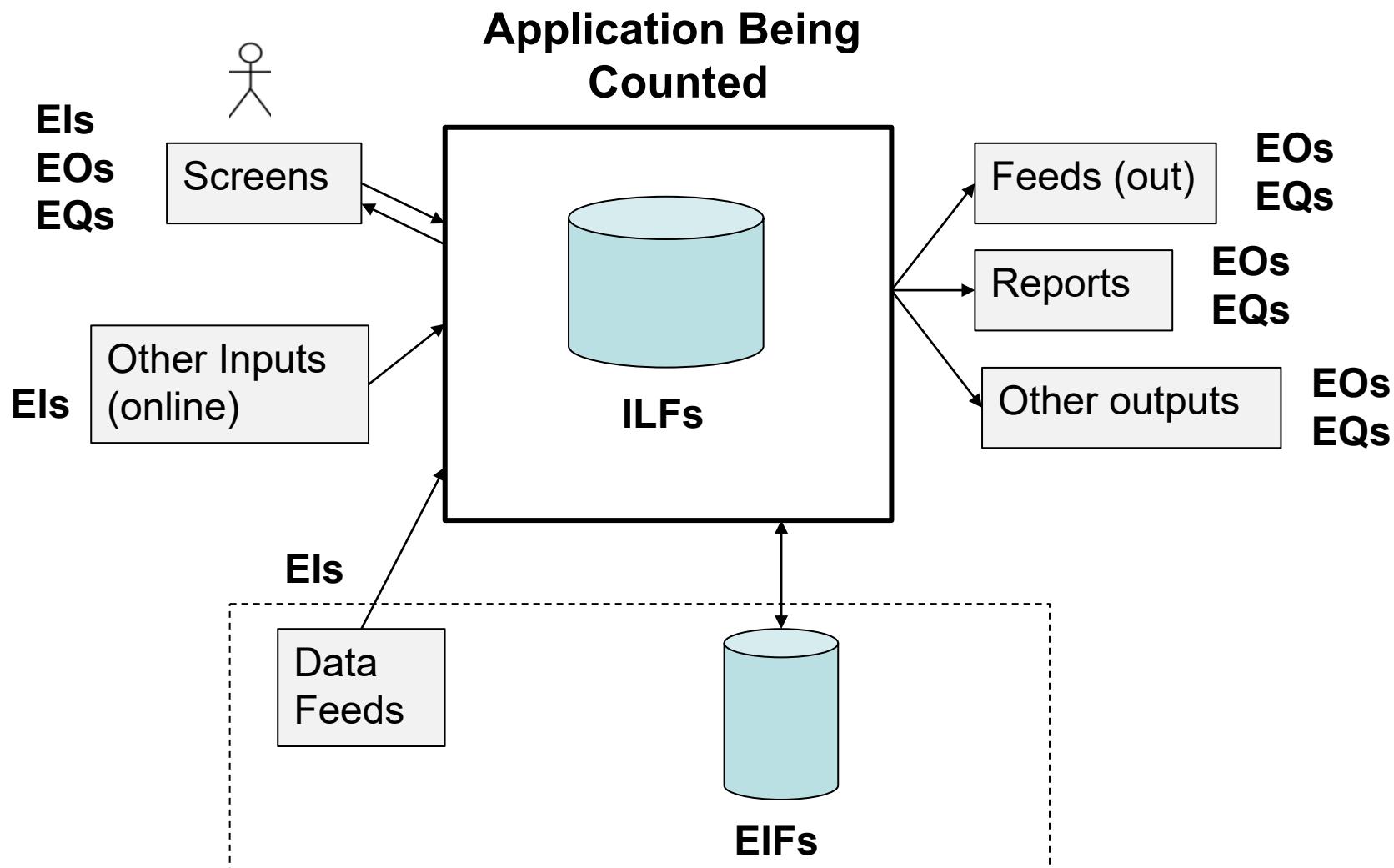




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Automated Trading System

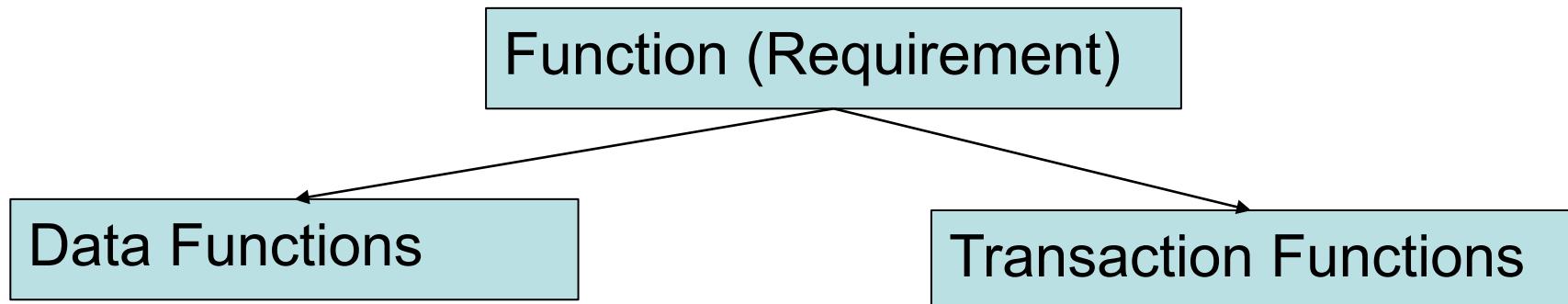






WEEK 10: FP

1. Categorize Requirements



Data Functions:

- Concerned with maintenance of the data for the application –
Internal Logical Files (ILF), External Interface Files (EIF)

Transaction Functions:

- Concerned with information being passes to and from the system -
External Inputs (EI), External Output (EO), External Inquiries/Queries (EQ)

1. Categorize Requirements (five categories)

Data Functions

- **Internal Logical File (ILF)**
 - A logical grouping of data that the system maintains over a period of time, and is modified using external inputs
 - examples - tables in a relational database, files containing user setting
- **External Interface File (EIF)**
 - A logical grouping of data that is maintained external to the system, but which may be used by the system.
 - examples - are the same as ILFs, except that the data is maintained outside the system, such as data hosted on a third-party servers, or data structures holding information about system state



WILLIAM DUNN

Transaction Functions

– External Input (EI)

- An input to the system from a user or another application, which is used to control the flow of the system, or provide data. External inputs generally modify internal logic files

examples - data fields populated by users, inputs files (e.g. program source code to a compiler), and file feeds from an external application.

– External outputs (EO)

- An output to the user that provides information about the state of the system

examples - screens, error messages, and reports that are shown to the user. Individual data fields in these are grouped as one external output

– External Inquiries/Queries (EQ)

- the input is not used to update an internal logic file, but is used to query the internal logic file and provide an output; the output is retrieved directly, with no derived data included
 - examples - reading a user setting, or reading a record from a database table



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Automated Trading System: Function Categories

R.1	Read the previous day's trading information (high price, low price, opening price, closing price) from a third-party-server.	EI
R.2	Save a complete "price history" in a database.	ILF
R.3	Based on the trends in prices for commodities, decide which commodities to bid for, and which to try to sell.	
R.4	Send information to an external e-trading account which places the bid/ask for each commodity.	EIF
R.5	When the bid/ask is either accepted or expires, record the result in a "transaction history" database.	ILF
R.6	At the end of the day, produce a report that summaries the transactions of the day along with the following information: profit/loss for the day; number of trades of each commodity; average market price of all commodities; account summary.	EO
R.7	At anytime the user can request a transaction history for a period which gives: transaction IDs; commodity type; bid/ask; price.	EQ



Software Engineering

1. Categorize requirements



2. Estimate a *complexity value* for each category or function



3. Compute *count total* from Complexity



4. Estimate *value adjustment factors*



5. Compute *total function point count*



WILLIAM DUNN

2. Estimate a *complexity value* for each category or function

- Complexity is ranked either ***simple, average or complex***
- Normally ***assigned for a category*** rather than for each requirement – rather crude
- A technique commonly used is based on Data Element Types (DETs), Record Element Types (RETs), and File Type References (FTRs):

Data Element Types (DETs)	A unique, user-recognizable, non-repeated data field in a system
Record Element Types (RETs)	A user-recognizable subgroup of data elements in an ILF or EIF
File Type References (FTRs)	A file (ILF, EIF) referenced by a transaction



Relationship between DETs, RETs, FTRs, and the function categories

Function	DETs	RETs	FTRs
Internal Logical Files (ILFs)	x	x	
External Interface Files (EIFs)	x	x	
External Inputs (EIs)	x		x
External Outputs (EOs)	x		x
External Inquiries (EQs)	x		x

Complexity table for Data Functions

	DETs		
RETs	1-19	20-50	51+
1	Simple	Simple	Average
2-5	Simple	Average	Complex
6+	Average	Complex	Complex

Complexity table for Transaction Functions

	DETs		
FTRs	1-5	6-19	20+
1	Simple	Simple	Average
2-3	Simple	Average	Complex
4+	Average	Complex	Complex



MELBOURNE

Automated Trading System: Function Categories

R.1	Read the previous day's trading information (high price, low price, opening price, closing price) from a third-party-server.	EI
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R.7	At anytime the user can request a transaction history for a period which gives: transaction IDs; commodity type; bid/ask; price.	EQ



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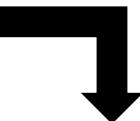
Automated Trading System: Function Categories

			DETs	RETs	FTRs	Complexity
R.1	EI	high price, low price, opening price, closing price, date	5		1	Simple
R.2	ILF	commodity name, high price, low price, opening price, closing price, date	6	1		Simple
R.3						
R.4	EIF	Commodity, bid/asking price, buy/sell	3	1		Simple
R.5	ILF	...	4	1		Simple
R.6	EO	...	5		3	Simple
R.7	EQ	...	4		2	Simple

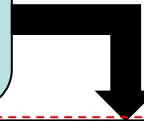


Software Engineering

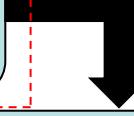
1. Categorize requirements



2. Estimate a *complexity value* for each category or function



3. Compute *count total* from Complexity



4. Estimate *value adjustment factors*



5. Compute *total function point count*



3. Compute **count total** from Complexity

- Using count and complexity estimates compute total count

Information Domain Value	Count	Weighting Factor			=	
		Simple	Average	Complex		
Internal Logical Files (ILFs)	<input type="text"/>	×	7	10	15	<input type="text"/>
External Interface Files (EIFs)	<input type="text"/>	×	5	7	10	<input type="text"/>
External Inputs (EIs)	<input type="text"/>	×	3	4	6	<input type="text"/>
External Outputs (EOs)	<input type="text"/>	×	4	5	7	<input type="text"/>
External Inquiries (EQs)	<input type="text"/>	×	3	4	6	<input type="text"/>
Count total						<input type="text"/>



WILLIAM DURRANT

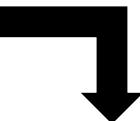
Automated Trading System: Computing Count Total

Information Domain Value	Count	Weighting Factor			=	14
		Simple	Average	Complex		
Internal Logical Files (ILFs)	2	×	7	10	15	= 14
External Interface Files (EIFs)	1	×	5	7	10	= 5
External Inputs (EIs)	1	×	3	4	6	= 3
External Outputs (EOs)	1	×	4	5	7	= 4
External Inquiries (EQs)	1	×	3	4	6	= 3
Count total					29	



Software Engineering

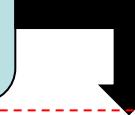
1. Categorize requirements



2. Estimate a *complexity value* for each category or function



3. Compute *count total* from Complexity



4. Estimate *value adjustment factors*



5. Compute *total function point count*



4. Compute value adjustment factors

- is computed based on 14 characteristics
- each of the characteristics is ranked on a scale of 0-5;
0 not important and 5 critical

- Data Communications
- Distributed Data Processing
- Performance
- Heavily Used Configuration
- Transaction Rate
- Online Data Entry
- End-User Efficiency

- Online Update
- Complex Processing
- Reusability
- Installation Ease
- Operational Ease
- Multiple Sites
- Facilitate Change



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Automated Trading System: Value Adjustment Factors

- Data Communications - 2
- Distributed Data Processing - 4
- Performance - 5
- Heavily Used Configuration - 2
- Transaction Rate - 4
- Online Data Entry - 2
- End-User Efficiency - 5

- Online Update - 2
- Complex Processing - 2
- Reusability - 2
- Installation Ease - 2
- Operational Ease - 2
- Multiple Sites - 2
- Facilitate Change - 2

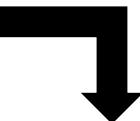
Assume the rating for all other features is 2

$$\text{Value Adjustment} = 2*5 + 4*2 + 10*2 = 38$$



Software Engineering

1. Categorize requirements



2. Estimate a *complexity value* for each category or function



3. Compute *count total* from Complexity



4. Estimate *value adjustment factors*



5. Compute *total function point count*



WILLIAM DUNN

5. Compute *total function point*

- Count total and value adjustment factors are then plugged-in to the following formula to estimate the total point count

$$FP = \text{count total} \times (0.65 + 0.01 \times \sum_{i=1}^{14} F_i)$$

F_i - VAF corresponding to the i -th VAF question



Automated Trading System: Compute total function point count

$$FP = \text{count total} \times (0.65 + 0.01 \times \sum_{i=1}^{14} F_i)$$

$$\begin{aligned} FP &= 29 \times (0.65 + 0.01 \times 38) \\ &= 29 \times 1.03 \\ &= 29.87 \end{aligned}$$

More information and examples of FPs can be found at
<https://alvinalexander.com/FunctionPoints/FunctionPoints.shtml>



- **Advantages of Function Points**

- Measures the size of the solution instead of the size of the problem
- Requirements are the only thing needed for function points count
- Can be estimated early in analysis and design
- Is independent of technology
- Is independent of programming languages



- **Disadvantages of Function Points**

- A well defined requirements specification is necessary
- Gaining proficiency is not easy, the learning curve is quite long
- Could be quite time-consuming thus could be costly

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cont...



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SWEN90016
Software Processes & Project Management

Quality Management

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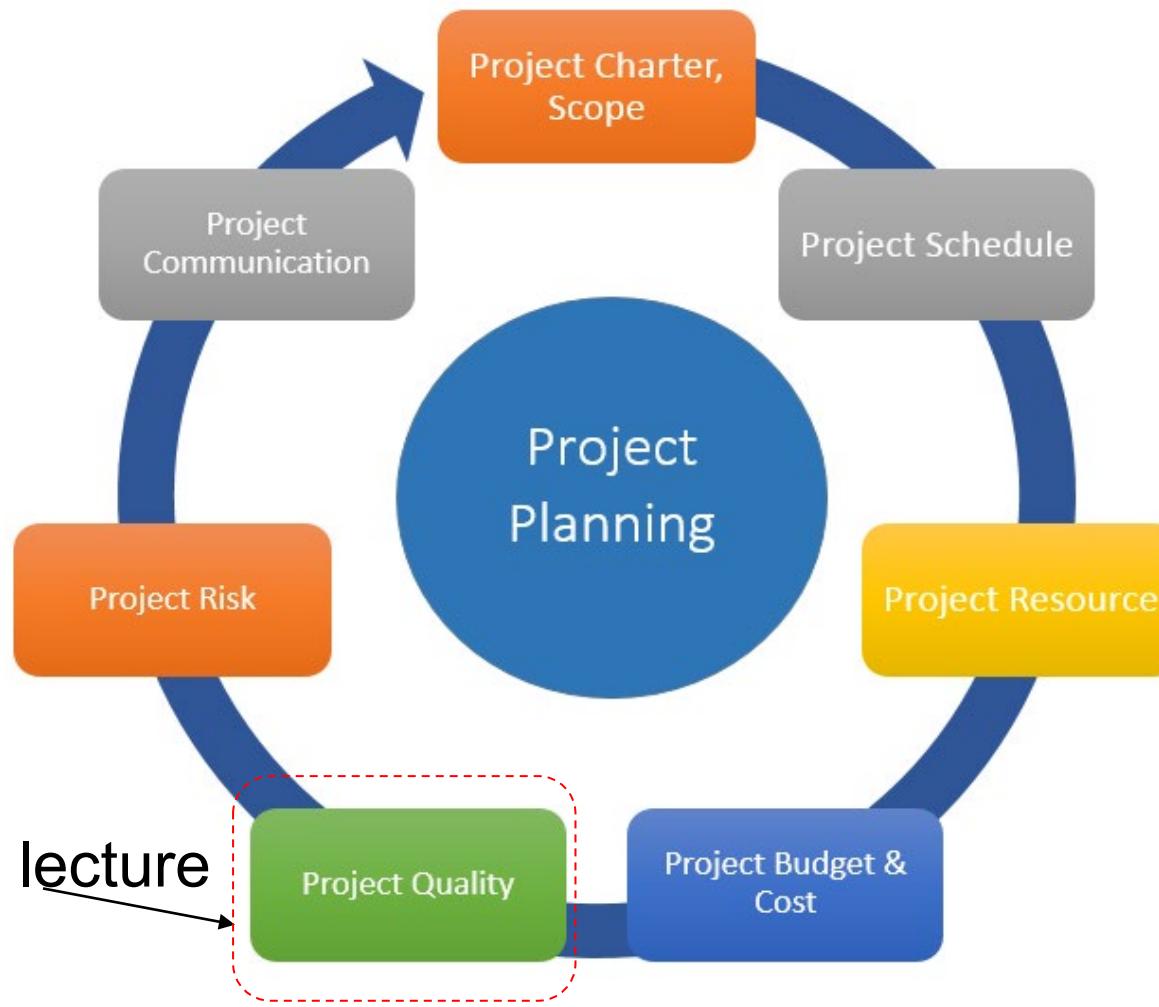
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2021 – Semester 1
Lecture 8



|



Quality Management

1. Understand the fundamentals of quality management
2. Understand the quality management process
3. Understand the following quality management activities:
 - Quality Assurance
 - Quality Planning
 - Quality Control and Monitoring



1. Understand the fundamentals of quality management
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Quality is not an act, it is a habit — Aristotle

- Evidence shows that we cannot simply fix up our software *post-hoc* and add in quality attributes after building the system
- Quality must be *built into the software from the beginning*
- In this topic you will learn how to built quality into the software through a range of *Quality Management* activities



- We define quality from two broad perspectives:
 - **End-user's Perspective:**

Typically, end-users judge the quality of a product by their interaction with it. For users, a system has quality if it is fit for purpose, is reliable, has reasonable performance, is easy to learn and use, and helps the users in achieving their goals. Sometimes, if the functionality is hard to learn but is extremely important and worth the trouble of learning, then users will still judge the system to have high quality. These are termed **external quality characteristics**, because they are typically associated with the external behaviour of the system.

- **Developer's Perspective:**

The developer's perspective typically also includes the number of faults that the system has, ease of modifying the system, ease of testing the system, the ease of understanding the system design, the re-usability of components, conformance to requirements, resource usage, and performance. These are mainly **internal quality characteristics**, because they are concerned with the quality of the internal structure of the system.



- Some claim:

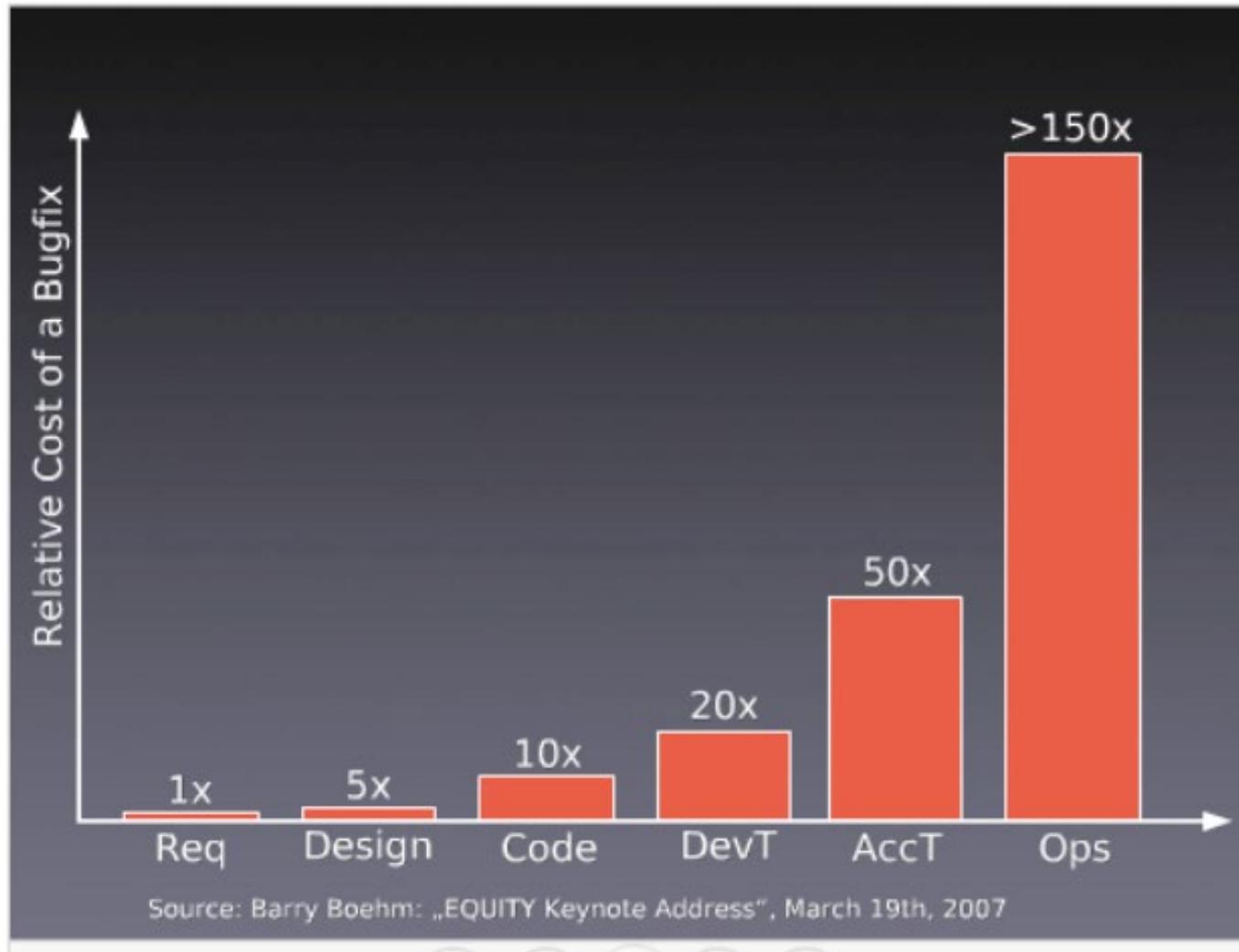
Most quality assurance activities are too costly - savings made from not using resources is greater than the cost incurred in fixing the faults

- For example, instead of performing formal reviews of requirements specification documents, it is far better to build the system, ask the client/user for feedback, and to correct any faults from there.
- Alternatively, one can simply release the system and correct faults as users report them.

- Empirical studies refute the above claim:
 - There are many studies in the area



Software Quality





Version 0.1

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THE UNIVERSITY OF MELBOURNE





1. Understand the fundamentals of quality management
2. Understand the quality management process
3. Understand the following quality management activities:
 - Quality Assurance
 - Quality Planning
 - Quality Control and Monitoring



1. ***Quality assurance:***

The establishment of a framework of organizational procedures and standards that lead to high-quality software

2. ***Quality planning:***

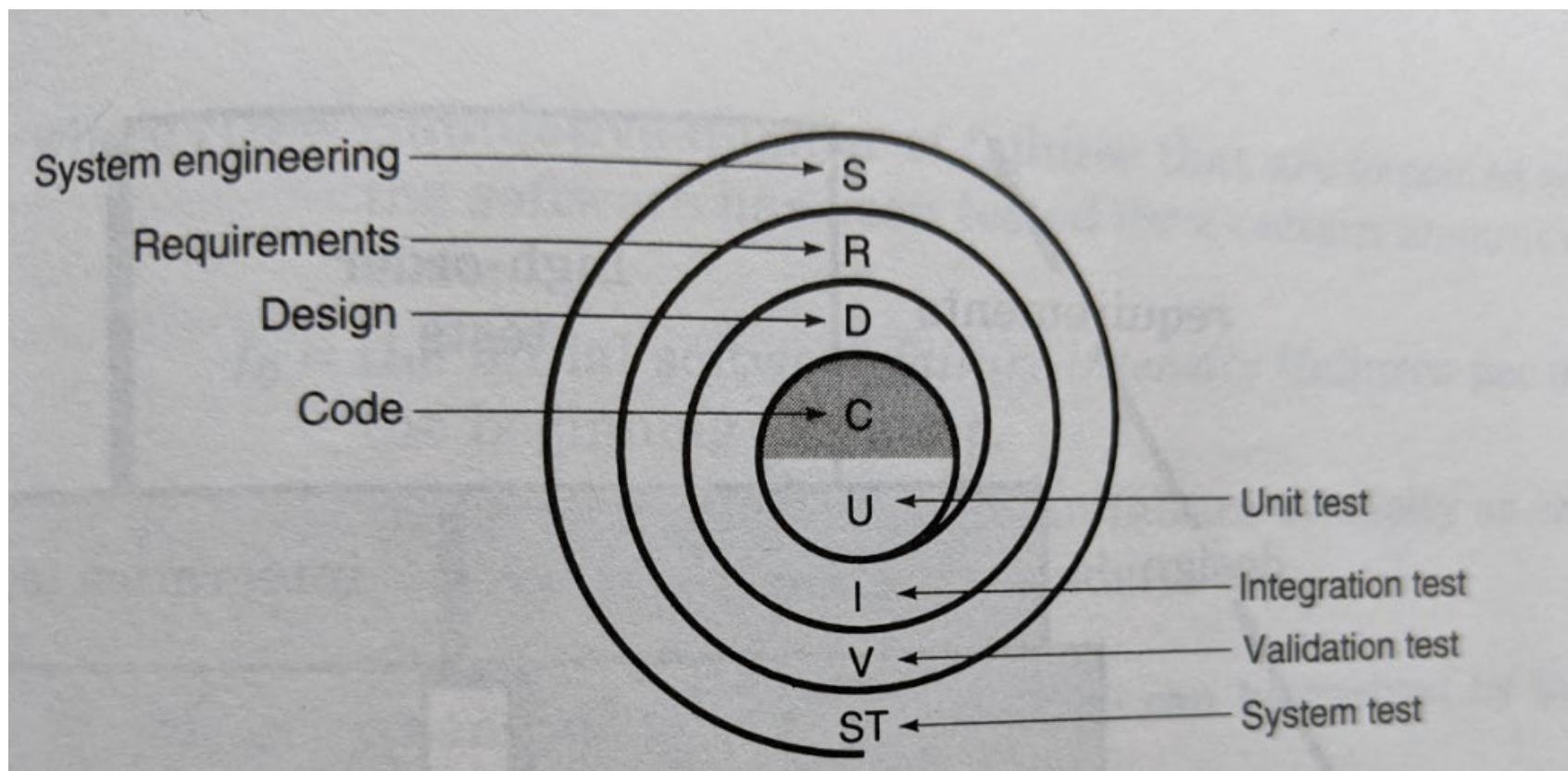
The selection of appropriate procedures and standards from the framework, adopted for the specific project

3. ***Quality control:***

Ensuring that the software development team has followed the project quality procedures and standards



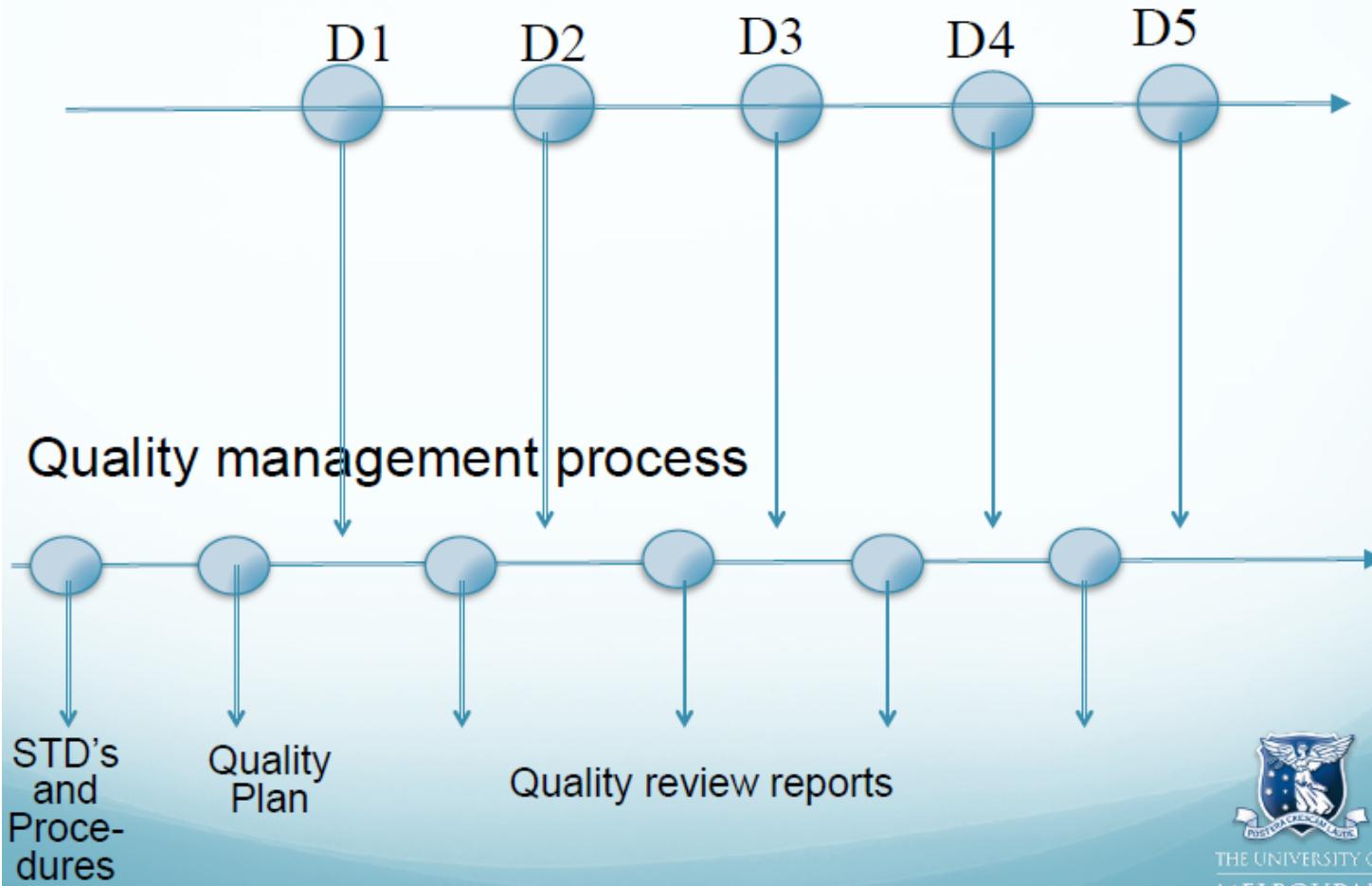
- Verification and Validation (V &V) are important aspects of quality assurance
- **Verification:**
 - Verification is an attempt to ensure that the product is built correctly, in the sense that the output products of an activity meet the specifications imposed on them in previous activities.
 - Verification normally involves two (sets of) artifacts: req. spec. vs design, design vs code; this is an internal developer activity.
 - Verification is ensuring you are *building the system right* (the right way).
- **Validation:**
 - Validation is an attempt to ensure that the right product is built—that is, the product fulfils its specific intended purpose.
 - Validation involves going back to the stakeholders to check if the product meets their requirements; this normally involves something/someone external.
 - Validation is ensuring that you are *building the right system* (to meet stakeholder needs).



[1] p421



SW development process





- Quality assurance process is primarily concerned with defining or selecting the *quality standards*
 - A standard might simply be defined as a *set of rules for ensuring quality*
 - Standards play an important role in the quality management process
- There are two types of standards:
 - Product standards:
 - These apply to the product being developed
 - Process standards:
 - These standards define the processes that should be followed during software development



Product Standards	Process Standards
Design review form template	Design review conduct
Requirements document structure	Design validation process
Documentation standards	Version release process
Coding standards to follow	Project plan approval process
Project plan format	Change control process
Change request form template	Test recording process

Product vs process standards



- Why are documentation standards important?
 - documents are the tangible manifestation of the software
- Documentation process standards
 - How documents should be developed, validated and maintained
- Document standards
 - Concerned with document identification, structure, presentation, changes highlighting, etc.
- Document interchange standards
 - How documents are stored and interchanged between different documentation systems
 - XML is an emerging standard for document interchange which will be widely supported in future



- Advantages of standards
 - Provide a framework around which the quality assurance process may be implemented
 - Provide encapsulation of best, or at least most appropriate, practice
 - Customers sometimes require a particular quality standard/level when choosing a software vendor
- Problems with standards
 - Not seen as relevant and up-to-date by software engineers
 - Involve too much bureaucratic form filling
 - Unsupported by software tools so tedious manual work is involved to maintain standards

Standards should not be avoided, but should be tailored as needed!



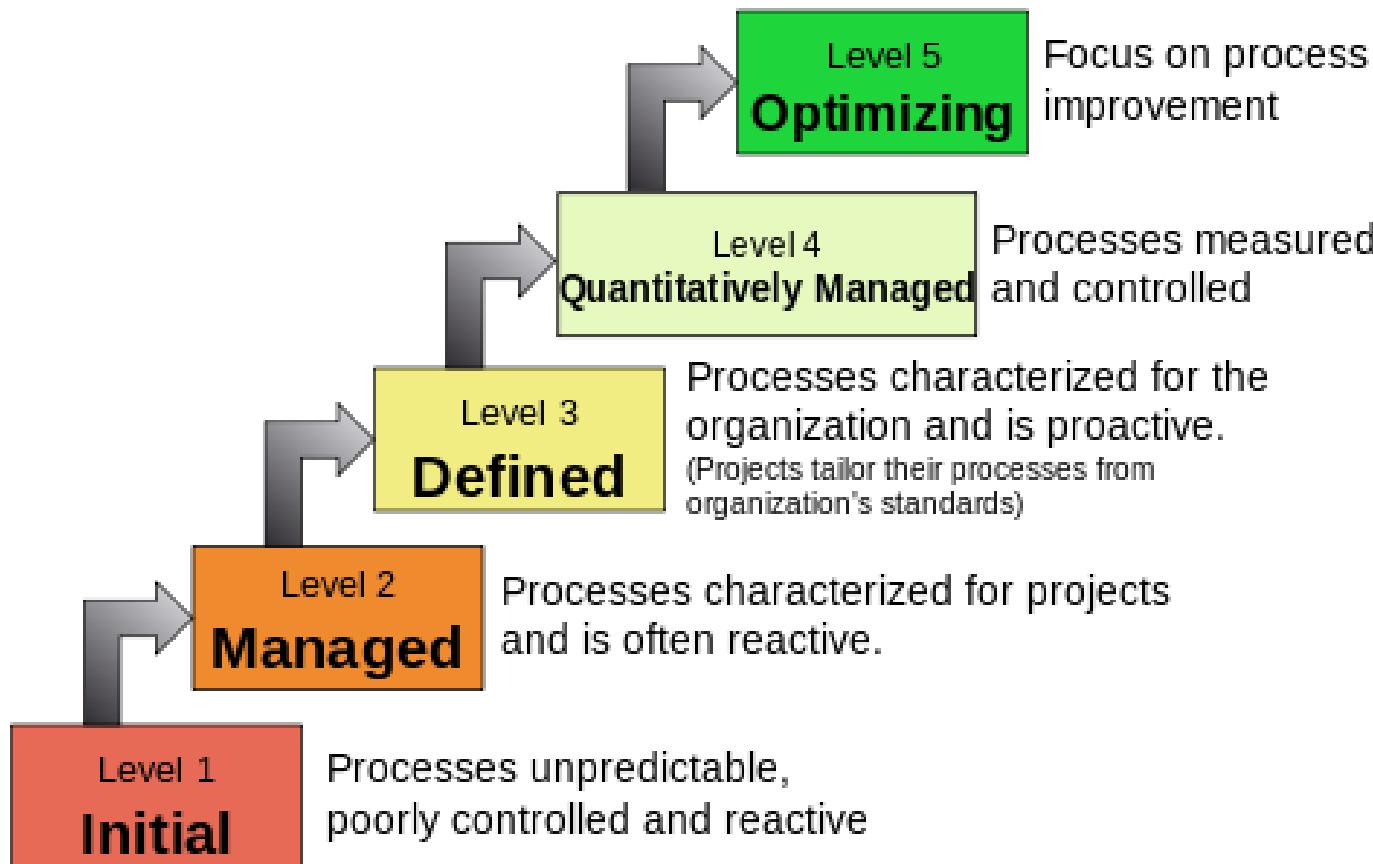
- Many standards and systems related to software quality exists today
- Some examples of software standards and systems
 - ISO 9000
 - Capability Maturity Model



- Developed by the Software Engineering Institute (SEI) at Carnegie Mellon University
- Describes the key elements of an effective software development process
- Describes an approach for software companies to move from an ad-hoc, immature process to a mature developed process
- Organizations are characterised being at a Level from 1-5 based on the processes they follow

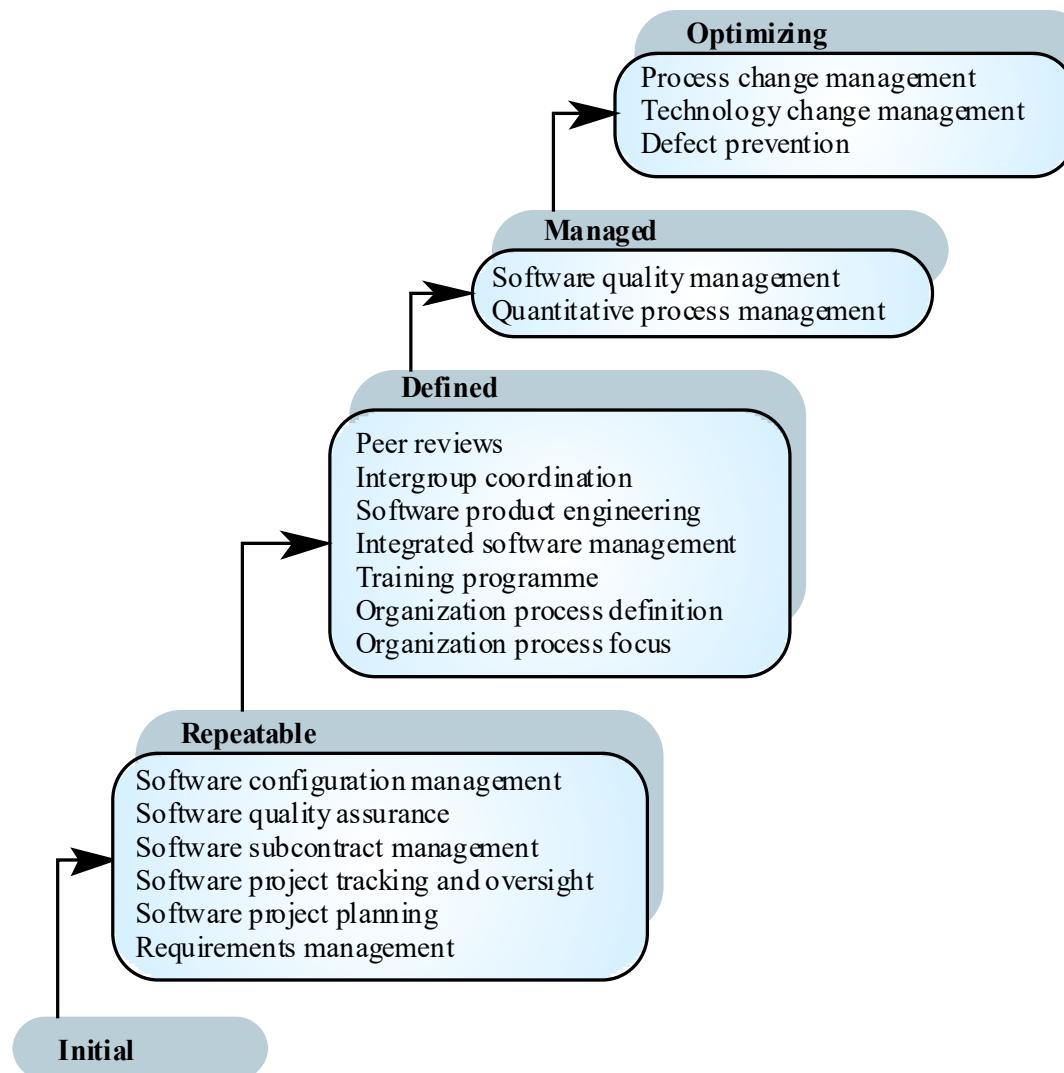


Characteristics of the Maturity levels





Version 1.0





Version 0.1 (2018)

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1. *Quality assurance:*

The establishment of a framework of organizational procedures and standards that lead to high-quality software

2. *Quality planning:*

The selection of appropriate procedures and standards from the framework, adopted for the specific project

3. *Quality control:*

Ensuring that the software development team has followed the project quality procedures and standards



- The process of selecting those standards and systems that are appropriate to a particular organization and project
- The outcome of the planning process is a:
 - Software Quality Plan (SQP), sometimes called a Software Quality Assurance Plan (SQAP)



- Software Quality Assurance Plan
 - Product Overview

A description of the product, intended market, and quality expectations
 - Product Plan

The critical release dates and responsibilities – could point to the schedule
 - Quality Goals

The quality goals and plans for the product, including identification and justification of critical product quality attributes
 - Process Description

The quality assurance processes that should be used for product development and management (reviews, audits etc)
 - Document and Coding Standards

Standards for the documents and coding standards
 - Risks and Risk Management

The key risks that might affect product quality and the actions to address these risks (could provide a link to appropriate risks in the Risk Management Plan)



Safety	Understandability	Portability
Security	Testability	Usability
Reliability	Adaptability	Reusability
Resilience	Modularity	Efficiency
Robustness	Complexity	Learnability

Software quality attributes

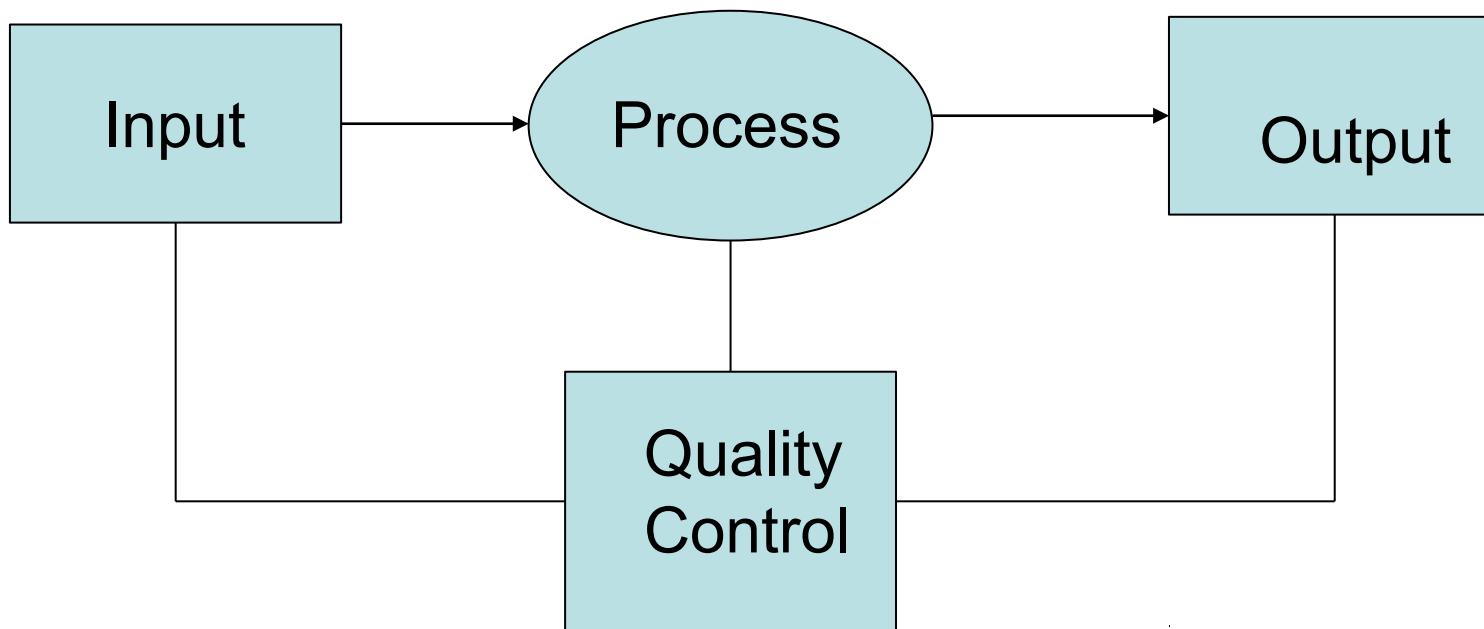
- Some of the quality attributes matter only to developers while others matter to end-users
- It is not possible for any system to be optimised for all attributes – trade-off is necessary to select the most important ones



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- Involves monitoring the software development process to ensure that the quality assurance procedures and standards specified in the SQP are being followed





- **Review** is a common technique used for verification and validation
- Artefacts produced during the development process are reviewed as a way of identifying problems seeking ways to improve them early
- Three common types of reviews:
 - Technical Reviews
 - Business Reviews
 - Management Reviews



- Reviews of artefacts is performed by **peers** in the development team but the author/s are involved
- The aim is uncovering problems in an artefact and seeking ways to improve the artefact
- Is considered a “soft” method for quality assurance - that is, nothing is executed
 - Some developers greet reviews with scepticism - however, empirical evidence suggests that such scepticism is unjustified



- Advantages of technical reviews:

- **Can be performed on any software artefact**, whereas many “hard” methods of quality assurance, such as testing and measurement, can be performed only on executable artefacts.
- **Earlier detection of problems** in software artefacts leads to lower costs of resolution.
- Studies show that roughly 30-70% of all programming faults found in a project were located using **source code reviews**, and up to 80% according to studies performed by IBM. Some studies demonstrated that **review techniques found several types of faults that testing failed to find**, and vice-versa.
- **Reviews find the actual faults in source code**, in contrast to testing, which merely indicates that there is a fault somewhere in the program. After a fault is detected with testing, it must then be located.
- Due to internal pressure of getting software releases out the door, programmers make more mistakes when correcting faults that were found during testing than they do **correcting faults during the review phase**



- Disadvantages of technical reviews:
 - Could be time and resource consuming
 - Should be carefully planned and executed to get the desired outcomes
- Types of technical reviews
 - Informal Reviews
 - Formal Reviews
 - Walk throughs
 - Code inspections
 - Audits



- **Informal Reviews:**

- A simple desk check or casual meeting with a colleague which aims to improve the quality of a document
- No formal guidelines or procedures that are followed
- The effectiveness of informal reviews is considerably less than formal reviews, because of the lack of diversity found in a group
- Checklists are tools that can help to improve the effectiveness of a review.
- A checklist is a list of questions that the reviewer must answer about an artefact, however, the questions are generic questions about that type of artefact
- Less time and resource consuming than a formal review



Example checklist for a Requirements Specification

Checklist for software requirements specification artifact	
Organisation and Completeness	
<ul style="list-style-type: none"><input type="checkbox"/> Are all internal cross-references to other requirements correct?<input type="checkbox"/> Are all requirements written at a consistent and appropriate level of detail?<input type="checkbox"/> Do the requirements provide an adequate basis for design?<input type="checkbox"/> Is the implementation priority of each requirement included?<input type="checkbox"/> Are all external hardware, software, and communication interfaces defined?<input type="checkbox"/> Have algorithms intrinsic to the functional requirements been defined?<input type="checkbox"/> Does the specification include all of the known customer or system needs?<input type="checkbox"/> Is the expected behaviour documented for all anticipated error conditions?	
Correctness	
<ul style="list-style-type: none"><input type="checkbox"/> Do any requirements conflict with or duplicate other requirements?<input type="checkbox"/> Is each requirement written in clear, concise, unambiguous language?<input type="checkbox"/> Is each requirement verifiable by testing, demonstration, review, or analysis?<input type="checkbox"/> Is each requirement in scope for the project?<input type="checkbox"/> Is each requirement free from content and grammatical errors?<input type="checkbox"/> Is any necessary information missing from a requirement? If so, is it identified as "to be decided"?<input type="checkbox"/> Can all of the requirements be implemented within known constraints?<input type="checkbox"/> Are any specified error messages unique and meaningful?	
Quality Attributes	
<ul style="list-style-type: none"><input type="checkbox"/> Are all performance objectives properly specified?<input type="checkbox"/> Are all security and safety considerations properly specified?<input type="checkbox"/> Are other pertinent quality attribute goals explicitly documented and quantified, with the acceptable tradeoffs specified?	
Traceability	
<ul style="list-style-type: none"><input type="checkbox"/> Is each requirement uniquely and correctly identified?<input type="checkbox"/> Is each software functional requirement traceable to a higher-level requirement (e.g., system requirement, use case)?	
Special Issues	
<ul style="list-style-type: none"><input type="checkbox"/> Are all requirements actually requirements, not design or implementation solutions?<input type="checkbox"/> Are all time-critical functions identified, and timing criteria specified for them?<input type="checkbox"/> Have internationalisation issues been adequately addressed?	



- **Formal Reviews:**

- A meeting with multiple stakeholders such as developers, testers, client
 - The group approach has benefits of bringing out different perspectives
- Meeting should adhere to the following constraints
 - The review team should be 3-5 members carefully chosen
 - The meeting should last no longer than 90 minutes
 - Following are the critical roles
 - Review Leader: responsible for organizing the review
 - Author: at least one author should be present
 - Reviewers: at least two or three non-author stakeholders
 - Recorder: responsible for recording all important review comments
- The review meeting could recommend one of the following:
 - Accept without further changes
 - Accept with proposed changes
 - Reject the artefact – this requires a re-review after modifications





- **Walkthroughs**
 - Walkthrough could be for code or a document
 - This is a review process where the author (the programmer or designer) leads a group of reviewers
 - Following are the main differences from a formal review:
 - Moderator, that leads the review is the author of the artefact being reviewed
 - Reviewers do not need preparation
 - When defects or inconsistencies are found, possible solutions are discussed
- **Code Inspections**
 - These are very similar to formal reviews, expect that the focus is on the code



- **Audits**

- Reviews of processes and products to determine if a particular product or process conforms to standards
- It is a type of technical review where the authors of the artefact being audited are not involved in the audit process at all – all the other roles are similar to a formal review
- Audits are typically performed by a team that is completely external to an organisation
- Two types of audits:
 - Product audits: to confirm that the product meets the standards
 - Process audits: to ensure that the team follows processes



- The goal of a business review is to ensure that the IT solution provides the functionality specified in the project scope and requirements document
- A business review can include all project deliverables to ensure that:
 - It is complete
 - Provides the information needed to move to the next phase or process
 - Meets the standards



- Compares the project's actual progress against a baseline project plan
- Project Manager is responsible for presenting the project progress and providing a clear picture of the current status
- Issues need to be resolved – e.g. resources reallocated as needed, change to the project course if needed
- May involve reviewing if the project meets the scope, schedule, budget and quality objectives



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Software Processes & Project Management

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The University of Melbourne*

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2021 – Semester 1
Lecture 9



Intended Learning Objectives

Ethics and Australian Computer Society Code Of Ethics.

Outsourcing.

Procurement.

Contracts.



L9.1 - Ethics





Why should organisations be ethical?

L9.1 - Ethics



Ethics – What is it?

- *Organisational ethics express the values of an organization to its employees and/or other entities irrespective of governmental and/or regulatory laws.*
- *Ethics are the principles and values used by an individual to govern his or her actions and decisions*

Ethics

Ethics in organisations are important because:



- **Satisfies Basic Human Needs:** Being fair, honest and ethical is one the basic human needs. Every employee desires to be such himself and to work for an organization that is fair and ethical in its practices.
- **Creates Credibility:** An organisation that is believed to be driven by moral values is respected in the society.
- **Unites People and Leadership:** An organisation driven by values is revered by its employees also. They are the common thread that link all employees regardless of position.
- **Set the basis for Decision Making:**
- **Long Term Gains:** Organisations guided by ethics and values last and are profitable in the long run.



Ethics

Ethics are not only for the 'big issues'

- Should we execute criminals?
- Can we destroy embryos for medical research?
- Lie under oath?



They inform our day-to-day interactions:

- How we treat our fellow colleagues.
- What information / resources can we use or take from work?
- Should we tell a work colleague a truth even though we know it will upset them?

Ethics

Questions to ask & consider before making a decision:

1. Would I be happy for this decision to be headlining the news tomorrow or be confronted with this in my work / friendship group?
2. Is there a universal rule that applies here?
3. Will the proposed course of action bring about a good result?
4. What would happen if everybody did this?
5. What will this proposed action do to my character or the character of my organisation?
6. Is the proposed course of action consistent with my values and principles?





Ethics – Your personal beliefs

An example:

Modern slavery encompasses slavery, servitude, the worst forms of child labour, forced labour, human trafficking, debt bondage, slavery like practices, forced marriage and deceptive recruiting for labour or services.

Many Australian businesses may be unaware of the risk that they have slavery in their business or supply chains. Statistically, the incidence of modern slavery within Australia appears to be relatively low, but it is likely that the statistics reflect a low level of awareness of the issues, and the actual incidence may be much higher, both domestically and overseas.

As at 2018, the Walk Free Foundation's Global Slavery Index estimated:

- In excess of 40 million people globally are subject to some form of modern slavery and collectively approximately US\$150 billion per year is generated in the global private economy from forced labour alone;
- ~25 million people (79% females) in Asia-Pacific Region are 'enslaved' (62 per cent of all people enslaved); and
- 15,000 people in Australia are enslaved.



Ethics

THERE IS
NO RIGHT WAY
TO DO
A WRONG THING.





WILLIAM DUNLOP

Australian Computer Society Code Of Ethics

1. The Primacy of Public Interest.
 - *You will place the interests of the public above those of personal, business or sectional interests*
2. The Enhancement of Quality of Life.
 - *You will strive to enhance the quality of life of those affected by your work*
3. Honest.
 - *You will be honest in your representation of skills, knowledge, services & products.*
4. Competence.
 - *You will work competently and diligently for your stakeholders*
5. Professional Development.
 - *You will enhance your own professional development, your colleagues & staff.*
6. Professionalism.
 - *You will enhance the integrity of the ACS & the respect of its members for each other.*

References: www.acs.org.au/content/dam/acs/rules-and-regulations/Code-of-Ethics.pdf
www.acs.org.au/content/dam/acs/rules-and-regulations/Code-of-Professional-Conduct_v2.1.pdf



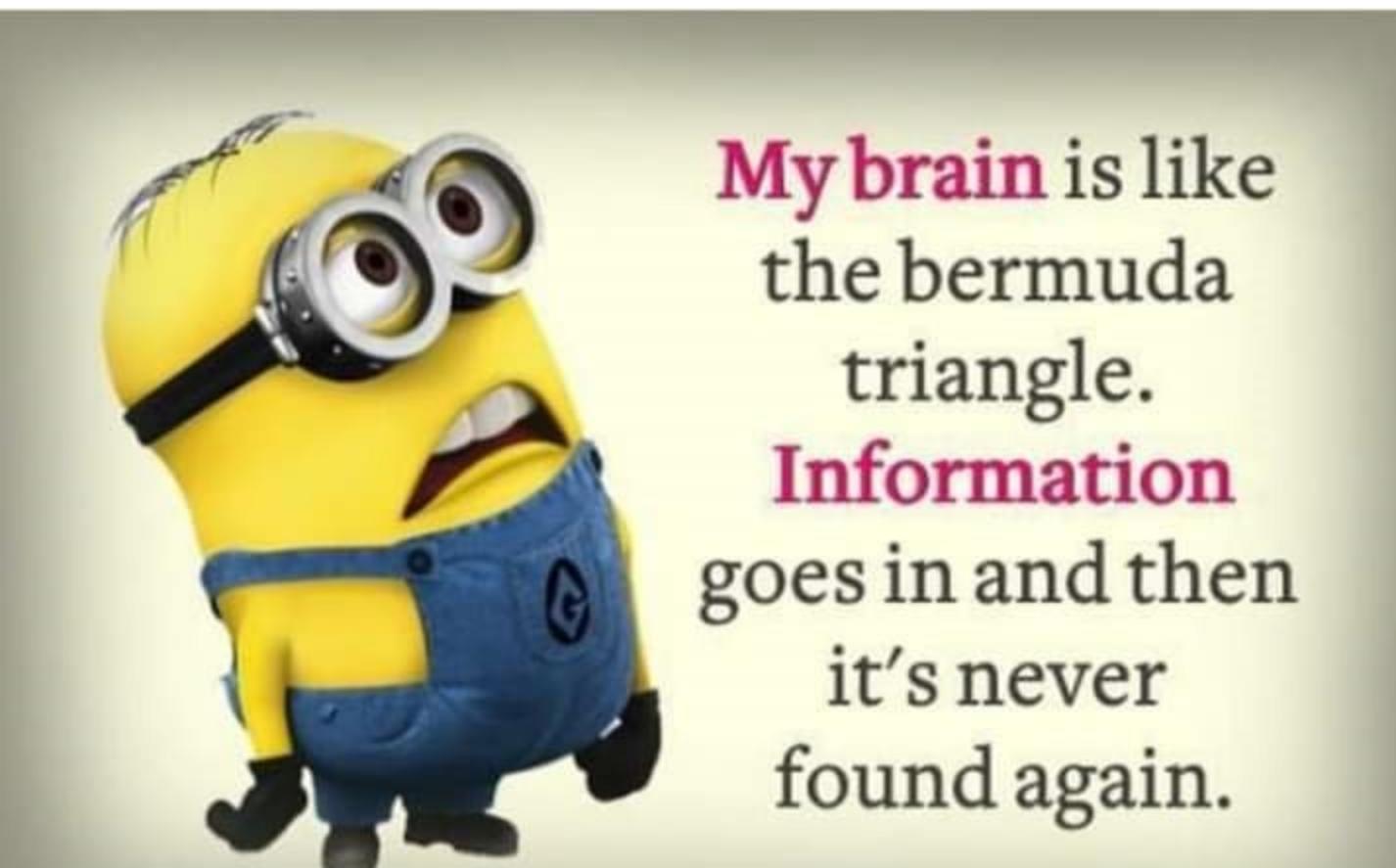
Question added for Assignment 1

THERE IS
NO RIGHT WAY
TO DO
A WRONG THING.





Revision 7:45pm tonight



Minion Quotes (2021, 01 May) Minion Quotes <http://www.facebook.com/Minion Quotes>



SWEN90016

Software Processes & Project Management

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2021 – Semester 1
Lecture 9

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Intended Learning Objectives

Ethics and Australian Computer Society Code Of Ethics.

Outsourcing.

Procurement.

Contracts.

What is Outsourcing

Definition: *The practice of engaging an external party (under contract) to perform services or create goods that are traditionally performed in-house by the company's own employees.*





What is Outsourcing

Definition: *The practice of engaging an external party (under contract) to perform services or create goods that are traditionally performed in-house by the company's own employees.*

Types of Outsourcing:

1. Onshoring:

- Relocating activities inside national borders to access targeted benefits.

2. Nearshoring:

- Activities relocated to another country with close proximity e.g. New Zealand, Indonesia.

3. Offshoring:

- Activities relocated to another country irrelevant of geographical location and time zones.

Examples

Various activities are better suited to the type of Outsourcing:

- Architecture
- Change Management
- Project Management
- Business Analysis
- Design
- Software Development Testing
- Operational (Application & Infrastructure) Support
- All the above



WILLIAM COOPER

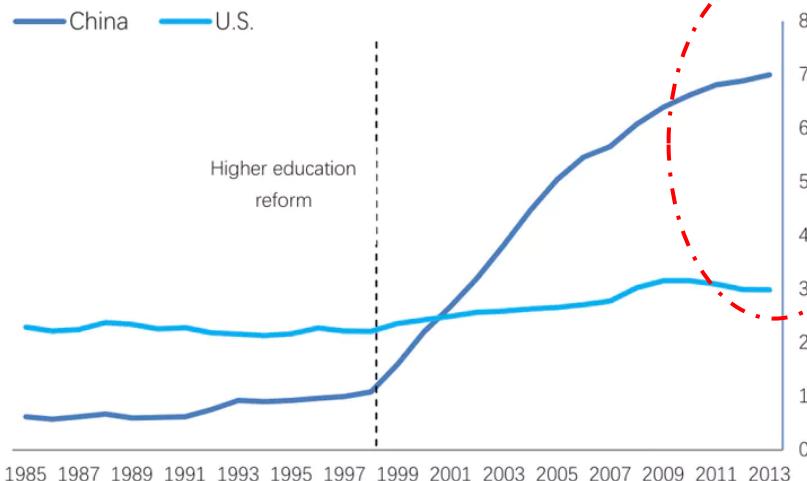
Why Outsource?

Accessing a broader skills base at a lower cost



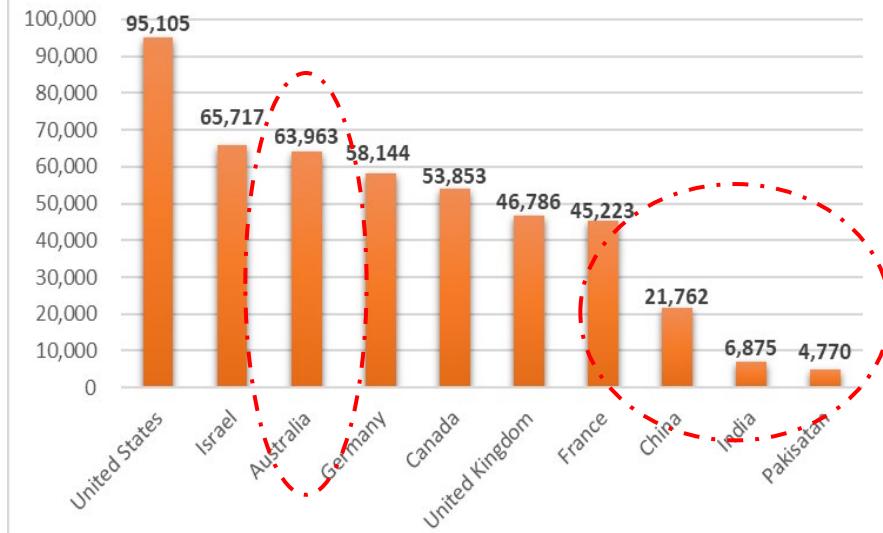
Annual enrolment of new students in higher education institutions

Millions



Source: China National Bureau of Statistics and US Department of Education

Software Engineer Avg Salary (USD)



Reference www.glassdoor.com.au/Salaries/index.htm



Why Outsource



Pros

- Reduces costs
- Access to difficult to find capabilities & skills
- Time savings – 24/7 based activities
- Freeing scares internal resources to focus on core business activities
- Leverage best practice
- Access to better Technology
- Lower training costs in high turn over jobs
- Flexibility – Ramp up and down
- Increased Accountability - Contracts
- Risk mitigation – Access established and proven approaches e.g. Agile, Project Management etc

Cons

- Loss of control
- Process / supply chain fragmentation
- Security issues
- Employees feel threatened
- Additional effort and cost to engage and manage
- Lower quality work / work to contract
- Time zone, cultural & language challenges
- Location stability - Political, Economic, Religious
- Ethical standards - environment, slave / child labour
- Difficult to change
- Damages to the local job markets
- Loss of Relationship building opportunity with key stakeholders

Outsourcing

Why you should Outsource your IT- Infrastructure example

<https://www.youtube.com/watch?v=KjJ6PBkf0ss>

Why Outsourcing is bad for business:

https://www.youtube.com/watch?v=V7fsElp2r_8



What would you do? You are the CEO of a medium sized company and are looking to outsource a majority of a large project to get access to critical skills at a cheaper price.

I would outsource to any company that provided the best deal.

I would not outsource anything and would do higher people to do all activities.

I would consider all items and risks and only outsource items that had no impact to my business.

I would get someone else to make the decision in case it all went wrong I had someone to fire.



Negatives of outsourcing include:

- Loss of control **A**
- Security issues **B**
- Employees feel threatened **C**
- Additional effort and cost to engage and manage **D**
- Time zone, cultural & language challenges **E**
- Location stability - Political, Economic, Religious **F**
- Ethical standards - environment, slave / child labour **G**
- All of the above **H**



L9.2 - What is Outsourcing and why is it used

Contrary to what the sales people tell you it is NOT a Silver Bullet.

Outsourcing is a powerful tool for Project managers and organisations and it does add value.

Critical to understand your key drivers, risks you want to / can manage and ensure you look at and include the total picture.





Intended Learning Objectives

L9.1 – Ethics and Australian Computer Society Code Of Ethics.

L9.2 – Outsourcing.

L9.3 – Procurement.

L9.4 – Contracts.



The Procurement Management Process

If there is no need to buy (outsource) any products or services from outside the organisation, then there is no need to perform any of the procurement management processes.

However you will find that most (if not all) projects will contain some sort of external sourcing which will require a procurement.

The Procurement Management Process consists of 3 broad stages:

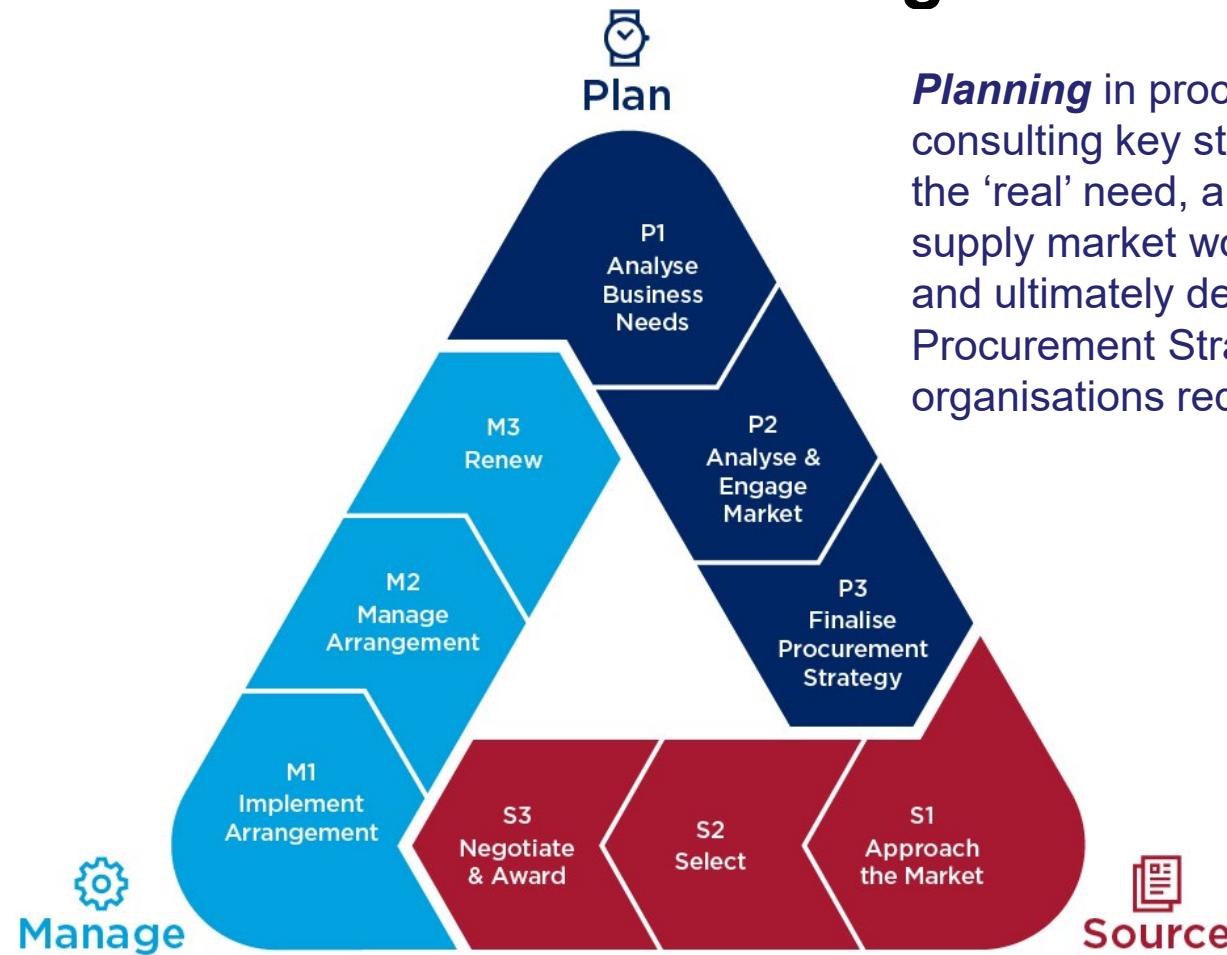
1. Plan.
2. Source.
3. Manage.



Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



The Procurement Management Process



Planning in procurement involves consulting key stakeholders to define the 'real' need, analysing how the supply market works, assessing risks and ultimately defining the best Procurement Strategy to meet the organisations requirements.

Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



The Procurement Management Process



Source, the principal objective of this stage is to identify and engage suppliers who will provide the best value for money outcome, in a framework of probity and fair dealing. A key deliverable for this stage is to determine the appropriate sourcing method, with consideration given to alternatives other than just tendering.

Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



L9.3 - The Procurement Management Process



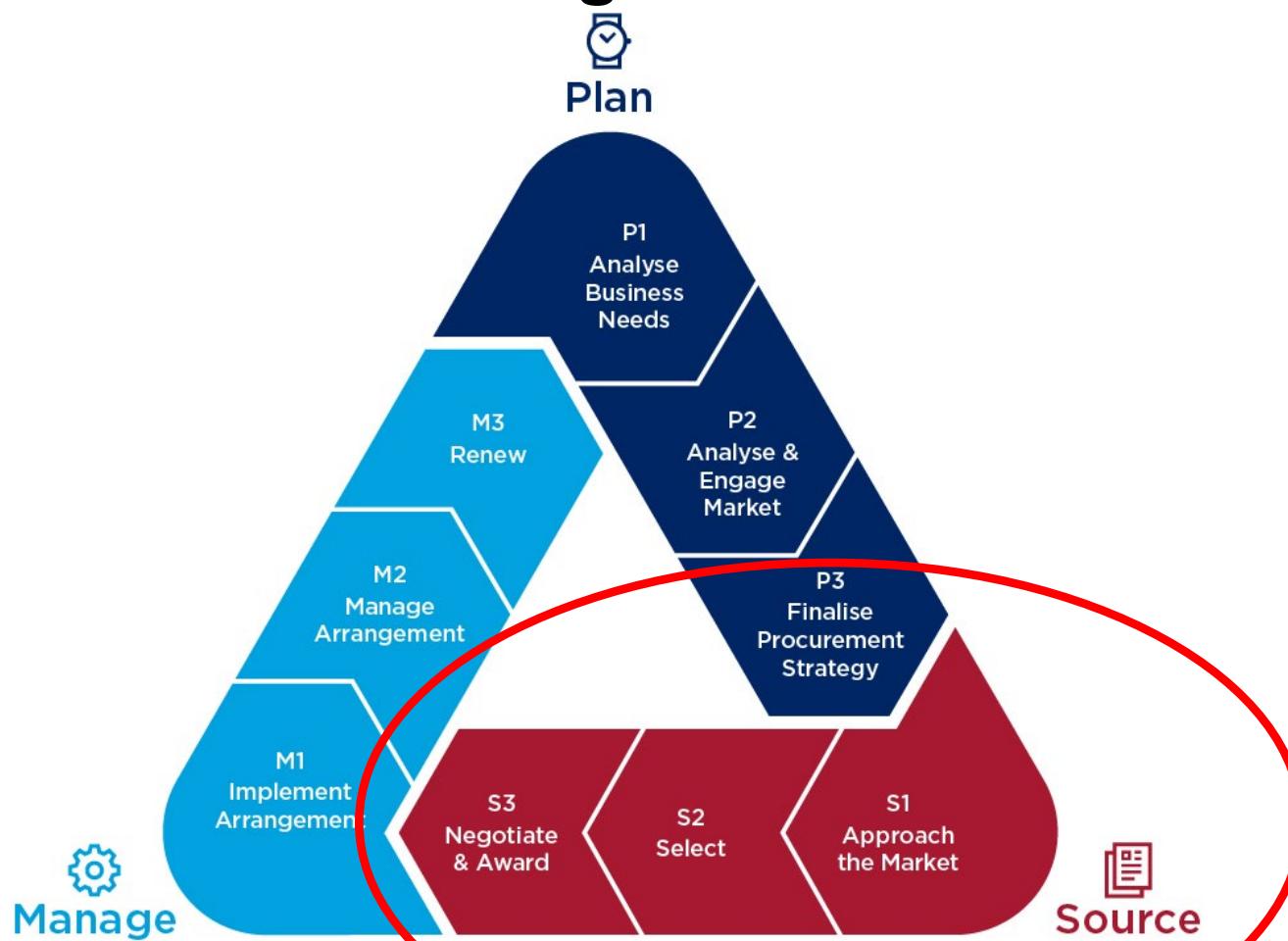
Manage, Every arrangement articulates the rights and responsibilities of the parties so it is important to identify, understand and manage them in order to better ensure you 'get what we contracted for'.

Signing an arrangement is not the end of a process, but rather the start of an on-going relationship with the supplier. It needs to be managed in order to deliver the best outcome for the organisation.

Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



The Procurement Management Process



Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



Sourcing Procurements



The procurement process is typically conducted with the issuing of a Request For X (RFx), where x = Bid, Information, Proposal, Tender or Quote.

RFx (request for x)

RFB (request for bid)	RFI (request for info)	RFP (request for proposal)	RFQ (request for quotation)	RFT (request for tender)
<ul style="list-style-type: none">■ Invitation for prospective suppliers to bid on service■ It is not a binding agreement■ Also called "invitation to bid"	<ul style="list-style-type: none">■ Gathers information for potential suppliers■ Used for major IT purchases■ Usually precedes RFP or request for offer	<ul style="list-style-type: none">■ Document posted to elicit bids from potential vendors■ Specifies evaluation criteria■ Used for complex IT projects or to boost competition	<ul style="list-style-type: none">■ Document eliciting quotes for a product or service■ Seeks itemized list of prices■ Used for simpler IT projects	<ul style="list-style-type: none">■ Invitation for suppliers to submit sealed bid■ Specifies services and timeframe■ Usually expected to conform to legally standardized structure



Sourcing Procurements - RFx



The RFx document is prepared by the buyer and will have specific information depending on the what it is (RFI, RFP, RFT/Q). It will typically include:

1. Purpose of RFx.
2. Organisation's Background.
3. Basic Requirements.
4. Hardware and Software Environments.
5. Description of RFx Processes & Evaluation.
6. ***Statement of Work and Scheduled Information.***
7. Appendices:
 - a. Current Systems Overview.
 - b. Systems Requirements.
 - c. Volume and Size data.
 - d. Required Contents of Vendor's Response to RFx.
 - e. Sample Contract.



Sourcing Procurements - SOW



A key component of the RFx document is to analyse the business needs and establish a detailed ***Statement of Work*** (SOW).

A Statement Of Work is a description of the work required. A good SOW is detailed and gives bidders an understanding of buyer's expectations, key items include:

- Scope of Work to be completed
- Location of where the Work is to be completed from
- Measurement and Performance criteria
- Deliverables, milestones and schedule
- Applicable Standards and Acceptable Criteria
- Any Special Requirements



Sourcing Procurements



Approach the Market, Select, Negotiate and Award:

- Deciding whom to ask and potentially do the work
- Sending appropriate documentation to potential sellers / bidders
- Obtaining proposals / bids
- Evaluating responses and selecting a preferred supplier
- Negotiating the contract
- Awarding a contract



Sourcing Procurements



Evaluation Processes:

1. Evaluation team review of RFx response and evaluate against predetermined criteria.
2. Schedule short-listed vendor presentations.
3. Check vendor references.
4. Short-listed vendor presentations.
5. Evaluation team site visits to short-listed vendors / references.
6. Evaluation team finalises evaluation and selects short-listed firms.
7. Best and Final Offer (BAFO) with short-listed firms.
8. Conduct final negotiation with preferred supplier.



Sourcing Procurements



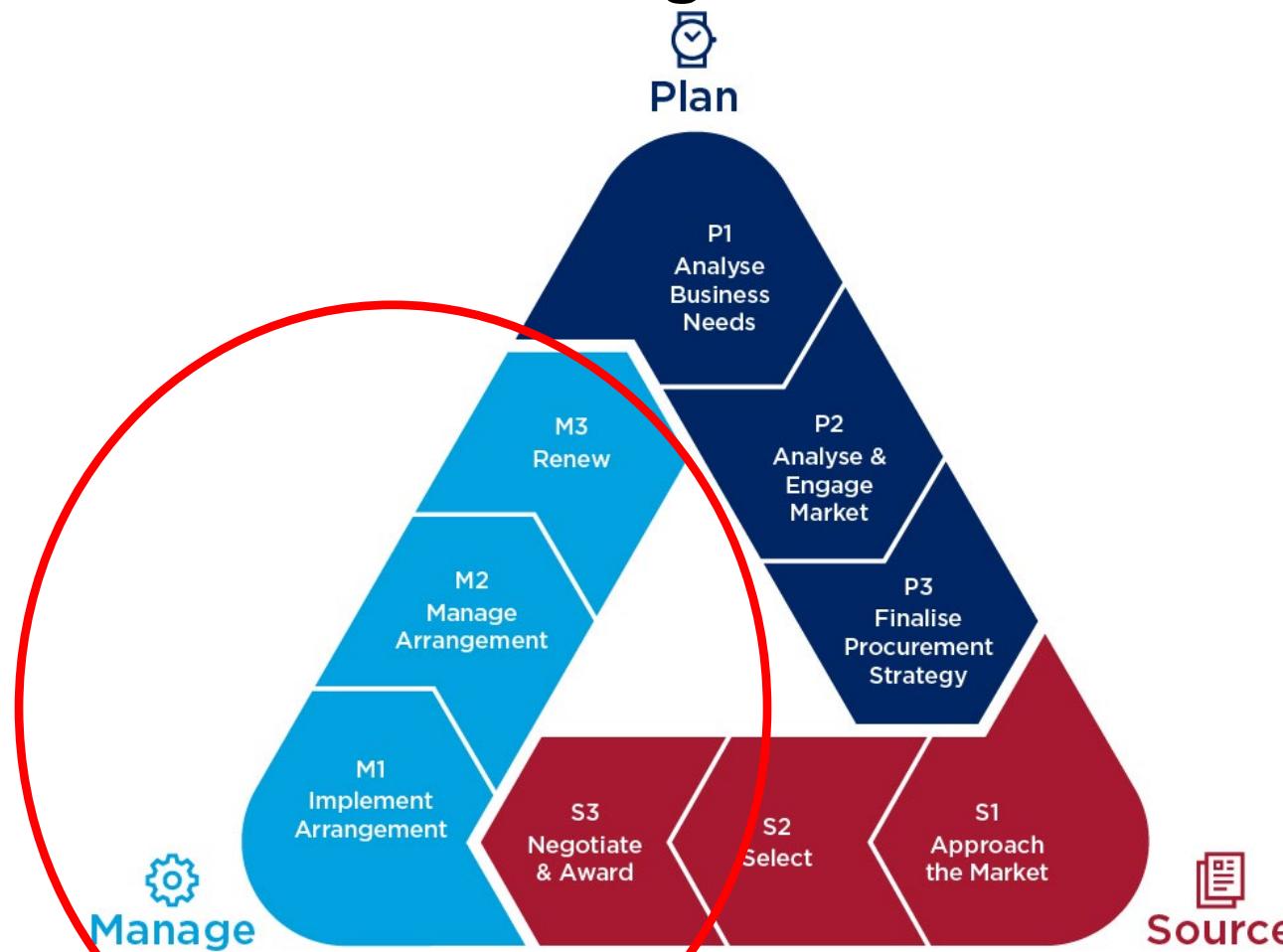
Sample Evaluation Sheet:

		Proposal 1		Proposal 2		Proposal 3	
Criteria	Weight	Rating	Score	Rating	Score	Rating	Score
Technical Approach	25%						
Management Approach	25%						
Past Performance	20%						
Price	30%						
Total Score	100%						

To calculate the score multiply the weight of the criterion by the rating for the proposal



The Procurement Management Process



Reference www.procurepoint.nsw.gov.au/policy-and-reform/nsw-government-procurement-information/nsw-procurements-approach



Managing Procurements



Implement, Manage & Renew:

- Implement the agreement & services as per the contract and SOW
- Manage the agreement to ensure the seller's performance meets contractual requirements
- Review and control all changes - It is critical that project managers and team members watch for Constructive Change Orders
 - If change is **requested** then contractor can legally bill the buyer for additional work

Managing Procurements



Renew / Closing Procurements:

- Involves completing, settling contracts and resolving issues
- The project team should:
 - Determine if all work was completed correctly and satisfactorily
 - Resolve any issues or outstanding items
 - Update records to capture all lessons learnt & outcomes
 - Archive information
 - Capture all knowledge and lessons learnt
- The contract itself should include requirements for formal acceptance and closure



The procurement process is typically conducted with the issuing of a Request For X (RFx)

True

False



The 3 stages of procurement are:

Plan, Manage and
hope it works

Plan, Source and
Manage

Source, Manage
and Contract

All of the above



Intended Learning Objectives

~~Ethics and Australian Computer Society Code Of Ethics.~~

~~Outsourcing.~~

~~Procurement.~~

Contracts.



L9.4 - Contracts





Contracts



Contracts are the one source of truth for all activities that are to be delivered by the external parties.

What is a Contract?

- A mutually binding agreement that obligates the seller to provide the specified products or services and obligates the buyer to pay for them
- A document that clarifies responsibilities and sharpens focus on key requirements – deliverables, quality, timeframes etc
- A document that must be detailed and accurate as they are used as the final position (you get out of them what you put to them)
- It is rarely used or relied on and seen as a last point of call.



Contracts



Different types of Contracts are used in different situations with all having pros and cons:

- **Fixed Price** contracts: involve a fixed total price for a well-defined product or service.
- **Time & Material** contracts: involve payment to the seller for actual time spent and any materials used in providing the service.



Contracts



Fixed Price

Time & Material





Fixed Price model

When to choose:



Clear deadlines



Detailed specification



Short project duration



Optional client's control



No changes planned

Pros

- ✓ No overpayments ✓ No distrust
- ✓ No supervision ✓ No turn-ups
- ✓ Low risk

Cons

- ✗ Longtime preparation ✗ Minor control over the process
- ✗ Lack of communication



Time and Materials model

When to choose:



Raw project concept



Workflow can change



Innovative idea



Little known target market



Intention to take control

Pros

- ✓ Flexible budget
- ✓ Easy start
- ✓ Part-payment opportunity
- ✓ No costs for preparations
- ✓ Agile orientation

Cons

- ✗ No deadlines
- ✗ Low budget control
- ✗ Time for participation



Contracts



Contracts should include specific clauses that take into account issues that are unique to the project – Quality, Time, Location etc

Key contractual conditions should include

- Intellectual Property Ownership and Indemnities
- Milestones and Deliverables
- Quality Criteria / Performance and Acceptance testing
- Variations / Change request process
- Non-Performance / Termination - Convenience, Breach etc
- Disengagement & Transition
- Liquidated Damages
- Fees and Penalties
- Warranties

Contracts are the one source of truth for all activities that are to delivered by the external parties

Yes
No
Sometimes

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