Software Project Management

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Introduction

- Many software projects fail:
  - due to faulty project management practices:
    - It is important to learn different aspects of software project management.

Introduction cont…

- Goal of software project management:
  - enable a group of engineers to work efficiently towards successful completion of a software project.

Outline of talk

In this introduction the main questions to be addressed will be:

- What is software project management? Is it really different from 'ordinary' project management?
- How do you know when a project has been successful? For example, do the expectations of the customer/client match those of the developers?

Why is project management important?

- Large amounts of money are spent on ICT e.g. UK government in 2003-04 spent £2.3 billions on contracts for ICT and only £1.4 billions on road building
- Projects often fail – Standish Group claim only a third of ICT projects are successful. 82% were late and 43% exceeded their budget.
- Poor project management is a major factor in these failures

What is a project?

Some dictionary definitions:

"A specific plan or design"

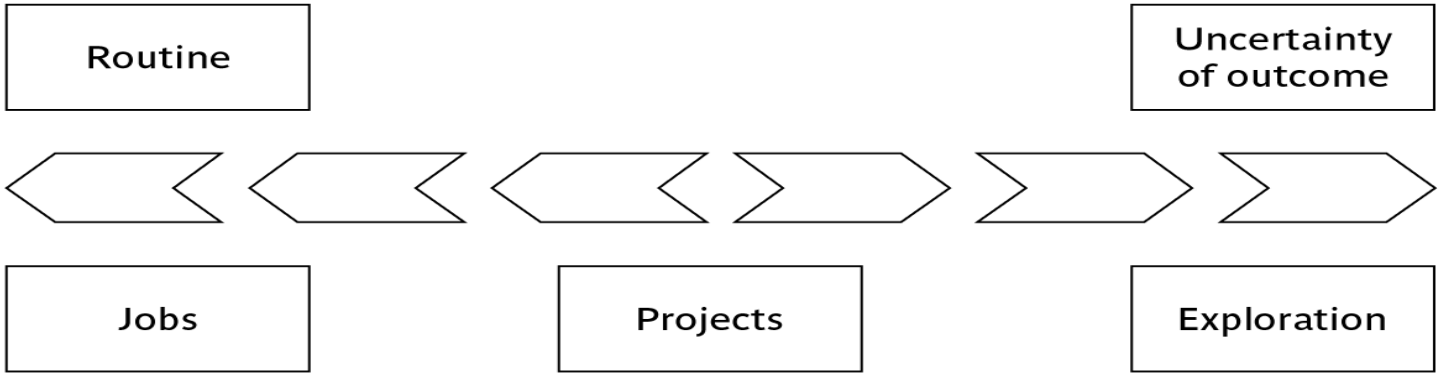
"A planned undertaking"

"A large undertaking e.g. a public works scheme"

Longmans dictionary

Key points above are *planning* and *size* of task

Jobs versus projects



'Jobs' – repetition of very well-defined and well understood tasks with very little uncertainty

'Exploration' – e.g. finding a cure for cancer: the outcome is very uncertain

Projects – in the middle!

Characteristics of projects

A task is more 'project-like' if it is:

- Non-routine
- Planned
- Aiming at a specific target
- Carried out for a customer
- Carried out by a temporary work group
- Involving several specialisms
- Made up of several different phases
- Constrained by time and resources
- Large and/or complex

Are software projects really different from other projects?

Not really …but

- Invisibility
- Complexity
- Conformity
- Flexibility

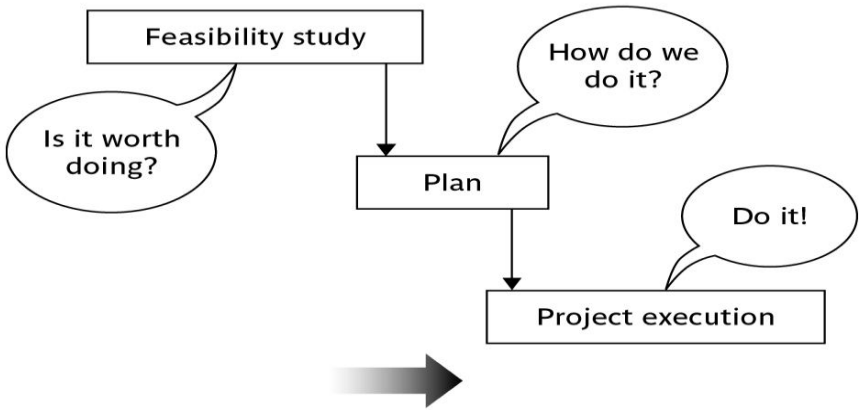
make software more problematic to build than other engineered artefacts.

Contract management versus technical project management

Projects can be:

- **In-house**: clients and developers are employed by the same organization
- **Out-sourced:** clients and developers employed by different organizations
- 'Project manager' could be:
  - a 'contract manager' in the client organization
  - a technical project manager in the supplier/services organization

Activities covered by project management



Feasibility study

Is project technically feasible and worthwhile from a business point of view?

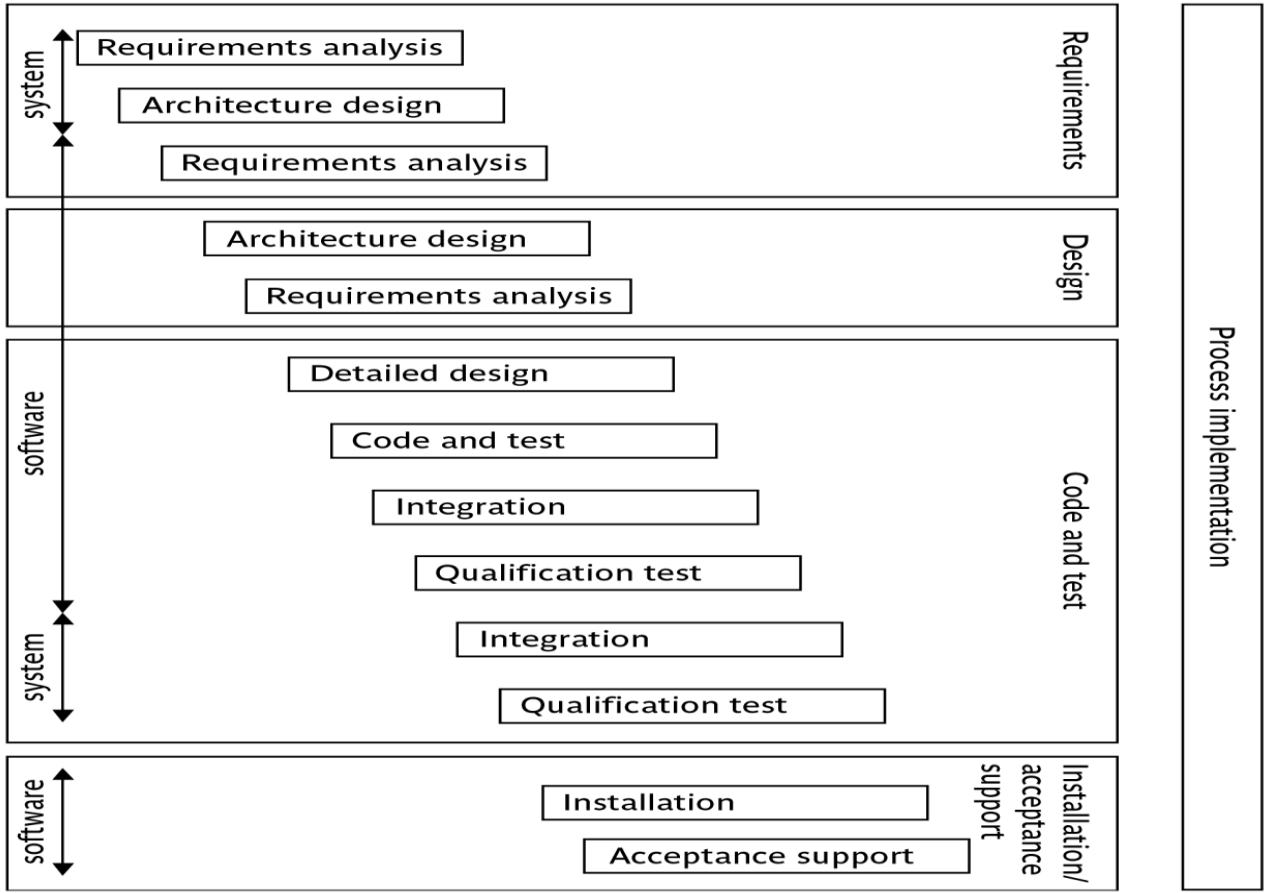
Planning

Only done if project is feasible

Execution

Implement plan, but plan may be changed as we go along

The software development life-cycle (ISO 12207)



ISO 12207 life-cycle

- Requirements analysis
  - Requirements elicitation: what does the client need?
  - Analysis: converting 'customer-facing' requirements into equivalents that developers can understand
  - Requirements will cover
    - Functions
    - Quality
    - Resource constraints i.e. costs

ISO 12207 life-cycle

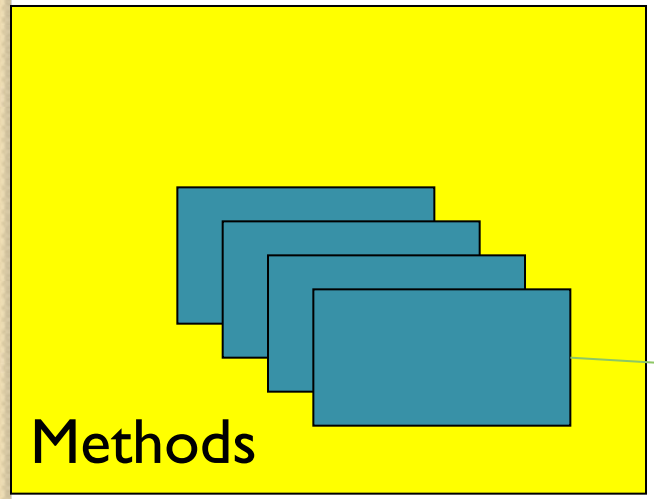
- Architecture design
  - Based on *system requirements*
  - Defines components of system: hardware, software, organizational
  - *Software requirements* will come out of this
- Code and test
  - Of individual components
- Integration
  - Putting the components together

ISO12207 continued

- Qualification testing
  - Testing the *system* (not just the *software*)
- Installation
  - The process of making the system operational
  - Includes setting up standing data, setting system parameters, installing on operational hardware platforms, user training etc
- Acceptance support
  - Including maintenance and enhancement

Plans, methods and methodologies

Methodology = a set of methods



A way of working

Context

Plan

\+ start and end dates for each activity, staffing, tools and materials etc

Some ways of categorizing projects

Distinguishing different types of project is important as different types of task need different project approaches e.g.

- Voluntary systems (such as computer games) versus compulsory systems e.g. the order processing system in an organization
- Information systems versus embedded systems
- Objective-based versus product-based
- Product-development versus outsourced

Project Charter

- Project Charter is an important high level document that authorizes the starting of a project and use of the required resources.
- Besides, it outlines the project objectives, deliverables and the resources required.
- It also documents the aspects that are out of scope, and identifies the main stakeholders, their roles and responsibilities.

Project Charter cont…

The project charter is usually a short document that is only a couple of pages long and typically contains the following:

- Overall objectives of the project and the broad items that are within the scope of the project and those that are out of scope.
- The time schedule in terms of the start date and the expected completion date of the project.

Project Charter cont…

- The important stakeholders and their responsibilities towards the project.
- Overview of the resources that will be needed for the project and the overall budget.
- Major risks to the project and the broad strategies that can be adopted for overcoming those.

Stakeholders

These are people who have a stake or interest in the project

In general, they could be *users/clients* or *developers/implementers*

They could be:

- Within the project team
- Outside the project team, but within the same organization
- Outside both the project team and the organization

Different stakeholders may have different objectives – need to define common project objectives

Setting objectives

- Answering the question '*What do we have to do to have a success?*'
- Need for a *project authority*
  - Sets the project scope
  - Allocates/approves costs
- Could be one person - or a group
  - Project Board
  - Project Management Board
  - Steering committee

Objectives

Informally, the objective of a project can be defined by completing the statement:

The project will be regarded as a success if…….

……

Rather like *post-conditions* for the project

Focus on *what* will be put in place, rather than *how* activities will be carried out

Objectives should be SMART

S – specific, that is, concrete and well-defined

M – measurable, that is, satisfaction of the objective can be objectively judged

A – achievable, that is, it is within the power of the individual or group concerned to meet the target

R – relevant, the objective must relevant to the true purpose of the project

T – time constrained: there is defined point in time by which the objective should be achieved

Goals/sub-objectives

These are steps along the way to achieving the objective. Informally, these can be defined by completing the sentence:

To reach objective X, the following must be in place

A……

B……

C……

etc

Goals/sub-objectives cont…

Often a goal can be allocated to an individual

Individual might have the capability of achieving goal on their own, but not the overall objective e.g.

Overall objective – user satisfaction with software product

Analyst goal – accurate requirements

Developer goal – reliable software

Measures of effectiveness

How do we know that the goal or objective has been achieved?

By a practical test, that can be objectively assessed.

e.g. for user satisfaction with software product:

- Repeat business – they buy further products from us
- Number of complaints – if low etc.

The business case

- Most projects need to have a justification or business case: the effort and expenses of pushing the project through must be seen to be worthwhile in terms of the benefits that will eventually be felt.
- A cost-benefit analysis will often be part of the project's feasibility study.
- This will itemize and quantify the project's costs and benefits.

The business case cont…

- The benefits will be affected by the completion date: the sooner the project is completed, the sooner the benefits can be experienced.
- The quantification of benefits will often require the formulation of a business model which explains how the new application can generate the claimed benefits.

The business case cont…

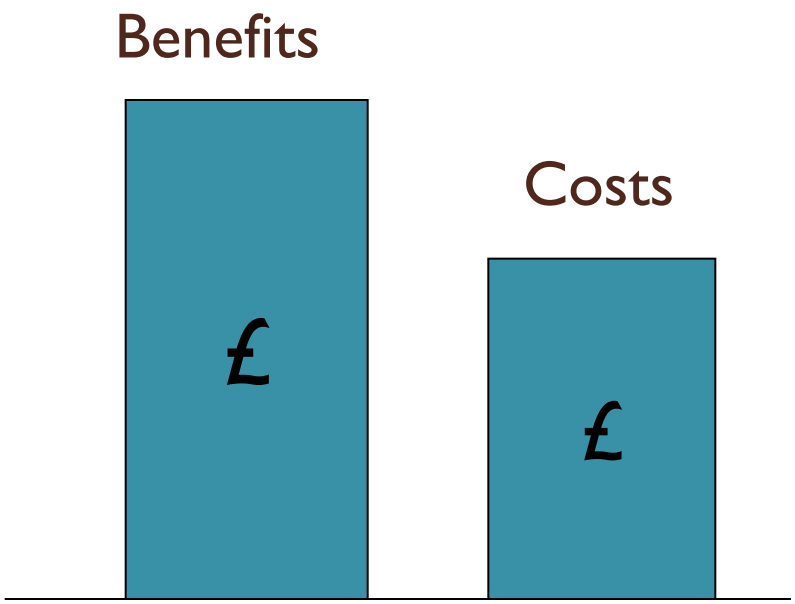
- A simple example of a business model is that a new web-based application might allow customers from all over the world to order a firm's products via the internet, increasing sales and thus increasing revenue and profits.

The business case cont…

Any project plan must ensure that the business case is kept intact. For example:

- that development costs are not allowed to rise to a level which threatens to exceed the value of benefits;
- that the features of the system are not reduced to a level where the expected benefits cannot be realized;
- that the delivery date is not delayed so that there is an unacceptable loss of benefits.

The business case cont…



Benefits of delivered project must outweigh costs

Costs include:

- Development
- Operation

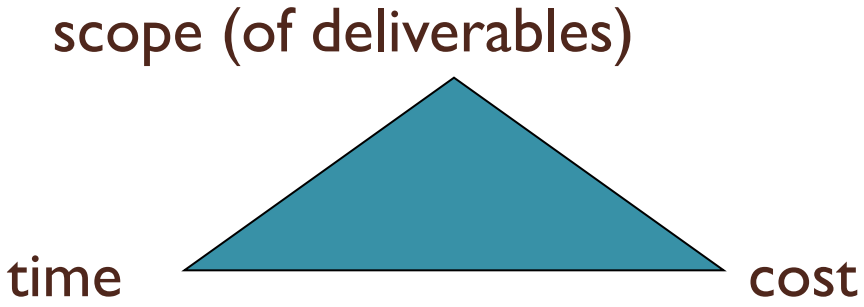
Benefits

Quantifiable

Non-quantifiable

Project success/failure

- Degree to which objectives are met



In general if, for example, project is running out of time, this can be recovered for by reducing scope or increasing costs. Similarly costs and scope can be protected by adjusting other corners of the 'project triangle'.

Other success criteria

These can relate to longer term, less directly tangible assets

- Improved skill and knowledge
- Creation of assets that can be used on future projects e.g. software libraries
- Improved customer relationships that lead to repeat business

What is management?

This involves the following activities:

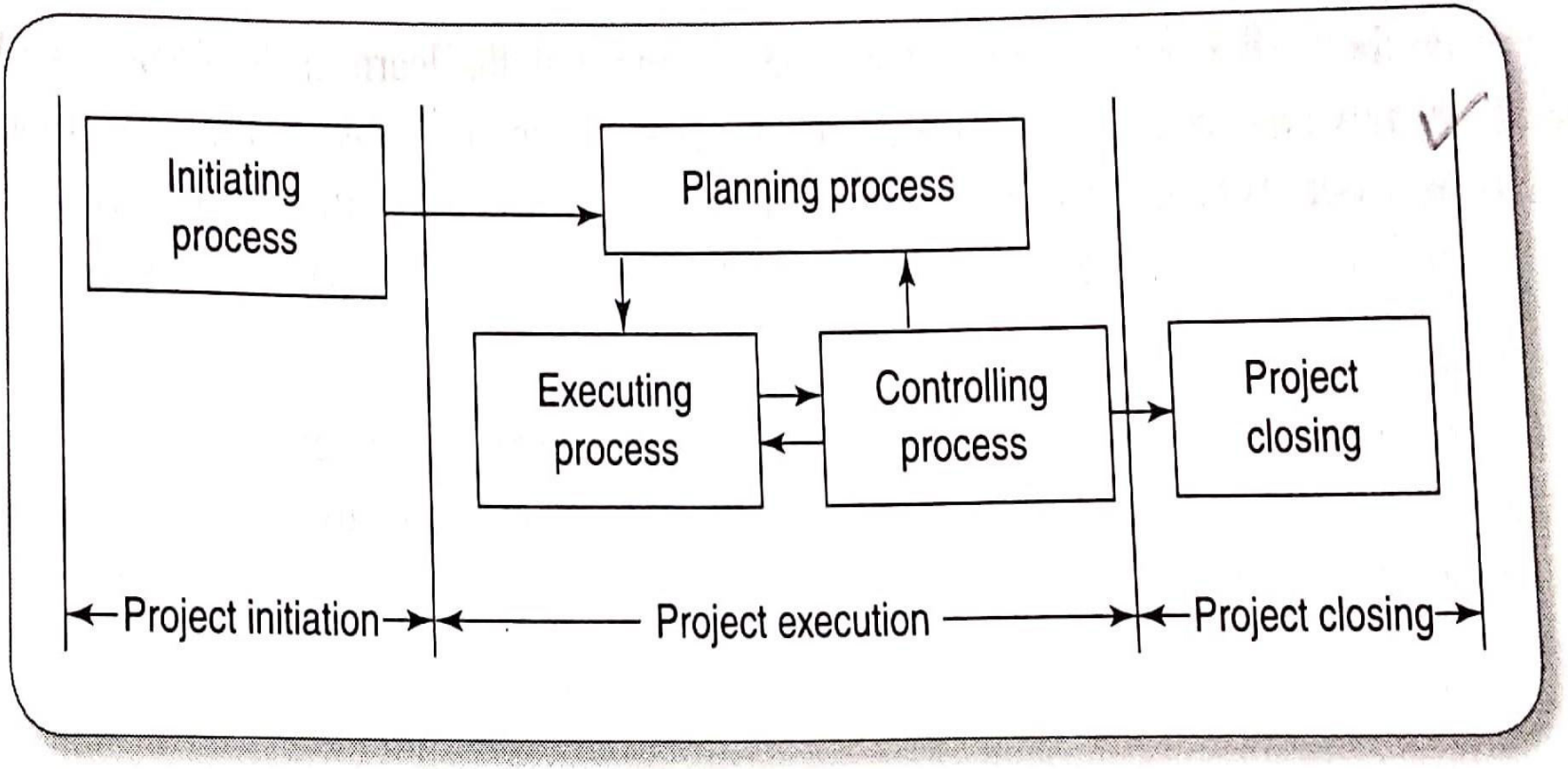
- Planning – deciding what is to be done
- Organizing – making arrangements
- Staffing – selecting the right people for the job
- Directing – giving instructions

continued…

What is management? cont…

- Monitoring – checking on progress
- Controlling – taking action to remedy hold-ups
- Innovating – coming up with solutions when problems emerge
- Representing – liaising with clients, users, developers and other stakeholders

Principal project management processes



Principal project management processes cont…

- Fig. shows that project management is carried out over three well defined stages or processes, irrespective of the methodology used.
- In the project initiation stage, an initial plan is made.
- As the project starts, the project is monitored and controlled to proceed as planned.

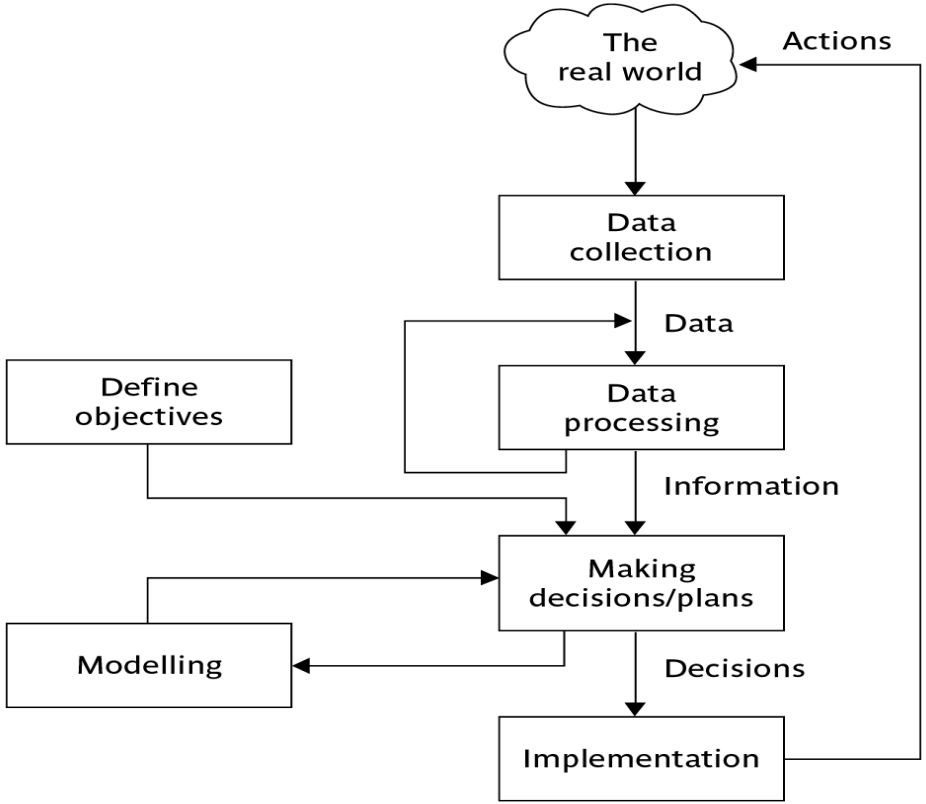
Principal project management processes cont…

- However, the initial plan is revised periodically to accommodate additional details and constraints about the project as they become available.
- Finally, the project is closed. In the project closing stage, all activities are logically completed and all contracts are formally closed.

Project Planning

- Carried out before development starts.
- Important activities:
  - Estimation
  - Scheduling
  - Staffing
  - Risk management
  - Miscellaneous plans

Management control



Management control

Data – the raw details

e.g. *'6,000 documents processed at location X'*

Information – the data is processed to produce something that is meaningful and useful

e.g. 'productivity is 100 documents a day'

Comparison with objectives/goals

e.g. we will not meet target of processing all documents by 31st March

continued…..

Management control – cont…

Modelling – working out the probable outcomes of various decisions

e.g. if we employ two more staff at location X how quickly can we get the documents processed?

Implementation – carrying out the remedial actions that have been decided upon

Software development and project management life cycles

- In contrast to the software development life cycle (SDLC), the project management life cycle typically starts well before the software development activities start and continues for the entire duration of the SDLC. This aspect has schematically been shown in Figure (next slide).

Fig: Project management life cycle versus software development life cycle

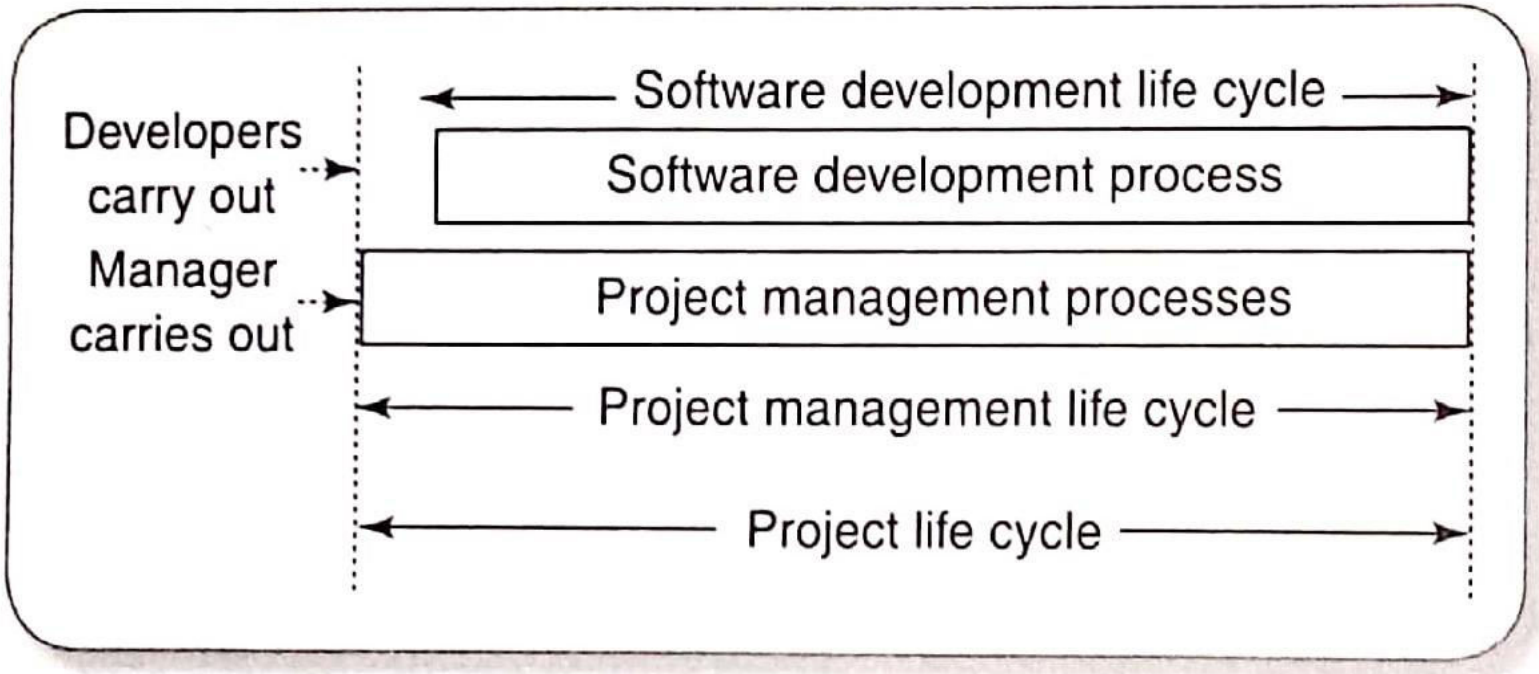


Fig: Project management life cycle versus software development life cycle

- A few examples of the project management processes carried out by a project manager include
  - project initiation,
  - planning, execution,
  - monitoring,
  - controlling, and
  - closing.
- As shown in Figure, ‘project life cycle’ is a more generic term and is often used to denote both software development life cycle and project management life cycle.

Software development and project management life cycles cont…

- The activities carried out by the developers during software development life cycle as well as the project management life cycle are grouped into a number of phases.
- Typical sets of phases and their sequencing in the software development life cycle and the project management life cycle have been shown in Figure (next slide)

Fig. Different phases of project management life cycle and software development life cycle

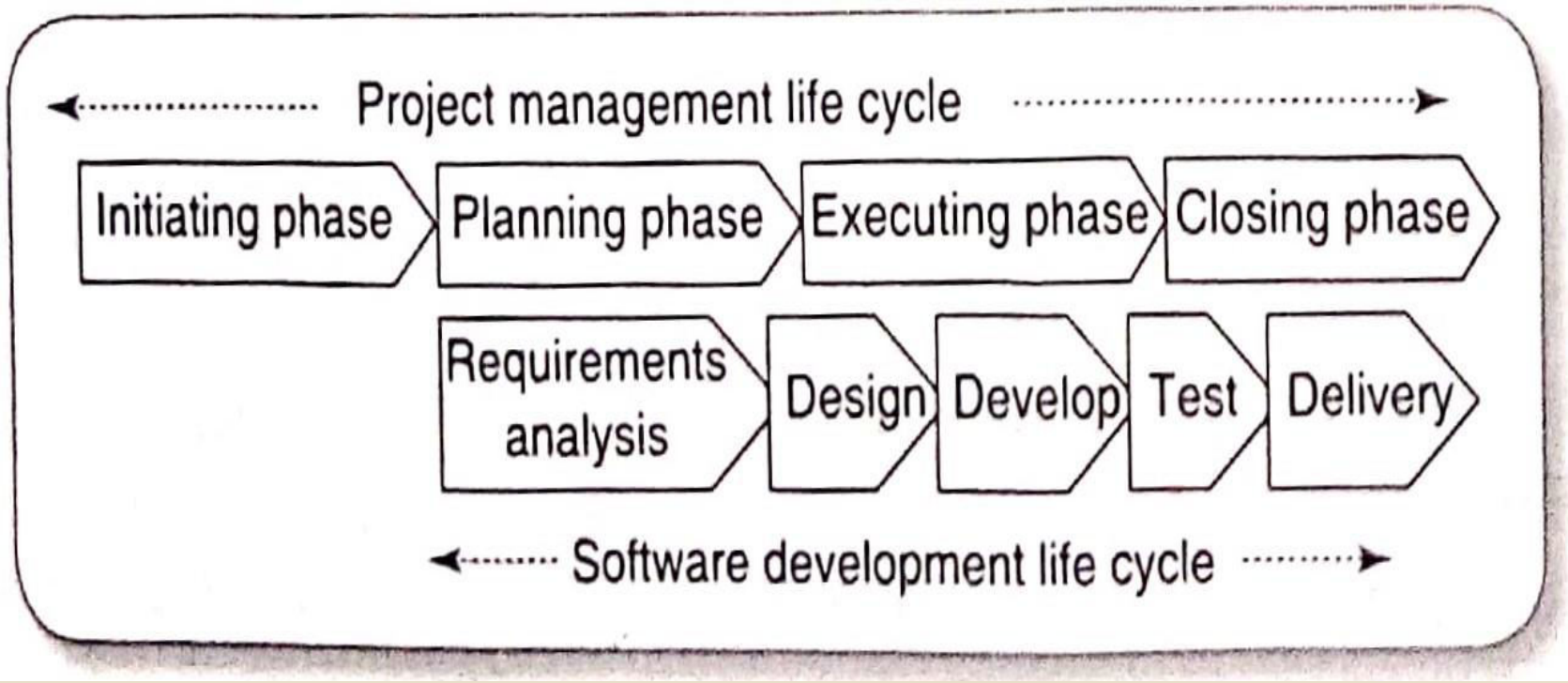


Fig. Different phases of project management life cycle and software development life cycle

- As can be seen from Figure, the phases of the software development life cycle are *requirements analysis, design, development, test and delivery*.
- The different phases of the project management life cycle are *initiation, planning, execution and closing*.
- Further observe from Figure that by the time the software development processes start, the initiation phase of the software project management life cycle is almost complete.

Project Managemet Life Cycle

- Project Initiation
- W5HH Principle
- Project biding
- Project Planning
- Project Execution
- Project Closure

Project Initiation

- The project initiation phase usually starts with project concept development.
- During concept development the different characteristics of the software to be developed are thoroughly understood.
- The different aspects of the project that are investigated and understood include: the scope of the project, project constraints, the cost that would be incurred and the benefits that would accrue.

Project Initiation cont…

- Based on this understanding, a feasibility study is undertaken to determine whether the project would be financially and technically feasible.
- This is true for all types of projects, including the in-house product development projects as well as the outsourced projects.

Project Initiation cont…

- For example, an organization might feel a need for a software to automate some of its activities, possibly for more efficient operation. Based on the feasibility study, the business case is developed. Once the top management agrees to the business case, the project manager is appointed, the project charter is written, and finally the project team is formed. This sets the ground for the manager to start the project planning phase.

Project Initiation cont…

- As has already been pointed out, during the project initiation phase it is crucial for the champions of the project to develop a thorough understanding of the important characteristics of the project.
- In his W5HH principle, Barry Boehm summarized the questions that need to be asked and answered in order to have an understanding of these project characteristics.

W5HH Principle

- The name of this principle (W5HH) is an acronym constructed from the first letter of each question. This set of seven questions is the following:
  - Why is the software being built?
  - What will be done?
  - When will it be done?
  - Who is responsible for a function?
  - Where are they organizationally located?
  - How will the job be done technically and managerially?
  - How much of each resource is needed?

Project bidding

- Once an organization's top management is convinced by the business case, the project charter is developed. For some categories of projects, it may be necessary to have a formal bidding process to select a suitable vendor based on some cost-performance criteria.
- If the project involves automating some activities of an organization, the organization may either decide to develop it in-house or may get various software vendors to bid for the project.

Project bidding

Different types of bidding techniques and their implications and applicability.

- Request for quotation (RFQ)
- Request for proposal (RFP)
- Request for Information (RFI)

Project planning

An important outcome of the project initiation phase is the project charter. During the project planning phase, the project manager carries out several processes and creates the following documents:

- ***Project plan*** This document identifies the project tasks, and a schedule for the project tasks that assigns project resources and time frames to the tasks.
- ***Resource plan*** It lists the resources, manpower and equipment that would be required to execute the project.

Project planning

- ***Financial plan*** It documents the plan for manpower, equipment and other costs.
- ***Quality plan*** Plan of quality targets and control plans are included in this document,
- ***Risk plan*** This document lists the identification of the potential risks, their prioritization and a plan for the actions that would be taken to contain the different risks..

Project execution

- In this phase the tasks are executed as per the project plan developed during the planning phase.
- A series of management processes are undertaken to ensure that the tasks are executed as per plan.
- Monitoring and control processes are executed to ensure that the tasks are executed as per plan and corrective actions are initiated whenever any deviations from the plan are noticed.

Project execution

- However, the project plan may have to be revised periodically to accommodate any changes to the project plan that may arise on account of change requests, risks and various events that occur during the project execution.
- Quality of the deliverables is ensured through execution of proper processes.
- Once all the deliverables are produced and accepted by the customer, the project execution phase completes and the project closure phase starts.

Project closure

- It involves completing the release of all the required deliverables to the customer along with the necessary documentation.
- Agreements with the vendors are terminated and all pending payments are completed.
- Finally, a post implementation review is undertaken to analyse the project performance and to list the lessons learnt for use in future projects.

Traditional versus Modern Project Management

- Projects are increasingly being based on either tailoring some existing product or reusing certain pre-built libraries.
- Facilitating and accommodating client feedbacks
- Facilitating customer participation in project development work
- Incremental delivery of the product with evolving functionalities.

Traditional versus Modern Project Management

- Requirements management
- Risk management
- Configuration management
  - Version management
  - Release management
- Proper estimation of cost, time etc.
- Scheduling
- Staffing

Summary

- Projects are non-routine - thus uncertain
- The particular problems of projects e.g. lack of visibility
- Clear objectives which can be objectively assessed are essential
- Stuff happens. Not usually possible to keep precisely plan – need for control
- Communicate, communicate, communicate!

References :

1. B. Hughes, M. Cotterell, R. Mall, *Software Project Management*, Sixth Edition, McGraw Hill Education (India) Pvt. Ltd., 2018.
2. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.

Thank you