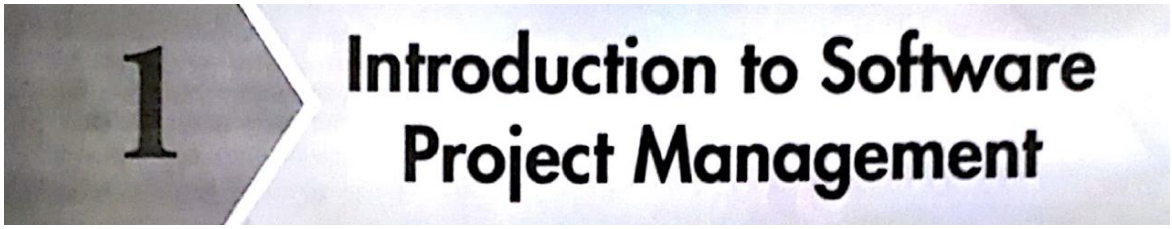
Unit I



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?

The two key questions are:

1. *What exactly is software project management?*

This is going to be tackled by looking firstly at what is meant by 'project'. We are then going to examine whether 'software project management' is really different from 'normal' project management. Is there anything special about software as opposed to other engineered artefacts?

2. *How do we define whether a project is a success or not?*

The point about studying project management is to be able to have successful projects. So how do we know if we have been successful?

Why is project management important?

- Large amounts of money are spent on ICT e.g. UK government in 2003-4 spent £2.3 billions on contracts for ICT and only £1.4 billions on road building
- Project often fail – Standish Group claim only a third of ICT projects are successful. 82% were late and 43% exceeded their budget.
- Poor project management a major factor in these failures

The methodology used by the Standish Group to arrive at their findings has been criticized, but the general perception of the prevalence of ICT project failure is still clear.

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

- An endeavor with specific objectives:
  - Usually consists of multiple tasks
  - With defined precedence relationships
  - With a specific time period for completion
- Non-Software Examples:
  - A wedding
  - An MBA degree
  - A house construction project
  - A political election campaign

Here are some definitions of 'project'. No doubt there are other ones: for example

'Unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including constraints of time, cost and resources'

BSO ISO 10006: 1997

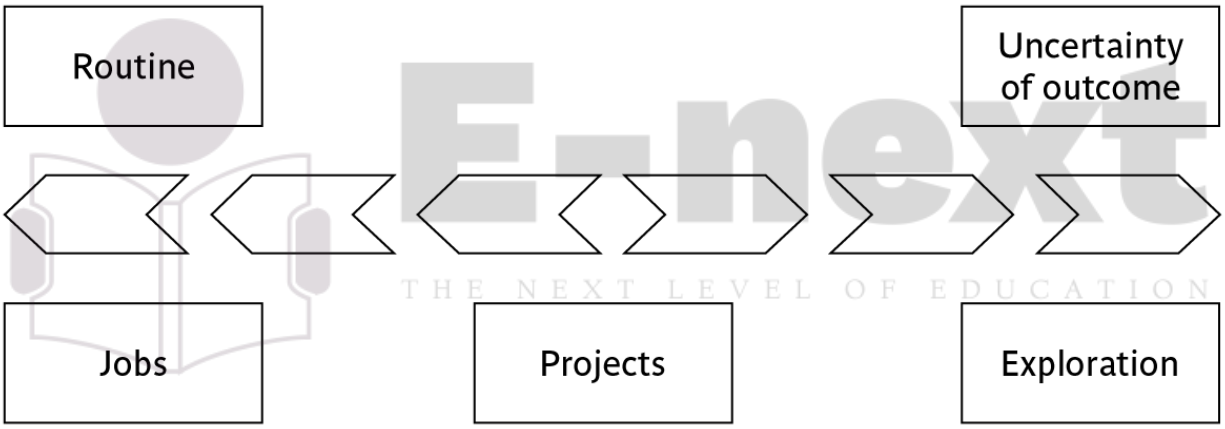
What is a Task?

- A small piece of work:
  - Meant to accomplish a straightforward goal
  - Effort of no longer than a few person-hours

- Involves only a few people
- May or may not be a part of some project
- Usually repetition of a previously accomplished task
- Process management may be relevant!

- Non-software Examples:
  - Attend a lecture class
  - Buy a chocolate from the market
  - Book a railway ticket

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!

On the one hand there are repetitive jobs a similar task is carried out repeatedly, for example Kwikfit replacing a tyre on a car or a lecturer giving an introductory talk on project management. The task is well-defined and there is very little uncertainty. In some organizations, software development might tend to be like this – in these environments software process management might be more important than software project management

On the other hand some exploratory activities are very uncertain. Some research projects can be like this – we may not be sure what the outcome will be, but we hope that we will learn some things of

importance. It may be very difficult to come up with precise plans, although we would probably have some idea of a general approach.

Projects seem to come somewhere between these two extremes. There are usually well-defined hoped-for outcomes but there are risks and uncertainties about achieving those outcomes.

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

Exercise 1.1 in the Software Project Management text is a good way of introducing this material if you have time. I have found this exercise to be a good 'ice-breaker'. Get each student to list the example activities in an order which matches the degree to which they merit the description of 'project'. You can create a grid on a whiteboard with the projects on the vertical axis and the positions 1st, 2nd, 3rd etc on the horizontal axis. You then go through asking how many put 'producing a newspaper' first, second, etc. (Avoid making jokes about this being like the Eurovision song contest). This is time-consuming but it does mean that every student participates in building up a general picture of people's perceptions, and you can discuss disagreements in perceptions as you go along.

Are *software* projects really different from other projects?

Not really …but... The factors

- Invisibility

- Complexity
- Conformity
- Flexibility

make software more problematic to build than other engineered artefacts.

This is based on Fred Brooks' paper No Silver Bullet: Essence and Accidents of Software Engineering which appeared in IEEE Computer 20(4) pp10-19 April 1987

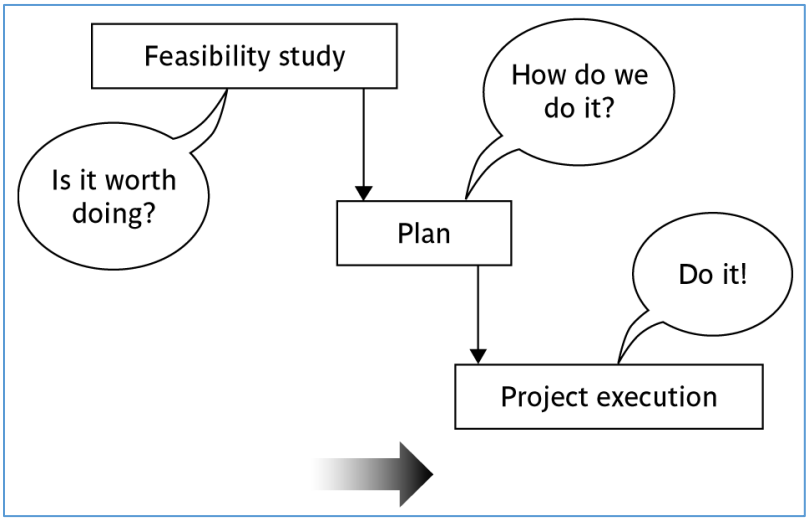
Contract management versus technical project management

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

In general the book looks at things from the point of view of the technical software project manager.

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

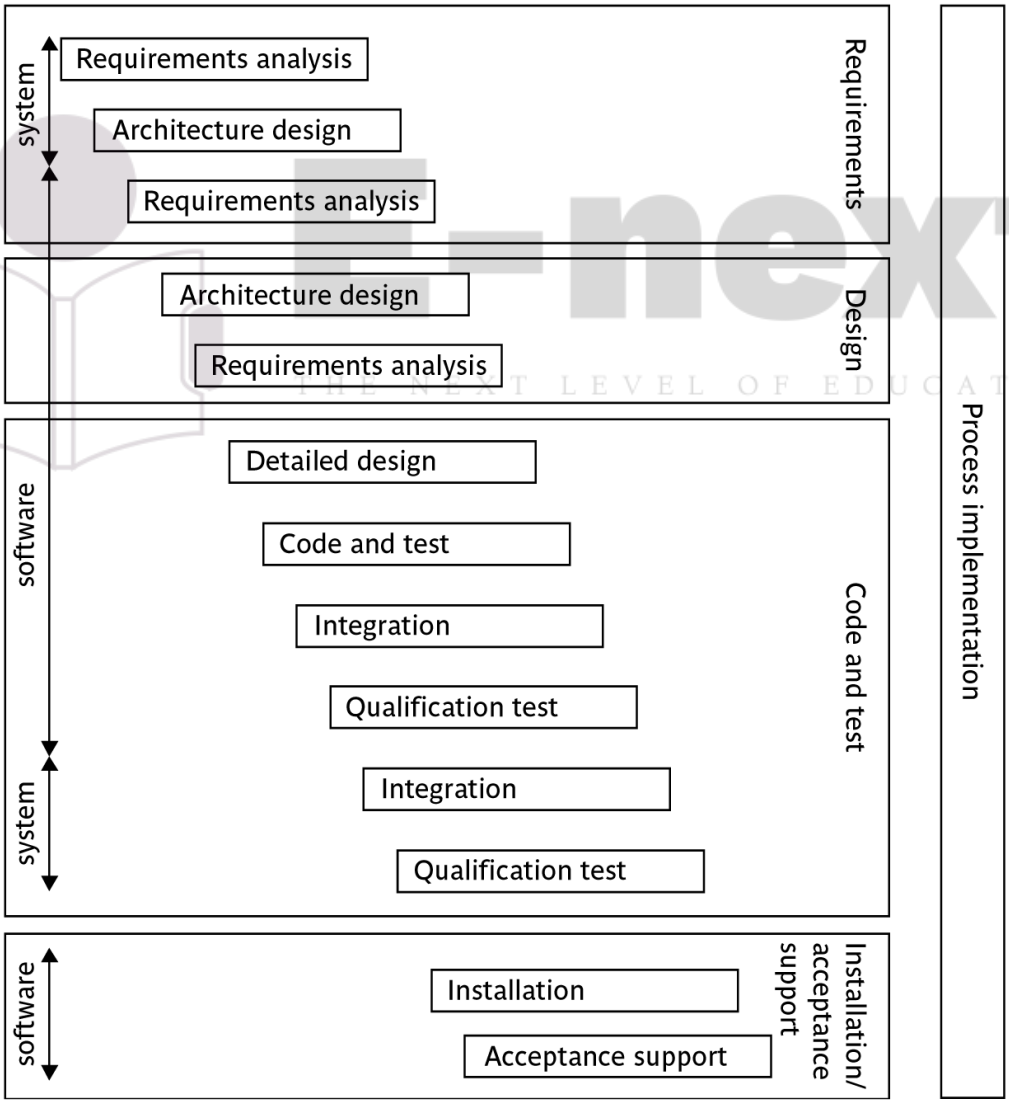
Execution:

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

There are two key points here.

1. *Often you see something like 'feasibility study' being put as the first stage of development life cycle, and indeed it might be. However, the recommendation of the feasibility study might be not to carry out the proposed project. Planning of the project should therefore take place after the feasibility study (or as a part of the feasibility study perhaps). Clearly the feasibility study itself might need a plan.*
2. *All plans are to some extent provisional and subject to change. The key point is that the evolving plan allows us to control the project.*

The software development life-cycle (ISO 12207)



Note that this is a technical model. It identifies the technical constraints on the order activities are done. This does NOT imply that a 'waterfall' approach is the only way to organize projects. The technical model could be implemented as increments or in an evolutionary manner.

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

The key point here is that requirement analysis has to face in (at least) two different directions. It needs to communicate and elicit the requirements of the users, speaking in their language. It needs to organize and translate those requirements into a form that developers can understand and relate to.

- 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

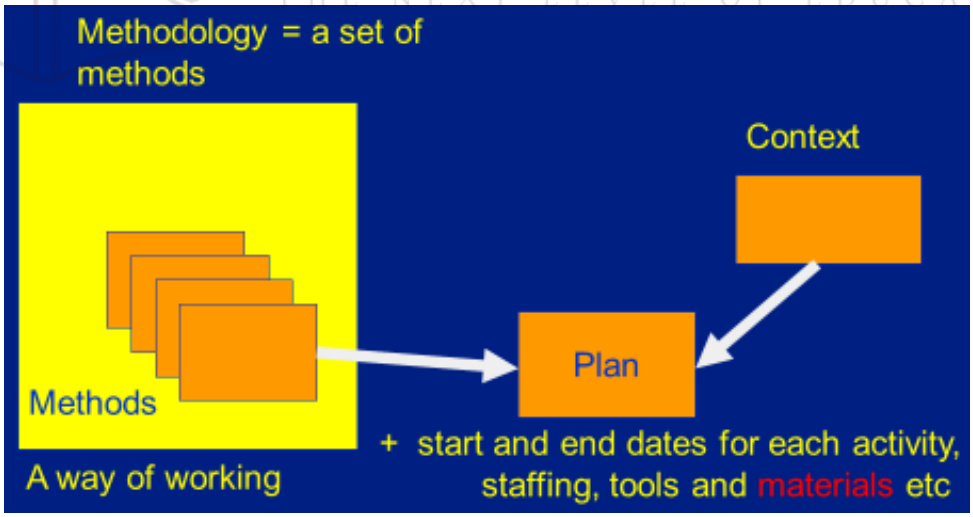
- *The software project will almost certainly be part of a larger project which has non-software elements. In a software engineering environment it could be the software will be embedded in hardware product of some kind. Thus there are system requirements for the product as a whole and software requirements for the software element.*

In a business information systems environment, the software development could be a relatively minor part of a much larger organizational change project.

- 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

The confusion about what 'aimplementation' really means could be mentioned. Does it mean implementing the design (that is, coding) or implementing the complete system in its user environment? It is best to use 'installation' to describe the latter in order to avoid confusion.

Plans, methods and methodologies



A plan of an activity must be based on some idea of a method of work. While a method relates to a type of activity in general, a plan takes one or more methods and converts them into real activities by identifying:

- *Start and end dates*

- *Who will carry it out*
- *What tools and materials would be needed.*

A methodology is a set of related methods. Strictly speaking 'methodology' ought to mean the study of methods!

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

- *With objective-based projects, a general objective or problem is defined, and there are several different ways in which that objective could be reached. The project team have freedom to select what appears to be the most appropriate approach.*
- *With product-based projects, the product is already very strictly defined and the development team's job is to implement the specification with which they have been presented.*
- *Arguably, information systems projects are more likely to be objective-based than is the case with software engineering.*
- *In many cases, an objective-based project could consider a problem and recommend a solution that is then implemented by a product-based project.*
- *Exercise 1.5 in the text is relevant here.*

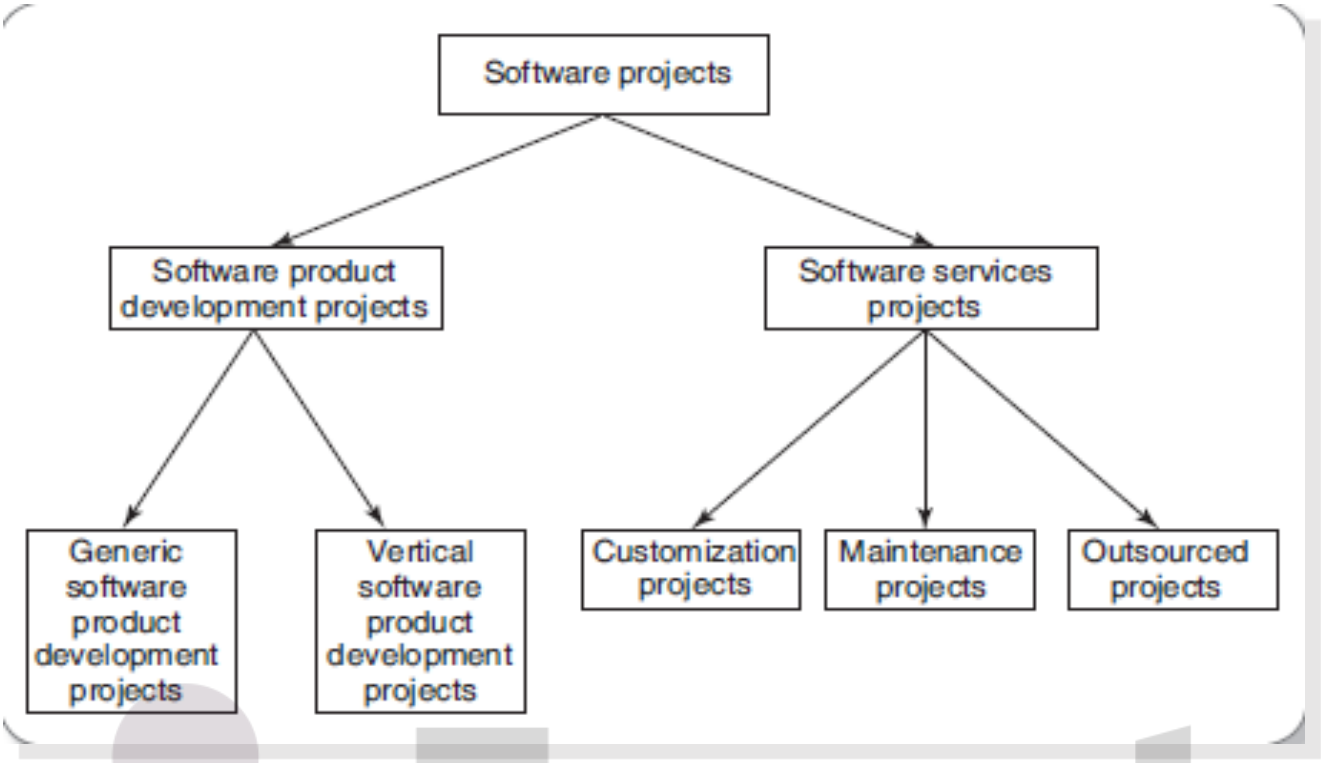


Fig. A Categorization of Software Projects

Two Types of Software Projects

- Software product development projects
- Software services projects

Software Services

- Software service is an umbrella term, includes:
  - Software customization
  - Software maintenance
  - Software testing
  - Also contract programmers who carry out coding or any other assigned activities.

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

Each stakeholder will have their own goals and concerns in relation to the project which may be different from those of the project as a whole. For example, a software developer might work to make a living, pay the mortgage, learn new things, solve interesting problems. The main stakeholders need, however, to understand and accept overall project objectives that everyone can agree to.

See Exercise 1.6 in the text.

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

- *Different people who are involved in a project (Stakeholders) will have different interests in the project and are likely to see different outcomes as being important.*
- *For example, end-users would want a system that is 'user-friendly', that is, easy to learn and to use, and a system that helps rather than hinders them from doing their jobs. Their managers may be more interested in whether the new system would allow them to reduce staffing levels.*

- *It is important therefore that a set of clearly defined objectives are identified and published for the project. Some individual or group needs to be pinpointed who acts as the main client for the project.*
- *See Exercise 1.7 in the text.*

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

The focus here needs to be on what the situation will be when the project is completed. In what ways will the world be different? The objectives should avoid describing activities:

e.g. 'a new payroll application will be operational by 4th April' not 'design and code a new payroll application'

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

I have seen some places where the R is said to stand for 'resource-constrained', that is that there is a target cost associated with the achievement of the objective.

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

Scoring a goal in football is a 'goal' or sub-objective on the way to achieving the overall objective of winning the match. Sub-objectives and objectives can be nested in a hierarchy, so that the objective of winning the match could itself be a goal or sub-objective on the way to winning the league etc.

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

Goals can be formulated in such a way that they represent what an individual or group need to do to contribute to the success of the project's objectives.

In the example above, the analyst or developer, by themselves, cannot guarantee user satisfaction. However, the analyst can contribute to the achievement of the objective by making sure the users' requirements are accurately recorded and the developer by making sure that the software is reliable.

See Exercise 1.7 in the text.

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 etc

See Exercise 1.8 in the text.

The business case

Benefits of delivered project must outweigh costs

Costs include:

- Development
- Operation

Benefits

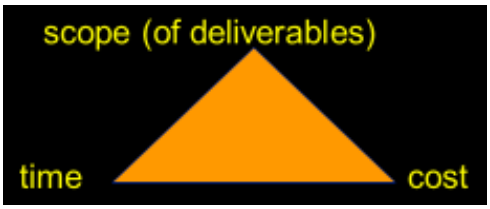
Quantifiable

Non-quantifiable

It is not always possible to put a precise financial on the benefits of a project. The client's willingness to pay up to a certain price to get a project implemented implies that they have informally identified a value to them of getting that project implemented.

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
- 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

Exercise 1.6 (a day in the life of a project manager) is of relevance here.

Project Planning

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

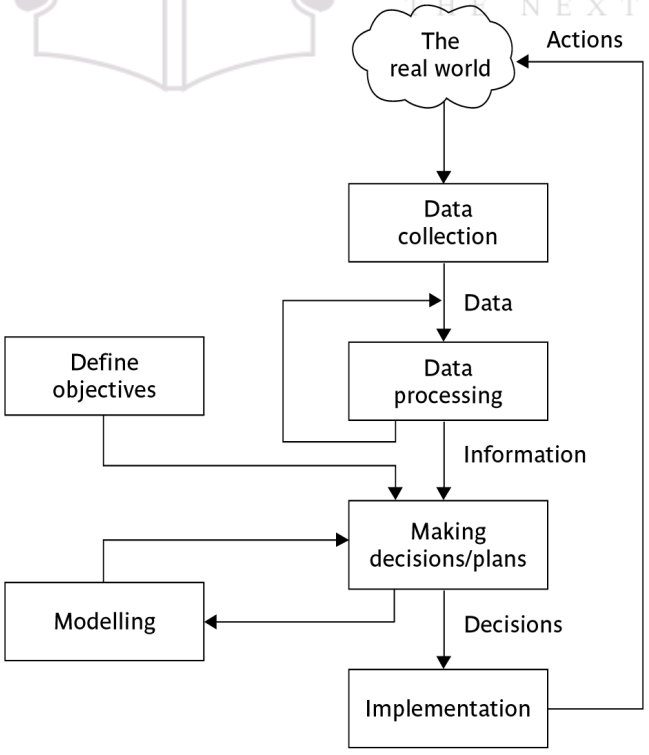
In the project initiation stage, an initial plan is made. As the project start, the project is monitored and controlled to proceed as per the plan. But, the initial plan is refined from time to time to factor in additional details and constraints about the project become available.

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.

Rather than making a long term project completion plan, the project manager now plans all incremental deliveries with evolving functionalities. This type of project management is often called Extreme project management.

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

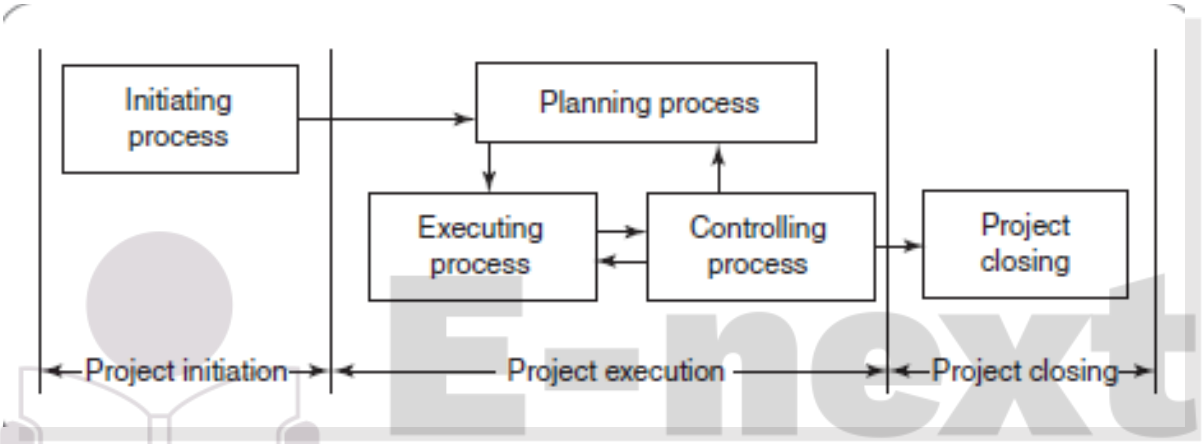
Modelling – working out the probable outcomes of various decisions

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

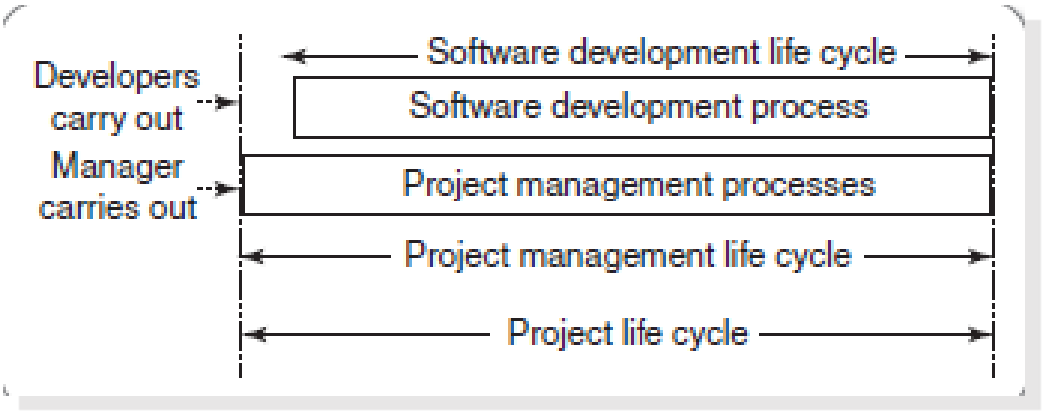
> *The authors' view is that an initially defective plan can often be remedied by good project control and management.*

Project Management Processes



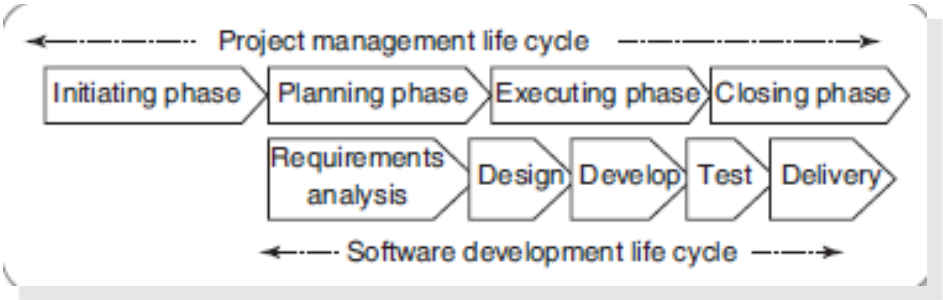
In the project initiation stage, an initial plan is made. As the project starts, the project is executed and controlled to proceed as planned. Finally, the project is closed.

Project Management Life Cycle Versus Product Development Life Cycle



During the software development life cycle, the software developers carry out several types of development processes. On the other hand, during the software project management life cycle, the software project manager carries out several project management processes

Phases of Project Management Life Cycle



Project Initiation

- 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

- A series of questions that lead to a definition of key project characteristics:
  - 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 Planning

- Various plans are made:
  - *Project plan: A*ssign project resources and time frames to the tasks.
  - *Resource plan: List the resources, manpower and equipment that required to execute the* project.

- *Financial plan: plan for manpower, equipment and other costs.*
- *Quality plan: Plan of quality targets and control.*
- *Risk plan: Identification of the potential risks, their prioritization and a plan* for the actions that would be taken to contain the different risks.

Project Execution

- Tasks are executed as per the project plan
- Monitoring and control processes are executed to ensure that the tasks are executed as per plan
- Corrective actions are initiated whenever any deviations from the plan are noticed.

Project Closure

- Involves completing the release of all the required deliverables to the customer along with the
- necessary documentation.
- Subsequently, all the project resources are released and supply agreements with the vendors are terminated and all the pending payments are completed.
- Finally, a post-implementation review is undertaken to analyze the project performance and to list the lessons learnt for use in future projects.

Key points in lecture

- 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!

Main topics to be covered

- The business case for a project
- Project portfolios
- Project evaluation
  - Cost benefit analysis
  - Cash flow forecasting
- Programme management
- Benefits management

The business case

- **Feasibility studies** can also act as a 'business case'
- Provides a justification for starting the project
- Should show that the benefits of the project will exceed development, implementation and operational costs
- Needs to take account of business risks

See page 22

It is worth recalling the difference between project success (the project is successfully completed) and business risks (the new product or system successfully established by the project goes on to generate benefits for the organization).

Contents of a business case

1. Introduction/ background

2. The proposed project
3. The market
4. Organizational and operational infrastructure
5. The benefits
6. Outline implementation plan
7. Costs
8. The financial case
9. Risks
10. Management plan

- **Introduction/background:** describes a problem to be solved or an opportunity to be exploited
- **The proposed project:** a brief outline of the project scope
- **The market:** the project could be to develop a new product (e.g. a new computer game). The likely demand for the product would need to be assessed.
- **Organizational and operational infrastructure:** How the organization would need to change. This would be important where a new information system application was being introduced.
- **Benefits** These should be express in financial terms where possible. In the end it is up to the client to assess these – as they are going to pay for the project.
- **Outline implementation plan:** how the project is going to be implemented. This should consider the disruption to an organization that a project might cause.
- **Costs:** the implementation plan will supply information to establish these
- **Financial analysis:** combines costs and benefit data to establish value of project

Financial analysis – we will see later that the comparative value of costs and benefits may not be obvious as the timing of costs and benefits need to be taken into consideration.

Project portfolio management

The concerns of project portfolio management include:

- Evaluating proposals for projects
- Assessing the risk involved with projects
- Deciding how to share resources between projects
- Taking account of dependencies between projects
- Removing duplication between projects
- Checking for gaps

There are three elements to PPM:

1. **Project portfolio definition**
   - Create a central record of all projects within an organization
   - Must decide whether to have ALL projects in the repository or, say, only ICT projects
   - Note difference between new product development (NPD) projects and renewal projects e.g. for process improvement
2. **Project portfolio management**

   Actual costing and performance of projects can be recorded and assessed
3. **Project portfolio optimization**

Information gathered above can be used achieve better balance of projects e.g. some that are risky but potentially very valuable balanced by less risky but less valuable projects

You may want to allow some work to be done outside the portfolio e.g. quick fixes

Cost benefit analysis (CBA)

This relates to an individual project. You need to:

- Identify all the costs which could be:

- Development costs
- Set-up
- Operational costs

- Identify the value of benefits
- Check benefits are greater than costs

Section 2.4 of the text expands this material.

Exercise 2.1 requires students to identify the potential costs and benefits of the Brightmouth College payroll application.

Product/system life cycle cash flows

- The timing of costs and income for a product of system needs to be estimated.
- The development of the project will incur costs.
- When the system or product is released it will generate income that gradually pays off costs
- Some costs may relate to decommissioning – think of demolishing a nuclear power station.

Net profit

Year	Cash-flow
0	-100,000
1	10,000
2	10,000
3	10,000
4	20,000
5	100,000
Net profit	50,000

'Year 0' represents all the costs before system is operation

'Cash-flow' is value of income less outgoing

Net profit value of all the cash-flows for the lifetime of the application

See Section 2.5 for further details. Exercise 2.3 is applicable here

Pay back period

This is the time it takes to start generating a surplus of income over outgoings. What would it be below?

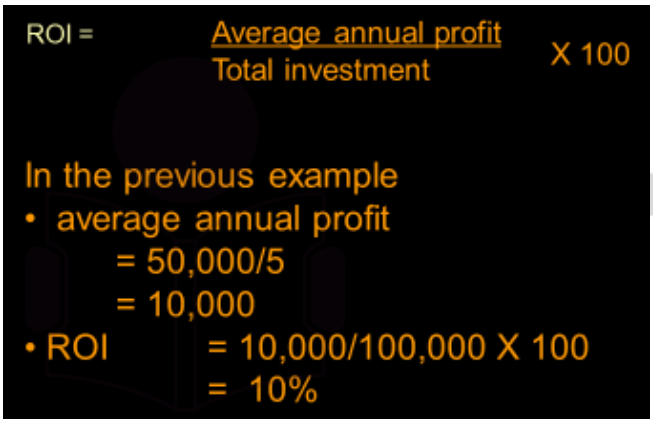
Year	Cash-flow	Accumulated
0	**-100,000**	**-100,000**
1	**10,000**	**-90,000**
2	**10,000**	**-80,000**

3	**10,000**	**-70,000**
4	**20,000**	**-50,000**
5	**100,000**	**50,000**

The payback period would be about 4.5 years. This can be calculated as the last year in which the accumulated cash flow was negative + (absolute accumulated cash flow at the end of that year / cash-flow for the next year) e.g. year 4 + (50,000/100,000). This assumes that the flow of cash is constant throughout the year in question e.g. £100,000/12 or £8,333 a month in year 5

Exercise 2.3. in the text is relevant here.

Return on investment (ROI)



Exercise 2.4. gives further practice is calculating ROI.

Net present value

Would you rather I gave you £100 today or in 12 months time?

If I gave you £100 now you *could* put it in savings account and get interest on it.

If the interest rate was 10% how much would I have to invest now to get £100 in a year's time?

This figure is the *net present value* of £100 in one year's time

If you invested £91 now you would get £9.10 in interest which would give you £100.10 in 12 months. The interest rate of 10% is used purely to make it easy to do the calculations, not because it is a realistic rate.

Discount factor

Discount factor = $1/(1+r)^t$

r is the interest rate (e.g. 10% is 0.10)

t is the number of years

In the case of 10% rate and one year

Discount factor = 1/(1+0.10) = 0.9091

In the case of 10% rate and two years

Discount factor = 1/(1.10 x 1.10) =0.8294

Applying discount factors

Year	Cash-flow	Discount factor	Discounted cash flow
0	-100,000	1.0000	-100,000
1	10,000	0.9091	9,091
2	10,000	0.8264	8,264
3	10,000	0.7513	7,513
4	20,000	0.6830	13,660
5	100,000	0.6209	62,090
		NPV	618

NPV is the sum of the discounted cash flows for all the years of the 'project' (note that in NPV terms the lifetime of the completed application is included in the 'project')

The figure of £618 means that £618 more would be made than if the money were simply invested at 10%. An NPV of £0 would be the same amount of profit as would be generated by investing at 10%.

Internal rate of return

- Internal rate of return (IRR) is the discount rate that would produce an NPV of 0 for the project
- Can be used to compare different investment opportunities
- There is a Microsoft Excel function which can be used to calculate

The Excel function in question is =IRR.

Dealing with uncertainty: Risk evaluation

- project A might appear to give a better return than B but could be riskier
- Draw up a project risk matrix for each project to assess risks – see next overhead
- For riskier projects could use higher discount rates

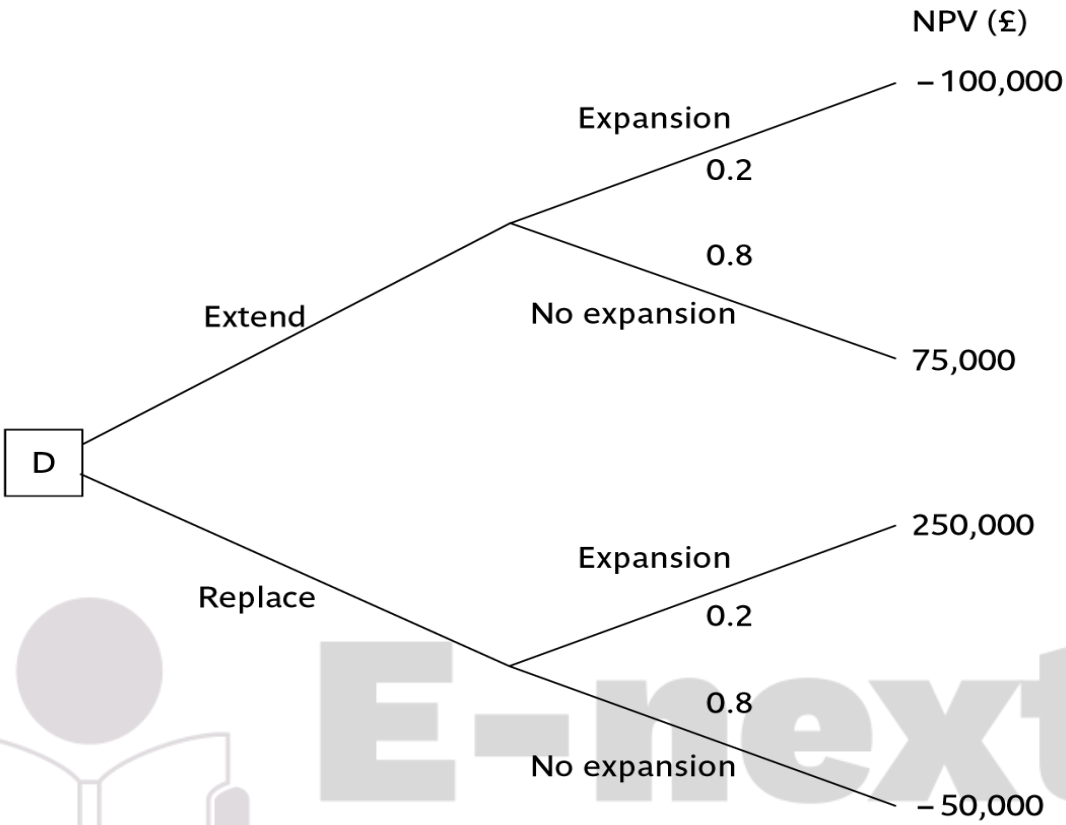
Example of a project risk matrix

Risk	Importance	Likelihood
Client rejects proposed look and feel of site	H	—
Competitors undercut prices	H	M
Warehouse unable to deal with increased demand	M	L
Online payment has security problems	M	M
Maintenance costs higher than estimated	L	L
Response times deter purchasers	M	M

TABLE 2.5 A fragment of a basic project/business risk matrix for an e-commerce application

In the table 'Importance' relates to the cost of the damage if the risk were to materialize and 'likelihood' to the probability that the risk will actual occur. 'H' indicates 'High', 'M' indicates 'medium' and 'L' indicates 'low'. The issues of risk analysis are explored in much more depth in chapter 7.

Decision trees



The diagram here is figure 2.2 in the text.

This illustrates a scenario that could relate to the IOE case study. Say Amanda is responsible for extending the invoicing system. An alternative would be to replace the whole of the system. The decision is influenced by the likelihood of IOE expanding their market. There is a strong rumour that they could benefit from their main competitor going out of business: in this case they could pick up a huge amount of new business, but the invoicing system could not cope. However replacing the system immediately would mean other important projects would have to be delayed.

The NPV of extending the invoicing system is assessed as £75,000 if there is no sudden expansion. If there were a sudden expansion then there would be a loss of £100,000. If the whole system were replaced and there was a large expansion there would be a NPV of £250,000 due to the benefits of being able to handle increased sales. If sales did not increase then the NPV would be -£50,000.

The decision tree shows these possible outcomes and also shows the estimated probability of each outcome.

The value of each outcome is the NPV multiplied by the probability of its occurring. The value of a path that springs from a particular decision is the sum of the values of the possible outcomes from that decision. If it is decided to extend the system the sum of the values of the outcomes is £40,000 (75,000 x 0.8 – 100,000 x 0.2) while for replacement it would be £10,000 (250,000 x 0.2 – 50,000 x 0.80). Extending the system therefore seems to be the best bet (but it is still a bet!).

Programme management

- **One definition:**

'a group of projects that are managed in a co-ordinated way to gain benefits that would not be possible were the projects to be managed independently' Ferns

The quotation is from a paper that appeared in the International Journal of Project Management August 1991

Programmes may be

- Strategic
- Business cycle programmes
- Infrastructure programmes
- Research and development programmes
- Innovative partnerships

- See Section 2.7
- ***Strategic***
- Several projects together implement a single strategy. For example, merging two organizations will involve many different activities e.g. physical re-organization of offices, redesigning the corporate image, merging ICT systems etc. Each of these activities could be project within an overarching programme.
- ***Business cycle programmes***

- A portfolio of project that are to take place within a certain time frame e.g. the next financial year
- ***Infrastructure programmes***
- In an organization there may be many different ICT-based applications which share the same hardware/software infrastructure
- ***Research and development programmes***
- In a very innovative environment where new products are being developed, a range of products could be developed some of which are very speculative and high-risk but potentially very profitable and some will have a lower risk but will return a lower profit. Getting the right balance would be key to the organization's long term success
- ***Innovative partnerships***
- e.g. pre-competitive co-operation to develop new technologies that could be exploited by a whole range of companies

Programme managers versus project managers

Programme manager	Project manager
Many simultaneous projects	One project at a time
Personal relationship with skilled resources	Impersonal relationship with resources
Optimization of resource use	Minimization of demand for resources
Projects tend to be seen as similar	Projects tend to be seen as unique

The programme manager may well have a pool of staff upon which to call. He/she will be concerned with ensuring the best use of staff e.g ensuring that staff have regular work with no periods of enforced idleness between project tasks. The project leader would think in terms of 'I need a Java programmer for four weeks' without being concerned which specific person it is (beyond obvious concerns that they are fully capable).

Strategic programmes

- Based on OGC approach
- Initial planning document is the **Programme Mandate** describing
  - The new services/capabilities that the programme should deliver
  - How an organization will be improved
  - Fit with existing organizatioal goals
- A **programme director** appointed a champion for the scheme

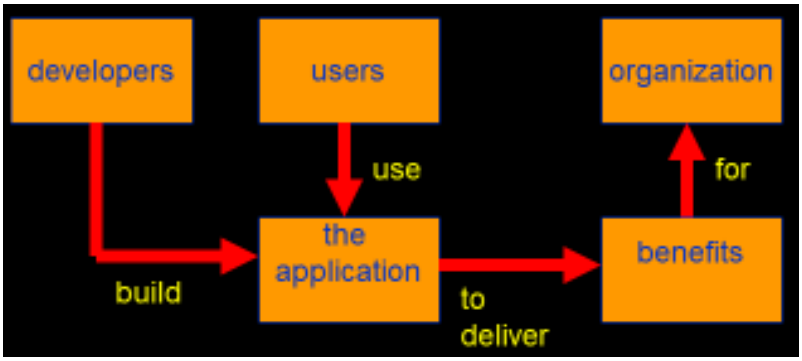
- *The material here is based on the UK government's Office of Government Commerce (OGC) approach which is described in detail in their publication Managing successful programmes.*
- *The programme director should be someone who is in a prominent position in the organization so that the seriousness and commitment of the organization to the programme are made clear.*
- *An example of what might be a programme is given in Section 2.9 in the text. It might be found at the IOE company that the customers' experience of the organization can be very variable and inconsistent. The employee who records the customer's requirements is different from the people who actually carry out the work and different again from the clerk who deals with accounts. Different maintenance engineers deal with different types of equipment. A business objective might be to present a consistent and uniform interface to the client. This objective might need changes to a number of different systems which until now have been largely self-contained. The work to reorganize each individual area might be treated as separate projects, co-ordinated at a higher level as a programme.*

Next stages/documents

- **The programme brief** – equivalent of a feasibility study: emphasis on costs and benefits
- **The vision statement** – explains the new capability that the organization will have
- **The blueprint** – explains the changes to be made to obtain the new capability

- The programme brief – is it worth it?
- The vision statement – the 'what'
- The blueprint – the 'how'

Benefits management



- Providing an organization with a capability does not guarantee that this will provide benefits envisaged – need for *benefits management*
- This has to be outside the project – project will have been completed

- Therefore done at *programme level*

To carry this out, you must:

- Define expected benefits
- Analyse balance between costs and benefits
- Plan how benefits will be achieved
- Allocate responsibilities for their achievement
- Monitor achievement of benefits

- ***Benefit profiles*** *can be produced that document when and how it is planned that the benefits will be experienced.*
- *As different components of the new capability are developed, a series of* ***tranches*** *of projects (projects grouped in different steps of the programme) may be completed, each with a set of associated benefits.*
- *The achievement of benefits might be made the responsibility of staff who are designated as* ***business change managers.***

Benefits

These might include:

- Mandatory requirement
- Improved quality of service

- Increased productivity
- More motivated workforce
- Internal management benefits

- *You could argue that as you have to comply with a mandatory requirement, the question of benefits is irrelevant in this case. However as failure to comply will a negative outcome (e.g. not being able to trade), avoiding that negative outcome is clearly a benefit which could be costed.*
- *'Internal management benefits' includes things like better decision-making. In the case of an insurance company a deeper analysis of insurance claims might help identify types of business that are most risky and allow the company to adjust premiums to cover these.*

- Risk reduction
- Economies
- Revenue enhancement/acceleration
- Strategic fit

- *'Economies' refers to cost-cutting e.g. using an automated telephone system to direct calls without human intervention could allow an organization to reduce staff.*
- *Revenue enhancement/acceleration e.g. the sooner that bills reach the customers, the sooner they can pay them.*
- *'Strategic fit' A change might not benefit any single group within an organization but might have to be made to obtain a benefit for the organization as a whole.*

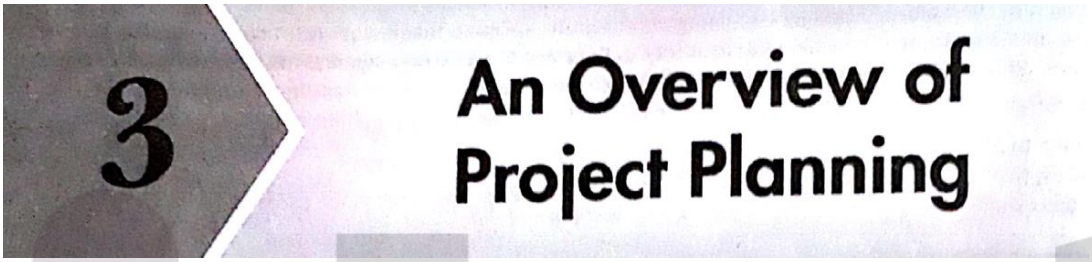
Quantifying benefits

Benefits can be:

- Quantified and valued e.g. a reduction of *x* staff saving *£y*
- Quantified but not valued e.g. a decrease in customer complaints by *x%*
- Identified but not easily quantified – e.g. public approval for a organization in the locality where it is based

Remember!

- A project may fail not through poor management but because it should never have been started
- A project may make a profit, but it may be possible to do something else that makes even more profit
- A real problem is that it is often not possible to express benefits in accurate financial terms
- Projects with the highest potential returns are often the most risky



'Step Wise' – aspirations

- Practicality
  - tries to answer the question 'what do I do now?'
- Scalability
  - useful for small project as well as large
- Range of application
- Accepted techniques
  - e.g. borrowed from PRINCE etc

The motivation for identifying an overall framework was that students, and others, were often at a loss as to where to start when new to project planning. A structured approach was seen as catering for the needs of such people.

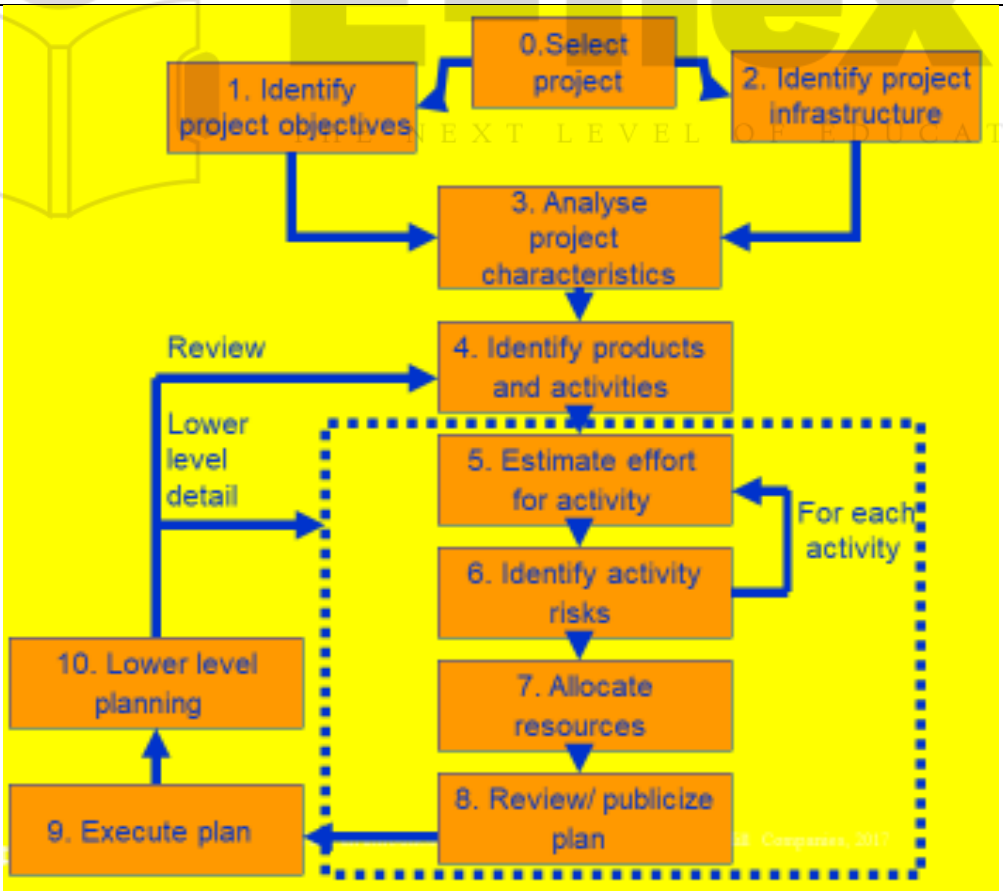
Students are perhaps most likely to come into contact with some kind of project planning (i) when they are involved in student projects, especially those carried in groups and (ii) if they are members of a project team when they are undertaking a placement year in industry. The first situation is probably

quite small-scale compared to the second. The same general principles of planning however relate to both.

The approach described here is designed to be applicable to a range of different types of project. For example, multimedia projects are not explicitly discussed, but one of the authors teaches a course project management for multimedia and the general approach described here seems to work satisfactorily when applied to these type of projects.

It might be asked why a standard approach such as PRINCE2 has not been adopted. In fact there is an outline of the PRINCE2 framework in an Appendix to the textbook. There has been caution about using PRINCE2 more centrally because:

- *PRINCE2 tend to be used mainly in the UK and many users of the Software Project Management textbook are from elsewhere*
- *The content of this course would be vulnerable to changes to the method imposed by its design authority*
- *PRINCE2 tends to focus more on procedural and bureaucratic matters at the expense of techniques – the few planning techniques that are associated with PRINCE, for example, the development of product flow diagrams, are used in the Step Wise approach as well.*



This is an overview of the main steps:

0. Select project There must be some process by which the project to be executed was selected. Chapter 3 on project evaluation looks at this in more detail.

1. Identify project objectives It is important that at the outset the main stakeholders are all aware of the precise objectives of the project. This has already been discussed in Chapter 1.

2. Identify project infrastructure This may not be a significant step where you are working on an in-house project in a very familiar environment. However, where the project is being carried out for external clients then you may need to investigate the characteristics of the environment in which the project is to be carried out.

3. Analyse project characteristics Different types of project will need different technical and management approaches. For example, a project to implement control software embedded in industrial equipment will need a different set of methods than a project to implement a business information system. A multimedia application would again need a different set of activities. (This is not to say that there could not be considerable overlaps in the approaches).

4. Identify products and activities With software projects, it is best to start by listing the products, both deliverable and intermediate, to be created. The activities needed to create the products can then be identified

5. Estimate effort for activity.

6. Identify activity risks Having assessed the amount of effort and the elapsed time for a project, the reasons why these might be vary during the actual execution of the project need to be considered. Where there is a very high risk of additional effort/time being needed then actions to reduce this risk may be formulated.

7. Allocate resources With software projects, these resources will mainly be staff, but could be equipment etc.

8. Review/publicize It is no good having a plan if no one knows about it

9. Execute Plan

10. Lower level planning Not all of a project, especially when it is large, can be planned in detail at the outset. Not all the information needed to plan the later stages will be available at the beginning: for example software development cannot be broken down into precise sub-tasks with realistic target times until more is known about what the overall design of the system is known.

A project scenario: Brightmouth College Payroll

- College currently has payroll processing carried out by a services company
- This is very expensive and does not allow detailed analysis of personnel data to be carried out
- Decision made to bring payroll 'in-house' by acquiring an 'off-the-shelf' application
- The use of the off-the-shelf system will require a new, internal, payroll office to be set up
- There will be a need to develop some software 'add-ons': one will take payroll data and combine it with time-table data to calculate the staff costs for each course run in the college
- The project manager is Brigette.

The last requirement – to build an 'add-on' – allows some software development issues to be addressed!

Step 1 establish project scope and objectives

- 1.1 Identify objectives and measures of effectiveness
  - 'how do we know if we have succeeded?'
- 1.2 Establish a project authority
  - 'who is the boss?'
- 1.3 Identify all stakeholders in the project and their interests
  - 'who will be affected/involved in the project?'

- ***1.1. Identifying objectives and measures of effectiveness.*** *This was discussed in chapter1. Key points are that the student project objectives must be such that a student can realistically be responsible for their achievement. For instance, an objective to reduce conflict between project team members would be at too high a level for a software developer: he or she is there to produce software and evaluation of the particular pyschometric test would be outside their capabilities. If the student was a psychology student and the project was regarded as a psychological one, then things might be different.*

- ***1.2.Establishment of a project authority*** *In the case of students on placement or carrying final year projects for outside organizations, the problem of identifying who has the final say on the project can occur surprisingly often, particular when different user groups have conflicting requirements. In larger, more formal projects, the project authority might reside in a Project Board or steering committee.*
- ***1.3 Identify all stakeholders in the project and their interests****. Stakeholders can be anyone who has an interest in the project. They may be users of the final application or might be involved in the development or implementation of the project.*

- 1.4 Modify objectives in the light of stakeholder analysis
  - 'do we need to do things to win over stakeholders?'
- 1.5 Establish methods of communication with all parties
  - 'how do we keep in contact?'

- ***1.4 Modify objectives in the light of stakeholder analysis.*** *The key point here is the need to ensure commitment to the project from the important stakeholders. This might need to be done by ensuring that there is some benefit from the project for them. Note this is a similar idea to Barry Boehm's 'Theory W' ('W' stands for 'everyone a* ***w****inner')*
- ***1.5 Establish methods of communication with all parties*** *In the case of a small student project, it might be mainly swapping email addresses and mobile phone numbers. With larger projects, it could involve setting up groups who meet regularly to co-ordinate action. Sometimes specific 'communication plans' are drawn up to deal with these issues.*

Back to the scenario

- Project authority
  - Brigette finds she has two different clients for the new system: the finance department and the personnel office. A vice principal agrees to be official client, and monthly meetings are chaired by the VP and attended by Brigette and the heads of finance and personnel
  - These meetings would also help overcome communication barriers

Applying these ideas to the scenario introduced earlier:

- ***Project authority***

- ***Stakeholders/revision to objectives*** *The application will not ultimately be a success if project team members are not happy to use the system. They might be happier to use the testing system if the results of their own tests were automatically notified to them personally by the software application, so that this might have to be added as a requirement for the project.*

- Stakeholders
  - For example, personnel office would supply details of new staff, leavers and changes (e.g. promotions)
  - To motivate co-operation Brigette might ensure new payroll system produces reports that are useful to personnel staff

Step 2 Establish project infrastructure

- 2.1 Establish link between project and any strategic plan
  - 'why did they want the project?'
- 2.2 Identify installation standards and procedures
  - 'what standards do we have to follow?'
- 2.3. Identify project team organization
  - 'where do I fit in?'

- *At the same time as establishing exactly what the project objectives are, the person responsible may know little about the organizational environment in which the application is to be developed and implemented. The actions in Step 2 address this problem.*

Step 3 Analysis of project characteristics

- 3.1 Distinguish the project as either objective or product-based.
  - Is there more than one way of achieving success?
- 3.2 Analyse other project characteristics (including quality based ones)
  - what is different about this project?

- *Step 3 is about examining the nature of the application to be built and the environment in which it is to be built and implemented and identifying the most appropriate technical approach.*
- ***3.1 Objective-based versus product-based projects**. With a product-based project the developers have to create a product, the specification of which is often (but not always) clearly defined. In an objective-based project, a problem is defined that needs to be solved but there could be more than one solution. For example, if an organization needed a payroll application they might consider (a) writing the system themselves (b) using a service company to do the payroll for them (c) acquire an off-the-shelf package*
- ***3.2 Analyse other project characteristics – such as is it an information system or an embedded real time or a multimedia application? Is it safety-critical? Etc etc.** The payroll application is clearly an information system. If an off-the-shelf application is adopted, there is plenty of guidance on how off-the-shelf applications can be accessed and selected that could be consulted by Brigette*

- Identify high level project risks
  - 'what could go wrong?'
  - 'what can we do to stop it?'
- Take into account user requirements concerning implementation
- Select general life cycle approach
  - waterfall? Increments? Prototypes?
- Review overall resource estimates
  - 'does all this increase the cost?'

- *Identifying high level risks could influence the general approach to the project. For example, if the users appeared to be uncertain about the precise nature of the requirement then a more iterative approach, including the use of prototypes to refine user needs, might be selected.*
- *If the application is very large and complex then breaking it down into increments might be the way to proceed. Chapter/lecture 4 looks at this in more detail.*

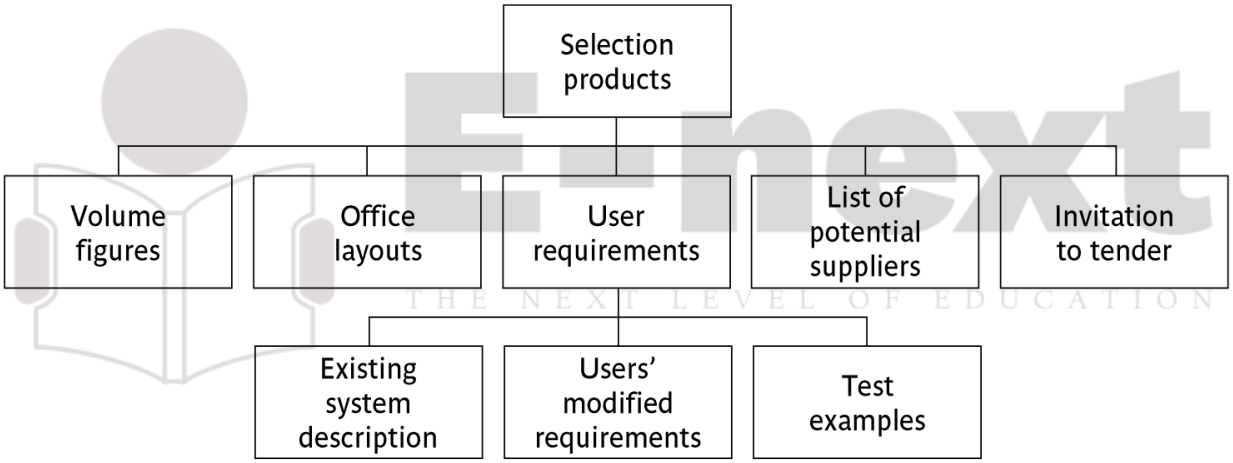
Back to the scenario

- Objectives vs. products
  - An objective-based approach has been adopted

- Some risks
  - There may not be an off-the-shelf package that caters for the way payroll is processed at Brightmouth College
- Answer?
  - Brigette decides to obtain details of how main candidate packages work as soon as possible; also agreement that if necessary processes will be changed to fit in with new system.

Step 4 Identify project products and activities

- **4.1 Identify and describe project products - 'what do we have to produce?'**



Here we follow the PRINCE approach of firstly identifying the products to be created. These products could be deliverables that will eventually be handed over to the customer, or intermediate products such as specifications and design documents, that are produced along the way.

The PBS is a way of listing these products.

*In the scenario, one set of products will relate to the products needed to produce one or more invitations to tender (ITTs) to supply the hardware and software needed to operate the new payroll application. In order to allow the most suitable configuration to be identified the number of transactions and the size of the database needed will have to be identified – **volume figures.** To set up an appropriate network attached to secure printers and servers, a **layout of the proposed office** will need to be created. A **user requirement** will need to be produced which describes the existing system, identifies additional requirements (such as the need to be able to access database details in order to produce one-off queries and reports), and some **test data and expected results** which further*

*illuminate the details of the requirements. This test data could form the basis of user acceptance tests. A **list of potential suppliers** to whom ITTs could be sent will be needed, and the actual ITT itself which will, among other things, explain how the proposals of potential suppliers are to be submitted.*

Products

- The result of an activity
- Could be (among other things)
  - physical thing ('installed pc'),
  - a document ('logical data structure')
  - a person ('trained user')
  - a new version of an old product ('updated software')
- The following are NOT normally products:
  - activities (e.g. 'training')
  - events (e.g. 'interviews completed')
  - resources and actors (e.g. 'software developer') - may be exceptions to this
- Products CAN BE *deliverable* or *intermediate*

Product description (PD)

- Product identity
- Description - what is it?
- Derivation - what is it based on?
- Composition - what does it contain?
- Format
- Relevant standards
- Quality criteria

Create a PD for 'test data'

The names of products on the PBS can be rather vague. If you were to ask some one to produce, for example, the 'analysis report' in the usability testing scenario, then you would need to explain exactly what you mean by that. This is done via a Product Description. PDs can usually be re-used from one project to another.

Note that they are different from specifications – the explain in general terms what a product is and the description is relevant to all instances of that product. A specification describes a particular instance within the class of products.

4.2 document generic product flows

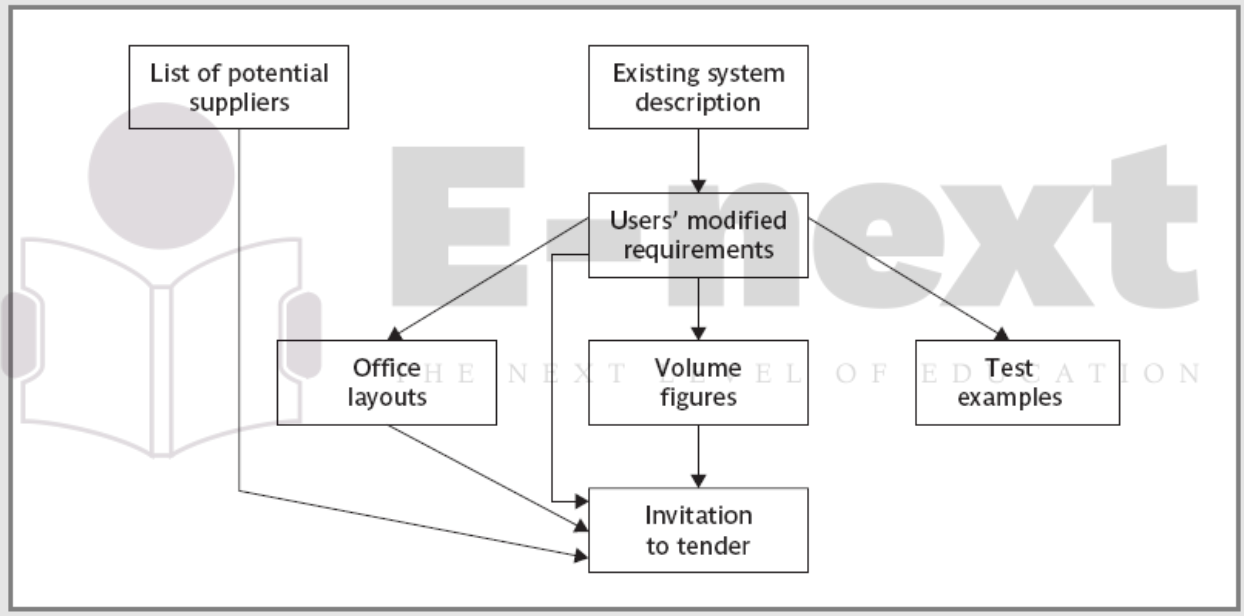


FIGURE B.1 Product Flow Diagram for the creation of an 'invitation to tender'

The product flow diagram shows the order in which the products have to be completed. Effectively it defines a method of working. The example above is a possible solution to Exercise 3.3 in the textbook.

*The flow of the PFD is generally from top to bottom and left to right. We do no put in lines which loop back. This is not because iterative and back-tracking is not accepted. Rather it is that you can in theory jump back to **any** preceding product.*

Step 4.3 Recognize product instances

- The PBS and PFD will probably have identified generic products e.g. 'software modules'
- It might be possible to identify specific instances e.g. 'module A', 'module B' …
- But in many cases this will have to be left to later, more detailed, planning

Step 4.4. Produce ideal activity network

- Identify the activities needed to create each product in the PFD
- More than one activity might be needed to create a single product
- Hint: Identify activities by verb + noun but avoid 'produce…' (too vague)
- Draw up activity network

An 'ideal' activity

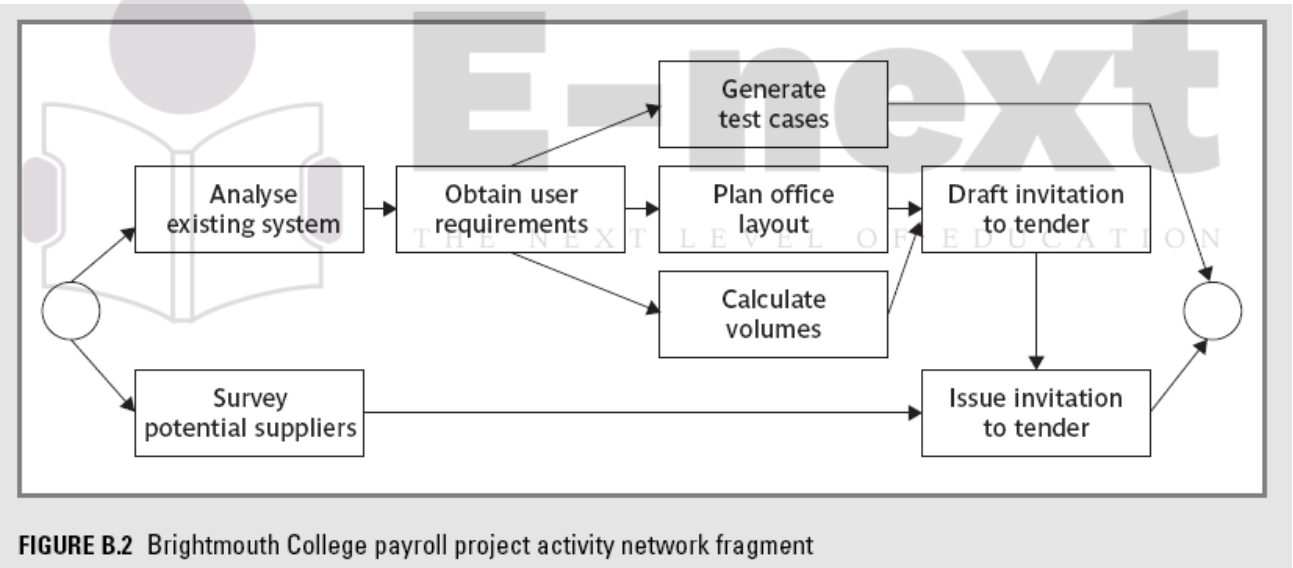
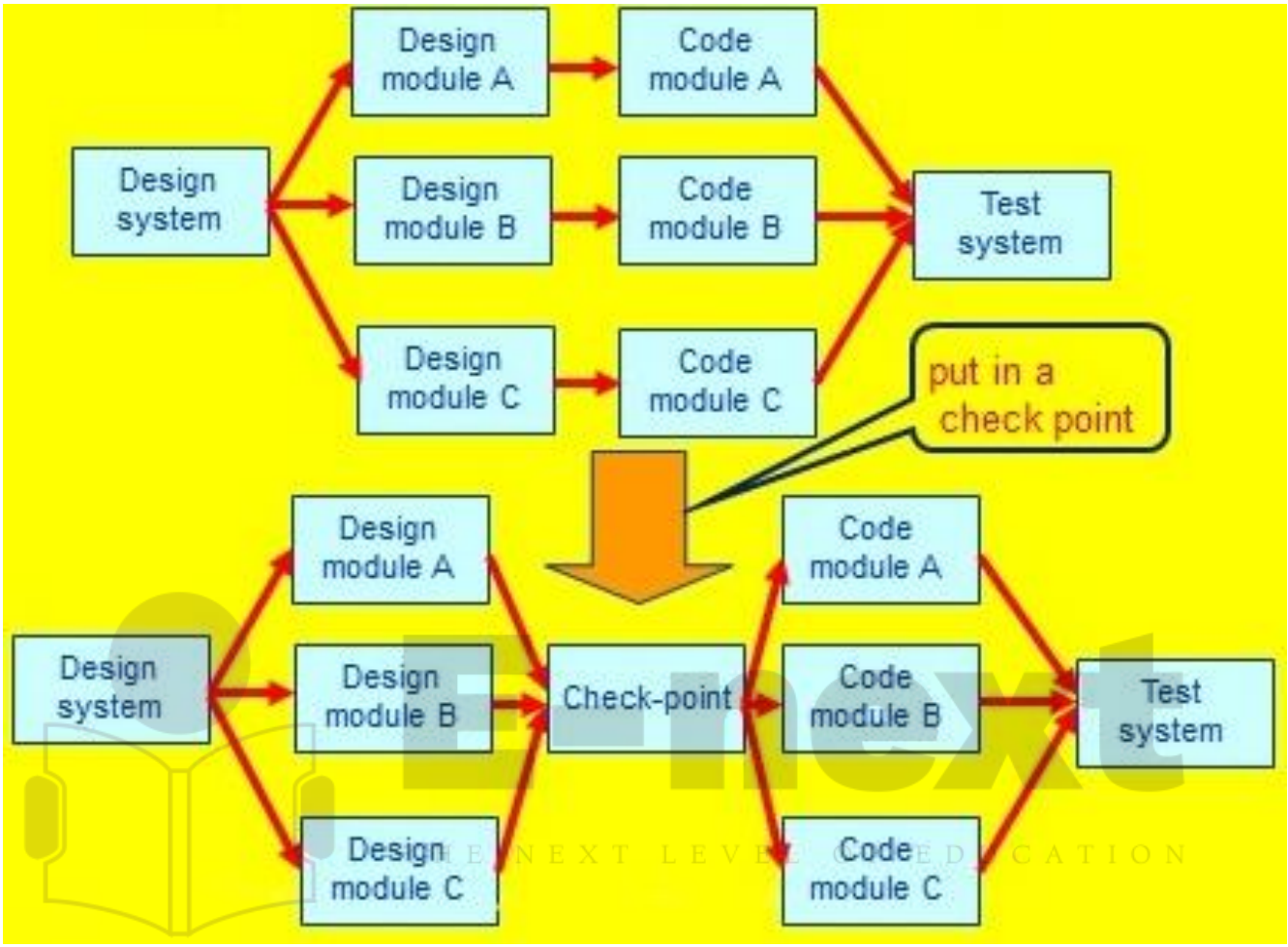


FIGURE B.2 Brightmouth College payroll project activity network fragment

The activity network is the basis of the data that is input to planning software tools like MS Project.

Step 4.5 Add check-points if needed



*There are some points in the project when we want to check that the quality of what we have done so far is a sound basis for further work. In the example we have decided to check that all the module designs are compatible with one another before continuing. Note that the benefit of reducing wasted work at a later stage when incompatibilities lead to products being reworked, has to be balanced against the delay caused by the check-point. The start of coding of modules A, B and C **all** have to wait for the completion of the design of **all** the modules A, B and C. With no check-point, module A could be coded as soon as the design of module A had been done without having to wait for B and C.*

Step 5:Estimate effort for each activity

- 5.1 Carry out bottom-up estimates
  - distinguish carefully between *effort* and *elapsed* time
- 5.2. Revise plan to create controllable activities

- break up very long activities into a series of smaller ones
- bundle up very short activities (create check lists?)

- *Effort is the total number of staff-hours (or days etc) needed to complete a task. Elapsed time is the calendar time between the time task starts and when it ends. If 2 people work on the same task for 5 days without any interruption, then the effort is 10 staff-days and the elapsed time is 5 days.*
- *Using the PBS/PFD to generate the activities often means that some activities are very small and others are huge. Often there is an activity called 'write software' which is 70% of a software development project. These large activities need to be broken down into more manageable small tasks. You should aim for the average length of your activities to be about the time between progress meetings e.g. if you have team progress meeting once a fortnight, try to make the tasks last about 2 weeks.*

Step 6: Identify activity risks

- 6.1.Identify and quantify risks for activities
  - damage if risk occurs (measure in time lost or money)
  - likelihood if risk occurring
- 6.2. Plan risk reduction and contingency measures
  - risk reduction: activity to stop risk occurring
  - contingency: action if risk does occur

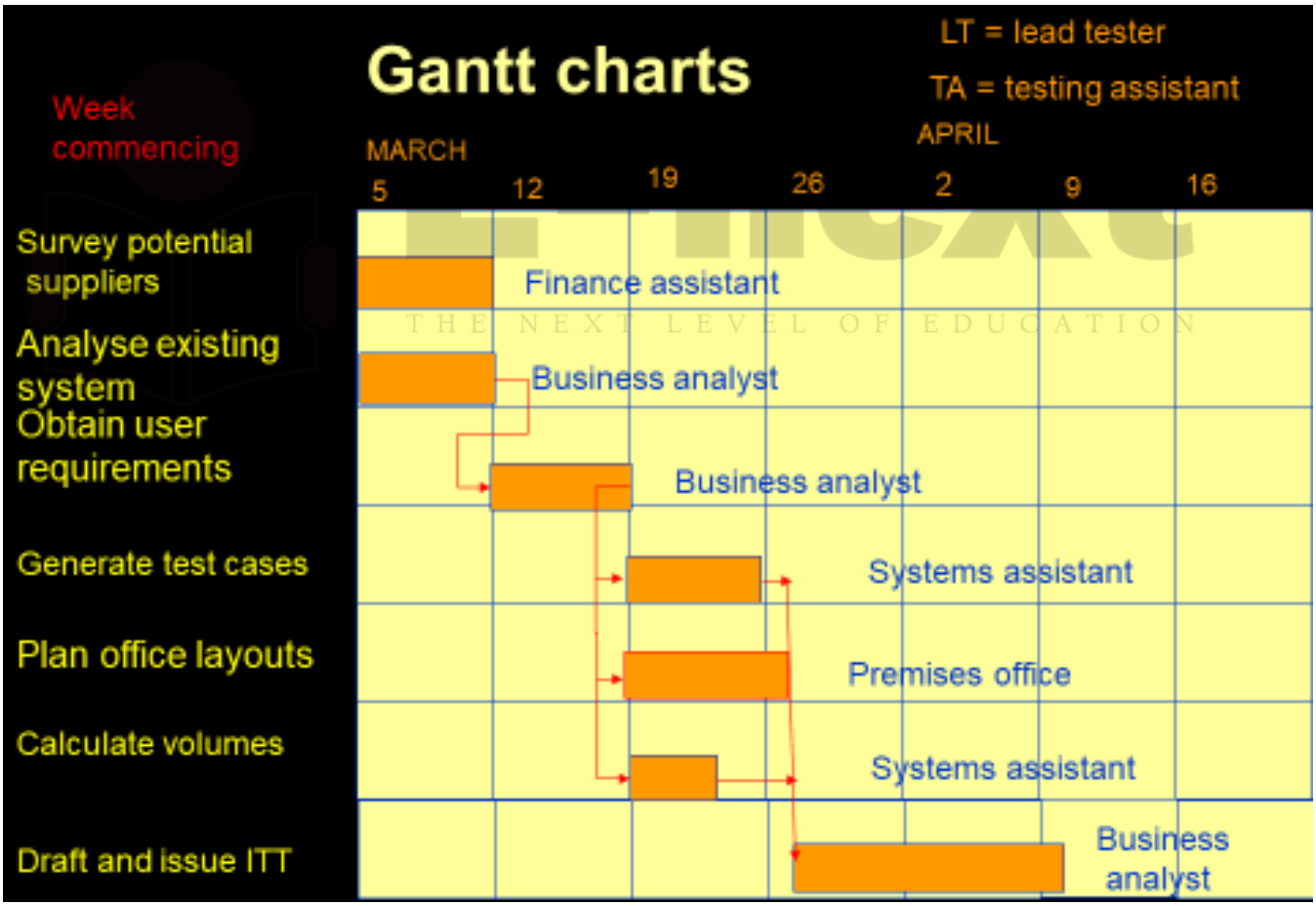
Note that we have already considered some high level risks that could affect the project as a whole at Step 3. Estimates of the effort and duration of activities can be quite tricky. When you produce an estimate for an activity it is worth reflecting about the events which could cause the assumptions upon which you have based your estimate to be wrong. Where the risk seems very high, then you might try to introduce new activities specifically designed to reduce the risk, or to formulate a contingency action if the risk should materialize. For example, there is not much you can do to stop people getting the flu at a critical time in the project, but you might be able to have a plan to bring in temporary cover for sickness in the case of time-critical activities.

- 6.3 Adjust overall plans and estimates to take account of risks
  - e.g. add new activities which reduce risks associated with other activities e.g. training, pilot trials, information gathering

Step 7: Allocate resources

- 7.1 Identify and allocate resources to activities
- 7.2 Revise plans and estimates to take into account resource constraints
  - e.g. staff not being available until a later date
  - non-project activities

You now need to allocate resources (in particular, staff) to the activities in the plan. Where there is a resource constraint, that is there are not enough staff (or other resource) of the right type to start all the activities that run in parallel at the planned time, then the start of some activities may need to be delayed until the appropriate resources are available.



We now have the basic information needed to produce a plan. One way of presenting the plan is by means of a Gantt chart (named after Henry Gantt).

Step 8: Review/publicise plan

- 8.1 Review quality aspects of project plan
- 8.2 Document plan and obtain agreement

Step 9 and 10: Execute plan and create lower level plans

We have noted already that it is not feasible to produce a detailed plan for all stages of the project right at the beginning of the project planning process and not all the information needed for the detailed planning of the later stages is available at the outset. Initially an outline plan for the whole project would be produced, plus a detailed plan for the first stage.

Key points

- Establish your objectives
- Think about the characteristics of the project
- Discover/set up the infrastructure to support the project (including standards)
- Identify **products** to be created and the **activities** that will create them
- Allocate resources
- Set up quality processes