Chapter 4: Development, Implementation and Evaluation Phases

Answers to Test Your Knowledge

1. What is project management?

   Project management is a term used to describe the planning, organising, leading and keeping track of the development and implementation progress of an information system.

2. What are the benefits of project management?

   Project management is a strategy used to keep the progress of the system moving. Only when a project is carefully managed can there be delivery of an information system that:
   - Works as designed;
   - Satisfies the goals of the organisation and is also
   - Built on time and within budget.

3. Define the following project management terms:
   a. Target or
   b. Milestone

   At various points of the project a target, a milestone or a decision date will be defined. Reviews of progress will be made at those times and decisions made about further progress, additional resource requirements, the need to reduce some of the functions proposed.

   c. Critical path

   The critical path of a set of tasks is identified so that if a task on the path happens to go over time, then the final completion date will be delayed. The total duration of the project may be found by adding the times allocated for each task that lies on the critical path.

   d. Slack time

   The duration of the tasks that can be increased, or the start of those tasks delayed by a certain amount without causing a delay in the completion date for the project. Slack times can aid in getting around unplanned contingencies such as components not being developed or delivered on time.

   e. Gantt Chart

   The lines on Gantt charts are linked to a time scale and the length of the tasks on the chart indicate the time planned to be taken to do each task, and the boundaries show the starting and ending times. Gantt charts can also be used to keep track of progress by marking off how much of a task has been done. Arrows on the chart show the dependency of one task on another. However Gantt charts do not show the resources required or other information about the task like a PERT chart can.

   f. PERT chart

   PERT charts show a project as a network of linked tasks. Each task in the project is a node. The tasks that are on the same vertical line can be done at the same time, concurrent or parallel tasks. The arrows connecting the nodes show those that are dependent on each other. However the PERT chart does not graphical show the length of time

   g. Dependency

   Task A is said to be 'dependent' upon Task B if Task A cannot start until Task B has been completed.

   h. Resources

   Each task in the project can be allocated resources that can include people or equipment. Some project management software will also perform calculations on these resources, such as total amounts needed or total costs.

4. Why are different teams of people involved in projects at different stages?

   When creating a system, different teams of people will be involved in the project at different stages. A project plan should specify the nature, size and duration of use for each of these resource requirements. As the project progresses, people from the organisation will become part of the project team for a short time because of their expertise or their areas of responsibility within the organisation. Planning for the hire of extra staff to ensure the completion of the project needs to be undertaken early.

5. Why should systems be tested?

   A major part of project management is the testing of the new system. Time must be allocated for the implementation of the testing plan developed in the design phase. Testing procedures need to focus first on the most critical parts of the project, to ensure that the main functionality of the system is available by the due date.

6. What does handing over the system mean and when does it occur?

   Once testing has been completed, the system needs to be handed over for day-to-day use by the organisation in the implementation phase. Before this is done another review is needed to check that the initial aims and objectives have been achieved and the full design has been developed. Often not all parts of the design can be developed as planned and the reasons and impact of the non-development need to be examined. Also the results of the various tests need to be reviewed as they may indicate further work on some parts of the sub-systems may be needed.

7. Why do systems need to be evaluated?

   Once the system is up and running, an evaluation needs to be conducted after a period of time. The responsibility for organising the evaluation falls into the project management area. If the evaluation highlights some problems then they need to be fixed. Again the project manager will be involved in organising and supervising the remedying process.

8. Explain the difference between the following system development strategies:

   i. top-down

      The Top-down approach allows for a completely new system to be built by starting with the main aims of the system and then breaking them down into smaller sub-systems, sub-sub-systems, and so on.

   ii. bottom-up

      The **Bottom-Up** approach anticipates that a system is already exists and there is a considerable amount of patching up an old system or using parts of an old system to determine much of the structure of the new one.

   iii. RAD

      Rapid Application Development provides a way of producing a workable version quickly and then modifying it after feedback from clients and users.

   iv. Prototyping

      A prototyping approach may be used as part of the overall development process and is especially useful in the design phase. RAD often incorporates prototyping. A prototype is an earlier, smaller or partially completed, ‘no frills’, version of the information system. With this approach the designer can demonstrate various alternative features to the users. If the user feedback indicates that there are any problems with the prototype system it can be modified and then re-assessed again. The refinement process continues until both the user and the designer are satisfied. The prototype can be an actual program developed using a RAD tool or a simulation of processing using a spreadsheet or input and output screens and reports using a word processor.

v. Agile.
Agile software development processes are built on iterative development like prototyping and RAD but add a more people-centric viewpoint. Agile processes use feedback, rather than planning, as their primary control mechanism. The feedback is driven by regular tests and releases of the evolving software. However they have the drawback of not providing for detailed long-term planning.

9. List the factors that need to be considered when deciding between purchasing off-the-shelf software and developing custom-built software.

Commercial (Off-The-Shelf) Software

- Reduced Upgrade Costs
  Commercially packaged software is often updated regularly.
- Reduced Costs
  As commercially written software is written by large organisations their software development costs are spread amongst customers who purchase this software.
- Less implementation time
  Commercially purchased software has been designed, implemented, tested, documented and evaluated before entering the market. Therefore when purchasing software that is commercially written, the wait for implementation is not there.
- Same software, other companies
  Other companies that are using the same application can be contacted to get feedback on the software's performance, and the solutions to problems experienced.
- Less technical support
  Organisations that use commercially purchased software do not need as many specialised Information Technology staff.
- Reliability
  Given that commercial software has been thoroughly tested before it is sold to customers, most of the major errors should have been located and eliminated by the software vendor company.

Custom-Built Software

- Individual requirements
  Organisations often decide to develop custom-built software because the commercially available packages do not suit the organisation's requirements.
- Minimize disruptions
  An organization may choose to develop its own software because it causes fewer disruptions in the day-to-day running of the organisation.
- Work-around existing systems
  Whether software is commercially- or custom- built it must be able to merge in with the current system. Generally, custom-built software works better with existing systems because the programmers can integrate the existing package with the new one, so that software works harmoniously with existing applications.
- Software must integrate with current technology
  It is very rare that companies would change their entire hardware just to cater for the needs of one application. After investing much time, effort and money into hardware, organisations would not scrap their hardware and purchase new technology just because one application will not run on it.

10. When selecting local or overseas hardware suppliers, is it best to purchase from the cheapest supplier? List the factors that need to be taken into account when making the decision.

Sometimes there is no clear choice between competing components so the decision needs to be based on technical, human, economic and operational reasons.

- Availability of Components
  Hardware and software components need to be available to be implemented as required.
- Geographic Location of Suppliers
  The usual decision is to choose a local supplier because of related matters such as warranties, repairs or training that are easier to access from a local supplier.
- Compatibility of Components
  There may be a particular brand of software that exactly suits a company's way of handling their stock and warehouse functions but the structure of the files from the old

legacy system would make the transfer of the data from one format to another very expensive.

- Costs – Establishment and Ongoing
  Studies have shown that establishment costs for information systems are usually much less than the ongoing costs of maintaining new equipment.
- Reliability of Suppliers
  Since a business usually has a long term relationship with their equipment suppliers the reliability of the supplier needs to be checked.
- Ergonomic Requirements
  When purchasing and installing new equipment the personnel requirements of the staff using it are very important; and there are ergonomic requirements included in the Occupational Health and Safety regulations that need to be adhered to.
- Reliability and Robustness of Components
  Computers that are used in non-office situations such as factories, cars and planes, or in the outdoors need to be more reliable and robust than the normal desktop computer.
- Training Requirements
  Most new hardware and software involves the training of users and technicians that can be very expensive, especially if it needs to take place in a location that is not close to the organisation.

11. The establishment costs for an information system is usually much less than the ongoing costs of maintaining the new equipment. Do you agree with this statement?
    Yes. For example: for the small home office, the cost of colour printer cartridges can far outweigh the cost of the original printer even in the first year of use. It may be cheaper in the long term to get a small laser printer for the majority of the in-house printing and outsource the colour printing.

12. Why is it important to check the reliability of suppliers?
    Since a business usually has a long term relationship with their equipment suppliers the reliability of the supplier needs to be checked with other companies that use the supplier.

13. What does the term ergonomics mean? Provide some examples.
    The applied science of equipment design intended to maximize productivity by reducing operator fatigue and discomfort. This includes lighting, type of desk, chair and size of the monitor and type of keyboard and mouse. Some users have great difficulty with a track-pad or mouse-stick that can be found on a notebook computer. The size and clarity of notebook computer screens can be straining on the eyes, and the position of the keyboard can also be a problem .For these types of situations an external mouse, keyboard and screen may be necessary. The external components can come in the form of individual items or combined together in a docking station that can be expensive.

14. Describe the tests conducted to establish whether a component of a computer is acceptable for a critical system.
    i. Computers should be able to run 24/7, all day every day, in critical situations such as Web and mail servers need to be fault tolerant. This can mean purchasing computers that have more than one processor that work in clusters that can share tasks. In the event of a breakdown of one processor or computer the overall functioning of the system will not be effected and will allow time for repairs to be made.
    ii. There must be real-time storage and backup of critical data which usually requires extra equipment to enable the data to be recovered quickly if a breakdown occurs. A second hard disk in a mirroring situation where the data is recorded twice is a simple solution. There are more complicated devices that use RAID technology (Redundant Array of Independent (or Inexpensive) Disks).
    iii. The reliability requirements of an information system may mean the purchase of an uninterrupted power supply (UPS) that contains batteries and sometimes a generator. The batteries allow the system to continue operating so it can be safely shut down or allow a generator to come online to take over the supply of power.

15. Why would training requirements influence the choice of hardware or software purchased?

Most new hardware and software involves the training of users and technicians that can be very expensive, especially if it needs to take place in a location that is not close to the organisation. This factor may influence the choice of hardware and software to some extent but would not override the purchase if there were other major factors involved. However the combining of training with the company that supplies the components can be a benefit as often the training can take place onsite and be tailored to the exact requirements of the business.

16. What is meant by acceptance review and testing?
Before the system can be handed over for day-to-day use by the organisation in the implementation phase a review is needed to check that the initial aims and objectives have been achieved and the full design has been developed. Often not all parts of the design can be developed as planned, and the reasons and impact of the non-development need to be examined. Also various tests need to be performed as they may indicate further work on some parts of the system may be needed. Most of the testing can take place before the implementation of the hardware and software but some can only take place during and after the implementation because of dependency of parts of the new system on hardware and software already installed.

17. What should be included in a testing plan?
A testing plan involves specifying the following for each item of hardware and software to be tested:
- A description of what is to be tested;
- The reason why the test is to be conducted;
- A test schedule - how, who, where and when the testing is to be performed;
- Test data and the expected results of the tests;
- Testing the impact of other factors;
    - Testing for data and information security needs to be done.
    - Disaster recovery procedures also need to be tested.
    - Testing of a system within an organisation is essential but also testing of the system's inter-operability with the systems of other organisations needs to be performed.
    - User interface testing and useability testing needs to be performed using actual users and experts in that field;
    - Reviews of other similar systems needs to be done and some of the problems encountered in them need to be tested for as well.;
    - Robustness testing involves testing the system to extremes, such as climate extremes and electrical shocks, and being able to withstand the electric power being shut-off and started again without using the proper close-down and start-up procedures;
    - Testing for normality is not a true test of a system. Of course the system needs to be tested to ensure that the capabilities that were specified in the design are correctly performed. But the system should be tested for circumstances that are beyond the design.
    - Many of the other factors need to be tested in a **review process**. Legal, health and safety, personnel and other such issues need to be reviewed by experts to be certain that sufficient consideration has been given to them in the designs and the designs implemented appropriately;

18. What is the difference between alpha testing and beta testing?
The testing that is conducted during the development phase is called **alpha testing** and is mostly done in **simulated testing** conditions. A second testing stage, called **beta testing** involves where possible, the implementation of the system in the **real-world** environment where it can be tested by a number of the intended users out in the field at the normal place of work.

19. What is a conversion plan?
Once the system is believed to be reliable and functioning in the way it was intended then it is available for use in the normal operations of the organisation. The system now enters a period known as the **conversion phase** during which the changeover to the new system takes place. One recommended way to proceed with the implementation is to formulate a formal **conversion plan**. The timing and management of the conversion plan is organised by the project manager and their team. A conversion plan describes the tasks that have to be

undertaken in order to move to full scale use of the new system. The plan should include the tasks to be undertaken and who will be responsible for each task. There should be a timetable that indicates when each task will start and finish. It is a good idea to have a conversion manager on the development team who will be responsible for overseeing the conversion.

20. What is the difference between?
    a. Direct Conversion: there is a complete change over in a very short period from the old system to the new system.
    b. Parallel Systems: Parallel Systems involves running both the old system and the new system side-by-side for a period of time.
    c. Pilot Approach: Sometimes the pilot approach is preferred. Where a new system involves drastic changes in an organisation or very new techniques are to be used it is sometimes advisable to implement a working version of the system in one small department of the organisation before launching the application on the organisation as a whole
    d. Phase-In Method: In a very large organisation it may be best to implement the new system though a phase-in method. It may be that the application is large or complex or large numbers of staff require training or equipment has to be purchased over time. Whatever the reason, it may not be possible or desirable to implement the new system at once in the whole organisation. Often the phase-in is done one site or department at a time.

21. When changing over the system how much impact should it have on the organisation?
    The main consideration is that the organisation has the least amount of disturbance during, before and after the changeover. Factors that affect the implementation of a system are based on technical, economic and operational considerations.

22. Describe other factors that need to be implemented or could affect the implementation.
    - Procedural Requirements of the New System: When choosing a changeover method, there are a number of procedural factors that need to be considered. In particular, the effects of the proposed system on the efficiency and effectiveness of information processing is of concern. If the impact on the organisation's abilities to perform is significant then the changeover method needs to be changed.
    - Data and Information: Often data from the old system needs to be transferred to the new system. Since file formats of the old and new systems may be different, fields may be merged or split, or extra fields may be included
    - Cost Of Implementation: The financial costs involved in the changeover can be significant so an organisation may decide to introduce the new system in sections at any given time
    - Effects on Organisations and Individuals: There are many effects associated with implementing an information system. Benefits can be positive such as providing job enrichment. However there can also be negative effects on individuals in the organisation and customers who have to adapt to the changes.
    - Training of Staff and Customers: One of the major issues with respect to the implementation of a new system is the training of staff and customers.
    - Types and Purposes of User Documentation: Instructions about how to use software must accompany the new system.
    - The Nature of the System: The type of hardware and software in the system may be a basis for deciding the type of changeover method.
    - Disaster Recovery Plans: A disaster recovery plan is a written plan detailing the procedures that need to take place if there is a major disaster.
    - Network and Data Security: System access controls, virus and hacking security and backup security

23. What does the term depersonalisation of services mean?
    Despite some of the cost saving benefits of a new information system many customers still prefer dealing with other people on a day-to-day basis rather than a website or an automated phone system.

24. Why is the training of staff and customers necessary?
    There are two main reasons training is important. The first and obvious reason is that users of the system need to learn how to perform the procedures that are part of the new system. The second reason is the necessity to build confidence in the system while overcoming any negative attitudes.

25. What are the key elements in a training strategy?
    - Who is to be trained: Within most organizations there will be experienced and inexperienced users or operators as well as managers, programmers and/ or technicians who are responsible for the system. Each group needs specialised training.
    - The training to take place: It is important to be clear about what each group needs to learn, to be able to use the new system efficiently and effectively.
    - Who should conduct the training: The key requirement for good training is to have an instructor who has a command of the software and good communication skills.
    - The length of the training course: Obviously the length of the training will depend on the needs of the person being trained. What is clear is that 'one-off' sessions without follow are poor ways in which to deliver effective training. On-going support is often necessary.
    - Where and when the training will take place: The time and place for training should be clearly described. The training sessions should take place when users are fresh and able to concentrate. Sessions should not be scheduled in such a way as to make training seem like a punishment.

26. Why are there different types of user documentation and for whom are they created?
    - Technical Reference Manual: A technical reference manual is created for technicians and describes how the system operates. It also describes the specifications of the hardware and the software.
    - User Guide: A user guide is a non-technical guide to support the use of the system. It is a basic set of instructions. Instructions may include how to perform such functions as install the system, turn on the system, save files, and print reports, and generally how to navigate around the program.
    - User Manual: A user manual contains more extensive details about the program than the user's guides.
    - Quick Start Guide: A quick start guide is a non-technical guide that allows the user to get started on installing and using the program. This guide only provides very basic details on the most common features of the program and is often only one page.
    - Procedures Manual: A procedures manual illustrates the steps and procedures that must be followed when operating the system. It provides details of which tasks need to be performed, by whom and when.
    - Trouble-shooters Guide: A trouble shooters guide briefly describing how to deal with malfunctions of the system. It provides tips and hints on how to overcome problems that are to be performed before the technicians are called.

27. What are the four components to a disaster recovery plan?
    - The Emergency Plan: The Emergency plan, states the actions to be taken as soon as the disaster has happened.
    - The Backup Plan: The development of a system for making effective backups needs to have been developed for this plan to be effective. The appropriate people should be trained and the documentation detailing the exact procedures to be followed needs to be produced.
    - The Recovery Plan: The recovery plan specifies the operations that need to take place so that the system can be fully operational.
    - The Test Plan: The test plan is a dry run of the disaster recovery plan. It is a simulation of a disaster and is written so that tests on how the organisation would respond to the disaster can be conducted.

28. What data and network security features need to be implemented?
System Access Controls: A successful changeover method would need to cater for any data and information security and access requirements. All passwords and other security arrangements need to be documented and in place before the system is put into service.
Software security includes:
    - Logon names and passwords to access different levels of the information system and can stop unauthorised people having access to data when there is no need for it;
    - Encryption, which is the coding of data so others who are unauthorised cannot read it;
    - Biometric security methods such as the scanning of fingerprints and the scanning of the eye's retina;
    - Keeping logs of activities –files used - who, when and how, and which computer was used.
    - Making files 'read only'

Physical security includes:
    - Surveillance cameras;
    - Keys for locks;
    - Smart cards;
    - Tracking of staff movement with radio devices;
    - Guards to monitor and watch staff.

Virus and Hacking Security: For networks virus protection and firewall standards and procedures need to be implemented. Filtering criteria for email and file attachments, and limits on access to the Internet need to be setup. Procedures for monitoring of network and user activities, such as logs, need to be put in place.
Backup Security: Backup equipment and procedures need to be implemented.

29. Describe a backup system.
A four-week backup plan is illustrated below, it uses:
- Daily tape backups that are reused each week;
- Separate weekly tape backups that are reused each month;
- A monthly tape backup that is kept as a permanent record.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Tape D1	Tape D2	Tape D3	Tape D4	Tape D5	Tape D6	Tape W1
Tape D1	Tape D2	Tape D3	Tape D4	Tape D5	Tape D6	Tape W2
Tape D1	Tape D2	Tape D3	Tape D4	Tape D5	Tape D6	Tape W3
Tape D1	Tape D2	Tape D3	Tape D4	Tape D5	Tape D6	Tape M1

30. Describe the four types of software upgrades.
Slipstream upgrade - this is a relatively small upgrade to the software. It happens routinely and is often done without inconveniencing the users of the system.
Patch - a patch is a small change that corrects a problem. Patches are often used to rectify small bugs that may appear in a program. Anti-virus program manufacturers often release patches to their in-field installed code to detect and provide remedies for new viruses.
New Release - a new release improves on some parts of the software but it fundamentally operates the same as before. It will require minor alterations to user documentation, and also possibly involves more retraining.
New Version - the program is currently on the system, however a new version will upgrade the current version, because there are new functions and features that can be used.

31. What is a maintenance agreement?
A maintenance contract negotiated at purchase time ensures that the suppliers or their designated maintenance organisation are the designated people to ensure that the equipment can be replaced or fixed as soon as possible.

32. What steps are involved in an evaluation?
After a pre-determined period of time an evaluation of the system needs to be performed. The

evaluation needs to take place after the system has had time to settle down. Users need to become familiar with the system and minor problems with hardware and software need to have been solved. The time for these to happen can be months.
An evaluation plan needs to be produced that specifies the following in detail:

- The evaluation criteria to determine if the new information system is a success. The criteria come from the logical design and the physical design (especially the testing table);
- The techniques and procedures for collecting data about each criterion.

33. What items need to be evaluated to determine the success of a new system?
Evaluation of the Main Goals and Objectives: In the beginning of the project goals and objectives were formulated based on the analysis of the problems and difficulties in the old system.
Evaluation of Design Goals and Objectives: In the Design Phase the detailed goals and objectives formed the basis of the design, such as decreasing the delay to print reports and to speed up processing.. The designs were translated into hardware and software specifications for the new system. The evaluation of the implementation of these specifications involves examining detailed data that has been collected from the day-to-day operations of the new system.
Evaluation of Other Factors: Other factors need to be considered when determining the success of the new system. Factors such as usability, effectiveness, efficiency, cost and maintenance need to be evaluated. There are also other factors to do with economic, operational, technical, and other individual and organisational requirements that are particular for each organisation and information system.

- Usability - The usability of the system refers to how easy it is to operate.
- Effectiveness - The output needs to suit the purpose and be in formats that follow the appropriate conventions. The information produced by the system needs to be accurate, and comprehensive with nothing omitted that is needed and no extra superfluous information.
- Efficiency - Efficiency means cost, time and effort. Each part of the new system needs to have data collected about these three areas and be evaluated to determine any problems.
- Costs - Economic costs associated with a new system need to be examined to determine whether the development and the operating costs are within budget.
- Maintenance - Another significant factor in the new system's success is how often and for how long the system needs attention. The mean-time-between-failure (MTBF) is a common measure of the need for maintenance and the mean-time-to-repair (MTTR or down-time) gives a measure of the ease of repair of the system.

34. What is the difference between a qualitative evaluation and a quantitative evaluation? Provide an example for each.
Qualitative evaluation involves asking the managers, users and customers of their opinion of the system as a whole and any particular problems they have noticed. This can be done with interviews and questionnaires.
Quantitative evaluation involves measuring and recording facts and statistics about the performance of the system. Statistical survey data can also be collected from users and customers and analysed.

35. Why is it necessary to log equipment breakdowns?
The log can be analysed to determine how often, for how long and why the equipment has been unreliable and caused down time.

36. Why does quality assurance testing take place?
Quality assurance testing is a technique used to evaluate the success of a system routinely and/or randomly. It is virtually impossible to tests all functions of the system in the evaluation phase, especially if the new system is rather large, therefore it is easy to randomly select a number of aspects and place those components through some testing to see how the system copes in various situations.

37. Why is it important to record user comments?
    Comments by customers who have indirect contact with the system are often another good indicator to monitor the success of the new system. Often a different perspective can be obtained from their complaints.

38. What benefits can be derived from surveys, interviews and questionnaires?
    Another valuable technique is to perform in-depth interviews with users and customers. This can be done face-to-face with a survey, or through a questionnaire delivered by post and returned anonymously. This will give an accurate picture of the state of the system within an organisation.

39. Why is it important to monitor staff reactions?
    When a new information system is introduced there can be a variety of staff reactions. Depending on how ready employees are for the change the reaction can be very welcoming or very negative accompanied by uncooperative behaviour. It is important to consult staff during the analysis, design, development and implementation phases to short-cut any negative reactions.

40. What statistics need to be collected when evaluating a new system?
    - Efficiency – it is relatively easy to take measurements of the time taken for various functions to be performed. The costs involved can be calculated as well as the number of staff required and the amount of equipment. The number of items produced or processed in a certain time span should also be measured.
    - Effectiveness – statistics about the system can be collected in a survey, as well as comments, and classified under the headings of relevance, accuracy, presentation and amount of information.