IT1105 - Information Systems & Technology

BIT – 1ST YEAR – SEMESTER 1
University of Colombo School of Com puting

Student Manual

Lesson 6:
Systems Development

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Duration: 10 hrs

Instructional Objectives

Students will be able to:

- Define the term information systems planning and identify reasons for initiating a systems development project
- Identify the different stakeholders in the system development process
- Identify different approaches to system development
- Identify the different phases of traditional System Development Life Cycle (SDLC)
- Describe the advantages/disadvantages of in-house development vs. outsourcing

6 Systems Development

6.1 An Overview of Systems Development

6.1.1 Introduction

When an organization needs to accomplish new tasks or modify existing tasks, a new system has to be developed or the existing system has to be modified.

The activity of creating or modifying existing systems is called Systems Development. It includes all aspects of the process ranging from identifying problems to be solved to implementation of the total solution.

Organisations can outsource its software development rather than developing it internally. There are advantages as well as disadvantages of outsourcing. However, many organisations consider it as a cost effective approach.

6.1.2 Participants of the Systems Development

It is a well known factor that a team effort is required for a successful systems development. The development of a system can be done within the organization (if there is an IS development team) or be developed through another external organization. Typically, following members will contribute to the systems development process. However, this combination may vary according to the nature of the project.

- Users – people who interact with the system regularly. May include managers
- Managers
- Systems Analysts – professionals who specializes in analyzing and designing business systems.
- Systems Developers or programmers – specialists responsible for modifying or developing programs to satisfy user requirements
- Other support personnel - such as technical specialists and quality assurance staff (testing purposes) and external companies such as vendors and suppliers

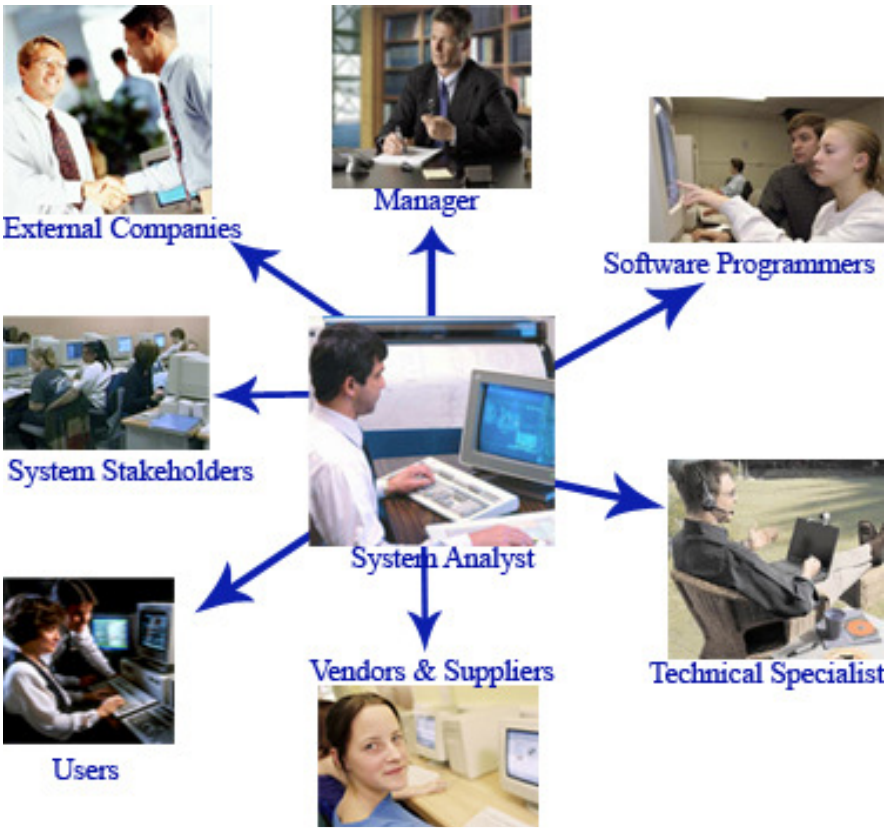


Figure 6.1: Participants in Systems Development

This team is also referred as the development team. This team is responsible for identifying the objectives of the information system and developing a system that meets these objectives.

6.1.3 Initiating Systems Development

Development of a system begins when an individual or a group capable of initiating organization change become aware of the need for a new or modified system.

Eg. Managers at a Railway company, for example, can initiate a systems development project when they decide to expand the company's Web site to allow the users to log on to the site to reserve seats in a train, to look at the train schedule on a particular day etc.

The following diagram illustrates the typical reasons to initiate a systems development project.

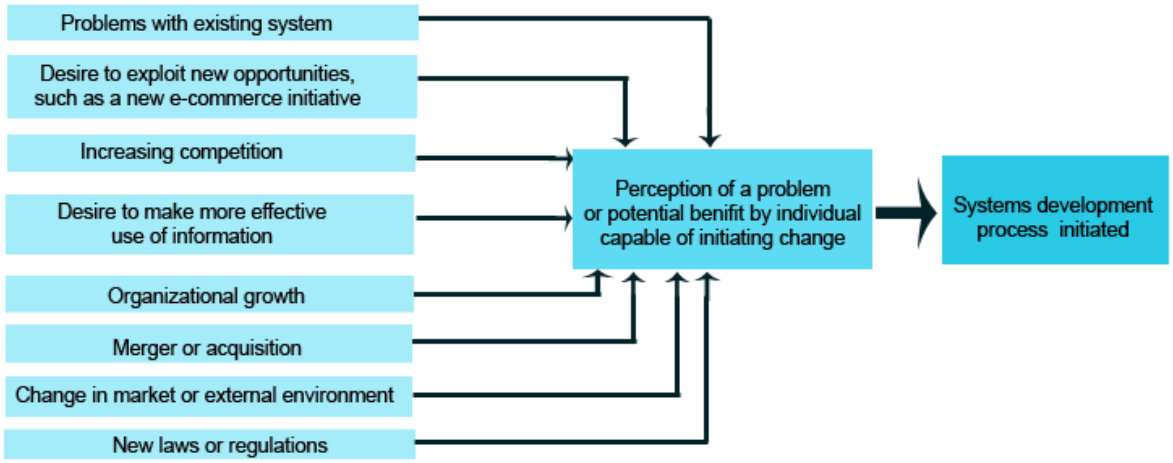


Figure 6.2: Typical reasons to initiate a Systems Development Project

6.1.4 Information Systems Planning

Information Systems Planning involves the translation of strategic and organizational goals into systems development initiatives. In other words Information systems planning transforms organizational goals outlined in the strategic plan into specific systems development activities.

Figure 6.3: IS planning's link to the strategic/organizational goals

Aligning IS and Corporate Goals – Aligning goals of the organization and the goals of the information systems is very important for any successful systems development.

Benefits of Aligning IS and Corporate Goals

- Information technology's use in the organization will last a long way into the future
- It ensures better use of Information system resources including funds, personnel and time

The steps of IS planning is illustrated in the following figure:

Figure 6.4: steps of IS planning

Developing Competitive Advantage – Today, many companies look for systems development projects that will give them competitive advantage.

Improving company's customer relationship may help the company to achieve a competitive advantage.

Eg. A Bus company, for example, can initiate a systems development project when they decide to develop a Web site to allow the users to log on to the site to reserve seats in a bus, to look at the bus schedule on a particular day etc.

Establishing Objectives of Systems Development

Achieving the business goals by delivering the correct information to the correct individual at the correct time is the overall objective of systems development.

Defined Organization goals will in turn define the objectives for the System
Eg. A factory manufacturing computers might discover that minimizing the total cost of owning and operating its equipment is critical to meet production and profit goals.

An important factor for the above example would be 'minimizing equipment maintenance and operating cost'. This would be one of the objectives for the proposed system.

6.2 Different approaches to Systems Development

6.2.1 The Traditional Systems Development Life Cycle

Systems Development Life Cycle is another name given for the systems development process. The following diagram illustrates the system development life cycle and its main phases.

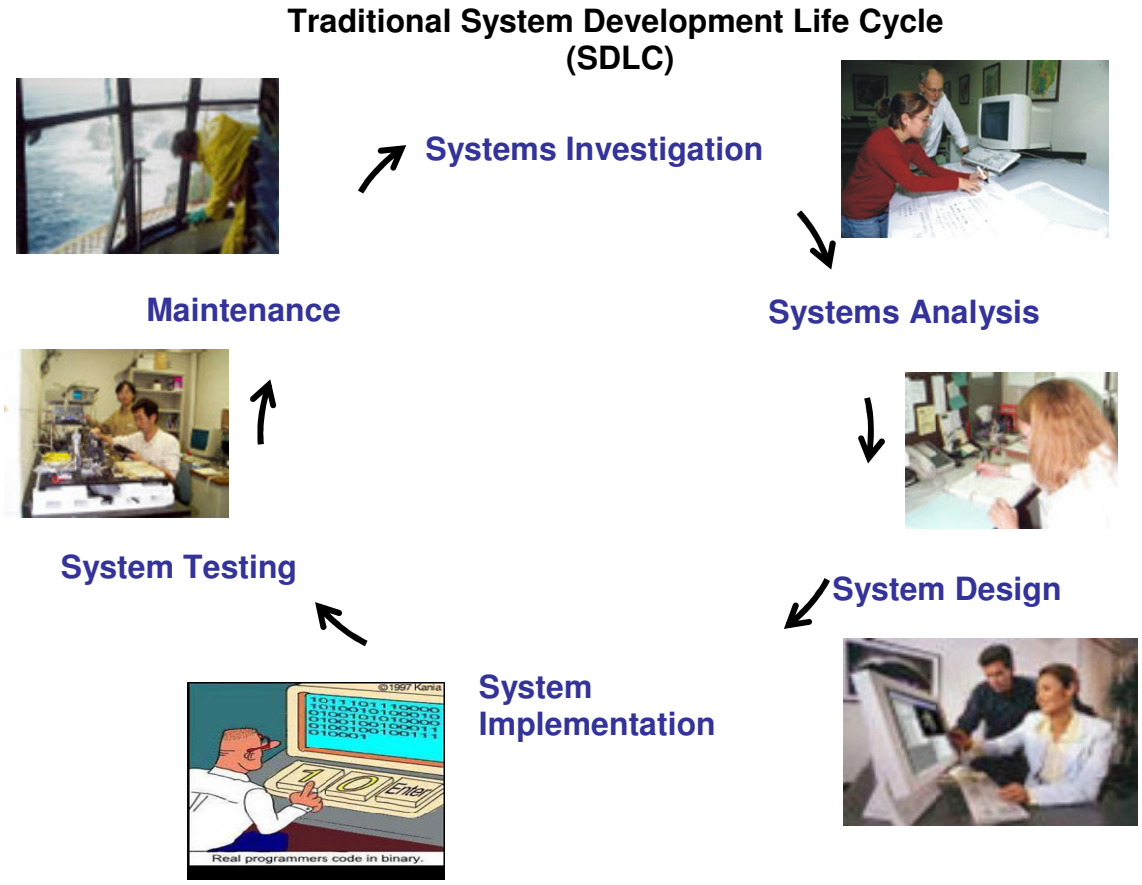


Figure 6.5: Traditional Systems Development Life Cycle

Sometimes, information learnt in a particular phase requires cycling back to previous phase.

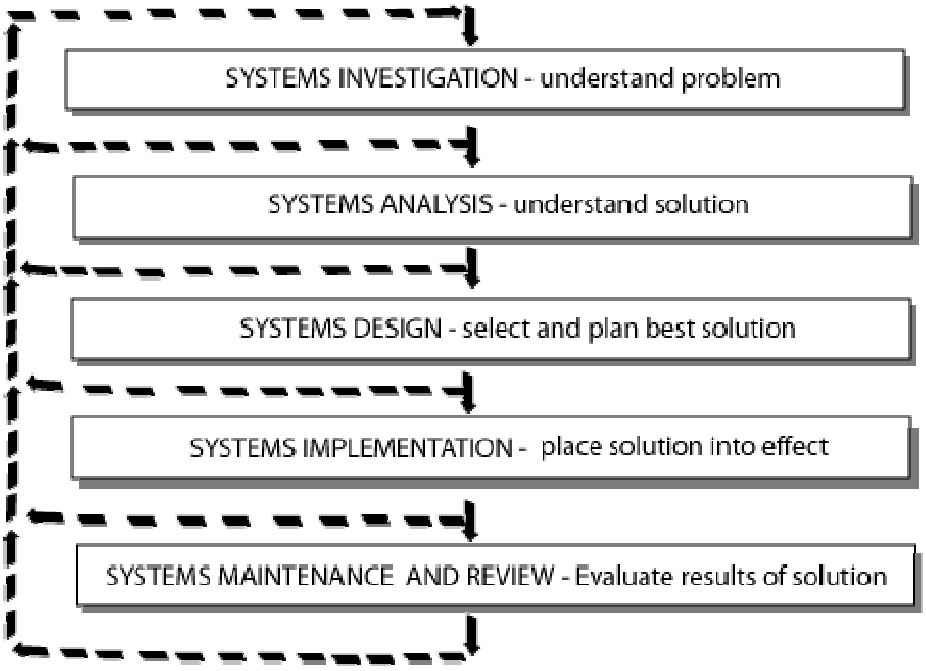


Figure 6.6: Cycling back to Previous Phases

The following table briefly describes the activities in each phase.

Table 6.1: Phases and activities in the traditional systems development life cycle

Phases	Activities
Systems Investigation	Understanding problems and opportunities
Systems Analysis	Study the existing system and identify the strengths, weaknesses, and opportunities for improvement.
Systems Design	Select and plan best solution
Systems Implementation	Place solution into effect
Systems Testing	Test results
Systems Maintenance	Ensures that the system operates and modifies the system so that it continues to meat the changing business needs.

We will discuss about the traditional systems development life cycle in section 6.3.

6.2.2 Prototyping

Prototyping takes an iterative approach during the systems development life cycle. The following activities take place during each iteration of the life cycle.

- Requirements are identified and analyzed
- Alternative Solutions are identified and analyzed
- New solutions are designed
- Portion of the system is also implemented
- Users are encouraged to use the prototype and provide feedback

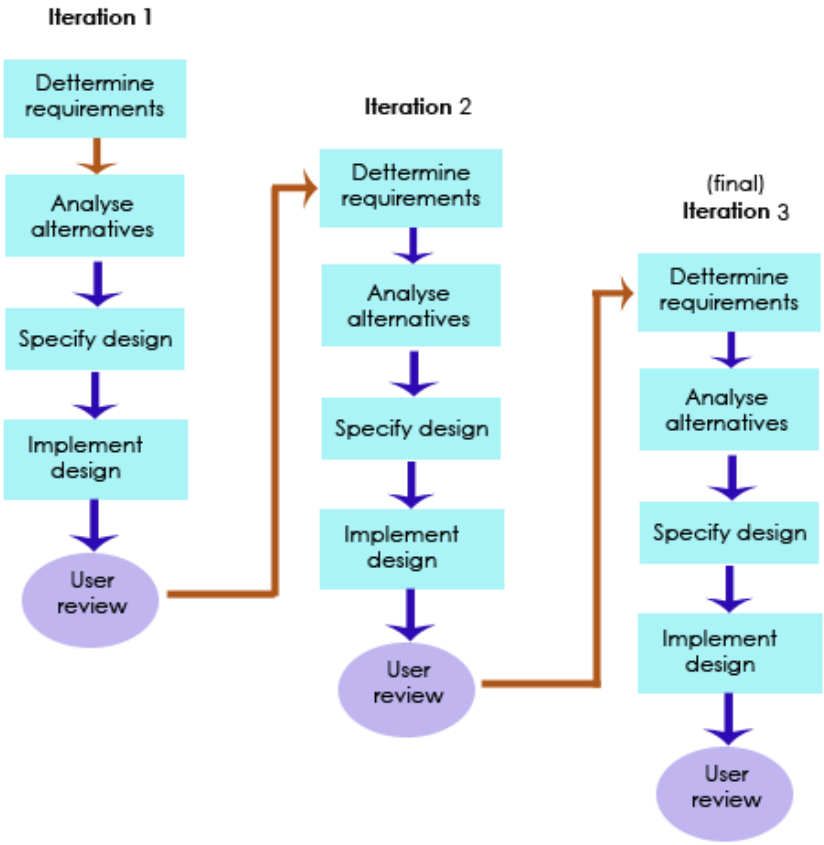


Figure 6.7: Prototyping is an Iterative Approach to Systems Development

At the beginning either you develop an initial model of a major subsystem or scale down version of the entire system.

Eg. Prototype developed to show the screen images of the entire system. Initial processing activities will be simulated. You will refine it gradually to build the actual system.

6.2.3 Rapid Application Development (RAD)

Tools, techniques methodologies are used in this popular approach to speed up the development.

RAD is the merger of various structured techniques with prototyping techniques and Joint Application Development ***(JAD)*** techniques to accelerate systems development.

Joint Application Development emphasize participative development among users, and others involved with the system.

RAD is considered as most suitable for Decision Support Systems and Management Information systems.

Other approaches to rapid development such as Agile Development or Extreme programming (XP), allow system modifications while they are been developed.

6.2.4 End-User Systems Development

The term end-user systems development describes any systems development project in which the primary effort is undertaken by a combination of business managers and users.

The flexibility of many packaged software programs available in the market has also enabled non IS employees to develop solutions to meet their requirements. Employees who develop their own systems believe that by bypassing formal requests to the IS department stating the required needs and resources, they are able to develop systems more quickly. Furthermore, they believe they have a clear idea as to what is required and therefore able to develop systems that match their requirements.

Two disadvantages of end-user development are lack of training to effectively develop and test a system and poor documentation. Lack of documentation can lead to errors when these systems are updated.

However, due to the importance of some of the end-user developments many IS organizations help end-user development by providing them with necessary resources.

6.3 **Phases in the Traditional Systems Development Model**

6.3.1 Systems Investigation and Analysis

The First phase in the traditional Systems Development Life Cycle of a business information system is the systems investigation. The purpose of this phase is to establish the project scope, goals, schedule, and budget required to solve the problem or opportunity represented by the project.

In general systems investigation attempts to find out the following:

- Primary problems that might be solved by new or enhanced system
- Opportunities that might be provided by new or enhanced system
- New hardware, software, databases, telecommunications, personnel, or procedures that are required in a new system to improve an existing system
- Variable and Fixed costs
- Associated risks

Participants in Systems Investigation

First step in Systems Investigation is to identify the members of the development team who should participate in the investigation phase of the project.

System investigation team is made up of upper-and middle level managers, a project manager, Information System Personnel, users and any one who has an interest in the information system.

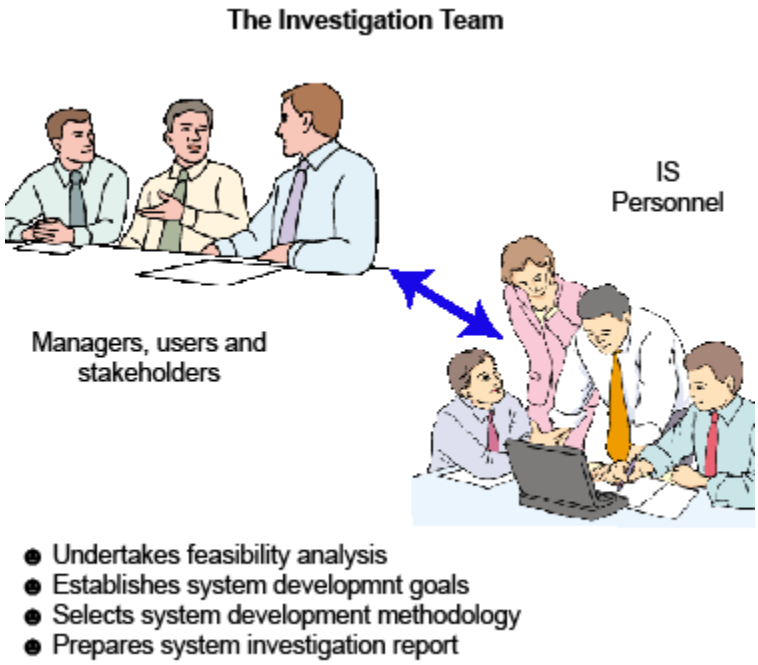


Figure 6.8: The Systems Investigation Team

Feasibility Analysis

Feasibility is the measure of how beneficial or practical to develop an information system for an organization. Feasibility Analysis is the process by which feasibility is measured.

Feasibility Analysis is the assessment of the technical, economical, legal, operational, and schedule feasibility of a project.

❖ **Technical feasibility**

Technical Feasibility is to find out

- whether the solution is technically practical?
- whether we currently possess the necessary technology (Hardware/ Personnel) ?

❖ **Economic Feasibility**

Economic Feasibility is a measure of the cost-effectiveness of a project or solution. Is the solution cost-effective?

❖ **Legal Feasibility**

Legal Feasibility is to find out whether laws or regulations may

- prevent a systems development project
- limit a systems development project

It involves investigation of existing and future laws to find out whether a legal action against the project is possible.

❖ **Operational Feasibility**

Operational Feasibility is a measure of how well the solution will work in the organization. It is also a measure of how people feel about the system/project.

Example: Because of deadly hospital errors, a healthcare consortium looked into the operational feasibility of developing a new computerized physician order entry system to require that all prescriptions and every order a doctor gives to staff be entered into the computer. The computer then checks for drug allergies and interaction between drugs. If operationally feasible, the new system could save lives and help avoid lawsuits.

❖ **Schedule Feasibility**

Schedule Feasibility determines whether the solution can be designed and implemented within an acceptable time period. It is a process that involves time management and resource management for the requirements of the project.

The System Investigation report

The System Investigation Report consists of the following:

- Summary of the results of the systems Investigation
- Summary of the process of feasibility analysis
- Recommendation of the course of action to be taken

Recommendations can be categorized in to three types:

- Proceed to systems analysis phase
- Modify the project in some manner
- Drop the project

Subsequently an advisory group consisting of senior management and users from the Information Systems department and the other functional areas will review the systems investigation report.

Systems Analysis

Systems Analysis is the next phase of the Systems Development Life Cycle. If the systems investigation report approves the project for further study, the project has to proceed to the systems analysis phase. Systems analysis seeks a general understanding of the solution required to solve the problem.

The following are the main activities of systems analysis phase:

- Gathering information related to the existing system
- Determine the requirement for the new system
- Consider alternative solutions within these constraints
- Investigate the feasibility of the solution

6.3.1.1 Data Collection

More details about the problems and needs listed in the system investigation report can be collected during this activity. The strengths and weaknesses of the existing system are also emphasized during this process.

Identifying and locating the various sources of data (including both internal and external sources) is the first task in data collection.

Eg.

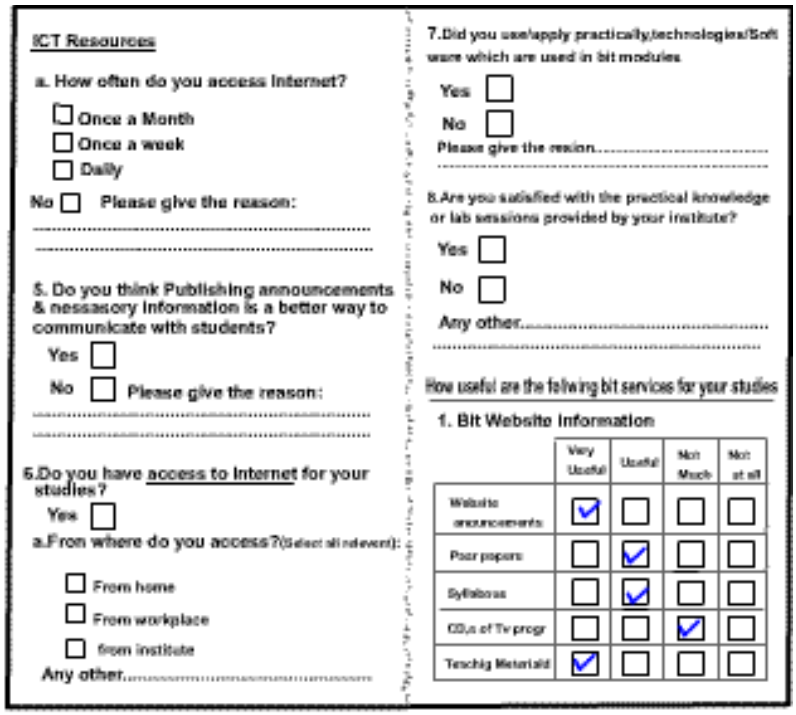
Internal sources – users, managers or any one who has an interest in the system,

Organizational charts, Forms and Documents, financial reports

External sources – Customers, Suppliers, Government agencies, consultants etc.

Data collection begins, after data sources have been identified. The following are some of the popular methods used to collect data:

- Interviews
- Direct Observation
- Questionnaires



ICT Resources

a. How often do you access Internet?

- Once a Month
- Once a week
- Daily

No Please give the reason:

.....

.....

5. Do you think Publishing announcements & nessasory information is a better way to communicate with students?

Yes

No Please give the reason:

.....

.....

6.Do you have access to Internet for your studies?

Yes

a.From where do you access?(Select all relevent):

- From home
- From workplace
- from institute

Any other.....

7.Did you use/apply practically/technologies/Soft ware which are used in bit modules

Yes

No

Please give the reason.....

.....

8.Are you satisfied with the practical knowledge or lab sessions provided by your institute?

Yes

No

Any other.....

.....

How useful are the folwing bit services for your studies

1. Bit Website Information

	Very Useful	Useful	Not Much	Not at all
Website announcements	☑	☐	☐	☐
Past papers	☐	☑	☐	☐
Syllabuses	☐	☑	☐	☐
CDs of Tv progr	☐	☐	☑	☐
Teaching Meterials	☑	☐	☐	☐

Figure 6.15: A sample Questionnaire

Data Analysis

The next step after collecting data is to manipulate the collected data so that the development team members can use them. This manipulation is called data analysis. The following are some of the techniques/tools used in data analysis.

- Data Modeling – entity relationship diagrams
- Activity Modeling
- Application Flowcharts

6.3.1.2 Requirement Analysis

Correct systems can only be developed, if you know exactly

- what the users , stakeholders and organization wants to do and
- what the system must do

Confirming user or systems requirements is one of the most difficult procedures in systems analysis. Communication problems will affect the identification of requirements.

Requirements Analysis tools

CASE tools are the most popular tools used to document requirement analysis. When requirements are confirmed entity relationship diagrams, data-flow diagrams, and other types of documentation will be stored in the CASE repository in CASE tools.

The Systems Analysis Report

Final deliverable of systems analysts is the Systems Analysis report. The following are the typical contents of this report:

- Strengths weaknesses of the current system
- Functional Requirements or the requirements for the new system.
- Organizational requirements for the new system
- Details about how the system to be developed will solve the problems

6.3.2 System Design

The purpose of **System Design** is to create a technical solution that satisfies the functional requirements for the system. At this point in the system development lifecycle, there should be a functional specification, containing a complete description of the operational needs of the various organizational entities that will use the new system. The challenge is to translate all of this information into technical specifications that accurately describe the design of the system, and that can be used as input to system implementation. The technical specification details, system outputs, inputs and user interfaces; specifies hardware, software, databases, telecommunications (networks), personnel and procedures, and shows all the relationships between the above components.

The completed design should lead efficiency in satisfying organization's needs. It should overcome shortcomings of the existing system and help the organization achieve its objectives and goals.
Two key aspects of system design are logical and physical design.

6.3.2.1 Logical and Physical Design

The logical design specifies what tasks the system will do, and the physical design refers to how the tasks are accomplished.

Logical Design

The logical design specifies what the system will do – the functional requirements of a system - to solve the problems identified in earlier analysis. The logical design specification documents the following:

- **Output Requirements:** All outputs from the system including the types, format, content, and frequency of the output (weekly, monthly, yearly, etc.). For example, a requirement that all sales reports must include the salesman's identification number is a logical design specification. In the analysis phase, the existing outputs were examined as a means of determining what data was required. This output is new output for the new system.

- **Input Requirements:** Input design can begin after the output design. All inputs specify the type, format, content, and frequency of the input. For example, the requirement that specifies the entering the customer name will automatically search for address information and display that data so that the user won't have to enter so much information is a logical design specification. The user interactions must be considered with input design. i.e. features for user friendly interface

- **Processing Requirements:** Calculations, formulas, comparisons, and other data manipulations must be documented. For example, a payroll system requires a gross and net pay computation, government tax withholding, various deductions and savings (contributions).

- **File and Database Requirements:** Files and databases that are required are specified at this stage. The Data Flow Diagrams and Entity Relationship diagrams are used in this stage. A Database Base Administrator is usually involved in this aspect of design.

- **Telecommunications Requirements:** Telecommunication and network requirements are documented. For example, requirements such as the desktops need to be linked together, the network must be mirrored for disaster recovery, the system will be accessed offsite are a logical design specification.

- **Procedure Requirements:** All systems require procedures to run application and handle problems. How to run the application, user documentation, system documentation, and other maintenance procedures must be specified. For example, the procedure to add new customer account may involve a series of both manual and computerized tasks.

- **Controls and Security Requirements:** Backups and their frequencies have to be determined and documented. For example, a file that has zip codes along with city and states does not change often and probably doesn't need to be backed up everyday.

- **Personnel and Jobs: If the new sy**stem will require additional employees, or if there will be changes in jobs associated with one or more existing positions, they all must be identified and documented.

Physical Design

The physical design must specify the characteristics of the system components necessary to put the logical design into action. The physical design includes the following:

- **Hardware Specifications:** Specify physical and performance characteristics of all computer equipments needed. For example, install point-of-sale terminals at each checkout station in each store, and interconnect them in a local area network.

- **Software Specifications:** Specify software by capabilities. For example, if instant database updating is specified in the logical design, then the physical design must specify a database management system that allows this to occur.

- **Database Specifications:** Specify the type, content, structure and distribution of databases. The relationships between data elements established in the logical design must be mirrored in the physical design as well. For example, develop relational database which organize customer and product data into multiple tables for easy access.

- **Telecommunications Specifications:** specify the characteristics of the communication software, media, and devices. For example, if the logical design specifies that all members of a department must be able to communicate via email, then the local area network configuration and the communication software that are specified in the physical design must possess this capability.

- **Personnel Specifications:** Specify the qualifications of personnel mentioned in the logical design. For example, all hardware and software must be easy to operate by regular store personnel with minimal training requirements.

- **Procedures and Control Specifications:** specify auditing, backup, and output distribution methods to minimize the crimes and frauds identified in the logical design and running of each application in the system.

Systems Design Consideration

A number of special design considerations should be taken into account during the system design phase. In this section, interface design which focus on the user interaction with the system and system security design which focus on maintaining a stable operating environment for the system are discussed.

Interface Design

A critical aspect of the information system is the quality of the user interface. The design of the user interface defines how the user will interact with the system. To most users, the interface is a graphical user interface with windows, dialogue boxes, and mouse interaction. It can include sound, video and voice commands. User's capabilities and needs differ widely; each user interacts with the system in different ways. It might be also required that different approaches to the interface are needed for different parts of the system. Therefore, there are many user interfaces to consider, and the user interface is becoming larger part of the system as information systems become more interactive and accessible.

System security design
It is frequently important for most information system departments to make the data that reside on an internal system, secure. They establish tight system controls to maintain the data security. Systems controls can help prevent computer misuse, crime, and fraud by managers, employees and others. Examples of system controls – use of passwords/user-ids, audit trails, firewalls etc.

Evaluating and Selecting a Systems Design

The request for proposal (RFP) is one of the most important documents generated during system development. This is used when several different vendors are candidates for the new system and their competitive proposals are to be solicited. The primary purpose of the RFP is to communicate requirements and desired features to prospective vendors.

Soon after the RFPs are sent to prospective vendors, organizations will start receiving proposals. The final step in system design is to evaluate the various alternatives and select the one that will offer the best solution for organizational goals. There can be many methods of evaluations such as cost benefit analysis etc.

Cost-benefit analysis is an approach that compares the costs and benefits of each proposed system.

The Design Report

A design report is the primary result of system design. It includes system specifications: a technical description that details system outputs, inputs and user interfaces, as well as all hardware, software, databases, telecommunications, personnel, and procedure components and the way these components are related. The design report reflects the

decisions made for system design and prepares the way for system implementation. It provides the blueprint and the base for the rest of the system development.

6.3.3 Factors Considered during Implementation

Once an information system has been successfully designed, it has to be installed properly so that it is now ready to use. There are many tasks that have to be completed before a system can be used and these tasks taken together is called system implementation. The diagram below shows the tasks in typical sequence:

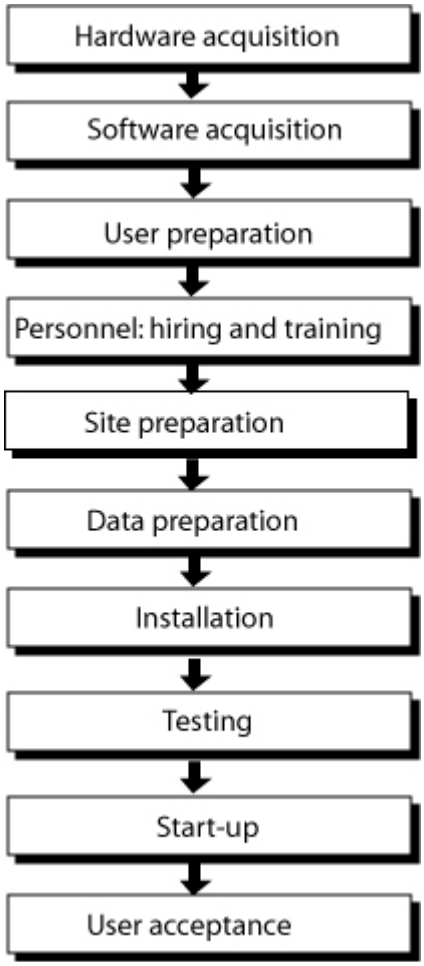


Figure 6.17: Steps in systems implementation

Hardware Acquisition

There are many ways in which the components can be acquired by companies. They can purchase, lease or rent computer hardware and other resources from an IS vendor. An IS vendor is a company that offers hardware, software, telecommunication systems, databases, IS personnel and/or other computer related resources. Types of IS vendors include general computer manufacturers such as IBM & HP, small computer manufacturers like Dell, peripheral equipment manufacturers such as Epson & Cannon, computer dealers and distributors and leasing companies.

In addition to buying, leasing or renting computer hardware, it is possible to pay only for the computing services that a company uses. In such cases, you need to make payment only for using computer power used, as you pay for your electricity. This mechanism may be known as "pay-as-you-go", "on-demand" or "utility" computing.

Software Acquisition
Software too can be developed in-house or purchased from external developers. Sometimes to share the cost of development of software companies may get together and develop the software.

- **Externally Developed Software**

When using externally developed software, customers have an option either to purchase off-the-shelf software or to outsource development work.

The following reasons drive companies to purchase or lease externally developed software:

1. Lower costs
2. Less risk regarding the features and performance of the package
3. Ease of installation
4. Little doubt that the company's need will be met
5. The amount of development effort is less

Companies acquiring externally developed software should carefully consider the following before arriving at a decision to purchase or rent.

- Review needs, requirements and costs – the software should satisfy the organizational needs and user needs. Software may have features not required by the company
- Acquire software – Development of requests for proposals, performing financial analysis and negotiating the contracts must be undertaken
- Modify or customize software – may have to be modified to satisfy - organizational and user needs. Some software vendors will assist in modification while others may prohibit changes altogether
- Acquire software interfaces – these are programs needed for the new software to work with other software used in the organization
- Test and accept software – Should be completely tested by users in the environment in which it is run before it is accepted
- Monitor and maintain the software and make the necessary modifications

Most companies have had to abandon acquired or leased software because they cannot be integrated with existing software.

- **Internally Developed Software**

Software can be developed by in-house staff or companies can outsource the development of all the software required or part of it.

Software can be developed using object-oriented technologies or other traditional methodologies. Object-oriented technologies have the advantage of reusing existing objects from other software packages. Upgrading the code is also easier with object-oriented architecture.

Some advantages of in-house development are as follows:

1. Meeting all user & organisational requirements
2. More flexibility in including additional features & changes
3. Company will have an advantage over their competitors as the latter will not be able to duplicate the software quickly
4. It is possible to reuse modules from other software that company has previously developed

Companies developing software in-house will require to maintain a chief programmer team, which is a group of skilled, IS professionals who design & implement a set of programs. The team has total responsibility for building the best software possible.

User Preparation

This is the process by which managers, decision makers, employees, other users and stakeholders of a new system are prepared to use the system. The training can be provided by in-house staff or by outside training personnel.

IS Personnel: Hiring & Training

Depending on the complexity of the system, organizations may have to hire new personnel or train new IS personnel. An IS manager, systems analysts, computer programmers, data entry operators may be needed for the new system. Training programmes have to be conducted for IS personnel as for the other users. However, the kind of training needed for IS personnel will be different from that for the other users and may be of a more technical nature.

Site Preparation

Preparation of the location of the new system is known as site preparation. Complexity and size of the system will determine the amount of site preparation that has to be carried out. For larger systems, more space would be required with special wiring, air-conditioning, additional furniture, cables may have to be laid to connect various components, better security systems for protection and additional power circuits too may be needed.

Data Preparation

The data to be used in the new software has to be converted or prepared in a format suitable to be used by the new software. The new software or a database system will then maintain the computer data files.

Installation

Installation means placing of all the computer equipment in the correct location. Usually representative/s of the manufacturer or vendor from whom

the equipment was ordered would attend to the installation. Usually the IS manager of the company would supervise the installation to see that it is done correctly. The manufacturer or vendor's representative/s should test the equipment after installation to see that all components work properly.

Testing

Testing is done in accordance to make sure that the new system does exactly what is intended. Insufficient testing can result in mistakes and problems.

There are several types of testing done at different stages of development. The unit testing is performed on each program of the system. Test data is developed in such a way that each statement is executed by the computer. Abnormal data too is given in the execution of the program to see whether problems are created.

Sometimes output of one program becomes input to another program. Therefore it is necessary to test all the programs taken together which is called system testing. Volume testing is done by executing the system with a large amount of data. This is done to ensure that the system can handle a large amount of data under normal conditions. Integration testing is done by integrating the new system with any other older systems that it must work with. Acceptance test is the final check before the system is accepted by the users. This may be done with any tests required by the user. Acceptance testing ensures that all specifications defined for the system are met. Involving users in acceptance testing may help them to get familiar and interact better with the system.

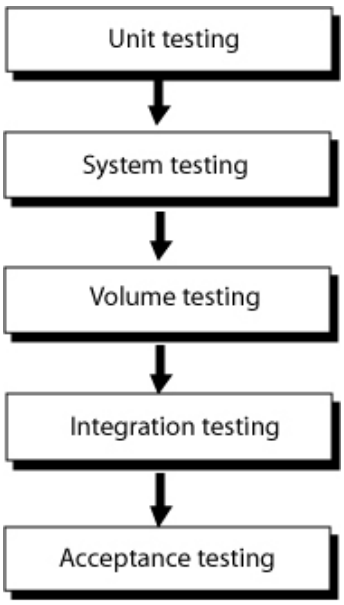


Figure 6.18: Types of testing

Start-Up

Start-up is the process of making the tested new system operational. There are many ways in which this could be done. Direct conversion is one such strategy where the old system is abandoned and the new system put into

operation. This could be a risky way to start-up as any errors in the system would affect the company operations adversely. However, for a well-tested system direct conversion may be appropriate. It can create a lot of anxiety among the IS personnel. This is the least desirable approach in the start-up.

In a phase-in approach, components of the new system are gradually brought in while components of the old system are slowly phased-out. This kind of conversion creates less anxiety for the operational staff but can take a long period to finally get the new system completely operational.

Pilot start-up involves running the new system to one set of users while the others use the old system.

In the parallel start-up both new system and old system are run concurrently for some time. The outputs of the two systems are compared and if there are any differences, they are corrected. When the users are finally satisfied with the new system, the old system is stopped. This could be a costly way of starting-up as two systems to run at the same time will require more personnel & resources.

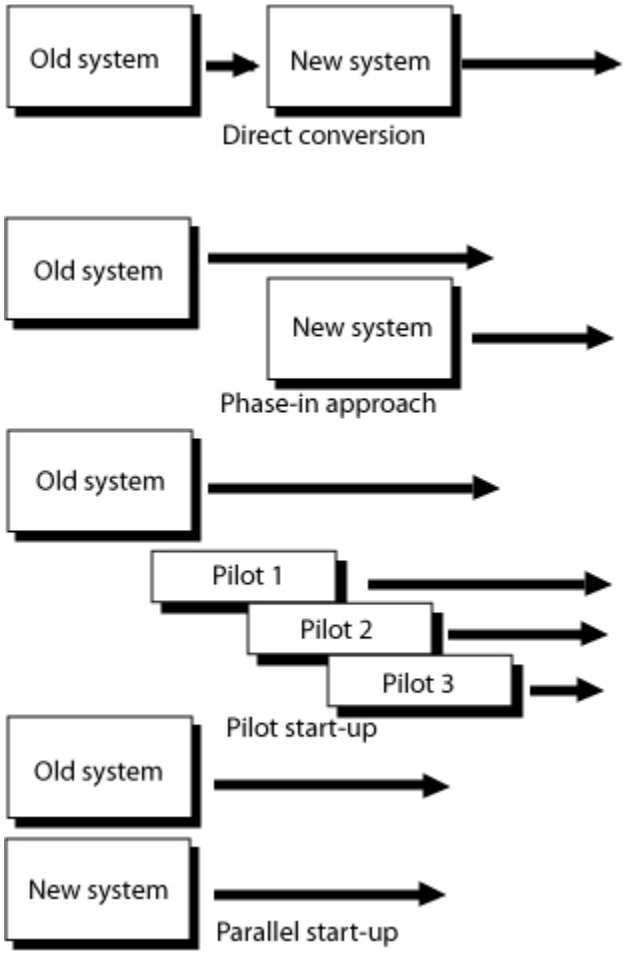


Figure 6.19: Start-Up approaches

User Acceptance

In delivering complex systems, a formal agreement signed by the user that the system is acceptable and has the user's approval. This is a legal document, which would state that

the new system works without any problems and frees the provider from any liability for problems that occur after the user acceptance document is signed.

6.3.4 System Maintenance and Review

Maintenance involves checking, changing and enhancing a system to make it more useful to users and the organization. Maintenance can be very expensive for old systems – especially for legacy systems. Sometimes it may be cheaper to change into a new system than do changes to an old system. If a system has a number of problems, to do the changes, the entire system development cycle has to be gone through. To fix small problems, minor modifications may be sufficient.

Reasons for Maintenance

Some of the reasons for program maintenance are as follows:

- Changes in business processes
- New requests from stakeholders, users and mangers
- Bugs or errors in the program
- Technical and hardware problems
- Corporate mergers and acquisitions
- Government regulations
- Change in the operating system or hardware on which the application runs
- Unexpected events such as floods, fires or terrorist attacks

Most companies prefer to do maintenance to their old systems rather than acquiring new systems as existing systems perform many important functions and they have spent large amounts of money on acquiring them.

Systems Review

Systems review is the final step in the development process. It is done to make sure that the new system operates as expected by the users & the organization and works according to the specifications given earlier. System review is actually a comparison of the expected performance and the benefits with the actual performance and the benefits derived from the system once it is in operation.

System reviews can detect any problems in the system too which can then be corrected. Internal employees, external consultants can perform the system reviews.

6.3.4.1 Types of Reviews

There are two types of review procedures. Event-driven reviews and time-driven reviews. Event-driven reviews are initiated by certain events occurring in the organization such as a problem with an existing system, a merger between two organizations, need of a new system etc.

Time-driven reviews are performed after a specified amount of time. These may be monthly, annual, review every few years or five-year reviews. This kind of review an existing system is monitored on a schedule. Many organizations may use both types of reviews on different occasions.

6.3.4.2 Factors Considered during System Review

Some factors considered during system review include the following;

Mission: Does the computer system help the organization to achieve its overall mission?

Organizational goals: Does the computer system satisfy the specific goals expected from it?

Hardware & Software: Are they up to date and able to handle present processing needs as well as those in the future

Database: Up to date and accuracy of the database and whether the storage space adequate to handle present and future storage needs?

Telecommunications: Does it provide satisfactory speeds in communications? Does it provide a fast customer service?

Information systems personnel: Are they well trained and sufficient and capable of performing current and future processing tasks?

Control: Are rules and procedures for system use and access acceptable? Do they protect the system against errors, invasion of privacy, fraud etc.

Training: Are there adequate training programs for users as well as IS personnel?

Costs: Are development and operating costs within the proposed budget? Does the organization have a sufficient IS budget to support the organization in the future?

Complexity: Is the system user-friendly, easy-to-use or difficult to understand?

Reliability: What is the mean time between failure (MTBF)?

Efficiency: Does it minimize costs, time and the use of information resources?

Response time: Does the system respond to customer needs satisfactorily during peak times?

Documentation: Does the documentation up to date and reflect the current situation?

6.3.4.3 Advantages/Disadvantages of developing In-house vs. Outsourcing

If an organization does not have a capable IS team, development of software can be handed over to another organization which is specialized in software development. This is known as outsourcing of software development. When software development is outsourced, it is possible to get the expertise which is not available internally. However, there are risks such as delays due to lack of control the client organization has over the outsourced organization. Sometimes outsourcing can be less expensive than developing internally, if the necessary resources and capabilities are not available. However, the relationship between the client organization and the development organization has to be maintained well in order to avoid disputes.