

PAPER – 6 : MANAGEMENT INFORMATION AND CONTROL SYSTEMS

QUESTIONS

Basic Concepts of Systems

1. Write a note on Cost benefit Analysis

Transaction Processing Systems

2. Explain in detail the various components of Transaction Processing System.

Basic Concepts of MIS

3. Explain the misconceptions or myths of Management Information System.

Systems Approach and Decision Making

4. Explain in brief the System approach to problem solving.

Decision support and Executive Information Systems

5. (a) What is a Decision Support System?
(b) How does an Executive Information System differ from traditional Information system?

Enabling Technologies

6. Explain the benefits of Client-Server Technology.

System Development Process

7. Briefly describe the traditional and prototyping approaches to Systems Development.
8. Define the following terms:
 - (a) System flowcharts
 - (b) Data dictionary

Systems Design

9. Write short notes on
 - (a) System Manual
 - (b) Function codes

System's Acquisition, Software Development and Testing

10. Write a short note on System Testing
11. (a) List out various financial decisions that can be made with the help of financial information system

- (b) Write in brief the procedures involved in validation of Vendor's proposal.

Systems Implementation and Maintenance

- 12. (a) Discuss in brief the various activities involved in Conversion.
- (b) What is the purpose of the system evaluation? How is it performed?

Design of Computerised Commercial Applications

- 13. Discuss various files and Inputs used for designing a Cost Estimations System.
- 14. (a) What is Financial Accounting? Describe in brief the processing and output required for it.
- (b) Illustrate using data flow diagram, the activities and data flows involved in payroll processing.

Enterprise Resource Planning: Redesigning Business

- 15. Define the following terms:
 - (a) Business Process Reengineering
 - (b) Quality Management Module
- 16. Explain in brief the ERP implementation methodology.

Controls in EDP Set-up: General Controls

- 17. What are data coding controls? With suitable examples explain transcription and transposition errors.
- 18. What do you mean by "Disaster Recovery Plan"? Discuss its various components in detail.
- 19. Write short notes on
 - (a) Discretionary Access Control
 - (b) Firewalls
 - (b) Encryption

Detection of Computer Frauds

- 20. Explain in brief the Disk imaging and analysis technique for detection of Computer Frauds.

Cyber Laws and Information Technology Act 2000

- 21. List out the objectives of Information Technology Act 2000.
- 22. Discuss briefly the powers of Central Government under Section 87 to make rules in respect of Information Technology Act, 2000.

23. Define some of the following terms as mentioned in Information Technology Act, 2000:

- (a) information
- (b) electronic form
- (c) data
- (d) key pair.

Audit of Information Systems

24. (a) List out the factors that prove ineffective in IS audits compared to manual audit method.
- (b) Write a note on Concurrent Audit Techniques.

Information Security

25. What is the role of the Security administrator?

Use of Simple Case Tools, Analysis of Financial Statements using Digital Technology

26. (a) What are CASE Tools? Describe in detail CASE classification.
- (b) Describe 4GL Workbenches in detail.

SUGGESTED ANSWERS/HINTS

1. Cost benefit analysis: The benefits that are derived from the information must justify the cost incurred in procuring information. Using costing techniques, we can find out the total as well as the marginal cost of each managerial statement but benefits are hard to quantify, i.e., they are usually intangibles. In fact, the assessment of such benefits is very subjective and its conversion into objective units of measurement is almost impossible. However, to resolve this problem, we can classify all the managerial statements into many categories with reference to the degree of importance attached, say, (a) absolutely essential statements, (b) necessary statement, (c) normal statements, (d) extra statements. The statements falling in the first category cannot be discontinued whatever be the cost of preparing them. The second category statements may have a high cost but may be discontinued only in stringent circumstances. The normal statements may include those, which can be discontinued or replaced if their costs are too high. In the last category we may list those statements which may be prepared only if the benefits arising out of them are substantially higher than the costs involved.
2. Components of The Transaction Processing System: The principal components of a transaction processing system include inputs, processing, storage, and outputs. These components or elements are part of both manual and computerized systems.

Inputs: Source documents, such as customer orders, sales slips, invoices, purchase orders, and employee time cards, are the physical evidence of inputs into the transaction processing system. They serve several purposes:

- Capture data.
- Facilitate operations by communicating data and authorising another operation in the process.
- Standardize operations by indicating what data require recording and what actions need to be taken.
- Provide a permanent file for future analysis, if the documents are retained.

Source documents are typically forms carefully designed for ease of use and accurate data capture.

Processing: Processing involves the use of journals and registers to provide a permanent and chronological record of inputs. The entries are done either by hand in simple manual systems (journalised) or by a data entry operator using a PC. Journals are used to record financial accounting transacts, and registers are used to record other types of data not directly related to accounting.

Journals are used to provide a chronological record of financial transactions. It is theoretically possible, but not often practicable, to use the two column general ledger as the only book of original entry. However, to effect a division and saving of labour, special journals with special analysis columns are used to record similar and recurring transactions. Some of the more common special journals that may be kept are as follows:

- sales journal: used to summarise sales made on account
- purchase journal: used to summarize purchase made on account
- cash receipts journal: used to summarize receipts of cash
- Cash disbursements journal: used to summarise disbursements of cash.

These four types of journals are often used in conjunction with a separate general ledger to provide a complete bookkeeping system. Special columns can be used in these books of original entry to facilitate recording transactions or for classification of data.

Storage: Ledgers and files provide storage of data in both manual and computerised systems. The general ledger, the accounts / vouchers payable ledger, and the accounts receivable ledger are the records of financial account. They provide a summary of a firm's financial accounting transactions. All accounting transactions must be reflected in the general ledger. A debit – credit entry is input for every transaction. Traditionally, this process has been called posting. The general ledger generates a trial balance to test the accuracy of the entire prior record keeping.

Computer storage: A file is an organized collection of data. There are several types of files. A transaction file is a collection of transaction input data. Transaction files usually

contain data that are of temporary rather than permanent interest. By contrast, a master file contains data that are of a more permanent or continuing interest. To illustrate this difference, consider the posting of sales on accounting to the accounts receivable ledger. Because a sales journal is a chronological record of sales-on-account transactions, it may be called a transaction file. The transaction file consists of raw data concerning sales to customers. Although there may be several sales to the same customer, this will not be known until the transaction data are processed. The process of posting sales to the accounts receivable ledger summarizes sales to an individual customer.

Computer Processing: When computers are used for processing, two different modes of processing accounting transactions are possible. These modes are batch processing and direct processing. Batch processing is conceptually very similar to a traditional manual accounting system. Batches of transactions are accumulated as a transaction file. Transaction files are printed to provide documentation of inputs to the accounting system. Transaction files are subsequently posted to ledgers by computer programs. The ledgers are then periodically processed to generate financial statements. The flow of processing in a batch processing computer system is essentially same as in a traditional manual system- source documents to journals (transaction files), journal to ledgers, and ledgers to financial statements.

In direct processing, individual transactions are posted directly to ledgers rather than being batched to build a transaction file. A ledger may be periodically processed to generate a listing of transactions that have been posted to it over some period of time. But this transaction file is created as a by-product of posting the ledger. Ledgers are periodically processed to generate financial statements.

Outputs: There is a wide variety of outputs from a transaction processing system. Any document generated in the system is an output. Some documents are both output and input (e.g., a customer invoice is an output from the order-entry application system and also an input document to the customer). Other common outputs of a transaction processing system are the trial balance, financial reports, operational reports, pay cheques, and voucher cheques (payments to vendors).

The trial balance lists the balances of all the accounts in the general ledger and tests the accuracy of the record keeping. Thus, it is fundamental to financial control and preparation of financial statements.

Financial reports summarize the results of transaction processing and express these results in accordance with the principles of financial reporting. Two common financial reports are the balance sheet and the income statement. In addition to these two reports, a wide variety of financial reports can be prepared to suit the needs of management and others. Operational reports summarize the results of transaction processing in a statistical or comparative format. Reports summarizing goods received, goods ordered, customer orders received, and other such activities are essential to the operation of a firm. The nature and content of such reports depend on the nature of a firm and its transaction processing activities.

3. Misconceptions or Myths about MIS: Some of the misconceptions or “myths” about MIS are:
- (i) The study of management information system is about the use of computers. This statement is not true. MIS may or may not be computer based, computer is just a tool, just take any other machine. Installing a MIS depends largely on several factors such as, how critical is the response time required for getting information; how big is the organisation, and how complex are the needs of the information processing.
 - (ii) More data in reports means more information for managers: This is a misapprehension. It is not the quantity of data, but its relevance, which is important to managers in process of decision-making. Data provided in reports should meet information requirements of managers. It is the form of data and its manner of presentation that is of importance to business managers. Unorganised mass of data creates confusion.
 - (iii) Accuracy in reporting is of vital importance: The popular belief is that accuracy in reporting should be of high order. At the operating level, it is true. Other examples, where accuracy is really important, can be the dispensing of medicine; the control of aircraft; the design of a bridge etc. Accuracy, however, is a relevant but not an absolute ideal. Higher levels of accuracy involve higher cost. At higher decision levels, great accuracy may not be required. The degree of accuracy is closely related to the decision problem. Higher management is concerned with broad decisions on principles and objectives. A fairly correct presentation of relevant data often is adequate for top management decisions. For a decision on a new project proposal, top management is not interested in knowing the project cost in precise rupee terms. A project cost estimated at a fairly correct figure is all what it wants.
4. To solve problems managers must view the organisation as a dynamic whole and they should anticipate the intended as well as unintended impacts of their decisions. By using systems approach management will understand that they do not solve individual problems. Rather, they intervene in a system of interrelated parts and the managerial functions. The procedure usually followed to solve problems by systems approach can be outlined in fig 4.1.

To understand, how the system approach to problem solving is applied, let us consider the problem of long delays between receipts of orders and delivery in some hypothetical company. To seek a solution for the problem by applying systems approach, we would make use of the aforesaid six steps.

- (i) Defining of the problem: The problem involved here is of inordinate delay between the receipt of orders and their delivery. This problem affects the vendor in many ways, e.g., a bad reputation, loss of customers, reduction in profitability and even stoppage of due payments.

- (ii) Gathering and analysing data concerning the problem: The problem of delay in meeting orders, in this case, say, arises due to the following reasons:
 - a. Excessive orders in the hand of vendors.
 - b. Shortage of power (fall in production due to shortage of power)
- (iii) Identification of alternative solutions: To over-come the stated problem by system approach, suppose the following two solutions exist.
 - a. Refusal of orders, in case the total size of the orders exceeds the plant-capacity of one shift.
 - b. To run the plant in double shift, to meet the commitment in time. Any shortfall in power supply may be met by installing a generator.
- (iv) Evaluation of alternative solution: Out of the two identified solutions under the preceding step, the second solution say accounts for an overall increase in the profitability of the concern after off-setting additional cost for the generator produced power. It also helps in retaining customers and growth of the concern.
- (v) Selection of the best alternative: Under this step, management more closely examines the alternatives and puts its stamp on the best possible alternative. In this case say the second alternative is finally chosen.
- (vi) Implementation of the solution: The implementation of the solution requires the necessary policy changes. Besides this, the resources required to run the plant in double shift and installation of a generator also are to be arranged. Finally, appropriate procedures are developed to exercise smooth production and timely supply to customers; the concerned officers are accordingly instructed.

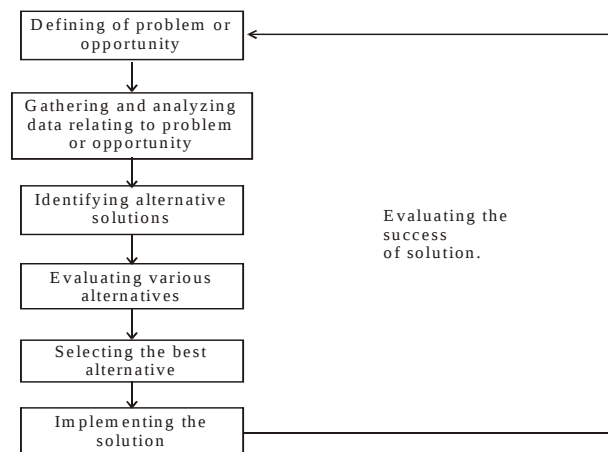


Fig 4.1: A System approach to problem Solving

5. (a) A decision support system (DSS) can be defined as a system that provides tools to managers to assist them in solving semi structured and unstructured problems in their own, somewhat personalized, way. Often, some type of modelling environment – perhaps a very simple environment such as the one accompanying a spreadsheet package – is involved. A DSS is not intended to make decisions for managers, but rather to provide managers with a set of capabilities that enables them to generate the information required by them in making decisions. In other words, a DSS supports the human decision-making process, rather than providing a means to replace it.

Systems that replace human decision making – rather than support it – are sometimes called programmed decision systems. These systems are used to make routine, structured decisions, such as approving loans or credit, reordering inventory, triggering reminder notices, and selecting audit samples. In programmed decision systems, the focus is on doing something more efficiently. On the other hand; in decision support systems, the focus is on helping decision makers become more effective.

Technically, a DSS does not need to involve high technology. For example, to a novice accountant in a large accounting firm, the advice offered by a senior tax partner might be part of that novice's decision support system.

- (b) An Executive Information System (EIS) is a tool that provides direct on-line access to relevant information in a useful and navigable format. Relevant information is timely, accurate, and actionable information about aspects of a business that are of particular interest to the senior manager. The useful and navigable format of the system means that it is specifically designed to be used by individuals with limited time, limited keyboarding skills, and little direct experience with computers. An EIS is easy to navigate so that managers can identify broad strategic issues, and then explore the information to find the root causes of those issues.

Executive Information Systems differ from traditional information systems in the following ways:

- EISs are specifically tailored to executive's information needs.
- They are able to access data about specific issues and problems as well as aggregate reports.
- They provide extensive on-line analysis tools including trend analysis, exception reporting.
- They can access a broad range of internal and external data.
- They are particularly easy to use (typically mouse or touch-screen driven).
- They are used directly by executives without assistance.

- Screen-based - All EISs are delivered through terminals using easy-to-use software.
- Information tends to be presented by pictorial or graphical means.
- Information is presented in summary format, e.g. sales for the whole company. There is, however, the facility to 'drill down' to other levels of information to see how the sale figure were arrived at -by geographical location, by product group etc. (although individual transactions are not usually available).
- The ability to manipulate data, to project 'what if' outcomes and to work with modeling tools within the system are also evident in EIS. This is particularly so with external information that can be 'superimposed' onto the company's information, e.g. sales forecasts with information from the Meteorological Office about the weather.

EIS require large amounts of capacity and processing power within both the system and the network, and whilst suppliers' hardware costs per unit of power are falling, the software costs required to support such systems are increasing, and this will be where the efficiencies are required in the future. Although most computer systems may contain some of the above characteristics, they can be differentiated from EIS in a number of ways. Most MIS and operational systems are based on transaction processing carried out by a variety of on-line and batched inputs. Unlike the EIS, information is usually presented in numerical or textual form and reporting is by exception, usually in printed report format. Also, EISs tend to be externally-focused, strategically-based systems using both internal and external data, whereas other computer systems mainly concentrate on internal control aspects of the organisation.

6. Benefits of the Client /Server Technology: Client/server systems have been hailed as bringing tremendous benefits to the new user, especially the users of mainframe systems. Consequently, many businesses are currently in the process of changing or in the near future will change from mainframe (or PC) to client / server systems. Client / Server have become the IT solution of choice among the country's largest corporations. In fact, the whole transition process, that a change to a client/ server invokes, can benefit a company's long run strategy.
 - People in the field of information systems can use client/server computing to make their jobs easier.
 - Reduce the total cost of ownership.
 - Increased Productivity
 - End user productivity
 - Developer productivity
 - Takes less people to maintain a client/server application than a mainframe

- The expenses of hardware and network in the client/server environment are less than those in the mainframe environment
 - Client/server applications make organisations more effective by allowing them to port applications simply and efficiently.
 - Reduce the cost of the client's computer: the server stores data for the clients rather than clients needing large amounts of disk space. Therefore, the less expensive network computers can be used instead.
 - Reduce the cost of purchasing, installing, and upgrading software programs and applications on each client's machine: delivery and maintenance would be from one central point, the server.
 - The management control over the organisation would be increased.
 - Easy to add new hardware to support new systems such as document imaging and video teleconferencing which may not be feasible or cost efficient in a mainframe environment.
 - Can implement multiple vendor software tools for each application.
7. Approaches to Systems Development: Since organisations vary significantly in the way that they automate their business procedures, and since each new type of system usually differs from any other, several different systems development approaches are often used within an organisation. These approaches are briefly described:
- (i) Traditional approach: In the traditional approach of the systems development, activities are performed in sequence. Fig 7.1 shows examples of the tasks performed during each phase of the traditional approach. Managers and users are most likely to interact with systems analysts, systems designers and application programmers when the traditional approach is used. During the preliminary investigation and requirement analysis phases in which user information needs are identified, systems development activities are usually led by a systems analyst. The system analyst may play a less important role during the design and implementation stages. During these later stages, they may turn over the project to system designers. If new programs are required to be written or existing programs are to be modified, application programmes become involved during the software development and implementation stages.

When the traditional approach is applied, an activity is undertaken only when the prior step is fully completed. Managers and users consider and review the work performed by MIS professionals during each stage of process before proceeding to the next stage. Managers will probably review diagrams, explanation charts and so on, in order to ensure that the work is accurate and complete. If the work is satisfactory, managers and users formally sign off or accept the work and allow the

systems development team to proceed to the next step. It is important under traditional approach that managers and users should thoroughly review the work before granting their permission to start the next activity.

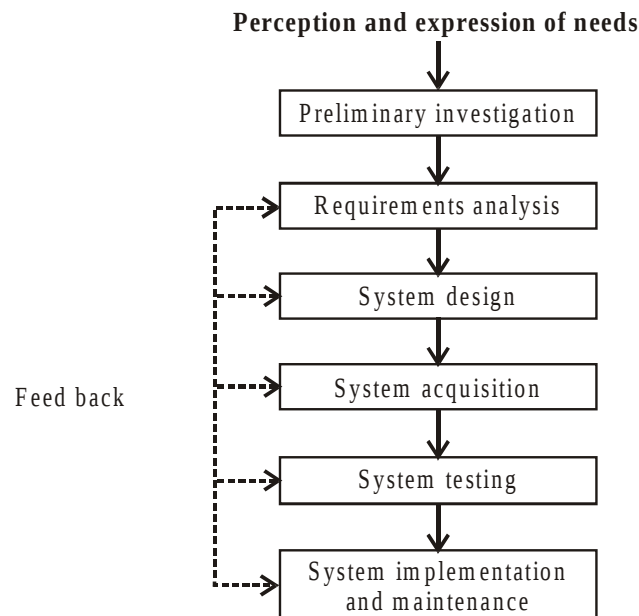


Fig 7.1 Traditional approach to system development

The traditional approach is applied to the development of larger computer based information systems such as the transaction processing systems. Because the processing requirements of these systems are well understood, the risk of users and systems analysts misperceiving the system are less than for other types of systems.

- (ii) Prototyping approaches: The traditional approach sometimes may take years to analyse, design and implement a system. In order to avoid such delays, organisations are increasingly using prototyping techniques to develop smaller systems such as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all of a system. A prototype is a usable system or system component that is built quickly and at a lesser cost, and with the intention of being modifying or replacing it by a full-scale and fully operational system. As users work with the prototype, they make suggestions about the ways to improve it. These suggestions are then incorporated into another prototype, which is also used

and evaluated and so on. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is used to develop the real system.

Experimenting with the prototype helps users to identify additional requirements and needs that they might have overlooked or forgotten to mention. In addition, with prototyping, users have a clearer visual picture of what the final version will look like and they do not have to sign off on a system which is presented to them in the form of diagrams and specification lists. Decision supports semi-structured or unstructured management decision environment, are ideal for the experimentation and trial-and-error development associated with prototyping. Expert systems are ideal for prototyping approach because expert knowledge usually requires continual refinements. Prototyping can also be used in the development of transaction processing system. It is most commonly used during the system design stage, for instance, to develop the mock screen for input etc.

Prototyping can be viewed as a series of four steps:

Step 1: Identify Information System Requirements: In traditional approach, the system requirements have to be identified before the development process start. However, under prototype approach, the design team needs only fundamental system requirements to build the initial prototype, the process of determining them can be less formal and time-consuming than when performing traditional systems analysis. (The team can develop the detailed requirements of the system later after users have had time to interact with the prototype and provide feedback.)

Step 2: Develop the Initial Prototype: In this step, the designers create an initial base model – for example, using fourth-general programming languages or CASE tools. In this phase, the goals are “rapid development” and “low cost.” Thus, the designers give little or no consideration to internal controls, but instead emphasize such system characteristics as “simplicity,” “flexibility,” and “ease of use.” These characteristics enable users to interact with tentative versions of data entry display screens, menus, input prompts, and source documents. The users also need to be able to respond to system prompts, make inquiries of the information system, judge response times of the system, and issue commands.

Step 3: Test and Revise: After finishing the initial prototype, the designers first demonstrate the model to users and then give it to them to experiment. At the outset, users must be told that the prototype is incomplete and requires subsequent modifications based on their feedback. Thus, the designers ask users to record their likes and dislikes about the system and recommend changes. Using this feedback,

the design team modifies the prototype as necessary and then resubmits the revised model to system users for reevaluation. Thus iterative process of modification and reevaluation continues until the users are satisfied – commonly, through four to six interactions.

Step 4: Obtain User Signoff of the Approved Prototype: At the end of Step 3, users formally approve the final version of the prototype, which commits them to the current design and establishes a contractual obligation about what the system will, and will not, do or provide. Approximately half of these approved prototypes become fully functional systems. The remaining, throwaway prototypes are not developed – typically because the modifications required to make them functional are too costly or in other ways not practical. But this does not mean that type prototyping exercise has been a failure. To the contrary, it signals an impractical system and thus saves an organisation a great deal of time and money!

Prototyping is not always the best systems design approach. For example, the design team can be misled if it relies on a small portion of the user population for developing its models (and thus satisfies the informational needs of non-representative employees). For this reason, prototyping is not normally appropriate for designing large or complex information systems that serve many users with significantly different informational needs. Also, prototyping is not commonly used for developing traditional AIS applications such as accounts receivable, accounts payable, payroll, or inventory management, where the inputs, processing, and outputs are well known and clearly defined.

Prototyping makes use of the expertise of both the user and the analyst, thus ensuring better analysis and design, and prototyping is a crucial tool in that process.

- 8 (a) Systems flow chart: It is a graphic diagramming tool that documents and communicates the flow of data media and information processing procedures taking place in an information system. This is accomplished by using a variety of labeled symbols connected by arrows to show the sequence of information processing activities. System flow charts typically emphasise the media and hardware used and the processes that take place within an information system. Thus, they represent a graphic model of the physical information system that exists or is proposed. Systems flow charts are widely used to communicate the overall structure and flows of a system to end-users. An example of flow chart symbols are represented below:

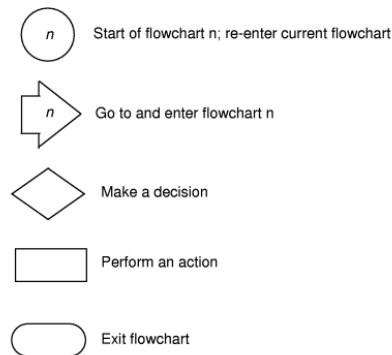


Fig. 8.1 Flowchart Symbols

- (b) **Data Dictionary:** A data dictionary is a computer file that contains descriptive information about the data items in the files of a business information system. Thus, a data dictionary is a computer file about data. Each computer record of a data dictionary contains information about a single data item used in a business information system. An example of data dictionary is drawn below.

Name of data field	File in which stored	Source document	Size in bytes	Type
Inventory quantity on hand	Inventory master file	Form number ABC 123	4	Numeric

← Data dictionary

9. (a) **System Manual:** The basic output of the system design is a description of the task to be performed, complete with layouts and flowcharts. This is called the job specifications manual or system manual. It contains:
- (i) General description of the existing system.
 - (ii) Flow of the existing system.
 - (iii) Outputs of the existing system – the documents produced by existing system are listed and briefly described, including distribution of copies.
 - (iv) General description of the new system – its purposes and functions and major differences from the existing system are stated together with a brief justification for the change.
 - (v) Flow of the new system – this shows the flow of the system from and to the computer operation and the flow within the computer department.
 - (vi) Output Layouts.
 - (vii) Output distribution – the distribution of the new output document is indicated and the number of copies, routing and purpose in each department shown. The

output distribution is summarized to show what each department will receive as a part of the proposed system.

- (viii) Input layouts – the inputs to the new system are described and complete layouts of the input documents and input disks or tapes provided.
 - (ix) Input responsibility – the source of each input document is indicated as also the user department responsible for each item on the input documents.
 - (x) Macro-logic – the overall logic of the internal flows will be briefly described by the systems analyst, wherever useful.
 - (xi) Files to be maintained – the specifications will contain a listing of the tape, disk or other permanent record files to be maintained, and the items of information to be included in each file. There must be complete layouts for intermediate or work file; these may be prepared later by the programmer.
 - (xii) List of programs – a list of the programs to be written shall be a part of the systems specifications.
 - (xiii) Timing estimates – a summary of approximate computer timing is provided by the systems analyst.
 - (xiv) Controls – this shall include type of controls, and the method in which it will be operated.
 - (xv) Audit trail – a separate section of the systems specifications shows the audit trail for all financial information. It indicates the methods with which errors and defects will be prevented or eliminated.
- (b) Function codes: Function codes state the activities or work to be performed without spelling out all of the details in narrative statements. Analysts use this type of code frequently. Data required for input varies depending on what function is needed. For example, appending or updating a record in a transaction processing system would require only the identification key of the record and the function code. On the other hand, adding a new record would require all data elements to be input, including the function code.
10. System Testing: System-level testing must be conducted prior to installation of an information system. It involves: (a) preparation of realistic test data in accordance with the system test plan, (b) processing the test data using the new equipment, (c) thorough checking of the results of all system tests, and (d) reviewing the results with future users, operators and support personnel. System level testing is an excellent time for training employees in the operation of the IS as well as maintaining it. Typically, it requires 25 to 35 per cent of the total implementation effort.

One of the most effective ways to perform system-level testing is to perform parallel operations with the existing system. Parallel operations consist of feeding both systems

the same input data and comparing data files and output results. Despite the fact that the individual programs were tested, related conditions and combinations of conditions that were not envisioned are likely to occur. Last minute changes to computer programs are necessary to accommodate these new conditions.

For an interactive information system project, the process of running dual operations for both new and old system is more difficult than it is for a batch-processing system, because the new system has no true counterpart in the old system. One procedure for testing the new interactive system is to have several remote input terminals connected on line which are operated by supervisory personnel backed up by other personnel operating on the old system. The outputs are checked for compatibility, and appropriate corrections are made to the on-line computer programs. Once this segment of the new system has proved satisfactory, the entire terminal network can be placed into operation for this one work. Additional sections of the system can be added by testing in this manner until all programs are operational.

During parallel operations, the mistakes detected are often not those of the new system, but of the old. These differences should be reconciled as far as it is feasible economically. Those responsible for comparing the two systems should clearly establish that the remaining deficiencies are caused by the old system. A poor checking job at this point can result in complaints later from customers, top management, salespersons, and others. Again, it is the responsibility of the system developers and analysts to satisfy themselves that adequate time for dual operations has been undertaken for each functional area changed.

11. (a) Financial Decisions: Various financial decisions made with the help of financial information system are as follows:
 - (i) Estimation of requirement of funds: A careful estimation of funds and the timing when they will be required can be made. This can be done by forecasting all physical activities of the firm and translating them into monetary units.
 - (ii) Capital Structure Decision: Decisions taken to select an optimum mix of different sources of capital structure. There are various options available for procuring funds. Decision maker has to decide the ratio between debt & equity, long term and short term funds etc.
 - (iii) Capital Budgeting Decisions: Funds procured from various sources are required to be invested in different assets. With the help of capital budgeting, decision maker can determine feasibility of investment in long term assets. This will help in attainment of financial objective.
 - (iv) Profit Planning: Financial decision concerning profits and dividends can be taken by decision maker.

- (v) Tax management: Tax planning is aimed at reducing of outflow of cash resources by way of taxes so that the same may be effectively utilised for the benefit of business. The purpose of tax planning is to take full advantage of exemptions, deductions, concessions, rebates, allowances and other reliefs.
 - (vi) Working Capital Management: Working capital is concerned with investment of long term funds into current assets. Decisions are to be taken for effective financing of current assets required for day-to-day running of the organisation.
 - (vii) Current Assets Management: Policy decisions are taken regarding various items of current assets. Credit policy determines the amount of sundry debtors at any point of time. Inventory policy is to be determined jointly between finance and production department.
- (b) Validation of Vendors' Proposals: This process consists of evaluating and ranking the proposals submitted by vendors. The following factors have to be considered towards rigorous evaluation.
- (i) The Performance Capability of Each Proposed System in Relation to its Costs: It is imperative that a vendor system be capable of processing the organisation's data within the time frames desired by management. Otherwise, delays in providing needed outputs will occur once the computer system is operational. There are many measures of performance, including speed, response time, number of users supported, and system testing. One way to examine the operating efficiency of a particular system is to use a benchmark test. With this approach, the vendor's system performs a data processing task that the new system must perform (e.g., payroll processing), and representatives of the organisation then examine the outputs for accuracy, consistency, and efficiency.
 - (ii) The Costs and Benefits of Each Proposed System: The accountants on the design team will analyze the costs of every vendor's proposed system in relation to the system's anticipated performance benefits – i.e., they will perform a cost-benefit analysis for each proposed system. In this effort, the accountants should also investigate the differences between purchasing and leasing each vendor's system. If the steering committee elects to purchase its computer system, the accountants should then advise the committee on a realistic depreciation schedule for the new system.
 - (iii) The Maintainability of Each Proposed System: Maintainability refers to the ease with which a proposed computer system can be modified. For example, this flexibility enables a firm to alter a portion of a payroll system to reflect new tax laws. Because the costs of maintaining a large information system are typically five times as much as the costs of initially acquiring or developing a system, the evaluators should place considerable emphasis on this dimension.

- (iv) The Compatibility of Each Proposed system with Existing Systems: Compatibility refers to the ability to implement and interface the new system with existing computer resources and software. In some instances, this comes down to hardware issues. For example, it may not be possible to run specific software modules of the new system on some of the company's older local area network servers, which will consequently have to be upgraded. But compatibility issues can also involve the operating system, existing application software, or procedural concerns as well – for example, the requirement that employees learn a whole new set of procedures for inputting data.
 - (v) Vendor Support : Vendor support includes such things as (1) training classes that familiarize employees with the operating characteristics of the new system, (2) help in implementing and testing the new system, (3) assistance in maintaining the new system through a maintenance contract, and (4) backup systems for temporarily processing company data if required. The availability of “business-hours-only” versus “round-the-clock” support is another consideration. Most vendors charge extra for enhanced services.
- 12 (a) Activities involved in conversion: Conversion includes all those activities which must be completed to successfully convert from the previous system to the new information system. Fundamentally these activities can be classified as follows:
- (i) Procedure conversion;
 - (ii) File conversion;
 - (iii) System conversion;
 - (iv) Scheduling personnel and equipment;
 - (v) Alternative plans in case of equipment failure.
 - (i) Procedure conversion: Operating procedures should be completely documented for the new system. This applies to both computer-operations and functional area operations. Before any parallel or conversion activities can start, operating procedures must be clearly spelled out for personnel in the functional areas undergoing changes. Information on input, data files, methods, procedures, output, and internal control must be presented in clear, concise and understandable terms for the average reader. Written operating procedures must be supplemented by oral communication during the training sessions on the system change.

Despite many hours of training, many questions will have to be answered during conversion activities. Brief meetings must be held when changes are

taking place in order to inform all operating employees of any change initiated. Qualified system personnel must be in the conversion area to communicate and coordinate new developments as they occur. Likewise, revisions to operating procedures should be issued as quickly as possible. These efforts enhance the chances of successful conversion.

Once the new system is completely operational, the system implementation group should spend several days checking with all supervisory personnel about their respective areas. As with every new installation, minor adjustments should be expected. Channels of communication should be open between the systems development team members and all supervisory personnel so that necessary changes can be initiated as conditions change. There is no need to get locked into a rigid system when it would be beneficial for the organisation to make necessary changes. Thus, the proper machinery for making changes must be set in place.

- (ii) File conversion: Because large files of information must be converted from one medium to another, this phase should be started long before programming and testing are completed. The cost and related problems of file conversion are significant whether they involve on-line files (common database) or off-line files. Present manual files are likely to be inaccurate and incomplete where deviations from the accepted format are common. These files suffer from the shortcomings of inexperienced - and, at times, indifferent - personnel whose jobs are to maintain them. Computer generated files tend to be more accurate and consistent. If the existing system is operating on a computer but of different configuration, the formats of the present computer files are generally unacceptable for the new system.

Besides the need to provide a compatible format, there are several other reasons for file conversion. The files may require character translation that is acceptable to the character set of the new computer system. Data from floppy disks, magnetic tapes, and comparable media will have to be placed on magnetic disk and/or mass storage files in order to construct an on-line common database. Also, the rearrangement of certain data fields for more efficient programming may be desired.

In order for the conversion to be as accurate as possible, file conversion programs must be thoroughly tested. Adequate control, such as record counts and control totals, should be required output of the conversion program. The existing computer files should be kept for a period of time until sufficient files are accumulated for back up. This is necessary in case the files must be

reconstructed from scratch after a "bug" is discovered later in the conversion routine.

- (iii) System conversion: After on-line and off-line files have been converted and the reliability of the new system has been confirmed for a functional area, daily processing can be shifted from the existing information system to the new one. A cut-off point is established so that database and other data requirements can be updated to the cut-off point. All transactions initiated after this time are processed on the new system. System development team members should be present to assist and to answer any questions that might develop. Consideration should be given to operating the old system for some more time to permit checking and balancing the total results of both systems. All differences must be reconciled. If necessary, appropriate changes are made to the new system and its computer programs. The old system can be dropped as soon as the data processing group is satisfied with the new system's performance.
- (iv) Scheduling personnel and equipment: Scheduling data processing operations of a new information system for the first time is a difficult task for the system manager. As users become more familiar with the new system, however, the job becomes more routine.

Before the new design project is complete, it is often necessary to schedule the new equipment. Some program will be operational while others will be in various stages of compiling and testing. Since production runs tend to push aside new program testing, the system manager must assign ample time for all individuals involved. This generally means second shift for those working on programs. Once all programs are "on the air", scheduling becomes more exacting.

Schedules should be set up by the system manager in conjunction with departmental managers of operational units serviced by the equipment. The master schedule for next month should provide sufficient computer time to handle all required processing. Daily schedules should be prepared in accordance with the master schedule and should include time necessary for reruns, program testing, special non-recurring reports and other necessary runs. In all cases, the schedules should be as realistic as possible since scheduling an interactive system is more difficult than scheduling a batch-processing system.

The time required to assign remote batch programs under normal operating conditions in real time is a problem, since the number of interruptions that will

occur is generally unknown. Often, the solution is to assign a block of time each day for the operation of remote input-output devices. If this arrangement is not feasible, the system manager must look to past experience. When total random and sequential demands are not high, the machine will have sufficient capacity to complete all scheduled work even though batch-processing runs will be extended by random system inquiries.

Just as the equipment must be scheduled for its maximum utilisation, so must be personnel who operate the equipment. It is also imperative that personnel who enter input data and handle output data be included in the data processing schedule. Otherwise, data will not be available when the equipment needs it for processing. It is essential that each person follow the methods and procedures set forth by the MIS section; non-compliance with established norms will have an adverse effect on the entire system.

- (v) Alternative plans in case of equipment failure: Alternative processing plans must be implemented in case of equipment failure. Who or what caused the failure is not as important in case of equipment failure as the fact that the system is down. Priorities must be given to those jobs critical to an organisation, such as billing, payroll, and inventory. Critical jobs can be performed manually until the equipment is set right.

Documentation of alternative plans is the responsibility of the computer section and should be fully covered by the organisation's systems and procedures manual. It should state explicitly what the critical jobs are, how they are to be handled in case of equipment failure, where compatible equipment is located, who will be responsible for each area during downtime and what dead-lines must be met during the emergency. A written manual of procedures concerning what steps must be undertaken will help expedite the unfavourable situation. Otherwise, panic will result in the least efficient methods when time is of the essence.

- (b) System evaluation provides the feedback necessary to assess the value of information and the performance of personnel and technology in the newly designed system. The feedback provides information regarding adjustments required in the Information system.

There are two basic dimensions of information systems that should be evaluated. The first dimension is concerned with whether the newly developed system is operating properly. The other dimension is concerned with whether the user is satisfied with the information system with regard to the reports supplied by it.

- (i) Development evaluation: Evaluation of the development process is primarily concerned with whether the system was developed on schedule and within budget. It requires schedules and budgets to be established in advance and those records of actual performance and cost be maintained. Due to the uncertainty and mystique associated with system development, they are not subject to traditional management control procedures.
 - (ii) Operation evaluation: The evaluation of the information system's operation pertains to whether the hardware, software and personnel are capable to perform their duties and they do actually perform them so. Operation evaluation answers such questions.
 - 1. Are all transactions processed on time?
 - 2. Are all values computed accurately?
 - 3. Is the system easy to work with and understand?
 - 4. Is terminal response time within acceptable limits?
 - 5. Are reports processed on time?
 - 6. Is there adequate storage capacity for data?
 - (iii) Information evaluation: An information system should also be evaluated in terms of information it provides. Satisfaction can be used as a measure to evaluate the information provided by an information system. Measurement of user satisfaction can be accomplished using the interview and questionnaire technique. If management is generally satisfied with an information system, it is assumed that the system is meeting the requirements of the organization. If management is not satisfied, modifications ranging from minor adjustments to complete redesign may be required.
13. Files and Inputs used for designing Cost Estimation Systems: The cost estimation system requires a standard cost file. Here, standard costs are maintained for each labour, material, and machine classification as well as for standard manufacturing operations. These costs are the basis for preparing manufacturing cost estimates. The standard costs are updated on the basis of information provided by the budgeting system. Figure drawn below displays the flow and use of files and Inputs used in the system.
- The cost estimation system also maintains the bill of materials file, which contains a list of all materials required to produce each product. The file also includes approved vendors for each material.

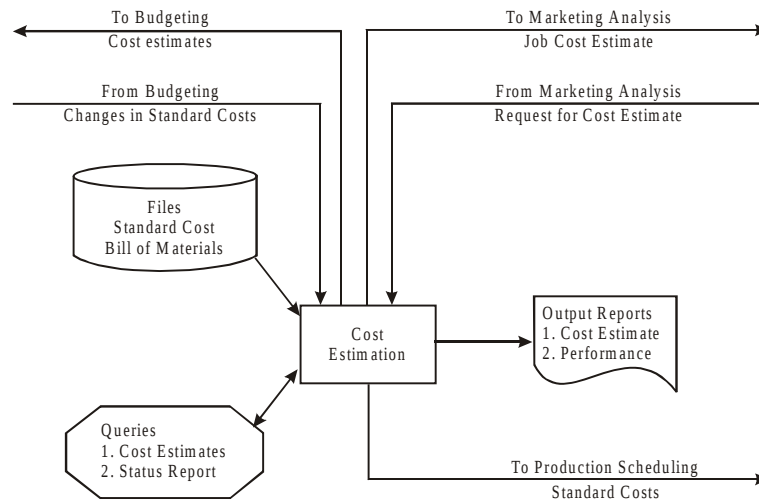


Fig 13.1 Files and Input in Cost Estimation System

14. (a) Financial accounting is concerned with entering all transactions and keeping track of the balances of the various account heads. The summary of the balances and of the transactions is presented in the form of profit and loss statement and balance sheet. The reports are used to understand the financial operations of the organisation.

Organisations are also concerned with the money owed by them to others (accounts payable) and amount of money which are owed to them (accounts receivable). Collection of money owed is usually a focus area for an organisation and therefore an analysis of the accounts receivable is very important.

Financial accounting as an area is extremely amenable to computerisation. All processing is well defined and numerical. Since accounts are subject to audit, existing manual systems are usually smooth and consequently the transition from manual systems to computerised systems is relatively smooth. The method of accounting is similar across companies, with a few minor differences. A large number of readymade software packages are available in the market.

To set up a financial accounting system, master data containing account heads (main as well as subsidiary accounts heads) along with a classification of accounts needs to be maintained.

The regular processing involves:

- entry of transactions
- printing of cash and bank books
- printing the general ledger
- producing the profit and loss statement and balance sheet
- producing other reports on accounts receivable and payable.

Annual processing involves closing the year, producing year-end reports and initialising the account heads for a new year.

For processing, transaction form the regular input. The following transactions are typical in most financial accounting systems :

- sales invoices
- purchase bills
- payment vouchers (bank and cash)
- receipt vouchers (bank and cash)
- transfer of money between various bank accounts
- journal vouchers
- debit notes
- credit notes

While all transactions are essentially processed using the conventional double entry (debit and credit) system, different forms are used for different transactions in order to capture additional information (e.g. cheque number and date in a bank payment) and reference data.

Processing includes:

- validation of the transactions-valid account heads, credit equal to debit, transaction date in valid range, etc.
- posting the transaction (credit and debit) under the correct account/sub account heads.
- summarising the accounts and transactions to produce the periodic profit and loss account and balance sheet
- printing details of accounts receivable (including age-wise analysis)
- printing details of accounts payable

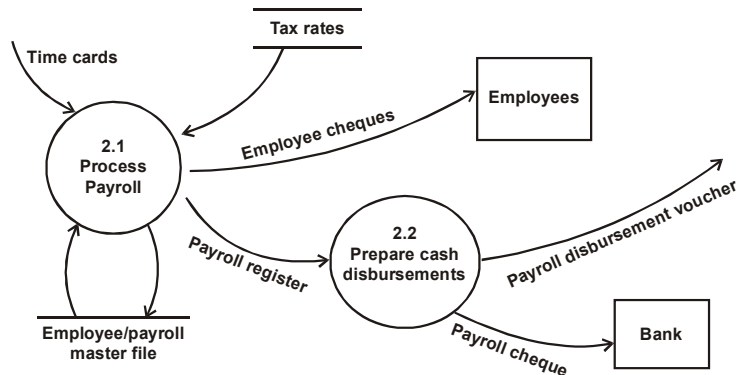
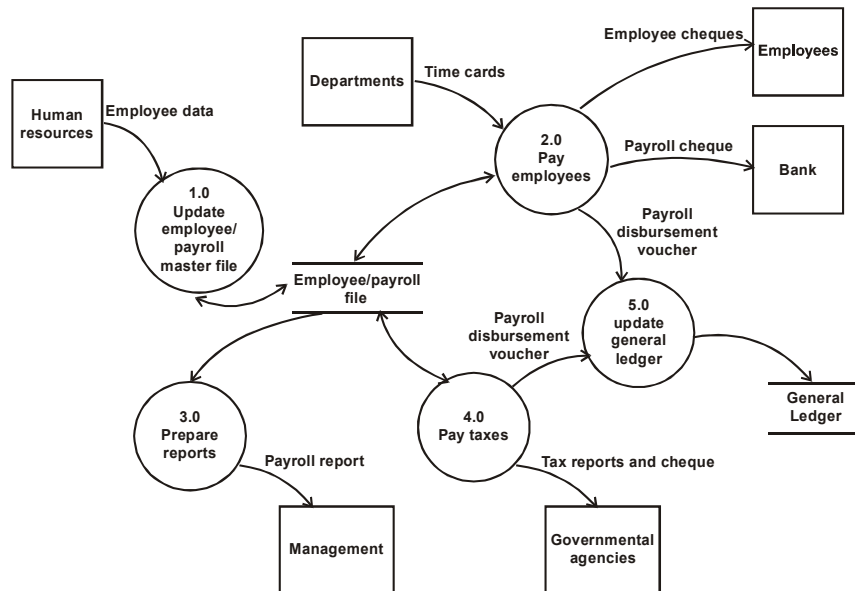
- Printing the day books and ledgers (records of transactions by date and type of transactions)
- facilitating reconciliation of accounting entries.

Annually, year-end activities require additional processing for incorporating the annual accounting entries and generating the Annual profit and Loss statement and Annual Balance Sheet. After the annual reports are generated and found satisfactory, the accounts are initialised with the year opening balances for the next year's processing.

Outputs of financial accounting systems include:

- cash book
- bank book
- sales day book
- purchase day book
- general ledger
- subsidiary ledgers
- trial balance
- profit and loss statement (usually monthly/quarterly)
- balance sheet (usually monthly/quarterly)
- accounts receivable details
- customer statement of account
- age-wise accounts receivable
- accounts payable detail statement
- transaction details for given type of transaction, date range, account head, etc.
- annual profit and loss statement
- annual balance sheet.

(b) DFD for payroll processing.



15. (a) Business Process Reengineering: The most accepted and formal definition for BPR, given by Hammer and Champy is " BPR is the fundamental rethinking and radical redesign of processes to achieve dramatic improvement, in critical, contemporary measures of performance such as cost, quality, service and speed,"

This has a few important key words, which need clear understanding. Here, dramatic achievement means to achieve 80% or 90% reduction (in say, delivery time, work in progress or rejection rate) and not just 5%, 10% reduction. This is possible only by making major improvements and breakthroughs, and not small incremental changes (like those in Total Quality Management (TQM) or suggestion schemes).

- (b) Quality Management Module: - Quality management module provides the tools to administer organisations quality management procedures and activities. It is a flexible module which supports continuous improvements, tighter process control, increased audibility and certification requirements. Quality management module is tightly integrated with all modules of an enterprise. Implementing it in a logistics system provides a number of advantages. Some of these advantages are:

1. Verification of the quality of procured goods.
2. Reduction of administrative tasks through company-wide quality planning.
3. Recording of all pertinent quality data during the quality inspection.
4. Using the comprehensive functions for quality control.
5. Managing problems efficiently through quality notifications.
6. Creating a quality management information system.

16. ERP Implementation Methodology: Several steps are involved in the implementation of a typical ERP package. These are:

- (i) Identifying the needs for implementing an ERP package.
- (ii) Evaluating the 'As Is' situation of the business i.e., to understand the strength and weakness prevailing under the existing circumstances.
- (iii) Deciding the 'Would be' situation for the business i.e., the changes expected after the implementation of ERP.
- (iv) Reengineering the Business Process to achieve the desired results in the existing processes.
- (v) Evaluating the various available ERP packages to assess suitability.
- (vi) Finalising of the most suitable ERP package for implementation.
- (vii) Installing the required hardware and networks for the selected ERP package.
- (viii) Finalising the Implementation consultants who will assist in implementation.
- (ix) Implementing the ERP package.

The above mentioned steps are explained in detail, these are :

- (i) Identifying the Needs: Some of the basic questions, which are to be answered, are

- Why should an ERP package be implemented?
- Will it improve profitability?
- Can the delivery times of products be reduced?
- How does it improve customer satisfaction in terms of quality, cost, delivery time and service?
- Will it help to reduce cost of products?
- How can it help to increase business turnover and at the same time reduce manpower?
- Will it be possible to reengineer the business processes?

Other requirements to satisfy the information management are

- Need for quick flow of information between Business partners.
 - Effective MIS for quick decision making
 - Elimination of manual working.
 - High level of integration between various business functions.
- (ii) Evaluating the “AS IS” situation of the business: To understand the present situation of the business, the various functions should first be listed. The processes used to achieve business transactions should be listed in detail. The details of business process can be obtained by mapping the processes to the functions:
- Total time taken by the business processes.
 - Number of decision points existing in the present scenario.
 - Number of Departments/Locations of business processes.
 - The flow of information and its routing.
 - The number of reporting points currently available.
- (iii) Deciding the desired ‘Would Be’ situation:- The concept of ‘Benchmarking’ is used to see that processes achieved are the best in industry. Benchmarking is done on various factors like cost, quality, service etc. This concept enables to optimise the processes to gain overall benefits.
- (iv) Reengineering the business process:- Reengineering of business processes is done to
- Reduce the business process cycle time.
 - To reduce the number of decision points to a minimum.
 - Streamlining the flow of information and eliminating the unwanted flow of information.

- (v) Evaluation of various ERP packages:- Evaluation of ERP packages are done based on the following criteria:-

Flexibility: It should enable organizations to respond quickly by leveraging changes to their advantage, letting them concentrate on strategically expanding to address new products and markets.

Comprehensive: It should be applicable across all sizes, functions and industries. It should have in-depth features in accounting and controlling, production and materials management, quality management and plant maintenance, sales and distribution, human resources management, sales and distribution, and project management. It should also have information and early warning systems for each function and enterprise-wide business intelligence system for informed decision making at all levels. It should be open and modular.

It should embrace an architecture that supports components or modules, which can be used individually, expandable in stages to meet the specific requirements of the business, including industry specific functionality. It should be technology independent and mesh smoothly with in-house/third-party applications, solutions and services including the Web.

Integrated: It should overcome the limitations of traditional hierarchical and function oriented structures. Functions like sales and materials planning, production planning, warehouse management, financial accounting, and human resources management should be integrated into a workflow of business events and processes across departments and functional areas, enabling knowledge workers to receive the right information and documents at the right time at their desktops across organisational and geographical boundaries.

Beyond the company: It should support and enable inter-enterprise business processes with customers, suppliers, banks, government and business partners and create complete logistical chains covering the entire route from supply to delivery, across multiple geographies, currencies and country specific business rules.

Best business practices: The software should enable integration of all business operation in an overall system for planning, controlling and monitoring and offer a choice of multiple ready-made business processes including best business practices that reflect the experiences, suggestions and requirements of leading companies across industries. In other words, it should intrinsically have a rich wealth of business and organisational knowledge base.

New technologies: It should incorporate cutting-edge and future-proof technologies such as object orientation into product development and ensure inter-operability with the Internet and other emerging technologies.

Other factors to be considered are:

- Global presence of package.

- Local presence.
 - Market Targeted by the package.
 - Price of the package.
 - Obsolescence of package.
 - Ease of implementation of package.
 - Cost of implementation.
 - Post-implementation support availability.
- (vi) Finalisation of the ERP package:- Finalisation of the ERP package can be done by making a comparison of critical factors through a matrix analysis.
- (vii) Installation of Hardware and Networks:- This work is carried out in a phased manner depending on the schedule of implementation and need of the hardware components.
- (viii) Finalising the Implementation Consultants:-The factors of selection for consultants are:
- Skill set
 - Industry specific experience.
 - Cost of hiring the consultant.
- (ix) Implementation of ERP package: The general steps involved in the implementation are:
- Formation of team.
 - Preparation of plan.
 - Mapping of Business Processes to package.
 - Gap Analysis i.e., deviation of existing processes from standard processes.
 - Customisation.
 - Development of user-specific reports and transactions.
 - Uploading of Data from existing system.
 - Test runs.
 - User Training.
 - Parallel run.
 - Concurrence from user.
 - Migration to the new system
 - User documentation.
 - Post-implementation support.
 - System monitoring and fine tuning.
17. Data Coding Controls: Coding controls are checks on the integrity of data codes used in processing. A customer's account number, an inventory item number, and a chart of

accounts number are all examples of data codes. Two types of errors can corrupt a data code and cause processing errors: transcription, and transposition.

Transcription errors fall into three classes:

1. Addition errors occur when an extra digit or character is added to the code. For example, inventory item number 83276 may be recorded as 832766.
2. Truncation errors occur when a digit or character is removed from the end of a code. In this type of error, the inventory item above might be recorded as 8327.
3. Substitution errors are the replacement of one digit in a code with another. For example, code number 83276 is recorded as 83266.

There are two types of transposition errors. Single transposition errors occur when two adjacent digits are reversed. For instance, 83276 is recorded as 38276. Multiple transposition errors occur when nonadjacent digits are transposed. For example, 83276 is recorded as 87236.

Any of these errors can cause serious problems in data processing if they go undetected. For example, a sales order for customer 732519 that is transposed into 735219 will be posted to the wrong customer's account. A similar error in an inventory item code on a purchase order could result in ordering unneeded inventory and failing to order inventory that is needed. These simple errors can severely disrupt operations.

18. Disaster Recovery Plan: The term 'Disaster Recovery' describe the contingency measures that organisations have adopted at key computing sites to recover from, or to prevent any monumentally bad event or disaster. A disaster may result from natural causes such as fire, flood or earthquake etc. or from other sources such as a violent takeover, wilful or accidental destruction of equipment or any other act of such catastrophic proportions that the organisation could be ruined. The primary objective of a disaster recovery plan is to assure the management that normalcy would be restored in a set time after any disaster occurs, thereby minimising losses to the organisation. The disaster recovery plan must take into account the physical location of the computer centre, since it can increase or decrease the chance of a disaster. Protection against flood, fire, earthquake or water logging etc. must be considered.

Although each organisation would like to have a specifically tailored disaster recovery plan, the general components of the plan would be as follows:

- (i) Emergency Plan: This part of the Disaster Recovery Plan (DRP) outlines the actions to be undertaken immediately after a disaster occurs. It identifies the personnel to be notified immediately, for example, fire service, police, management, insurance company etc. It provides guidelines on shutting down equipment, termination of power supply, removal of storage files and removable disks, if any. It sets out evacuation procedures like sounding the alarm bell, activating fire extinguishers, evacuation of personnel. It also provides return procedures as soon

as the primary facility is ready for operation like backing up data files at off-site, deleting data from disk drives at third party's site, relocation of proper versions of backup files, etc.

- (ii) **Recovery Plan:** This part of the DRP sets out how the full capabilities will be restored. A recovery committee is constituted. Preparing specifications of recovery like setting out priorities for recovery of application systems, hardware replacement etc. will be the responsibility of Recovery Committee.

The following steps may be carried out under this plan:

- ◆ An inventory of the hardware, application systems, system software, documentation etc. must be taken.
 - ◆ Criticality of application systems to the organisation and the importance of their loss must be evaluated. An indication must be given of the efforts and cost involved in restoring the various application systems.
 - ◆ An application systems hierarchy must be spelt out. This would be used when the management decides to accept a degraded mode of operation.
 - ◆ Selection of a disaster recovery site must be made. A reciprocal agreement with another organisation having compatible hardware and software could be made. However, systems availability and data security problems must be considered at this point. Hiring a service bureau is another option. If the situation warrants, a fully operational backup site could also be considered.
 - ◆ A formal backup agreement with another company must be made. This should cover the periodical exchange of information between the two sites regarding changes to hardware/software, the time and duration of systems availability, modalities of testing the plan etc.
- (iii) **Backup Plan:** Organisations no matter how physically secure, their systems are always vulnerable to the disaster. Therefore, an effective safeguard is to have a backup of anything that could be destroyed, be it hardware or software. As the software is concerned, it is necessary to make copies of important programs, data files, operating systems and test programs etc. in order to get back into operation before the company can suffer an intolerable loss. Often, the originals are stored at site that is physically distant from the actual site, and where duplicate copies are used for processing. The backup copies must be kept in a place which is not susceptible to the same hazards as the originals.
- (iv) **Test plan:** This plan looks after the testing of DRP and analysis of the result. It identifies deficiencies in the emergency, backup or recovery plan. It contains procedures for conducting DRP testing like

- (i) Paper walk-throughs: It involves critical personnel in the plan's execution, reasoning out what might happen in the event of different disasters.
 - (ii) Localised tests: It simulates system crash. This test is performed on different aspects of DRP.
 - (iii) Full operational test: It is nearer to disaster conditions. Paper walkthrough and localised tests should have been conducted before completely shutting down the operations to simulate disasters.
19. (a) Discretionary Access Control: The system administrator usually determines who is granted access to specific resources and maintains the access control list. In distributed systems, however, resources may be controlled (owned) by end users. Resource owners in this setting may be granted discretionary access control, which allows them to grant access privileges to other users. For example, the controller, who is the owner of the general ledger, grants read-only privileges to a manager in the budgeting department. The accounts payable manager, however, is granted both read and write permission to the ledger. Any attempt by the budgeting manager to add, delete, or change the general ledger will be denied. The use of discretionary access control needs to be closely supervised to prevent security breaches due to its liberal use.
- (b) Firewalls: Organisations connected to the Internet or other public networks often implement an electronic "firewall" to insulate their Intranet from outside intruders. A firewall is a system that enforces access control between two networks. To accomplish this:
- All traffic between the outside network and the organisation's Intranet must pass through the firewall.
 - Only authorised traffic between the organisation and the outside, as specified by formal security policy, is allowed to pass through the firewall.
 - The firewall must be immune to penetration from both outside and inside the organisation.

Firewalls can be used to authenticate an outside user of the network, verify his or her level of access authority, and then direct the user to the program, data, or service requested. In addition to insulating the organisation's network from external networks, firewalls can also be used to insulate portions of the organisation's Intranet from internal access. There are a number of firewall products on the market. Firewalls can be grouped into two general types: network-level firewalls, and application-level firewalls.

Network-level firewalls provide low cost and low security access control. This type of firewall consists of screening router that examines the source and destination

addresses that are attached to incoming message packets. The firewall accepts or denies access requests based on filtering rules that have been programmed into it. Similar to an intelligent PBX, the firewall directs incoming calls to the correct internal receiving node. Network-level firewalls are insecure because they are designed to facilitate the free flow of information rather than restrict it. This method does not explicitly authenticate outside users. Using IP spoofing, hackers can disguise their message packets to look as if they came from an authorized user and thus gain access to the host's network.

Application-level firewalls provide a high level of customizable network security, but can be extremely expensive. These systems are configured to run security applications called proxies that permit routine services such as e-mail to pass through the firewall, but can perform sophisticated functions such as logging or user authentication for specific tasks. If an outside user attempts to connect to an unauthorized service or file, the network administrator or security group can be notified immediately.

- (c) Encryption: Encryption is the conversion of data into a secret code for storage in databases and transmission over networks. The sender uses an encryption algorithm to convert the original message called clear text into a coded equivalent called cipher text. At the receiving end, the cipher text is decoded (decrypted) back into clear text. The encryption algorithm uses a key, which is a binary number that is typically from 56 to 128 bits in length. The more bits in the key, the stronger the encryption method. Today, nothing less than 128 bit algorithms are considered truly secure. Two general approaches to encryption are private key and public key encryption.

- 20. Disk imaging and analysis Technique: It enables the fraud investigator to discover evidence of transactions that the fraudster thought were inaccessible or had been destroyed. They can be used where evidence of the commission of a fraud may have been retained in a computer. For example, such evidence may be in the form of word processing documents showing the stages in creation of a forged invoice or a blackmail letter; or files which demonstrate that an employee has been sending confidential information by e-mail to a competitor or copies of passwords of other members of staff or users of other computers or pornographic material. The technique can equally well be applied to a network or any other storage media. It just makes the job more complex.

The stages are as follows:

- (i) Using specialist hardware and software without the suspect necessarily being alerted, an exact copy of the computer hard disk is taken leaving the original completely intact and leaving no trace of the copying process. This is achieved by attaching the imaging hardware to the parallel port of the computer and running the

imaging software without using the computer's operating system. This preserves the integrity of the hard disk and the confidentiality of the investigation. The image is written directly to an optical disk which can then be copied onto a CD ROM for investigative purposes.

- (ii) The image copy of the disk is processed and areas of storage containing partially overwritten files and files which have been marked as deleted but not overwritten are recovered. In fact, it is a relatively straightforward process and one that is important to understand if the full benefits of disk imaging and analysis are to be appreciated. When a file is created on a computer, a reference to it is stored in the computer's file allocation table. This may be compared with the contents page or index of a book. Under normal circumstances, when a file is deleted from within the operating system in which it was created, the actual bytes that contain the file information are not physically removed from the hard disk. All that happens is that the reference to the file in the file allocation table is removed. This means that the space occupied by the file is made available to be overwritten by other data. However, at the time the image is taken it is probable that there will be a number of deleted files or file fragments that have not been overwritten and are therefore available to the investigator. The processing software can recover them.
- (iii) The final stage is the analysis of the processed image. This is done by search software, which can be programmed to find references to suspect transactions. The search is across all the text on the disk so that files which the suspect thinks have been destroyed and data which he may well have had no idea was being retained are searched. The extent of the searches depends upon the software used. In general terms, it should be possible to carry out single word searches, searches for phrases, searches for numbers, searches for parts of words and phrases, searches for words which sound like other words and linked searches of more than one word or phrase using Boolean operators (and, or, if, not etc). Outside the normal file structure, that is to say where live files are usually stored, information can be recovered for investigation from:
 - (a) Free space – It refers to areas of a file system not currently allocated for data storage. These areas may have been used before and may contain deleted data, which has not yet been overwritten.
 - (b) Lost chains – It refers to areas of the disk allocated for data storage but currently without a name or disconnected from the file system.
 - (c) Slack space – It refers to disk space allocated to files in allocation blocks normally of several hundred to several thousand bytes in size. Files rarely occupy a complete number of allocation blocks so some of the last allocation

block will be unused. This area may contain data, which has not been overwritten.

- (d) Deleted files: Files that have been “undeleted” by the processing software and made available for interrogation.
- (e) The contents of the Windows SWAP file – This is a disk cache created by Windows each time it is run. It is a storage area in which all kinds of data may be kept. The file may be large and is hidden from the user. It is seldom deleted and can contain entire documents, memoranda and database information. It can thus be extremely valuable to an investigator.
- (f) Internet cache files or temporary Internet files – When the Internet is accessed through Windows, copies of the Web pages looked at by the user are copied to the user's computer. These copies are stored in a folder called Temporary Internet files. Again, this folder is seldom inspected by the user and the files are seldom deleted. They can be of great interest to the investigator as it might provide a route map of Internet access.

21. Objectives of The Information Technology Act,2000

The objectives of the Act are:

- (a) to grant legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication commonly referred to as “electronic commerce” in place of paper based methods communication;
- (b) to give legal recognition to Digital Signature for authentication of any information or matter which requires authentication under any law;
- (c) to facilitate electronic filing of documents with Government departments.
- (d) to facilitate electronic storage of data;
- (e) to facilitate and give legal sanction to electronic fund transfers between banks and financial institutions
- (f) to give legal recognition for keeping books of account by Bankers in electronic form.
- (g) to amend the Indian Penal Code, the Indian Evidence Act, 1872, the Bankers' Book Evidence Act, 1891 and the Reserve Bank of India Act, 1934.

22. The powers of Central Government under Section 87 of the Act to makes rules in respect of Information Technology Act 2000 are:

- (1) The manner in which any matter may be authenticated by a digital signature.
- (2) The manner and format in which electronic records shall be filed or issued.
- (3) The type of digital signature, manner and format in which it may be affixed.

- (4) The security procedure for the purpose of creating same electronic record and secure digital signature.
 - (5) The qualifications, experience and terms and conditions of service of Controller, Deputy Controllers and Assistant Controllers.
 - (6) The requirements, manner and form in which application is to be made for a license to issue Digital Signature Certificates.
 - (7) The period of validity of the license.
 - (8) The qualification, experience of an adjudicating Officer, as well as other officers.
 - (9) The salary, allowances and terms and conditions of service of the Presiding Officer, etc.
23. (a) "information" includes data, text, images, sound, voice, codes, computer programmes, software and databases or micro film or computer generated micro fiche:
- (b) "electronic form" with reference to information means any information generated, sent, received or stored in media, magnetic, optical, computer memory, micro film, computer generated micro fiche or similar device;
 - (c) "data" means a representation of information, knowledge, facts, concepts or instructions which are being prepared or have been prepared in a formalised manner, and is intended to be processed, is being processed or has been processed in a computer system or computer network, and may be in any form (including computer printouts magnetic or optical storage media, punched cards, punched tapes) or stored internally in the memory of the computer;
 - (d) "key pair", in an asymmetric crypto system, means a private key and its mathematically related public key, which are so related that the public key can verify a digital signature created by the private key;
24. (a) The Computer Auditing Approach: The audit methods that are effective for manual audits prove ineffective in many IS audits because of these factors:
- ◆ Electronic evidence – Essential evidence is not physically retrievable by most auditors, and it is not readable in its original electronic form.
 - ◆ Terminology – The tools and techniques used in automated applications are described in terms that are difficult for the non-EDP auditor to understand.
 - ◆ Automated processes – The methods of processing are automated rather than manual, making it difficult for the non-EDP auditor to comprehend processing concepts and the logic of these concepts.

- ◆ New risks and controls – Threats to computer systems and the countermeasures to those threats (i.e. controls) are new to non-EDP auditors, and the magnitude of the risks and the effectiveness of the controls are not understood.
- ◆ Reliance on controls – In manual systems, the auditor can place some reliance on hard-copy evidence, regardless of the adequacy of the controls. Whereas, in automated systems, the electronic evidence is only as valid as the adequacy of controls.

Because the rate of these changes varies among systems in organizations, the methods and approaches of auditing automated information systems differ among applications and organizations. For example, some organizations still rely heavily on hard-copy evidence, and others have eliminated much of it.

- (b) Concurrent Audit Techniques: Millions of rupees of transactions can be processed in an on-line system without leaving a satisfactory audit trail. In such cases, evidence gathered after data processing is insufficient for audit purposes. In addition, since many on-line systems process transactions continuously, it is difficult or impossible to stop the system in order to perform audit tests. Thus, the auditor uses concurrent audit techniques to continually monitor the system and collect audit evidence while live data are processed during regular operating hours. Concurrent audit techniques use embedded audit modules, which are segments of program code that performs audit functions. They also report test results to the auditor and store the evidence collected for the auditor's review. Concurrent audit techniques are time-consuming and difficult to use, but are less so if incorporated when programs are developed.

25. Role of a Security Administrator: A security administrator is a person who is solely responsible for controlling and coordinating the activities pertaining all security aspects of the organisation.

A security administrator is a person who is solely responsible for controlling and coordinating the activities pertaining all security aspects of the organisation.

- A security administrator attempts to ensure that the facilities in which systems are developed, implemented, maintained and operated are safe from threats that affect the continuity of installation and or result in loss of security.
- The security administrator sets policy, subject to board approval.
- He also investigates, monitors, advise employees, counsels' management on matters pertaining to security.
- The security administrator is responsible for establishing the minimal fixed requirements for classification of information based on the physical, procedural, and

logical security elements. The needs to protect these securities are also stressed. He assigns responsibilities to job classifications and formulates what to be done in case of exceptions.

- The security administrator guides other information security administrators and users on the selection and application of security measures. he trains them of how to mark and handle processes, train security coordinators, select software security packages and solve problems

The security administrator also does the following

- ◆ Investigates all security violations,
- ◆ Advises senior management on matters of information resource control,
- ◆ Consults on matters of information security
- ◆ A security administrator also has the responsibility of conducting a security program, which is a series of ongoing, regular, periodic evaluations of the facilities available.
- ◆ A security administrator has to consider an extensive list of possible threats to the organisation, prepare an inventory of assets evaluate the existing controls, implement new controls etc.

The security administrator requires the assistance of many individuals because of their expertise in that particular field. The auditor should see to that these steps are performed on a regular basis, the results of the reviews are analyzed and documented, and advises the management on appropriate action in light of the results.

26. (a) CASE stands for 'Computer Aided Software Engineering'. CASE TOOLS are automated software tools.

Software Engineering is concerned with creation of Systems Software, which are produced by teams of people using sound Engineering principles. They use computing techniques and the aim is to produce automated tools to solve specific problems of users in the domain of their function such as Finance, Production, Sales etc and also to develop and produce software for such applications.

All dimensions of software engineering are coming together to form integrated environments .The four key components comprising these environments are

1. Analysis Dimension consisting of planning systems, defining requirements and designing systems.
2. Development Dimension consisting of traditional Programming Development Tools like Editors, Compilers, Debuggers, Code and Application Generators.
3. Management Dimension provides methods and tools needed to manage and control projects.

4. Support Dimension comprising all tools and techniques needed to sustain and evolve existing software systems.

There are a number of software tools available today, which support software engineers. These automated tools enable to improve productivity in the area in software development and specific application software areas.

CASE CLASSIFICATION

CASE technology allows different types of tools to be assessed and compared. It also provides a conceptual basis of understanding.

There are three categories of CASE tools.

1. Tools that support individual process tasks such as checking the consistency of a design, compiling a program, comparing test results and so on.
2. Work benches to support process phases such as specification, design etc. They consist of sets of tools with variable degree of integration.
3. Environments support for all or part of software process. Includes several different work benches which are integrated in some way.

The fig 26.1 lists this classification.

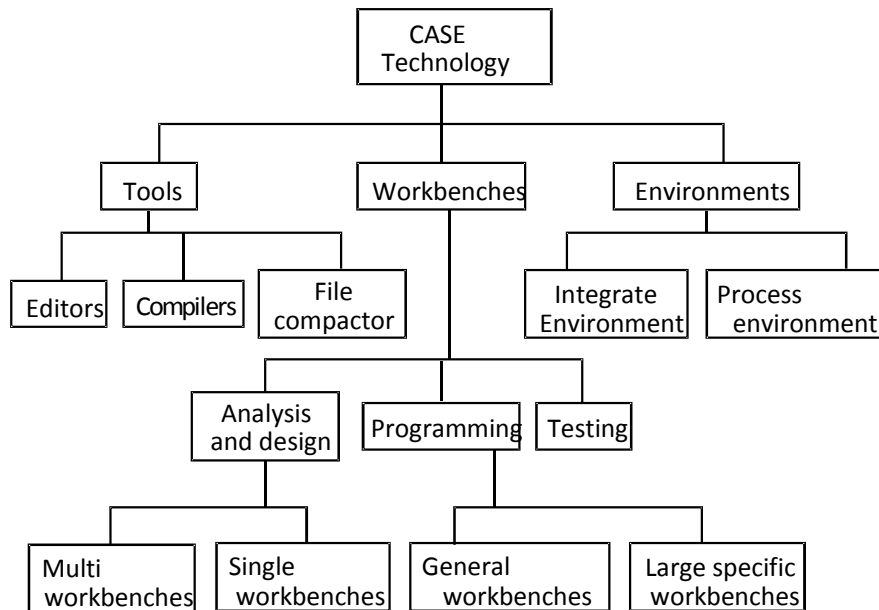


Fig. 26.1: Tools, Work benches and Environments

The table given below lists a number of different types of CASE tools and gives specific examples of each tool.

Tool type	Example
Management tools	PERT tools, estimation tools
Editing tools	Text editors, diagram editors, word processors
Configuration management tools	Version management system, change management system
Prototyping tools	High level language tools, user interface generators
Method support tools	Design editors, data dictionaries, code generators
Language processing tools	Compilers, interpreters
Program analysis tools	Cross reference generators, static analyzers, dynamic analyzers
Testing tools	Test data generators, file compactors
Debugging tools	Interactive debugging system
Documentation tools	Page layout program, image editors
Reengineering tools	Cross reference systems, program restructuring systems

(b) 4GL work benches: 4GL work benches are geared towards producing interactive application which rely on extracting information from an organizational data base, presenting it to end users on their terminal or work stations and then updating the database with changes made by users. The user interface usually consists of a set of standard forms or a spread-sheet. The tools which may be included in a work bench are:

- (a) a database query language such as SQL which may either be input directly or generated automatically from forms filled in by end users.
- (b) a form design tool which is used to create forms for data input and display.
- (c) a spread-sheet which is used for the analysis and manipulation of numeric information.
- (d) A report generator which is used to define and create reports from information in the database.

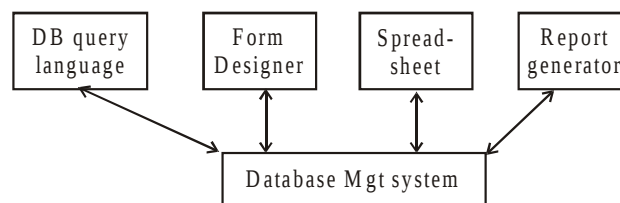


Fig 26.2: A 4GL Program Workbench