MANAGEMENT INFORMATION SYSTEM

CONCEPT OF MIS

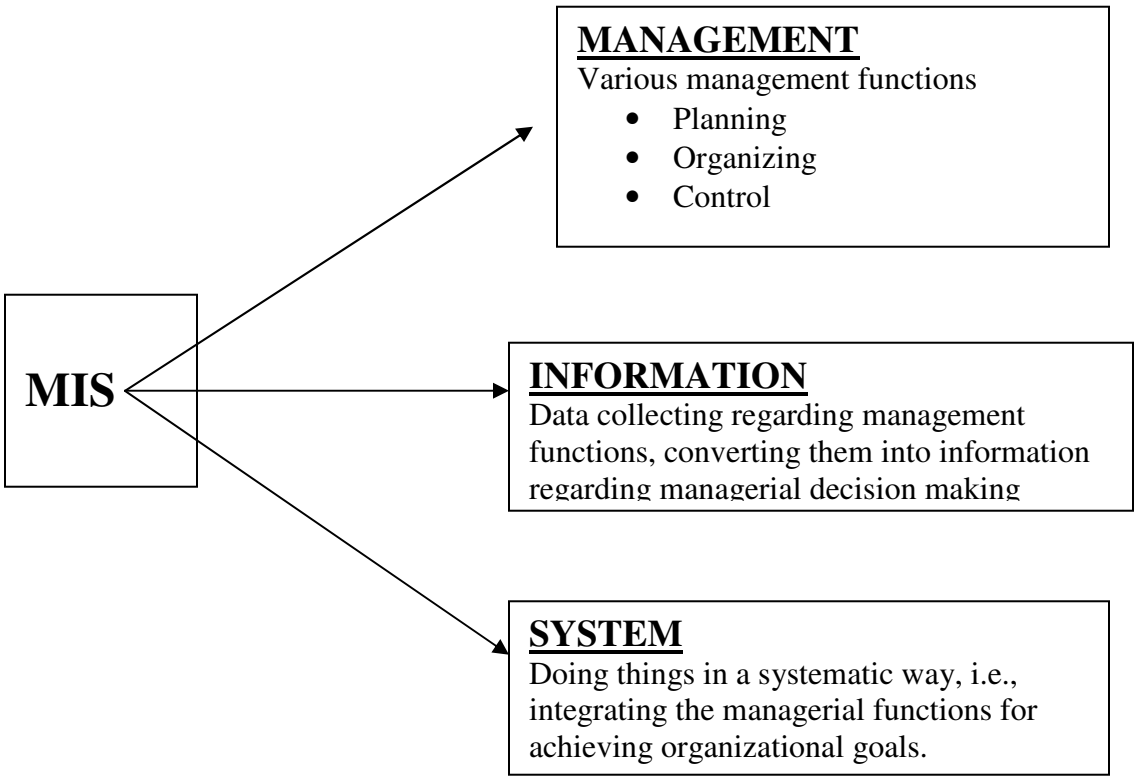
The purpose of an information system is to collect, store, and disseminate information from an organization s environment and internal operations to support organizational functions and decision making, communication, coordination, control and analysis, and visualization. Information systems transform raw data into useful information through three basic activities, input, processing, and output. From a business perspective, an information system represents an organizational and management solution based on ***Information Technology*** to a challenge posed by the environment. The information system is part of a series of value adding activities for acquiring, transforming, and distributing information that managers can use to improve decision making, enhance organizational performance, and ultimately, increase firm profitability.

Information systems literacy requires an understanding of the organizational and management dimensions of information systems as well as the technical dimensions addressed by computer literacy. Information systems literacy draws on both technical and behavioral approaches to studying information systems. Both perspectives can be combined into a sociotechnical approaches to systems.

The kinds of systems built today are very important for the organizations overall performance, especially in today's highly globalized and information based economy. Information systems are driving both daily operations and organizational strategy. Powerful computers, software, and networks, including the Internet, have helped organizations become more flexible, eliminate layers of management, separate work from location, coordinate with suppliers and customers, and restructure work flows, giving new powers to both line workers and management. ***Information Technology*** provides managers with tools for more precise planning, forecasting, and monitoring of the business. To maximize the advantages of ***Information Technology***, there is a much

greater need to plan the organization's information architecture and information technology infrastructure

Information systems have become essential for helping organizations deal with changes in global economies and the business enterprise. Information systems provide firms with communications and analytical tools for conducting trade and managing business on a global scale. Information systems are the foundation of new knowledge based products and services in knowledge economies and help firms manage their knowledge assets. Information systems make it possible for business to adopt flatter, more employees and management. Organizations are trying to become more competitive and efficient by transforming themselves into digital firms where nearly all core business processes and relationships with customers, suppliers, and employees are digitally enabled.



M I S Operational Level

D S S Middle Management Level

E S S Top Management Level

Some Important Definitions

- **Information Systems** Interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and visualization in an organization.
- **Information** Data that has been shaped into a form that is meaningful and useful to human beings.
- **Data** Streams of raw facts
- **Management** is a process by which organizational goals are achieved through the use of resources.
- **Resources**: *Inputs*
- **Goal Attainment**: *Output*
- **Measuring Success**: *Productivity = Outputs / Inputs*

There are 4 major functions of manager in management theory i.e. **planning, organizing, directing and controlling.**

Managerial decision is getting more complex for some reasons:

- Larger alternative space for **decision options** due to improved modern technology and communication systems.
- **Cost of making errors** can be very large because of the complexity and magnitude of operations, automation and chain reaction or even legal issues.
- Continuous in **fluctuating environment** and more **uncertainty** in several impacting elements.

Types of Information

- **Action vs. Non Action:** Any information on receiving it if one has to take certain action is known as action information. For example, if one receives information that something is wrong in the production line then immediate action has to be taken to rectify the matter.
- **Historical, Present, and Futuristic**: Any information which has been generated in the past is historical, information which is being generated during the current season is present information, and any future prediction is future information. For example, past records of an organization are historical information, reports of the ongoing operations are present information, and any future prediction using statistical or mathematical model is futuristic information.
- **Documentary V,s. Non Documentary**: Any information which has been documented somewhere is known as documentary information. For example, information on the walls of caves, books, journal, in-house publications, hard and soft copies from computers etc. Similarly any information which is verbal is non-documentary information. For example, information passed from one generation to another verbally; word to mouth advertisement of a product, information moving on the grapevine of an organization etc.
- **Formal Vs. Informal**: Information generated through is known as formal information. For example, the financial reports, balance sheets, production plans etc. Similarly any information which not generated formally, like office gossip is informal information.
- **Short Term Vs, Long Term**: Information which is required for short term planning is known as short-term information whereas information required for long term planning is known as long term information. For example, information required for planning a schedule for production will be short term information, whereas the information required for launching a new product will be long term or strategic information.
- **Internal Vs. External**: Information generated inside an organization is internal information, For example, information regarding the production capacity of a

factory. Similarly any information collected from outside the organization is external information, for example government rules and regulation regarding employment, quality of the product etc. or information about the business environment of a country.

- **Recurring Vs. Non Recurring**: Information being generated at more or less equal interval is known as recurring information, for example annual reports. Whereas information which are once in a while is known as non-recurring information, for example, an accident report or report regarding malfunctioning of a machine.

Types of Decisions

Programmed Versus Non-programmed Decisions

- Programmed decisions
  - made using a rule, procedure, or quantitative method
  - Easy to computerize using traditional information systems
- Non- decisions
  - Decision that deals with unusual or exceptional situations
  - Not easily quantifiable

Examples

- **Programmed**
  - How many workers to staff line A
  - What is the EOQ for raw material Z
  - How many turbines to power Lethbridge?

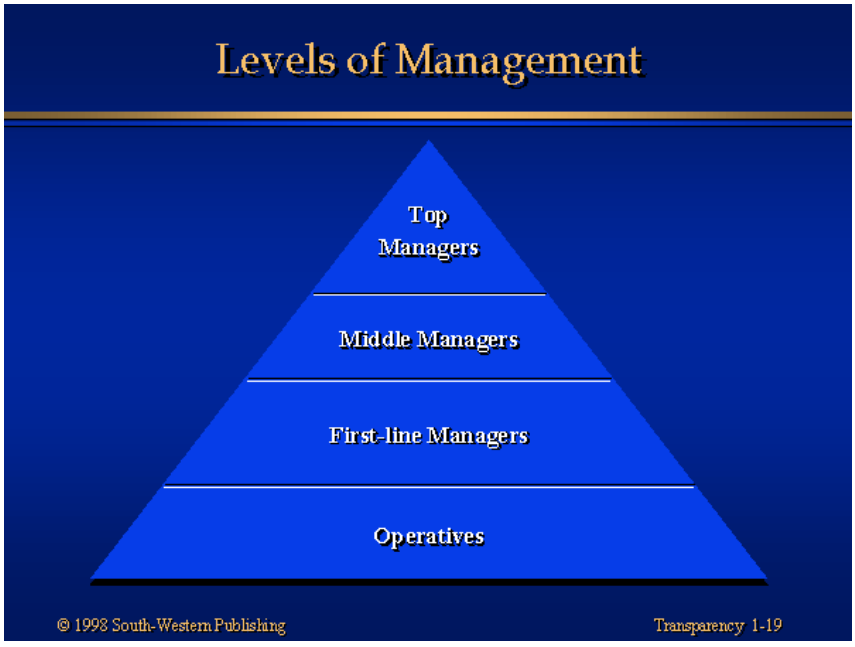
- **Non-Programmed**
  - What are the benefits of merging with XYZ
  - How will consumer react if we lower the price by 10%
  - What are the benefits of MacDonald's opening up Hotels

Optimization, Satisficing, and Heuristic Approaches

- **Optimization model:** a process that finds the best solution, usually the one that will best help the organization meet its goals
- **Satisficing model:** a process that finds a good—but not necessarily the best—problem solution
- **Heuristics:** commonly accepted guidelines or procedures that usually find a good solution

Management Information Systems in Perspective

- A management information system (MIS) provides managers with information that supports effective decision making and provides feedback on daily operations
- The use of MISs spans all levels of management



Inputs to a Management Information System

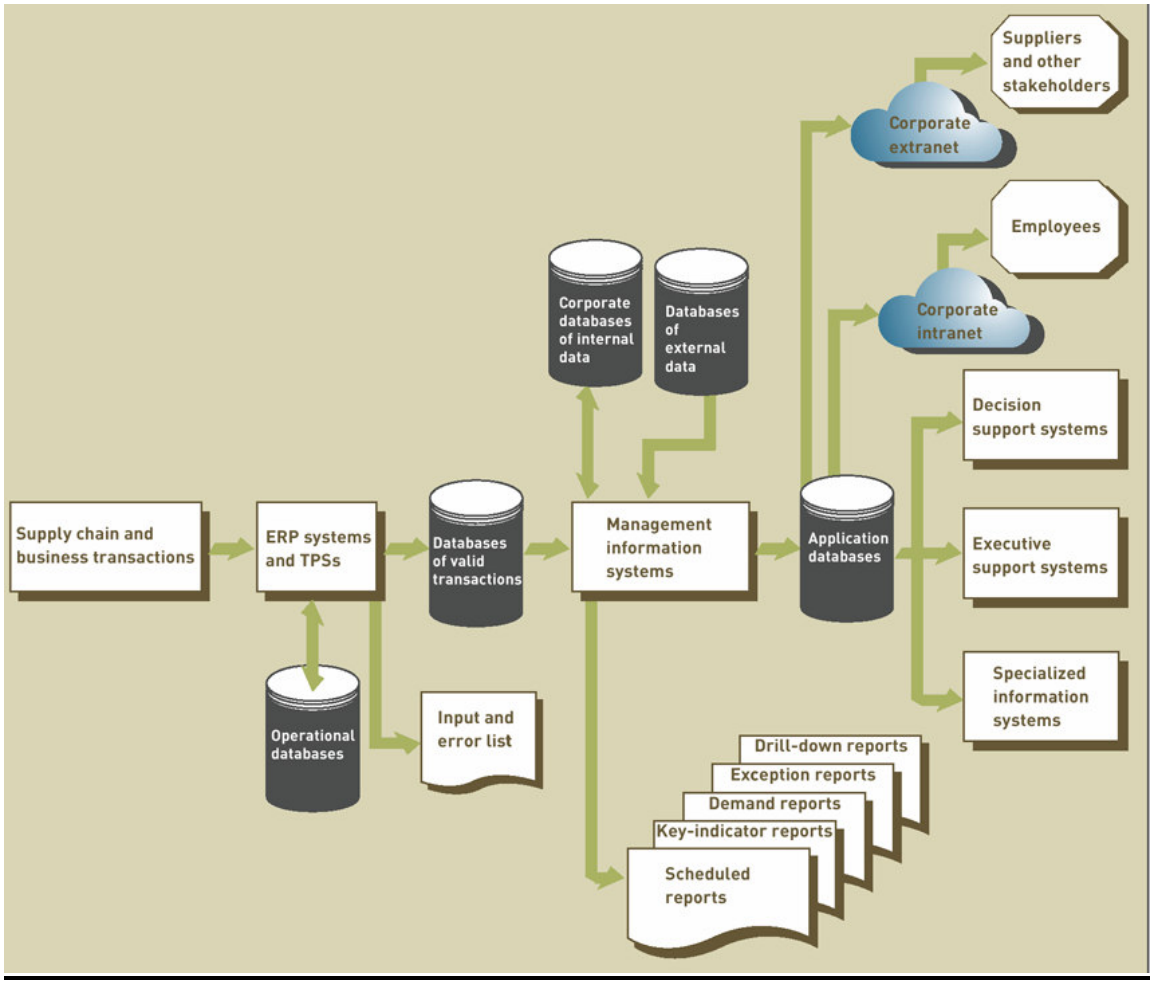
- Internal data sources
  - TPSs, ERP , SCM and related databases; data warehouses and data marts; specific functional areas throughout the firm

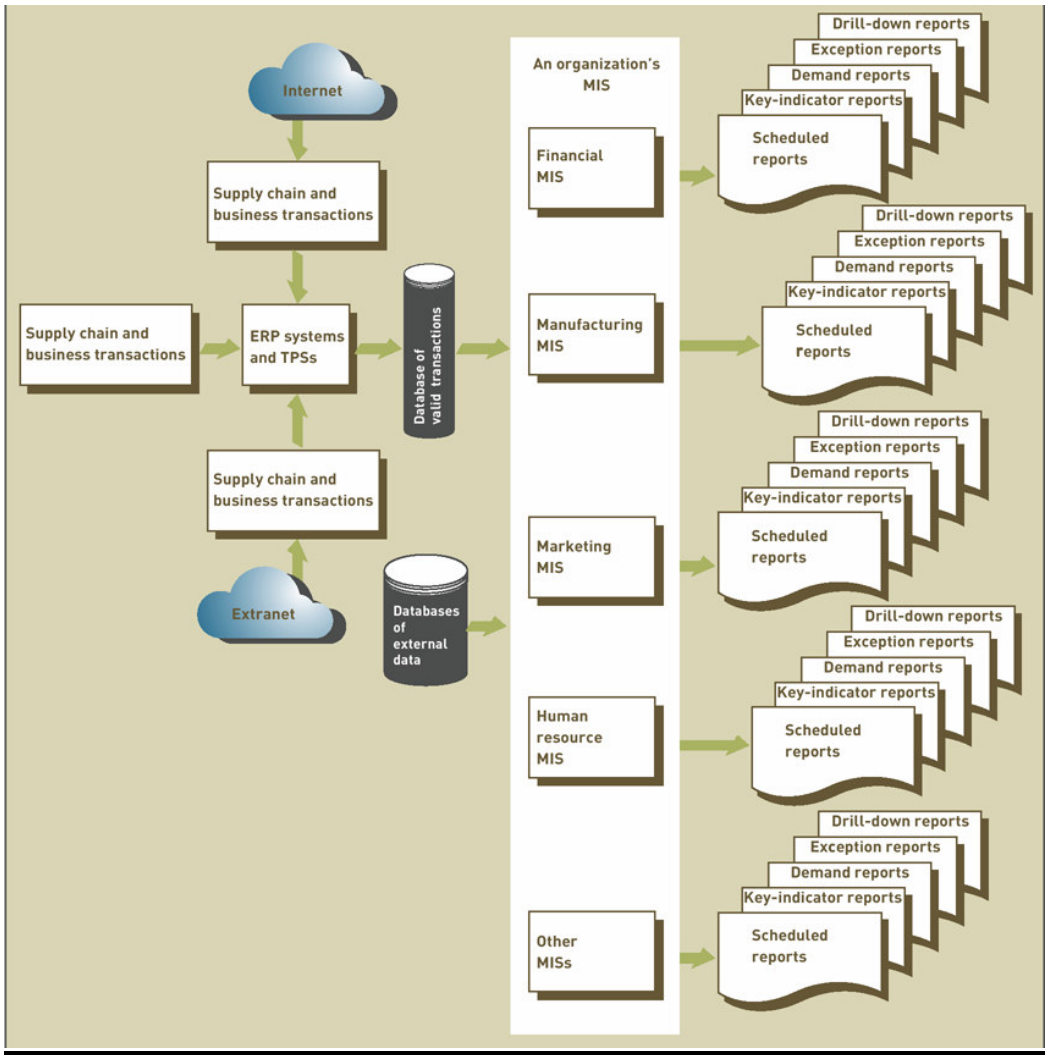
- External data sources
  - Customers, competitors, and stockholders, whose data is not already captured by the TPS; the Internet; extranets

Outputs of a Management Information System

- Scheduled report: produced periodically, or on a schedule
- Key-indicator report: summary of the previous day's critical activities
- Demand report: developed to give certain information at someone's request
- Exception report: automatically produced when a situation is unusual or requires management action
- Drill-down reports : provides increasingly detailed data about a situation

Sources of Managerial Information





Functional Aspects of the MIS

The MIS is an integrated collection of functional information systems, each supporting particular functional areas, as shown in the previous figure.

Types of Management Information Systems

- **Major Information Systems**
  - **Financial Information Systems** Information regarding flow of ***Finance*** in an organization. All organization has some kind of financial information system; this category of information is the flow of finance/money through out the organization, and if they are designed correctly, the profitability and responsibility accounting systems follow the organizational structure. These systems involve large amount of data concerned primarily with historical and internal, although in some areas

of financial planning, the system provides the futuristic look associated with planning. Budgeting is wholly futuristic. Some of the subsystem are:

- Financial Planning
- Cost Accounting
- General Ledger
- Asset Accounting
- Budgets
- Accounts Receivable/payable
- Payroll

Periodically, management approves some type of financial plan (the master budget) that assigns responsibility for maintaining incomes, investments, and costs within standard limits. This plan then becomes the basis for periodic reports on performance against plan, and these reports become the device by which control is exercised. Major problems in such a system involve:

- Determining equitable standards of control;
- Determining when action is required; and
- Obtaining rapid, up-to-date information on variances.

It is unlikely that the automation of financial records will decrease the problems associated with the first two attributes. It will, however, materially assist in speeding up reporting.

The financial system is probably the most important single management information system in the company, and in most companies it is the oldest and best developed. The major concern associated with this system is a vital tool for operating and planning. Moreover, the financial system has a very significant impact on other information systems when one considers that the ultimate common denominator of many operating decisions is the money.

Example – Billing

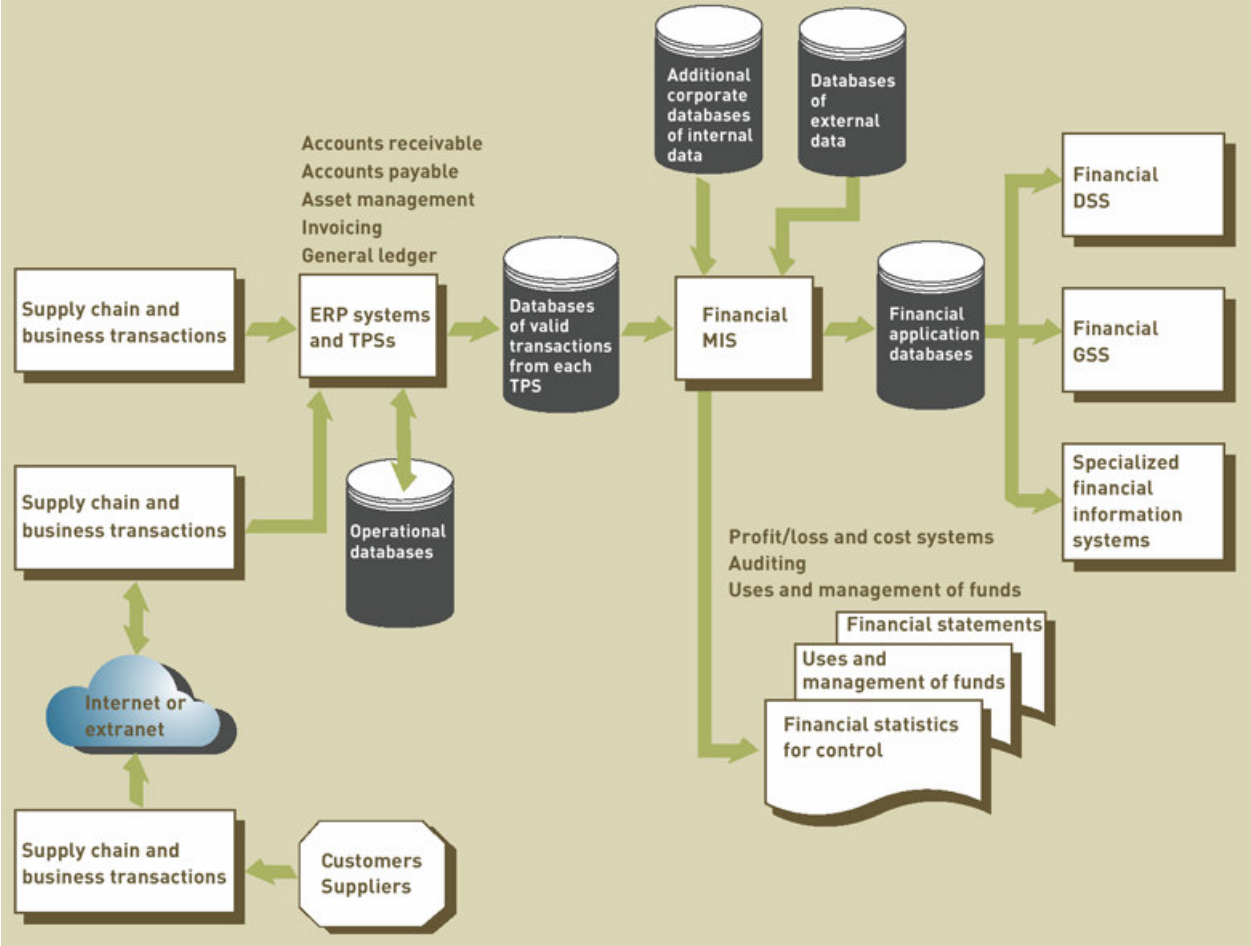
Billing is perhaps the most widely used data processing application. Despite the fact that the preparation of invoices is often viewed as a somewhat casual clerical function, the speed and accuracy of the operation can have a significant impact upon cash flow as well as customer goodwill. Additional advantages include clerical savings, timelier processing, the release of high-speed employees for other functions, and the flexibility to absorb additional work load during times of increased growth.

Objectives:

- Provide Input to other Subsystems
- Improve cash flow
- Maintain customer goodwill
- Timely invoice processing
- Keep salesmen informed

Other systems which receive information from it are:

- Accounts receivable
- Sales analysis
- Tax reports
- Commission statement
- Shipping documents
- Inventory



Overview of a Financial MIS

- **Logistics Information System** (Production/ Operation Information System) Concerned with the information about physical flow of goods/services. It covers such activities as:
  - Production planning and control
  - Inventory control and management
  - Purchasing
  - Distribution
  - Transportation

The logistics information system gives information about:

- Development of product/services
- Cost savings
- Management improvement

An examination of this area leads to the design of related and integrated subsystems throughout the company.

Examples:

a) Purchasing:

   Objectives:

   - Determining Economic Order Quantity (EOQ) to buy.
   - Reduce clerical costs.
   - Monitor buyer performance.
   - Identify high volume vendors to negotiate higher discounts.
   - Determine supplier performance by identifying late deliveries and poor quality.

b) Materials Planning:

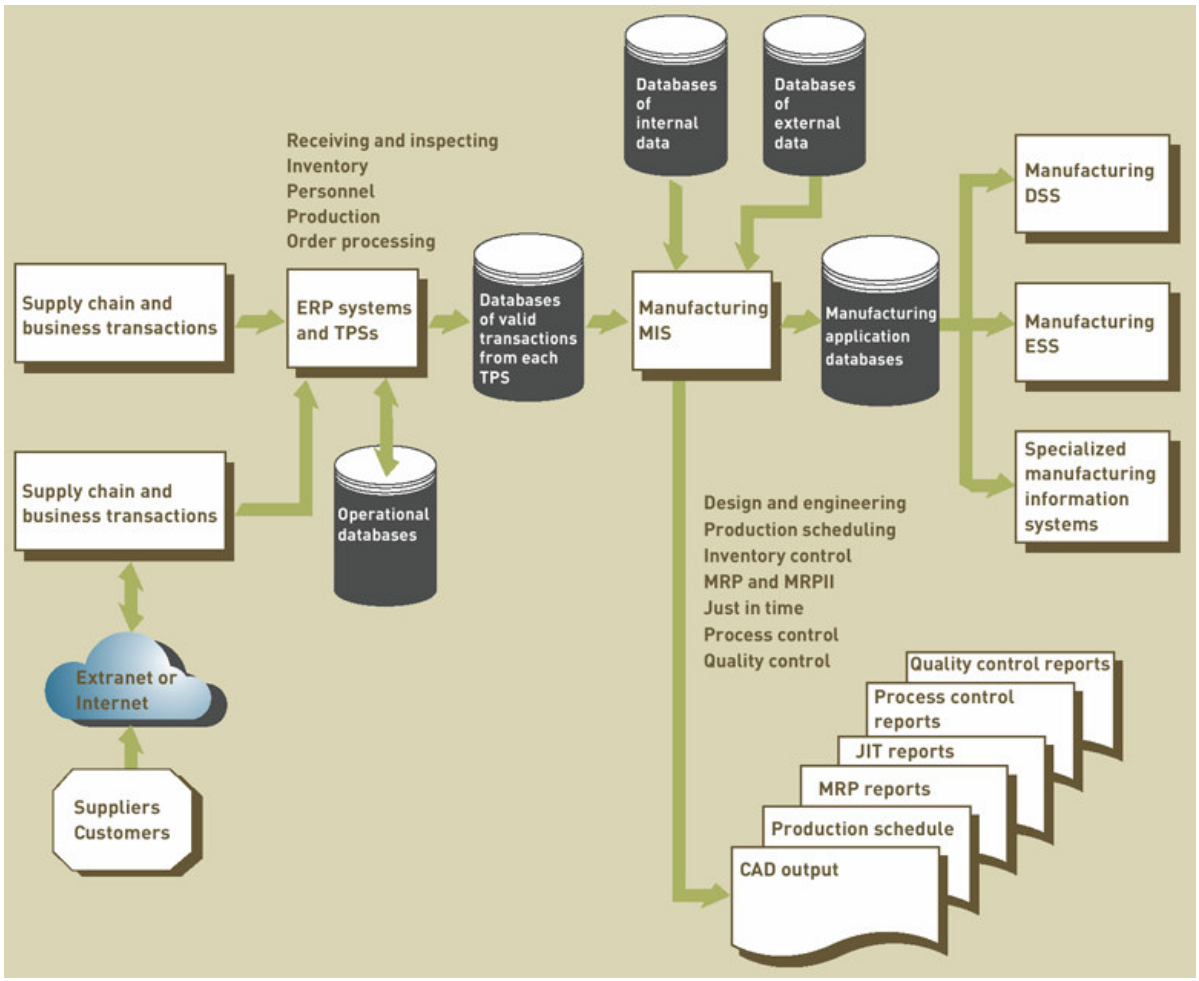
   Objectives:

   - Plan and control parts from a predetermined production schedule.
   - Reduce the time and costs of determining and ordering material requirements.
   - Allow no disruptive changes to production schedule.
   - Forecast changes in material requirements resulting from production schedule change.

c) Capacity Planning and Operations Scheduling:

   Objectives:

   - Evaluate alternatives of subcontracting or overtime to meet delivery dates.
   - Identify orders to be rescheduled to level the load.
   - Forecast time and location of equipment and tooling needs.
   - Compute start dates for shop orders to meet delivery dates.
   - Forecast skills and trades required.
   - Forecast order release dates.



Overview of a Logistic MIS

- **Marketing Information System**

  The basic areas of the marketing function that lend themselves to improvement through information systems include:

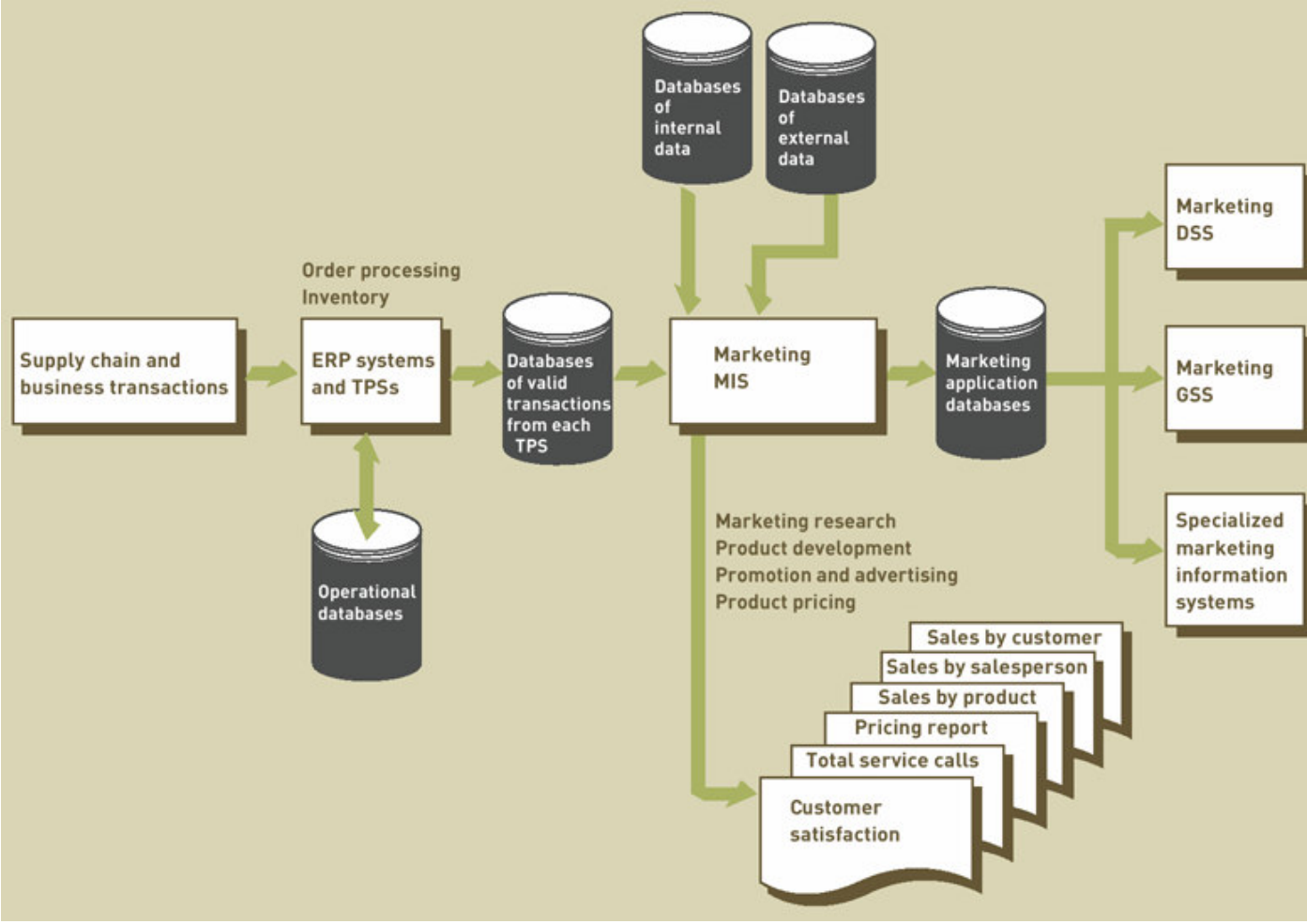
  - Forecasting/sales planning
  - Market research
  - Advertising
  - Operating and control information required to manage the marketing function, i.e., sales report, distribution cost reports etc.

  A well developed marketing information system will help manager make better decisions about:

  - Pricing
  - Advertising

- Product promotion policy
- Sales force effort, etc.

It requires both internal information, like sales report and external information like feedback from the market place. In fact the effectiveness of marketing information system depends to a large extent on feedback from the market place to the firm, so that the firm can judge the adequacy of its past performance as well as appraise the opportunities for new activities.



Overview of a Marketing MIS

Human Resource Information Systems (HRIS), **HR Technology** shape an intersection between human resource management (HRM) and information technology. It merges HRM as a discipline and in particular its basic HR activities and processes with the information technology field. The function of Human Resources departments is generally administrative and common to all organizations. Organizations may have formalized selection, evaluation, and payroll processes. Efficient and effective management of "Human Capital" has progressed to an increasingly imperative and complex process. The HR function consists of tracking existing employee data which traditionally includes personal histories, skills, capabilities, accomplishments and salary. To reduce the manual workload of these administrative activities, organizations began to electronically automate many of these processes by introducing specialized Human Resource Management Systems. Due HR executives rely on internal or external IT professionals to develop and maintain an integrated HRMS.

Human resource Management System generally encompasses:

- Payroll
- Work Time
- Benefit administration
- HR Management Information System
- Recruiting
- Training/Learning Management System

The **Payroll module** automates the pay process by gathering data on employee time and attendance, calculating various deductions and taxes, and generating periodic pay cheques and employee tax reports. Data is generally fed from the human resources and time keeping modules to calculate automatic deposit and manual cheque writing capabilities. This module can encompass all employee-related transactions as well as integrate with existing financial management systems.

The **Work Time** gathers standardized time and work related efforts. The most advanced modules provide broad flexibility in data collection methods, labour distribution capabilities and data analysis features. Cost analysis and efficiency metrics are the primary functions.

The **Benefits Administration module** provides a system for organizations to administer and track employee participation in benefits programs. These typically encompass insurance, compensation, profit sharing and retirement.

The **HR management module** is a component covering many other HR aspects from application to retirement. The system records basic demographic and address data, selection, training and development, capabilities and skills management, compensation planning records and other related activities. Leading edge systems provide the ability to "read" applications and enter relevant data to applicable database fields, notify employers and provide position management and position control. Human resource management function involves the recruitment, placement, evaluation, compensation and development

of the employees of an organization. Initially, businesses used computer based information system to:

- Produce pay checks and payroll reports;
- Maintain personnel records;
- Pursue Talent Management.

Online **Recruiting** has become one of the primary methods employed by HR departments to garner potential candidates for available positions within an organization.

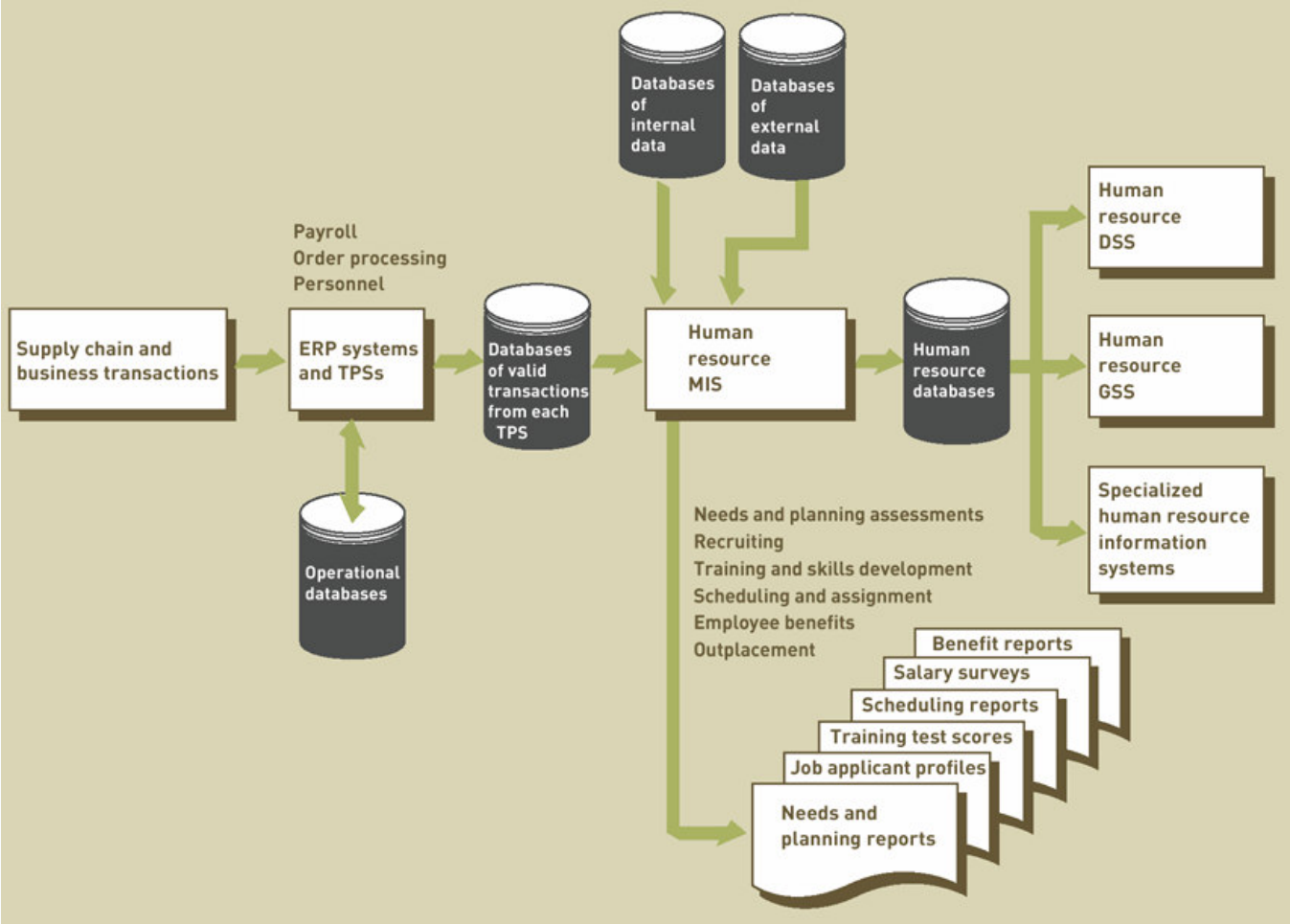
Talent Management systems typically encompass:

- Analyzing personnel usage within an organization;
- Identifying potential applicants;
- Recruiting through company-facing listings;
- Recruiting through online recruiting sites or publications that market to both recruiters and applicants.

The significant cost incurred in maintaining an organized recruitment effort, cross-posting within and across general or industry-specific job boards and maintaining a competitive exposure of availabilities has given rise to the development of a dedicated Applicant Tracking System, or 'ATS', module.

The '***Training Module'*** provides a system for organizations to administer and track employee training and development efforts. The system, normally called a Learning Management System if a standalone product, allows HR to track education, qualifications and skills of the employees, as well as outlining what training courses, books, CDs, web based learning or materials are available to develop which skills. Courses can then be offered in date specific sessions, with delegates and training resources being mapped and managed within the same system. Sophisticated LMS allow managers to approve training, budgets and calendars alongside performance management and appraisal metrics.

Many organizations have gone beyond the traditional functions and developed human resource management information systems, which support recruitment, selection, hiring, job placement, performance appraisals, employee benefit analysis, health, safety and security, while others integrate an outsourced Applicant Tracking System that encompasses a subset of the above.



Overview of a Human Resource MIS

Minor Information Systems

In addition to the major information systems described, many organizations have a variety of less important information requirements for which the design of an information system is desirable. Some are manual, some computer based, and some may be combination of manual and computer. Among the most common are:

1. **Purchasing**: In this rapidly growing area of application, some purchasing uses are automated. For example
    - Preparation of quote requests
    - Updating order records
    - Handling routine selection/follow-ups
    - Processing requisitions

- Checking history files as means of vendor selection.

More advance applications include:

- Order writing
- Vendor rating
- Computation of EOQ
- Payments of account payable cheques

2. **PERT**: Program Evaluation and Review Techniques, PERT, has become a widely used information device for controlling the time, cost, and work in a project or program. Modifications of the basic technique include PERT/TIME, PERT/COST, PERT/CPM (Critical Path Method), and PERT/LOB (Line of Balance)
3. **Research and Development**: This is a vital area for industrial companies but of less importance for financial and service organization.
4. **Simulation**: Although, strictly speaking simulation is not an information system, it may be classified as such because it is computer based and depends upon access to the company's data bank. It is a method for simulating decision and hence is a vital tool of planning.
5. **Strategic Planning**: This system deals with projections of the future and for the most part uses information systems that utilizes the entire range of information developed in the company, both external and internal

Advantages of Computerized Management information System

- **Speedy computations.** A computer allows the decision maker to perfom large numbers of computations very quickly and at low cost. Timely decicions are critical for many situations, ranging from a physician's decision in an emergency room to that of a stock trader.
- **Increrased productivity.** Assembling a group of decision makers, especially experts, may be costly. Computerized support can reduce the size of the group and enable the group members to be at different locations (sasving travel cost). Also, the productivity of staff support (such as financial and legal analysts) may be incresed.

- **Technical support.** Many decisions involve complex computations. Data can be store in different database and at Web sites possibly outside the organization. The data may include sound and graphics, and there may be need transmit them quickly from distant locations. Computers can search, store, and transmit needed data quickly and economically.
- **Overcoming cognitive limits in processing and stroge.** According to Simon (1997), the human mind is limited in its ability to process and information. Also, people may have difficulty in recalling information in an errorfree fashion when it is needed.

Systems Approach and MIS

Systems fall into a number of categories, and confusion may result, if we talk about systems behaviour and characteristics without identifying and specifying the kind of system we are talking about. Hence let us study different types of systems or system classification

System Classification

1. Conceptual System Vs Empirical System

Conceptual System	Empirical System
• Set of concepts, ideas or characteristics, this leads to theoretical structure—may or may not have counterpart in the real world Example: ▪ Economic theory ▪ Non –Euclidean geometry ▪ The general theory of relativity ▪ Organizational theory • System of explanation or classification • May appear in practical management affairs in the form of plans, accounting system structures, and classification of policies and procedures.	• Operational system of people, equipment and reports • Concrete operational systems made up of systems made up of people, materials, machines, energy, and other physical things. • May be derived from or based upon conceptual systems and thus represents the conversion of concepts into practice.

2. Natural System Vs. Manufactured System

Natural System	Manufactured
• Abound in nature Examples: ▪ Ecology of life ▪ Each living organism ▪ Water system ▪ Solar system	• Man made (formed when people first gathered in groups to live and hunt together. Examples: ▪ Computer system ▪ Music system

3. Social System, People-Machine System and Machine System

Social	People-Machine	Machine
• Made of people Examples: ▪ Political system ▪ Business organization ▪ Government agencies ▪ Social clubs ▪ Technical societies	• Made up of people and machines Examples: ▪ MIS ▪ DSS ▪ ESS	• Made up of machines only. Machines obtain their own inputs and maintain themselves. (pure machine system only in science fiction)

4. Open System Vs. Closed System

Open	Closed
• Interacts with the environment	• Does not interact with the environment.

5. Permanent system Vs temporary System

Permanent	Temporary
• System that operate for a time span that is long relative to the operations of humans in the system Examples ▪ Economic system ▪ Class system ▪ Caste system	• Are designed to last a specified period of time and then dissolve Examples ▪ A small group for some research work (Important for the accomplishment of specified tasks in business and for research in science.)

6. Stationary System Vs Non- Stationary System

Stationary	Non-Stationary
• Whose properties and operations either do not vary significantly or else vary only in repetitive cycles. Examples ▪ Educational system	• Whose operations may vary significantly Example ▪ A human being

7. Adaptive System Vs Non Adaptive System

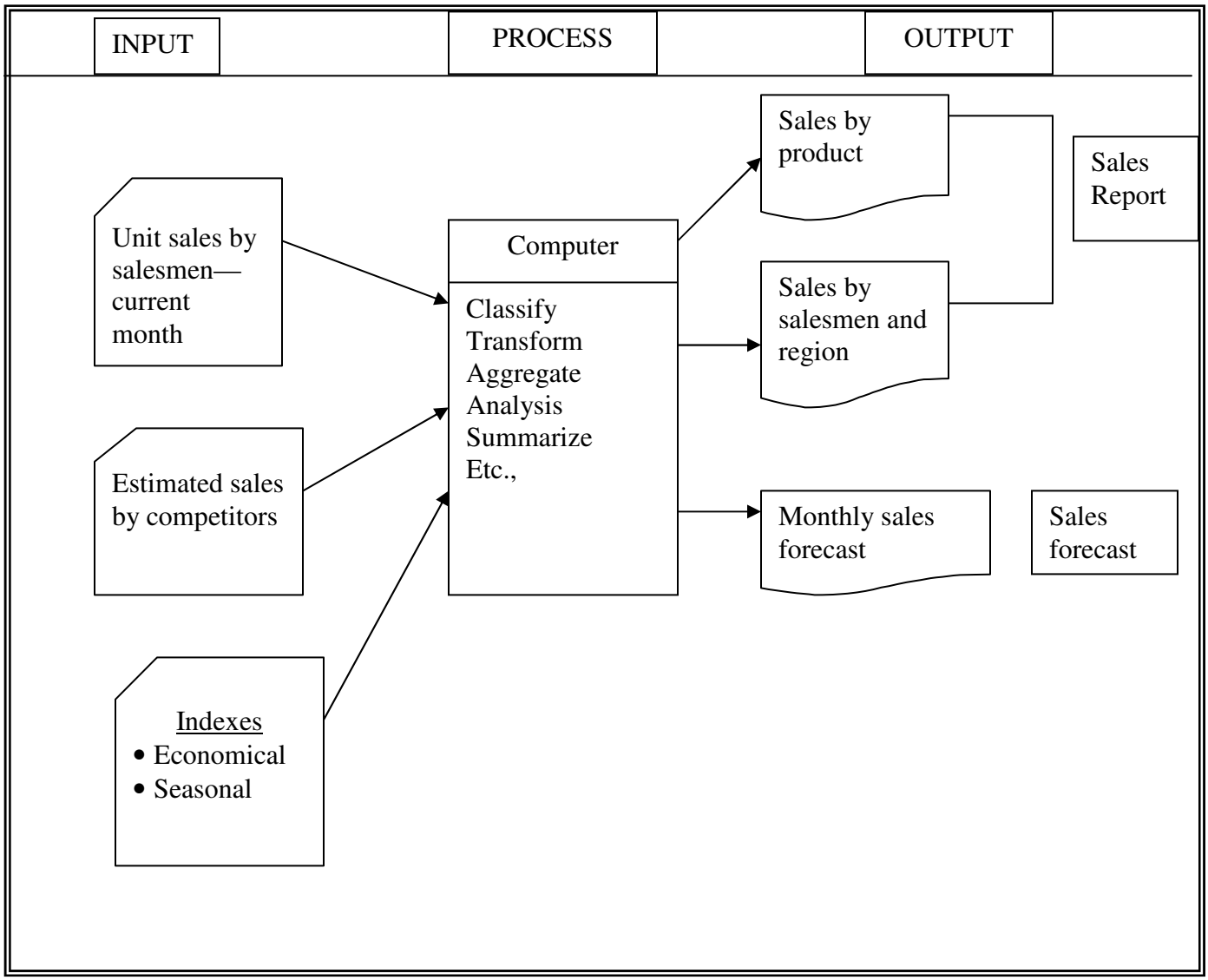
Adaptive	Non-Adaptive
• That reacts to its environment in such a way as to improve its functioning, achievement, or probability of survival. Example ▪ Evolution theory	• Does not react by itself Example ▪ Any artificial or man made system

8. Subsystem Vs Supersystem: The system in the hierarchy that we are most interested in studying or controlling is usually called the "system". The business firm is viewed as the "system" or the "total system" when focus is on production of goods, and sources of profit and income.

Subsystem	Supersystem
• Smaller system within the subsystem Example ▪ MARIS is a Subsystem of MIS	• Bigger system that encloses the system Example ▪ BHU is Supersystem o FMS

Some System Concepts

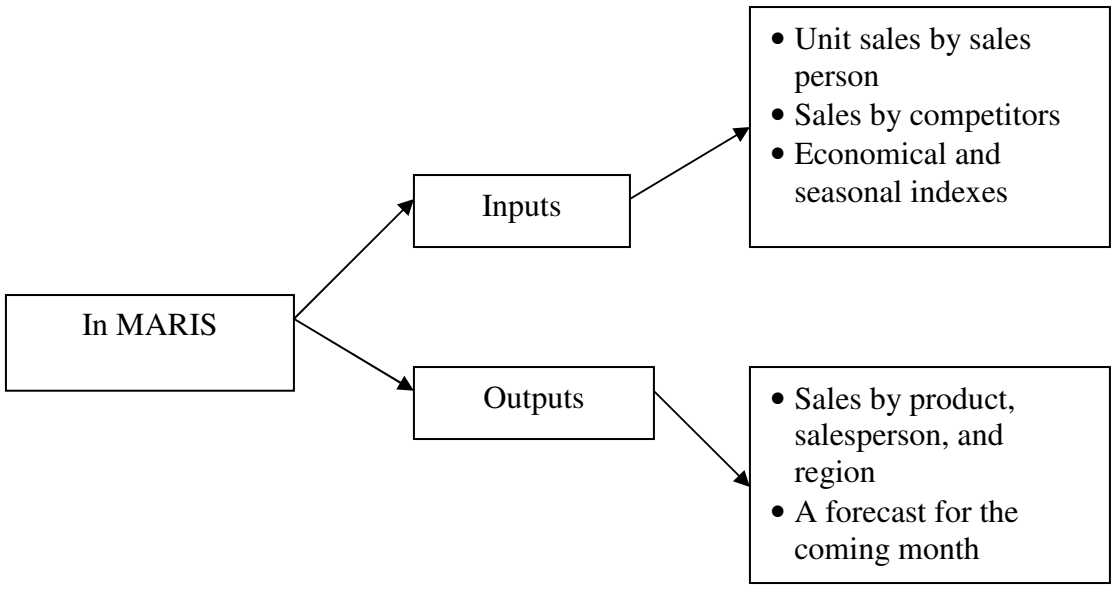
To understand system concept let us take the example of ***Marketing Information System*** **(MARIS)**



1) **Principle System Quantities or Variables**

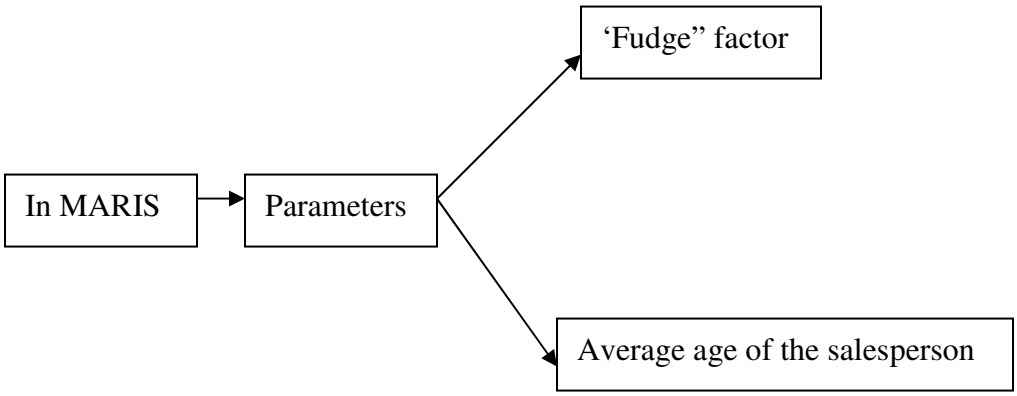
Are representations of amounts of information, energy, or matter that appear as inputs and outputs of the system

- An input is represented by a name or symbol that has specified dimensions and varies with time.
- Output variables have values for a particular point in time.



2) **System Parameters**

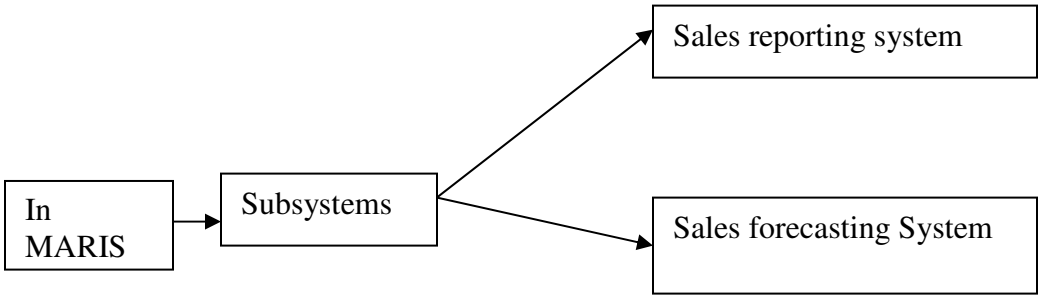
- Quantities that determine the state of the system are called parameters.
- Many quantities that enter into the relationships among the input variable and the output variables are considered constant for a specified period of time or system operational style. In essence, for a fixed set of these values, the system is said to be a specified 'state'.
- The parameters can be called 'variable constants'



- 'Fudge' factor corrects the sales forecast in the event that a competitor conducts a special promotion. Normally, this promotion 'fudge' factor changes in value from month to month, that is it is a constant characterizing the no-promotion state. However, it is turned on to a new value once in a while, when one or more competitors increase their promotional level.
- If the average age changes by more than 15 per cent, a change in this parameter is called for, and the selling function has changed its 'state'.

3). <u>Components</u>

- Various identifiable parts of the system.
- In the hierarchy of subsystems, the components exist at the lowest level.



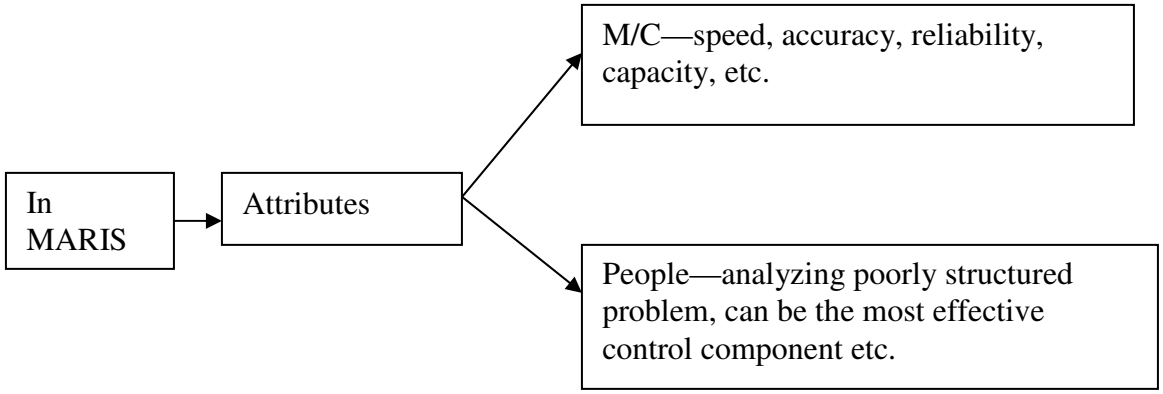
Components are:

- Telecommunication devices
- People
- Computer
- Procedural manuals

- Reports

4). Attributes of Components

- Properties or characteristics
- These characteristics affect the operation of the system in speed, accuracy, reliability, capacity, and many other ways.
- Choice must be made in system design between the use of humans and the use of machines, on the basis of attributes and cost.



Note: in MARIS speed need not be very high. Output should be clear, economical, and relatively permanent (output in printed format, which can be sent to the management once a month.)

5) Structure

- The set of relationships among objects and attributes, that is, a description of the way in which the objects and their attributes are connected defines the structure. Levels of relationship may be classified as:

First Order ---- ***functional*** and ***dyfunctional*** relationships caused by natural phenomena or varying attributes.

Second Order – ***symbiosis,*** it is the necessary relationship between dissimilar organisms, as for example plant and parasite.

Third order --- ***synergistic*** relationships in which attributes of objects reinforce each other to increase or improve system output.

In MARIS ----The ***functional*** relationships among the people and the equipment form the structure of the following entities.

- Organizational hierarchy
- Lateral relationships among the people in the system
- Relationship between the computer and the people.

The ***dyfunctional*** relationship is due to

- Poor system design
- Personality conflict
- Computer may fail to operate properly because of rough or careless treatment by people.

The ***symbiotic*** relationship

- The necessary relationship between the computer and humans. Each needs the other to accomplish system objectives.

The ***synergetic*** relationship

- Achievement by different individuals supplementing each other so that total output is greater than the simple addition of each individual's work.

6) Process

- Total process = net result of all ongoing activities in converting inputs into outputs
- Total process made up of many small processes.
- The functional relationship between an input and output is called the ***transfer function***

In MARIS --- the process is converting unit sales by salesmen (current month), estimated sales by competitors, and economical indices into sales report and sales forecast.

7) Boundaries

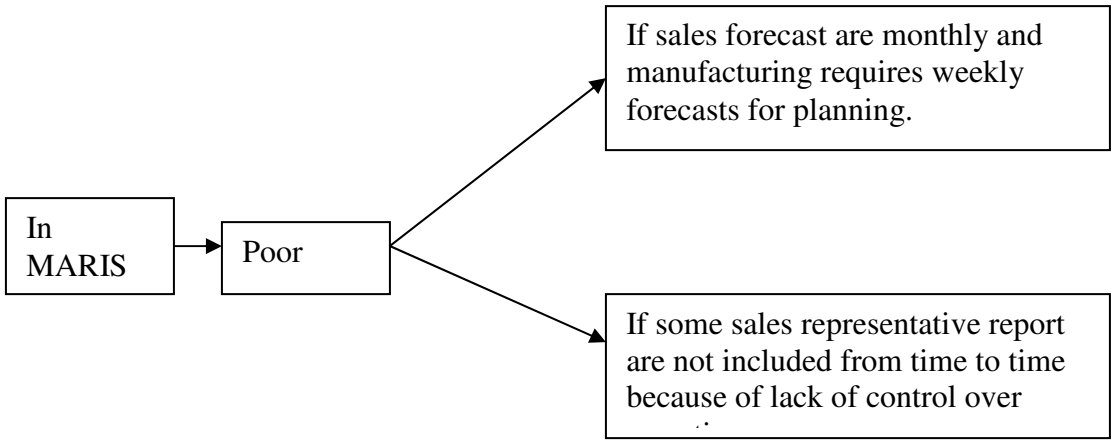
- The concept of boundary of a system makes it possible to focus on a particular system within a hierarchy of systems.
- Boundaries can be both conceptual as well as physical.

- The operational definition of a system in terms of its boundary is:
    - List all components that make up the system and circumscribe them. Everything within the circumscribed space is called the environment.
    - List all flows across the boundary. Flows from the environment into the system are inputs; flows from inside the boundary are called outputs.
    - Identify all elements that contribute to the specific goals of the system and include these within the boundary if they are not already included.

In MARIS --- the boundary is the demarcation of all the elements which helps in generating sales reports and sales forecast.

8) <u>Characteristics of Systems</u>

- For the solution of a given problem there are good systems and poor systems.
- Good –fit the requirements of the problem or of the decision makers.
- Poor –do not fit the requirements of the problem or of the decision makers



- There are many characteristics of systems that are important for ***<u>design</u>***, ***<u>production</u>***, ***<u>diagnosis</u>***, and ***<u>evaluation</u>***.
- Each characteristic must be considered in terms of its degree of importance for the system under scrutiny.

9) Checklist of Characteristics of Person-Machine Systems

- Performance of basic and subsidiary functions
- Accuracy of performance
- Cost
- Reliability
- Environmental adaptability
- Maintainability
- Replaceability
- Replaceability by successive models
- Safety and fail-safe features
- Producibility (feasibility of manufacturing)
- Optimum materials and process for size of manufacturing run.
- Simplification, standardization, and preferred size.
- Weight
- Size and shape
- Styling and packaging
- Compatibility with other systems or auxiliary equipment.
- Modular design
- Ease of operation (human engineering)
- Balanced design through trade-offs
- Ease of transporting and installing
- Legality
- Social aspects.

System Approach

The system approach is a variant of scientific method. It takes into account the objectives, environment, and internal interfaces of subsystems of the system and stresses on systematic process of problem solving. The problems, opportunities, and solutions are viewed in a systems context. System approach consists of the following steps:

i) Defining the problem
ii) Collecting data to describe the problem
iii) Identification of alternative solutions of the problem.
iv) Evaluation of identified alternatives.
v) Selection of the best alternative
vi) Implementation of the best alternative
vii) Gathering continuous feedback ascertain the working of the selected alternative.

Defining the Problem:

Defining the problem is the most important step of the system approach. The reason is very simple if the wrong problem is identified, the entire effort to develop solution will be of no use. Hence it is necessary to identify the problem correctly and distinguish between symptoms of the problem and the real problem. ***A problem can be viewed as a basic condition that is causing undesirable results.*** A related concept, that is, opportunity also needs attention at the same time. In fact, it is a basic condition that identifies the potential for desirable results. For example: In an organization sales persons are not meting the sales targets then it should not be treaded as salesman problem but problem of organization. The reason maybe:

- Pricing policy
- Quality of the product
- Less demand in market
- Environment in general, etc.

It is always better to collect the information about the real problem.

Collecting Data to Describe the Problem

In order to understand the problem, the system owner should study the environment, management practices, input resources, and the internal procedures and standards. First of all, the owner should study environment. For example: A micro computer business organization includes,

- Vendors
- Customers
- Competitors
- Total market analysis

Study of competitors will allow comparison of prices and promotion schemes. Another data to be collected and analyzed is about management practices, new market segments, methods of marketing etc. Sometimes it is not easy not very easy to collect data about the competitors, therefore, to address problems one has to identify alternative methods. There are many methods to do this as listed below:

- Interviews with employees, customers, suppliers, and managers.
- Questionnaire to influential/critical employees in the organization.
- Personal first hand observation of business systems of the organization.
- Evaluation of secondary information such as reports, procedure manuals, and other documents.
- Evaluation of accounting and financial reports to collect statistics about financial performance of the organization.
- Development, manipulation, and observation of models of business operations or systems affected by the problem or opportunities.

Identification of Alternative Solutions of the Problem

Problem: Competitors have dropped their prices on comparable microcomputers.

Alternative 1: Obtain product at lower cost

Alternative 2: Decrease cost of sales through tele-marketing.

Alternative 3: Offer additional services --- online diagnosis in case of problems or failure.

Alternative 4: Convince customers by showing additional features.

Evaluation of Identified Alternatives

Business Organization evaluates the extent to which each of these identified alternatives enables the organization to achieve its objectives. As can be seen from above alternatives, owner's objective is to increase the overall performance of sales personal.

Alternative 1: Purchase of low cost products from suppliers would enable the business organization to cut prices, as suggested in the first alternative, but would create difficult at the service end if these computers are not reliable. This may create problem for sales person to meet their targets.

Alternative 2: Introducing information technology tools for marketing might cut cost without compromising on quality. However, application of Information Technology will require additional infrastructure in terms of creating database of customers and developing promotional materials. However, this may in turn provide more time to sales persons to concentrate on direct sales.

Alternative 3: If the company is not in a position to reduce the price either as a policy or compulsion then it may adopt policy of better customer service which is distinctly better than the competitors. Company may offer on-line diagnostic support for failures or on call base service with preventive maintenance. Another way to satisfy the customer is to increase the warranty period of the machine. Many companies in India have adopted this practice and are quite successful in satisfying customers.

Alternative 4: Other alternative would be to produce products to the customers at same price but with additional value added features. For example, company may provide some of the specific software without additional charges. Such concerns give virus protection software, SPSS packages etc.

Selection of the Best Alternative

On the basis of the above evaluation, the business organization may decide that the application of Information Technology tools is the best alternative to reduce the cost sales overheads. With this approach same product can be marketed at reduced price at par with competitors without losing the profits. The increase in price will be accommodated by the reduction in overheads over a period of two to three years time and not immediately. In

addition to this, the organization will also have intangible benefits if computer based systems are in place.

Implementation of the Best Alternative

The implementation of this step requires the creation of a database of company's customers, development of application software, training of staff for new environments well as new systems for shipping, billing etc. In addition to this cost benefit analysis is also to be carried out by taking into account tangible/intangible benefits and direct/indirect costs. The steps of implementation can be as under:

- Establishing a computer based marketing section
- Development of application software.
- Creating databases of company's suppliers and existing customers, processes, environment etc.
- Feasibility analysis
- Cost benefit analysis
- Training of suppliers for the new environment, that is, system of supplies and system of billing.

Gathering Continuous Feedback to Ascertain the Working of the Selected Alternative

The success of this step can be achieved through feedback. Feedback is a process by which output of a system is measured against a standard. Any difference between the two is corrected by altering the input. This is necessary because business organizations have to find out whether the new system is meeting the objectives or not. If, not then what changes in management, standards, resources, and procedures would have to be made to achieve these objectives. For example, as per the output of the information system in the department, the last period operations are worse than planned, then manager will immediately plan corrective measures which are then fed back into the firm's operations. Let us suppose there are always shortages of finished goods inventory of modems in comparison to demand in the market. It sends signal to the management either to increase the production shift or even the production capacity.

On the basis of the above discussion, one may say that feedback is a "information for action" The faster the feedback loop, that is, the sooner deviations are identified and action taken, less chances of major problems in the organization. To mention as an

example problems of employees may be periodically discussed and identified for solution to their satisfaction and acceptance by management rather than waiting for a major breakdown or strike by the employees then take an action.

Another example can be taken from quality testing of finished products. You need a system which gives you the information about the quality of end product during the production process rather than a system which provide this information as an output of sales information systems which will be available only after reduction in sales or complaint by the customer. But by that time many assemblies may be in the production lines and continuance, which will result in heavy losses to the organization.

SYSTEM ANALYSIS AND DESIGN

1. **Analyze Problem**
    - Identify Problem
    - Identify Issues of People, Technology, and Organization
2. **Understand Problem**
    - Gather Information
    - Identify causes, history (What sustains the problem)
3. **Make Decision**
    - What should be done
    - What can be done
4. **Design Solution**
    - Logical Design
    - Physical Design
5. **Implement Solution**
    - Plan Implementation
    - Modify existing procedure as needed
    - Evaluate Solution

SYSTEM ANALYSIS AND DESIGN -THE FIVE STPES

1. **Problem Analysis -**Investigate the problem to determine what kind of problem it is. Gather preliminary information about the problem.
2. **Problem Understanding –** Accumulate detailed information about the problem by conducting interviews and studying documents, policies and procedures, including those pertaining to existing information systems. Analyze the problems, its technical, organizational, and people dimensions. State exactly what the problem is and what its causes are.
3. **Decision Making –** Specify solution objectives. State what the solution should be in precise terms. Typical solution objectives might be more efficient operations, reduced costs, tighter control, higher revenues, or improved decision making.

Consider constraints. Evaluate alternative solutions. Decide which alternative best meets the solution objectives within the specified constraints.

4. **Solution Design–** Develop a logical design capturing functional business requirements if the solution requires information systems application. Develop general specifications for how input, output, processing, database, procedure, and control components can meet the requirements of the proposed solutions. Translate the logical design into a physical design if the solution requires information systems applications. Decide which among several configuration of hardware and software best meets solution objectives given the functional requirements and specified constraints. Develop detailed specifications for input out put methods and media, database or file structure, processing logic, manual procedures, and control methods.
5. **Implementation -** Implement the solution code, list, and install the system if application solutions (the use of an information system to solve a problem) are required. Make the necessary modifications in procedures and management.

Some Important Definitions

- **Logical Design** The part of a solution design that provides a description of the general level of resources, the operational process, and the nature of outputs that the solution should require it describes what the solution should do, not how it should work physically.
- **Physical Design** The part of a solution design that translates the abstract logical system model into specifications for equipment, hardware, software and other physical resources.
- **System Analysis** The study and analysis of problems of existing information systems it includes the identification of both the organizations objectives and its requirements for the solutions of the problems.
- **Systems Design** A model or blue print for an information system solution to a problem it shows in detail how the technical, organizational, and people components of the system will fit together.

System Life Cycle

The system life cycle is the oldest method for building information system and is still used today for complex, medium, or large system projects. This methodology assumes that an information system has a life cycle similar to that of any living organism, with a beginning, middle, and an end. The life cycle for an information system has six stages

- Project definition
- Systems study
- Design
- Programming
- Installation
- Post implementation

The life cycle methodology has a very formal division of labor between end users and information systems specialists. Technical specialists such as systems analyst and programmers are responsible for much of the systems analysis, design, and implementation work end users are, limited to providing information requirements and reviewing the work of the technical staff. Formal sign offs or agreements between end users and technical specialists are required as each stages is completed.

First Stage - **Project Definition** stage in the system life cycle is the first stage and it is determined whether or not the organization has a problem and whether or not the problem can be solved by launching a system project.

Second Stage - **System Study** stage in the system life cycle analyzes the problems of existing systems, defines the objectives to be attained by a solution and evaluates various solution alternatives.

Third Stage- **Design** stage in the system life cycle produces the logical and physical design specifications for the system solution.

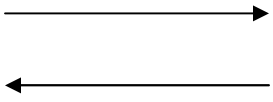
Fourth Stage – **Programming** stage in the systems life cycle translates the design specifications produced during the design stage into software program code.

Fifth Stage – **Installation** this consists of testing, training, and conversion the final step required to put a system into operation. The software is tested to make sure it performs properly from both a technical and a functional business stand point. Business and technical specialists are trained to use the new system. A formal conversion plan provides a detailed schedule of all the activities required to install the new system, and the old system is converted to the new one.

Sixth and Final Stage – **Post Implementation** in this final stage the system is used and evaluated while in production and is modified to make improvements.

Data Flow Diagram (DFD)

Data Flow Diagram shows how data flows to, from, and within an information system and the process that transforms the data. DFDs are constructed using four basic symbols. These symbols are



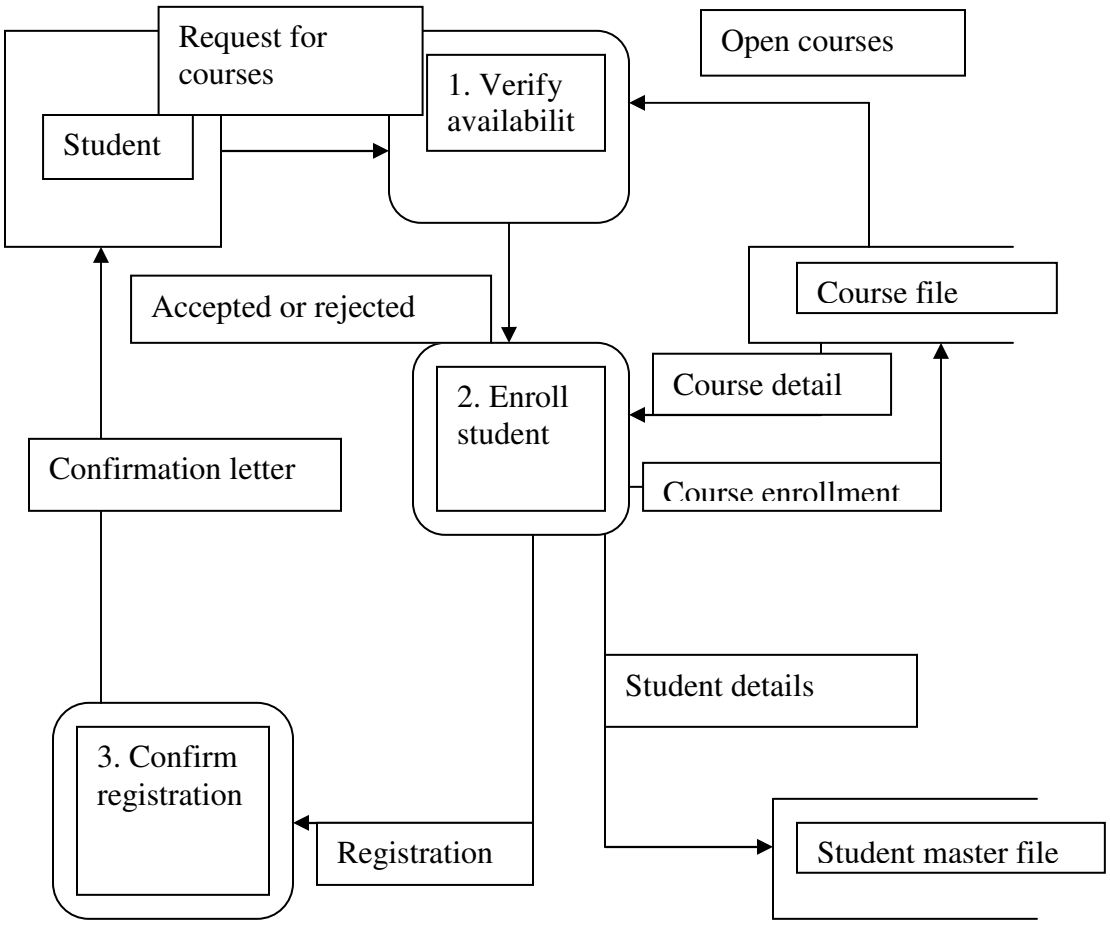
1. The data flow symbol, an arrow showing the flow of data.

2. The process symbols, rounded boxes or bubbles depicting processes that transform the data

3. The data store symbol, an open rectangle indicating where data are stored.

4. The external entity symbol, either a rectangle or a square indicating the sources or destination of data.

Example **Students Registration**



Data Dictionary

Data base Management System (DBMS) has three components, namely,

- A data definition language (DDL)
- A data manipulation language (DML)
- A data dictionary (DD)

Data Definition Language The component of a database management system that defines each data element as it appears in the database.

Data Manipulation Language A language associated with database management system that is employed by end users and programmers to manipulate data in the database. Example – SQL Structured Query Language

Data Dictionary An automated or manual tool for storing and organizing information about the data maintained in a database.

This is an automated or manual file that stores definition of data elements and data characteristics such as

- Usage
- Physical re presentation
- Ownership (who in the organization is responsibility for maintaining data)
- Authorization
- Security

Many data dictionaries can produce lists and reports of data utilization, groupings, program locations, and so on. A ***data element*** represents a field. Besides listing the standard name (AMT - PAY - BASE), the dictionary lists the names that reference this element in specific systems and identifies the individuals, business functions, programs, and reports that use this data elements

Example	**Data Dictionary**
NAME	AMT- PAY - BASE
FOCUS NAME	BASE PAY
PC NAME	SALARY
DISCRI PTION	EM PLOYEE S ANNUAL SALARY
TY PE	N (NUMERIC)
DATE CHANGED	01 / 01 / 2007
OWNERSHIP	COMPENSATION
U PDATE OWNERHI P	SITE PERSONNEL
ACCESS SECFFURITY	MANAGER, COMPENSATION PLANNING AND RESEARCH
	MANAGER, JOB EVALUATION SYSTEM
	MANAGER, HUMAN RESOURCE PLANNING
	MANAGER, SITE EQUAL OPPORTUNITY AFFAIRS
	MANAGER, SITE BENEFITS
	MANAGER, CLAIMS PAYING SYSTEMS
	MANAGER, QUALIFIED PLANS
BUSINESS FUNCIONS	COMPENSATION
USED BY	HR PLANNING
	EM PLOYMENT
	INSURANCE
	PENSION
PROGRAM USING	P101000
	P102000
	P103000
	P104000
	P105000
RE PORT USING	REPORT 124 (Salary increase tracking system)
	REPORT 448 (Group Insurance Audit Report)
	REPORT 452 (Salary review listing)
	PENSION REFERENCE LISTING

By creating an inventory of all the pieces of data contained in the database, the data dictionary serves as an important data management tool. For instance, ***business users*** could consult the dictionary to find out exactly what pieces of data are maintained for the sales or marketing functions or even to determined all of the information maintained by the entire enterprise. The ***dictionary*** could supply ***business users*** with the name, format, and specifications required to access data for report. ***Technical staff*** could use the dictionary to determine what data elements and files must be changed if a program is changed.

Most data dictionary is entirely passive. More advanced type are active change in he dictionary can be automatically utilized by related programs. For instance to change PIN codes from five to nine digits, one could simply enter the change in the in the dictionary without having to modify and recompile all application programs using PIN codes.

Information Retrieval

An information retrieval system consists of a set of procedures for storing items in a file in an organized way, so that they can be found in the future by people who are interested. A corollary to the definition is that items will not be located by someone who is not interested in their contents. The items might be facts, words, sentences, or documents. The file is constantly updated by the addition of new or more reliable information and by deletion of obsolete, incorrect, or unreliable information. Retrieval systems are necessary whenever data is stored and the exact requirements and timing of its ultimate uses are not known.

The ease of defining information retrieval does not mean that the underlying theory and the problems with which it is concerned are simple ones. Quite the converse is true. Some of the most complex problems which face logicians, scientists, and linguists today are information retrieval problems. The statement of the problem is simple, but its solution is complex.

Although tremendous research activity in the field of information retrieval during the past ten years has resulted in the publication of many papers treating the problem in various professional journals, unfortunately, nearly all this activity has been by scientists and operations research specialists. Most of these papers are too technical to be of value Most of these papers are too technical to be of value to the businessman. The subject, of course, has no been completely ignored in business publications. Several articles have appeared ha were very enthusiastic about the long range potential of information retrieval for business problem. A 1960 Fortune magazine article even suggested that information retrieval in 1960 occupied the same position as EDP did in 1950. It is expected that by 1965 expenditures in the United States for information retrieval equipment would jump to $100 million a year (from a level of $2 million a year) and would double every three years thereafter.

Progress in the technical development and large scale marketing of information retrieval systems has proceeded at a slower rate, and its ultimate impact appears to be more limited, than anticipated above. In our opinion, however, the nature of information retrieval problems and the tools for resolving them are sufficiently important that they should be understood by businessmen. This chapter therefore has two objectives:

- To present a description of the nature of information retrieval systems and the general types of problems they are designed to handle.
- To describe some of the problems which information retrieval techniques may be able to solve.

Requirements of Effective Information Systems

The equipment and techniques used in an information retrieval system will vary widely, depending on the characteristics of the environment. Some of the more important of these characteristics are:

- No. o items in a file.
- No. of requests for items from the file received each day
- The nature of requests (does the user know precisely what items she/he wants or does he/she need a considerable amount of assistance in locating the particular items relevant to her/his interest?
- Funds available to support the file's operations

Despite the varying structure of different information retrieval systems, however, the effectiveness of any individual system must be judged by how well it manages to meet the following five criteria:

- Does the IR system retrieve stored information within a satisfactory time? Once the user has decided he needs a set of facts very little time should pass before the system can locate them for him/her. For example, in a library, once the librarian is given the specific code number of a book, it should take only a short time for it to be located (provided, of course, that it is in the library). Thus for many proposed IT systems, a Random access file attached to a computer may be necessary because of the importance of having rapid access to randomly selected items.
- Does the IR effectively correlate information to desired degree of specificity, considering the character of its user's needs? For example, if you want information on electric air coolers, the system should be set up so that you will not have to search all the literature on electricity, air, and coolers to find the relevant information.

- Does the system contains valuable information and provide methods for screening out that which is less valuable? In other words, does it have some form of quality control? Several different problems are involved here:
    - Material should be excluded from the system that has little substantive content
    - As material becomes obsolete, it should be removed from the system.
    - The system should be indexed in such a way that a user can be quickly directed to those items which are relevant to his needs.
- Where appropriate, does the system provide access to expert human assistance? In many circumstances the advice of an expert will be of far more valuable than information gathered by searching currently available literature.
- Is the cost of the information system reasonable in the light of its accomplishments? The degree to which the first four objectives should be achieved must be balanced against the cost of the system. The economies of operating the system place a definite upper limit as to the speed and thoroughness of retrieval that is practicable to include the system.

Research of Information Retrieval

This section describes the areas of information retrieval in which particularly important research is being carried out. Its purpose is to clarify the nature of the problems that information retrieval techniques can be useful in solving.

Theory

The principal thrust of the work in information retrieval theory has been directed to the problem of indexing. The purpose of an indexing system is to maximize the "precision" and "recall" ratios for each user of the files.

$$\text{Precision Ratio} = \frac{\text{Number of relevant document retrieval}}{\text{Total number of documents retrieved}}$$

$$\text{Recall Ratio} = \frac{\text{Total number of relevant documents retrieved}}{\text{Total number of retrieval documents in the collection}}$$

An ideal system would provide the user with a value of one for both ratios. In practice, current system never achieves this, although constant efforts to improve their nature are being made.

When an indexing system must be selected for a particular collection of material, there are several different systems from which to choose. The most common of these include:

a) **Random Indexing**: each item is placed in the file as it is received. When information is desired, the entire collection must be searched. This is adequate for small collection, where search time is somewhat less than a minute.

b) **Classified Indexing**: this is what is found in most library catalogue systems. Each item is classified under one heading such as authors, title, or subject. This system makes it very difficult to locate the specific items which are relevant to a particular topic. For example, a book whose title is the "Theory of Systems" might have some excellent chapters on PERT. This indexing scheme, however, would never classify it in such a new way that a person interested in PERT literature could spot its applicability from its index. These indexes have a low "precision" ratio.

c) **Hierarchical Indexing**: Each item (books set of facts and so forth) is represented by **one card.** The items are classified by a series of subject headings which are ordered from a broad level of meaning down to a very specific level. For example, in a collection of business literature, one classification category might be 'marketing'. Within this category, items might be arranged into sub-categories such as pricing, promotion, and competition. Each of these subcategories might be further subdivided. It is difficult task to define these categories so that they contain the appropriate items. Often particular items will contain information

relevant to several subcategories. A set of rules must be developed to handle these situations. Thus, the users must be very familiar with the system's organization before they can make effectives also tend to have low "precision" and "recall" ratios.

d) **Inverted Indexing**: This recently developed technique is considered particularly useful for automated information retrieval projects. Instead of preparing one index card for each document, a card is prepared for each concept contained in the document. A concept refers to a single idea. All documents which contain information relevant to this concept will have their document number punched into an index card. These cards are called descriptor cards. Depending upon the degree of depth desired in the indexing system and the document's contents, the document number will be punched on one or more descriptor cards. Preliminary research has indicated that the most complex documents can be completely indexed by 100 or less descriptor cards. To prevent the problem of synonyms (several descriptor cards containing the same concept expressed in different words; an example of this might be "ferric oxide" vs. "iron rust"), a thesaurus that lists all synonyms is developed concurrently with the system.

As the system becomes larger, such things as homonyms and the grammatical use of words must be identified to allow the item to be properly handled. For example, the index should distinguish between "rubbing alcohol" and "drinking alcohol". Also, the different uses of the word 'man' must be distinguished in the following two sentences:

1) A man is sailing the ship.
2) We are going to man the ship.

In this case the grammatical use of the word 'man' will indicate how the sentence should be classified.

One of the characteristics of this system is that the number of descriptors does not increase proportionately with the number of items. For example, it has been shown that a file containing 10,000 items will require a little more than 5,000 descriptors, while files of 100,000 items will require less than 10,000 descriptors.

Inverted indexing has several advantages over the other indexing systems:

1) Items relevant to the user's interest can be located quickly. The user merely selects the concept cards that interest him/her and checks to see which document numbers appear on all or most of the descriptor cards.
2) It is easy to add new items to the system.
3) The index does not grow indiscriminately. The more documents that are added to the system, the slower the growth in the number of descriptors.

Further research in developing more powerful indexing techniques is being carried on in a no. of places. For example, the National Science Foundation had sponsored a project at the Association of Special Libraries and Information Bureau of London. Eighteen thousand documents in the field of aeronautics were selected and classified in four different ways. It is planned to search theses indexes with more than 1,000 questions to obtain significant data on the efficiency of the various factors involved in indexing technical documents. Particular attention will be paid to the incremental results which can occur from greater depth in indexing.

The second problem involved in indexing is how to index an item once the indexing scheme has been determined. An example of the type of research in this area has been done by Peter Luhn at IBM. He has developed various mechanical and statistical ways of indexing documents (using descriptors) and then preparing abstracts of these documents. His work was based on two key assumptions.

1. There is a very small probability that the same word is used to reflect more than one notion in any single paper.
2. There is a very small probability that an author will use different words to describe the same notion in a single paper.

The contents of the document were punched into IBM cards. The information on the cards was then transferred to magnetic tape for processing on a computer. The computer then counted the number of items each word appeared. Through comparison with a tape of "noise" words, words such as 'and", "the" etc., were eliminated from the analysis. The articles were indexed by the ten or fifteen remaining words which appeared most frequently in the text.

To prepare an abstract of an article the computer then computed a packing power fraction (defined below) for each sentence.

$$\text{Packing Power Fraction} = \frac{\text{Number of descriptor words in the sentences}}{\text{Number of significant words in sentence}}$$

Descriptor Words: One of the 15 to 20 most frequently appearing words in the text (excluding noise words)

Significant Words: Any word in a sentence that is not a noise word.

The abstract is then prepared by writing out the eight or ten sentences with the highest **Packing Power Fraction.** Preliminary results with this technique was very favourable .By implementing this method of abstracting, the time consuming and costly process of manually doing the work of indexing and abstracting was drastically reduced.

Searching for data, and hence deriving information, from on-line database servers is quickly becoming a nightmare. In previous years, the difficulty of gathering data from which to derive information stemmed from the inability of the user to find and access appropriate data sources. Today, we have too much data available on-line. The difficulty now is to find a relatively few truly relevant items from the vast number of identified sources. That is, we are faced with the task of locating a few relevant data trinkets from within a sea of available items, akin to the old adage of finding a needle in a haystack.

The data of today are electronically distributed and are represented in diverse formats. To efficiently process and extract information from these data requires distributed, efficient, portable, high-performance information processing engines. It is within this context that all of the projects described herein were developed.

Office Automation System (OAS)

These systems create, store, modify, and process inter personal communications, whether in written, verbal, and video form.

The prevalence of microcomputers in offices, along with a veritable explosion in new communications, computers, and storage devices has caused fundamental changes in the ways that business people communicate. At first, computer systems were used as word processors. Over time, interconnected computers let users share ***word processing files*** and messages electronically. Today a wide variety of OAS s exists.

With ***electronic mail systems,*** business people create and send messages to one another. On ***electronic bulletin boards***, files are essentially electronic posts on which people can leave public messages. Today these systems have become more useful because high quality graphics can be included in the messages. ***Facsimile*** (Fax) machines have been improved and reduced in cost, so documents containing text, illustrations, and graphics can be communicated over tele phone lines. Personal computers can both send and receive faxes, if they are properly equipped.

In parallel with these developments, computer technology has improved voice message systems. Business telephones are connected to sophisticated private branch exchange (P BX) systems - - computer based ***switch boards*** that not only support voice mail but also flexible call forwarding, telephone conferencing, and the like.

In addition, companies in document intensive industries such as insurance have developed image processing systems in which documents are ***scanned*** to produce an ***electronic image*** of every document it receives. Each image is coded with date, time, critical numbers (such as customer number, invoice number and the like), and comments. When a customer calls regarding insurance claim, the agent is able to electronically access all data and correspond about that claim.

Collaborative writing systems enable groups of people to work together, in parallel, in the development such as proposals. Participants use the system both to contribute their work and to review the work of others as it is developed.

Finally, large organization use ***video conferencing*** to let people communicate face to face with out traveling. At first, such capabilities were used to connect key executives in two

or three locations. Recently such systems have been used to connect thousands of people to see and hear the presentation.

Most of these systems have been developed in isolation from each other. ***Multimedia systems***, appearing today, create message that are composite of the separate capabilities text, drawings, images, data, voice, and motion video. In some systems, messages are not limited to elements physically stored at any one site. Instead, they are created on demand from data assembled from many sites.

OASs and New Human Capabilities

Doug Englebert one of the pioneers in OASs, predict that the real power of such systems will not be realized by improving our productivity in working as we do today. Rather, the ***greatest benefit will be to let people think, communicate, and work together in new ways***. OASs can change the way people view, conceptualize and solve problems.

Types of OAS Resources

Resources	Use
1. Word Power	Creates documents electronically
2. Electronic Mail	Sends and receives message electronically
3. Electronic Bulletin Board	Posts electronic notices
4. Facsimile (Fax	Sends documents over telephone lines
5. Voice Mail	Supports voice mail boxes, provides sophisticated tele phone facilities
6. Image Processing	Enables online access to pictures and documents
7. Collaborative Document Processing	Enables groups to share the drafting of documents
8. Video Conferencing	Communicates face to face without traveling
9. Multimedia	Creates composite documents and messages

For example, in hypertext systems, text, illustration, graphics, data, programs, audio, and video can be integrated into electronic documents. Users can read such a document sequentially or at random just as books can be read.

In OAS the media involved are so disparate (computers, telephones, television screens, coy machines, graphics plotters, audio equipment etc.) that no single chart can show any one over all architecture. In addition, specific applications are selected to meet the needs of particular companies and workgroups, and they may change over time. The needs of an architectural firm, the technical writing group of a software house, and the operations management group for a shipyard are significantly different, and OAS application must be selected to meet each set of needs.

Decision Support System (DSS)

Definition of DSS

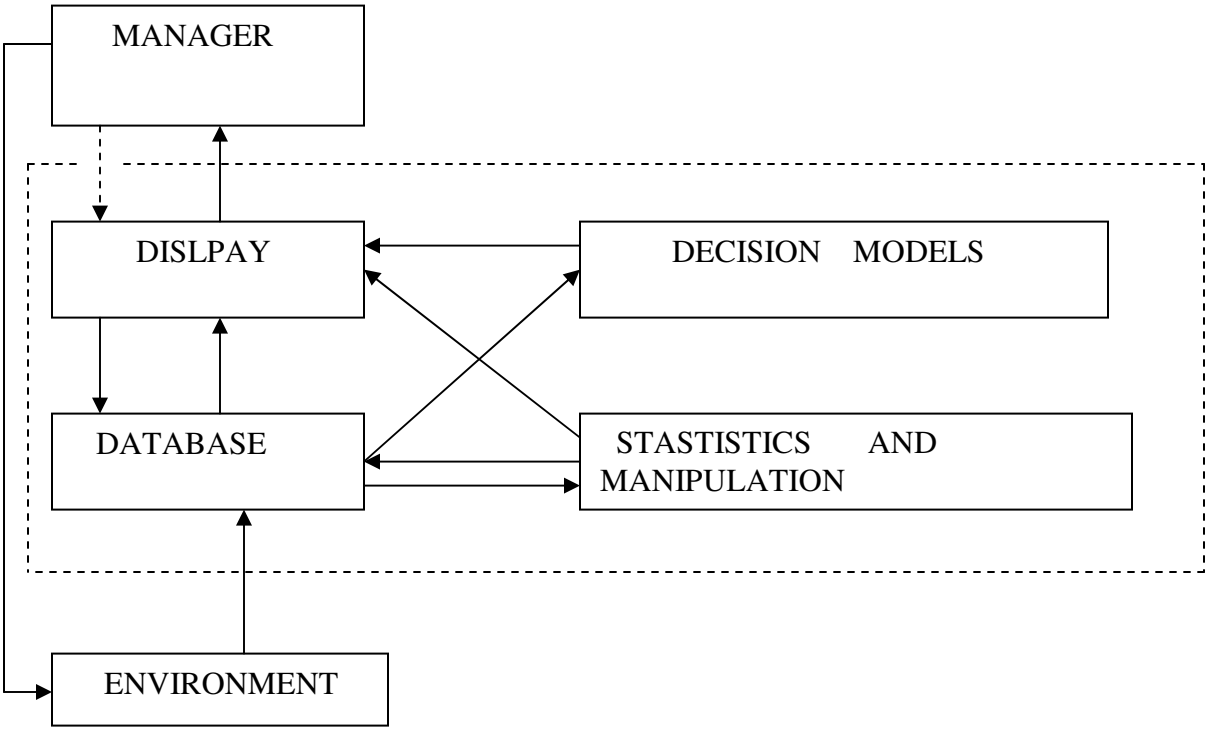
Scott Morton defined Decision Support System (DSS as ***Interactive Computer Based Systems,*** which help decision makers utilize data and modules to solve ***unstructured problems.***

Keen and Scott Morton stated that Decision Support Systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer based system for management decision maker who deal with semi structured problems.

Earliest definition by Gerritz is one who described DSS as an effective blend of human intelligence, information technology, and software that interact closely to solve complex problems.

Components of a Decision Support System

DSS is a coordinated collection of data systems, tools, and techniques with the necessary software and hardware through which an organization gathers and interprets relevant information from the business and environment and turns into information that can be acted upon.



The Distinct Elements of DSS are

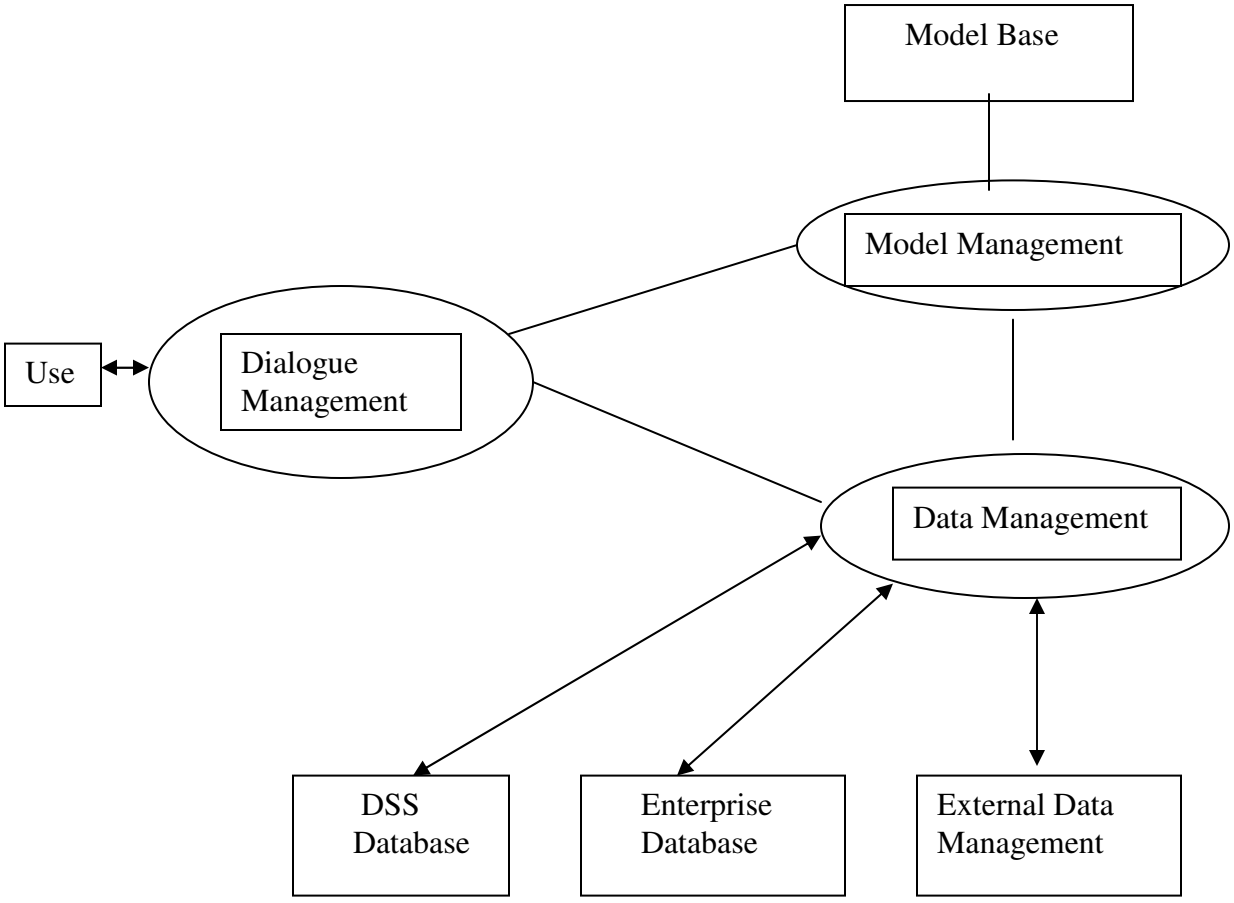
i) DSS Tools are programs or codes which are the foundations used to crate the DSS generators and in turn specific DSS. These are the building blocks of the DSS which as a user interface. Example Electronic Spread Sheets, 4GLS, RDBMS etc.

ii) DSS Generators the combination of DSS tools in the computer.

iii) Specific DSS

- Database The intelligence function develops and coordinates the flow of information from the multitude of external and internal resources. The primary task is to capture the data that can be used with the other components of the DSS to make decisions. A critical objective is to centralize all data in proper form and in sufficient detail so that it is accessible for decision making.
- Decision Models A model may be nothing more sophisticated than a rule of thumb, for example for each percent decline in territorial market share; trade promotion advertising should be increased by 5 percent. Models can be complicated computer driven mathematical equations. These quantitative and qualitative conceptualize how a system operates. The model ex presses perception as to what data and variables are important and how the variables are related.
- Statistics and Manipulation These aspects of the DSS produce meaningful information by relating the data into the models. The typical operations involve segregating numbers into groups, aggregating them, taking ratios, ranking them, plotting them, making tables and so forth. General managerial models proforma profit and loss statements, budget statements, forecasting statements etc. and more Complex models marketing mix planning,, product portfolio analysis, new product tracking are aspects of data analysis in this process.
- Display this is the interface between the business manager and the DSS.

The Fundamental DSS Program Structure



The above figure shows the fundamental structure of DSS application. Users interface with the ***dialogue management component***, which is a set of programs that manages the user interface and translates the user's requests into commands for the other two components.

The ***model management components*** maintains and executes models of business activity, including spread sheets, operations research models, financial models, and simulation models. The model management component is used to create, store, and modify models and to make them available to the user.

The ***data management component maintains*** DSS data. Its tasks include the DSS database, which contains both intermediate and final results of DSS studies, and managing interfaces to enterprise data and other external sources.

Not all DSS have all the components as shown in the figure. The selection of parts should match the problem domain of a specific DSS, so some parts may not be needed. A small DSS for a single use on a personal computer may have only one or two components.

DSS Task Environment

Tasks of DSS has four dimensions

- Degree of Structure designed to address unstructured or semi structured problems.
- Level of Application applied at all three levels of management, that is,
  - operational control
  - managerial control
  - strategic planning
- Phase of Decision Process involves three primary phases, namely,
  - Intelligence gathering
  - Alternative development
  - choice
- Recurrency both for regular task and once in a while tasks.

A Comparison of DSS and MIS

Factor	DSS	MIS
Problem Type	A DSS is good at handling unstructured problems that cannot be easily programmed.	An MIS is normally used only with more structured problems.
Users	A DSS supports individuals, small groups, and the entire organization. In the short run, users typically have more control over a DSS.	An MIS supports primarily the organization. In the short run, users have less control over an MIS.
Support	A DSS supports all aspects and phases of decision making; it does not replace the decision maker—people still make the decisions.	This is not true of all MIS systems—some make automatic decisions and replace the decision maker.
Emphasis	A DSS emphasizes actual decisions and decision-making styles.	An MIS usually emphasizes information only.
Approach	A DSS is a direct support system that provides interactive reports on computer screens.	An MIS is typically an indirect support system that uses regularly produced reports.
System	The computer equipment that provides decision support is usually online (directly connected to the computer system) and related to real time (providing immediate results). Computer terminals and display screens are examples—these devices can provide immediate information and answers to questions.	An MIS, using printed reports that may be delivered to managers once a week, may not provide immediate results.
Speed	Because a DSS is flexible and can be implemented by users, it usually takes less time to develop and is better able to respond to user requests.	An MIS's response time is usually longer.
Output	DSS reports are usually screen oriented, with the ability to generate reports on a printer.	An MIS, however, typically is oriented toward printed reports and documents.
Development	DSS users are usually more directly involved in its development. User involvement usually means better systems that provide superior support. For all systems, user involvement is the most important factor for the development of a successful system.	An MIS is frequently several years old and often was developed for people who are no longer performing the work supported by the MIS.

Executive Support System (ESS)

Executive Support System (ESS): Supports the information needs of very senior executives by summarizing and presenting data at the highest level of aggregation. Usually ESSs involve presenting reports in standard formats, and they often involve graphic characteristics of an ESS.

The primary goal of an ESS is to obtain data from a variety of sources, integrate and aggregate that data, and display the resulting information in an easy to use comprehensive format.

The characteristics of an ESS are:

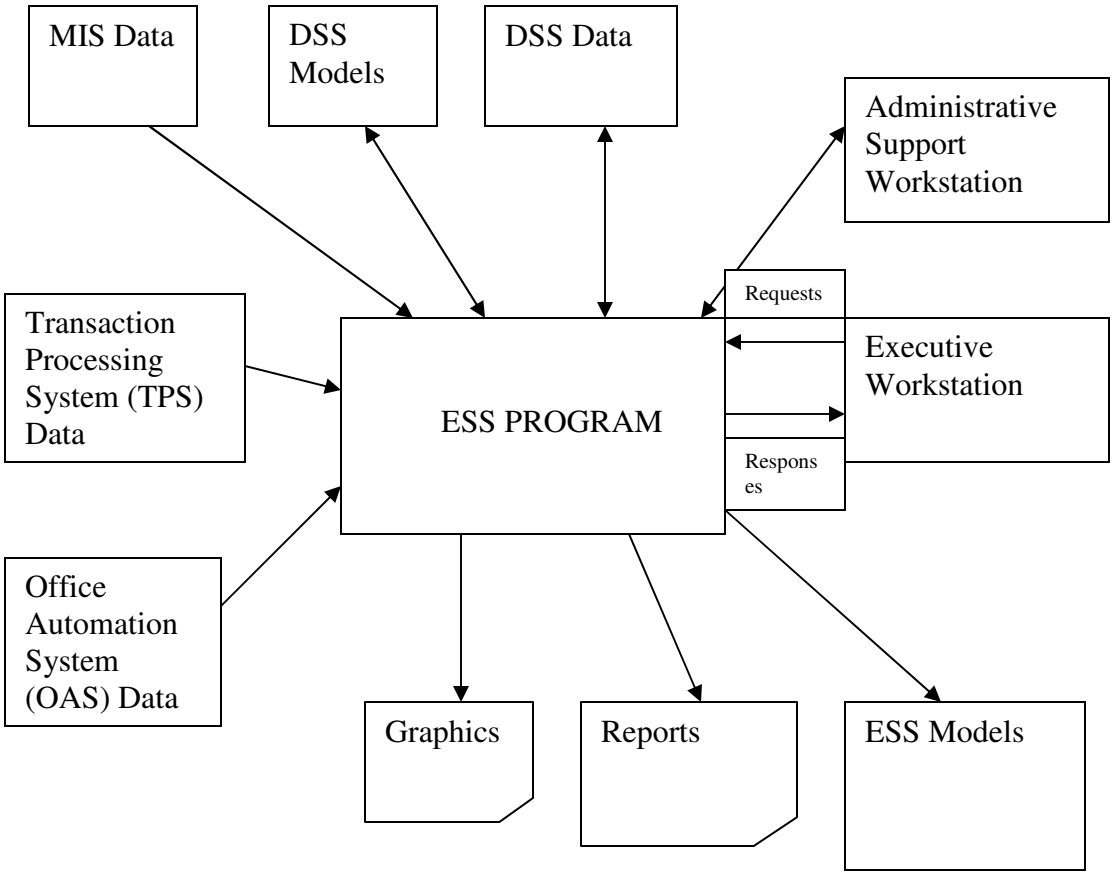
- Graphical
- Easy-to-use interface
- Broad, aggregate perspective
- Able to expand detail
- Provides context
- Integrates many sources of data
- Timeliness crucial

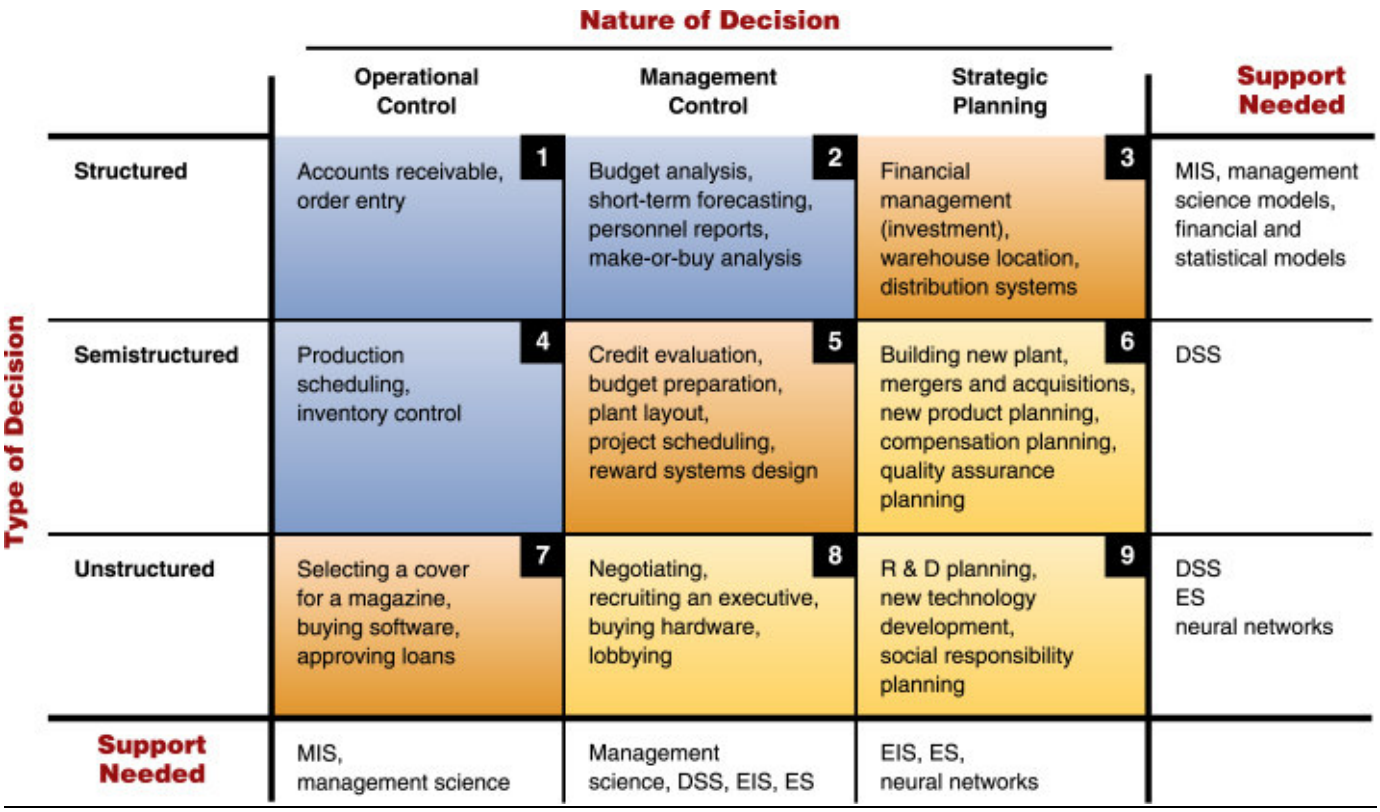
Pointing devices (light pen and mouse) and touch screens are often used. The goal is to require as little knowledge and skill on the part of the executives as possible.

ESS provides broad, highly aggregated information. At the same time, they can show further detail when, for example, an executive sees something that seems curious and wants to know the underlying data.

Executives are looking for differences that make a difference. Therefore, they want to see information within a context. As with the MIS reports described for Sarah Morris, this often means that facts are shown in relation to budget or to some prior period. Because executives have broad span of interest, an effective ESS must integrate many sources of data. And since executives typically need to respond rapidly to changing circumstances, timeliness is crucial. Information that is even a week old is often not useful.

As shown below ESS accepts data from all the other types of information systems. It also accepts input from personnel who support the executive, such as administrative assistants.


MIS Data
DSS Models
DSS Data
Administrative Support Workstation
Requests
Transaction Processing System (TPS) Data
ESS PROGRAM
Executive Workstation
Respons es
Office Automation System (OAS) Data
Graphics
Reports
ESS Models



A Framework for Computerized Decision Analysis

Expert System

Expert System: are a specialized type of information system which provides advice and assistance on semi-structured problems. An expert system uses reasoning to render advice, make recommendations, or diagnose problems. To do this, the expert system processes input data against a knowledge base. In most expert system today, the knowledge base consists of a set of rules.

For example, one organization uses an expert system to make recommendations to employees about the cost – effective means of shipping parcels. The user inputs size, weight, destination, and time constraints into the expert system. The system processes this data against a knowledge base of rules that tells which companies handle specific sizes of shipments, under what time constraints and at what costs. Thus, the system can make a recommendation about the most cost-effective transportation means.

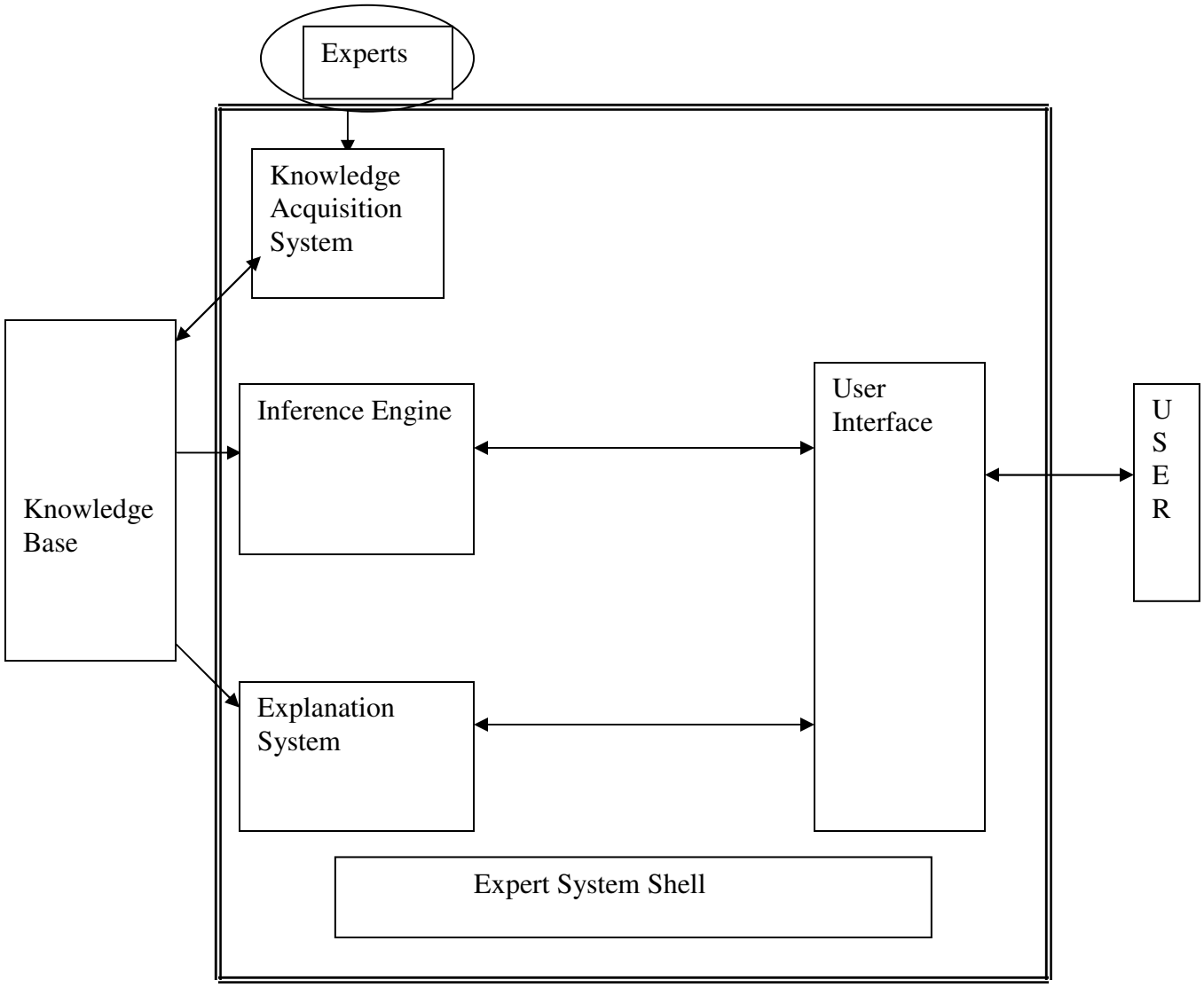
An expert system encodes knowledge that can take a human several months, years, or even decades to learn. The shipping advisor system, for instance, contains knowledge that shipping clerks normally require several months to learn. Using this expert system, new employees can be productive far more quickly. Also, when experienced and seasoned employees are promoted or otherwise leave the department, the benefit of their knowledge is retained, since it has been incorporated into the rule base.

The term expert system may be misleading. Most systems today do not posses the capability of a true human expert. It might be better to think of these systems as knowledge helpers and encodes than as true experts.

Architecture of an Expert System: The structure of a generic expert system is summarized in the next figure.

- The knowledge Base: contains rules, facts, and descriptions of objects.
  The first expert system encoded knowledge in programming language statements, an undesirable approach because the knowledge was difficult to find, understand, and change. With today's products, the knowledge base is almost always stored in data.
- Expert System Shell: is collection of programs for defining, administering, and processing an expert system.

Just as a DBMS is used to define, administer, and process a particular database application an expert system shell is used to define, administer, and process a particular expert system.



An expert system has four major components

a. The Inference Engine: processes the knowledge base to achieve the goal stipulated by the user.
b. User Interface: the communication link between the user and the Expert System.

c. Explanation system: helps the user by describing the need for certain information or by explaining the basis for recommendation that are produced.

d. Knowledge Acquisition System: is used by someone who has expertise in the problem to create, add to, or change knowledge base.

To understand the processing of an expert system, you must understand the concept of inferencing. Suppose you have the following set of rules and facts.

1. Employees with skill 100A can operate lathe or drill press.
2. The pay range for those employees at skill 100A is Rs. 27,000 to Rs. 38,000
3. Employee Amar operates a drill press.
4. Employee Shyam operates an articulated front-end loader.

Given these facts, you could make inferences to answer the question "What is the most Amar can be paid?"

How Inferences Engines Operate?

The goal of the inference engine is to process the rules systematically and efficiently.

Possible Questions

1. What is Amar's maximum pay?
2. What is Amar's life insurance?
3. Person X has a life insurance policy of Rs. 2, 50,000. Who would person X be?

Sample Rules to Answer the above Mentioned Questions

Rule No.	IF	THEN
1.	Job code = 100A	Minpay = 27,000, maxpay = 38,000
2.	Job code = 200A	Minpay = 23,000, maxpay = 25,000
3.	Operate = lathe or drill press	Job code = 100A
4.	Operate articulated front-end loader	Job code = 200A
5.	Minpay>25,000	Life insurance = 2,50,000
6.	Minpay<=25,000	Life insurance = 2,00,000
7.	Name = Amar	Operate = drill press
8.	Name = Shyam	Operate = articulated front-end loader
9.	Name = Ram	Operate = drill press

Consider question 1. Suppose the inference engine is programmed to examine each rule in sequence. If the rule is true, take the indicated action. To do this the engine needs working storage in which to store values of the variables and other data. For this problem, it needs to store values for variables names, operate, jobcode, minpay, maxpay, and life insurance.

To answer question 1, the inference engine sets the value of the variable name to "Amar" and examines the rules in sequence. Only rule 7 is true, and the inference engine sets the variable operate to "drill press". It then proceeds through the rules again and finds that both rules 3 and 7 are true. (The engine will have a means for determining that it has already taken the action for rule 7 and that it must stop considering that rule). Since rule 3 is true, the engine sets the value of the variable jobcode to "100A".

Working in this way, the engine will keep examining rules until it obtains a value for the variable maxpay set the value of the variable maxpay to 38,000 and thus answer the question.

Consider question 3. Here the engine is given a conclusion and asked to determine how that conclusion could have come about. To answer this question from the rules, the engine cannot make a definite answer. Instead, it can identify possible answers. To see why, rule 5: If variable life insurance equals "2, 50,000", then one possibility is that the person has paid greater than 25,000. However, this rule does not eliminate other possibilities. For example, the employee could have purchased his or her own insurance. Thus, when working backward from these rules, the engine can identify only possibilities.

These two questions illustrate the two most popular strategies for processing rules.

First ---- called Forward Chaining, starts with the given data and works forward, determining what results can be concluded from that data.

Seconds --- called Backward Chaining, starts with a possible conclusion or hypothesis and works backward to determine what might have held.

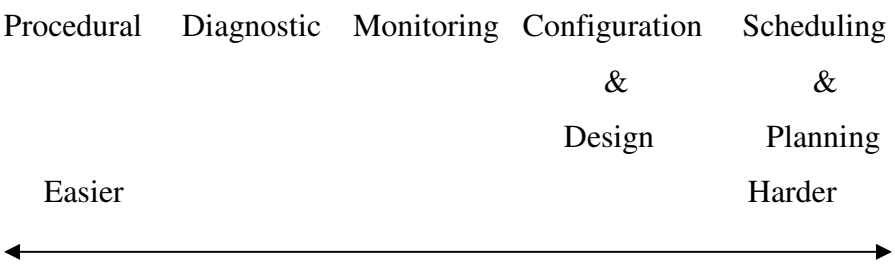
Both humans and expert systems use backward chaining when the number of possible outcome is small (hire/don't hire) and forward chaining when there are many possible outcomes (species identification of the two strategies.

An important capability of an inference engine is its ability to explain itself. At any point in the dialogue, in some expert systems, the user can command the system to explain its reasoning or why it is asking for specific information. The system explains by indicating the rules that have led to its current status.

What Problems can Expert System Solve?

Expert system cannot solve every problem nor are they effective at solving some problems as others.

Continuum of Expert System Problem Domains



The above figure shows a continuum of problems, in conceptually increasing order of difficulty, that have been solved by expert system The word conceptually hare means that a problem from a domain on the left is easier than an equivalent problem from a domain on the right. Thus, in general, diagnostic problems are easier than configuration and design problems, but a difficult diagnostic problem may be harder than an easy design problem.

1. Procedural Problems
    - Well defined, ordered procedures
    - Provide instructions and advice
    - Can perform classifications
        - ❖ Examples - Instructions to assemble components into a whole
            - Advice for using a new form
            - Classifications of things based on data about their observed characteristics

2. Diagnostic Problems
    - Involves identification of possible causes of a situation
        - ❖ Examples – Causes of an automobile malfunction
            - The source of failure in an electronic system (say TV)

Many of the expert systems that address diagnostic problems also provide suggestions for the solution. Thus MYCIN is one of the largest diagnostic expert systems (and the grandfather of many others). It not only identifies potential causes of infectious human disease but also produces a suggested treatment plan.

3. Monitoring Problems
    - Gather data from a process, evaluates that data, and, if appropriate, issue instructions to people or equipment to make changes to the process.
        - ❖ Examples – monitoring an assembly line or monitoring the life signs of a critically ill patient.

Monitoring are diagnostic systems that run iteratively. They examine data; look for out-of–ordinary conditions.

4. Configuration and design Problems
    - Accepts requirements statements and constraints and build a list of components or other designs that will fit those requirements
        - ❖ Examples – determine all the required components and subcomponents of a complicated machine that must be tailored to a given environment, such as a spaceship, or systems that recommend the best way to integrate a large number of components into a constrained space, such as the best way to route wires through the walls of an airplane.

XCON, one of the earliest design expert systems, builds a list of components required to configure VAX computers. Given the requirements of the basic components (CPU type, amount of memory, number and size of peripherals storage units), XCON determines the entire equipment configuration, including power supplies, cabinets cables, and the like.

5. Scheduling and Planning Problems

- Involve determining the best allocation of people, equipment, money, and time to accomplish specific tasks.
  - ❖ Examples – planning and scheduling for achieving management goal.

Scheduling and planning systems often require more knowledge than just rules and facts. Information about the characteristics of the entities involved is often necessary. For example, consider the problem of assigning people and machine in a machine shop. Suppose each week the shop is given a list of products to construct. To make a schedule for this shop, an expert must consider not just the rules of production but also the characteristics of the machine setups, the skills of the employees, and the use of apace in the workshop. This difficult assignment is probably beyond the current state of expert systems technology and practice.

Selecting a Computer

First Question: Do you really need a computer? (At present irrelevant)

Second Question: What do you want the computer to do for you?

For example:

- Word processing
- Accounting related processing activities
- Tracking the status of inventory as a whole and in restocking inventory.
- Storing some information in files.

Accounting Related Processing Activities

- Status of customer's account
- Large volume of hardcopy reports will have to be produced including
    - ❖ Accounting ledgers
    - ❖ Customer invoices
    - ❖ Special reports

Tracking the Status of Inventory as a Whole and in Restocking Inventory

- Check the status of any item in inventory
- Track inventory turnover
- Produce following reports
    - ❖ Detailed inventory listings
    - ❖ Inventory reorder report
    - ❖ Purchase order

Storage of Information

- Employees files
- Customer information
- Accounting files
- Inventory files

Third Question: What are the guidelines for buying a computer?

- Cost: The best hardware and software that will solve the problem for the least amount of money.

Note: The word to keep in mind is upgrade. You can often start with an inexpensive computer and then upgrade it by adding parts later. It is necessary to buy an expensive system to take of all your future needs-especially if you aren't sure what those needs will be. Moreover technology is also changing very fast and it is advisable to by parts as and when required.

- Sophistication of the Computer
  - ❖ Computer to remain in your office (PC) or be portable(Lap Top)
  - ❖ Should it be same or compatible with other computers?
  - ❖ Should it be able to use software you may already have?
  - ❖ Do you want it to show images in more than one color?
  - ❖ Should it be capable of holding a lot of information or large software programs?
  - ❖ Should it be up gradable and expandable? Will you be able to buy add-ons for it later that will make it faster, more powerful, more versatile and so on?
- Software Required
  - ❖ Word Processing: Will the computer be used for writing—such as letters, memos, and reports?
  - ❖ Spreadsheets: Will the computer be used to compute "what if" types of financial possibilities—as estimating costs, constructing bids, pricing products, calculating budgets, doing sales forecasts, and other form of money management?
  - ❖ File or Database Manager: Will the computer be used to crate mailing lists, address lists, list of possession or products, or other forms of record keeping?
  - ❖ Telecommunication: Will the computer need to exchange messages with other computer users and to access computer databases?

- ❖ Graphics: Will the computers be used to create charts and graphs.
- ❖ Integrated Packages: Will the computer have to mix any of the tasks listed above? Fo4r example, will sales is extracted from a file, manipulated on a spreadsheet, shown in graph form, put into report, and/or transmitted by phone to another computer user?
- ❖ Special Requirements: will the computer be used for desktop publishing (for say, publishing a news letter for your organization's employees)? Will it be used to do accounting tasks? Plan business strategy? Do stock market analysis? Special purpose software or industry specific software is available.

- Hardware Required
  - ❖ Processor (speed)
  - ❖ Memory (capacity)
  - ❖ Expandability
  - ❖ Secondary storage
  - ❖ Video display–monochrome(black & white, green & amber)/colour/colour with high resolution
  - ❖ Interface (connection with other devices say printers & telecommunication)
  - ❖ Printer (kind of printer) impact/non-impact. Speed of printer, and size of paper.
  - ❖ Modem (speed)
  - ❖ Other peripheral devices
    - o Mouse
    - o Speakers, mike
    - o Optical scanner
    - o Bar code scanner
    - o Voice recognition devices
    - o Chip-mounted real time clock inside the computer.
- Support
  - ❖ Advice and assistance

- Offer training classes
- Help in financing the purchase
- Maintenance contract- covering parts and labour in case of breakdowns?
- Documentation accompanying each piece of hardware and software.

Selecting Computer Personnel

Most often in our discussion about hardware software are so overwhelming that we underestimate the importance of liveware, which is computer personnel – because it is quality of this resource that is the bottomline in determining, utilizations of resources of any organization.

The selection Process consists of:

- Determining the nature and number of positions to be filled
- Selecting from among the job applicants
- Recruiting and then placing the candidates

A prerequisite to selection process is the preparation of ***Job Description*** and ***Job Specification***

Job Description: Defines duties that must be performed and equipment that is used, and working conditions associated with the jobs.

Job Specification: Qualification and experience (optional) of the candidates

The Various Occupational Categories in which Selection are made:

1. **Information System Manager:** Information system manager like all managers perform functions of planning, organizing, leading, and controlling the information needs of the organization. He/She must have technical degree as well as managerial ability.
2. **Systems Analyst and Designer:**
    - Gathering facts and figures
    - Analyzing
    - Modifying, designing/redesigning
3. **Programmers:**
    - Converting the work specification into machine readable language.
4. **Database Administrator:**
    - Monitoring and auditing database operations
    - Updating the DBMS software
    - Communicating with the users

5. **Computer Operator**

- Data entry
- Setting up the process

Organizational Aspects of Computerized Data Processing

The organization of the systems and computer activity is probably the most difficult and critical problem with which management is faced. The success of the entire effort may depend upon it; yet there are no hard and fast rules to be used as guides. ***The principal problem is the degree of centralization.***

The following are the ***benefits*** from centralization:

1) Substantial cost savings;
2) Systems and computer can be used far more efficiently.

The following are the ***problems*** associated with centralization:

1) The operating people may not participate sufficiently in the design of the information system;
2) The greater the degree of integration the more difficult and costly unanticipated changes become.

Factors Affecting Centralization

1) Size of the company
2) Attitude of operational personnel—the better their relationships with the staff people, the greater the degree of centralization, which will be practicable.

Note: Smaller organization---centralized

Bigger organization---decentralized

Medium organization---matrix

There are several types of activities included in the systems and computer effort and each of these activities must be considered in deciding on how to organize systems and data processing efforts.

First let us take the various stages in the development of the computerized MIS. These stages are different but the point where one stage ends and the other starts are not clear.

Stage 1: System Specification

1) Includes the design of all the aspects of a MIS that are important to the users
2) Principally includes the basic decisions as to what information should be provided by the system
    - Timing of the information

- Input format
- Output format

Example: I. **Budgetary Control System**

- The format of the budget proposal
- The procedure for approval
- The format and the timing of the budget performance reports would all be specified because they are important to the users.

II. **Automated Inventory Control**

May not include the format of the replenishment order to the supplier; as long as the order is intelligible, it makes no difference to the warehouse manager what the order looks like.

Stage 2: **Data Processing Implementation**

1) Concerned with those things that are important to the ***processing of the data***
2) Objective is to design a data processing system that will most efficiently implement the systems specified in stage 1.

Stage 3: **Programming**

1) Starts with the systems flow charts and ends when the program is running on the computer.

The foregoing stages of systems development are of course, interrelated. The systems specification must take into account the restraints inherent in the data processing functions; the data processing stage must take into account the capability of the equipment available. The important point is that the person responsible for data processing can restrict the systems requirements only as the result of the data processing capabilities; he is in no way responsible for deciding what kind of information should be generated by the system. The same is true of the programmer. He develops as efficient a program as possible to provide the specified data system.

It is not necessary that all systems should go through all the three stages. For example, a system for accumulating personnel information on top executives might be handled exclusively in one stage because the data processing, being relatively trivial in nature, can

be managed as part of the design of the system. Other subsystems go through only stages 2 or 3. There are two major reasons for this:

1) Many subsystems are well established. There specifications are already defined when they come up for management decisions; the only problem is to automate them. This is often true, for example, when accounting systems are automated.
2) Many subsystems require no system design at all of the stage 1 type. The requirements are prescribed by the nature of the task, as for example, in payroll or customer billing.

System Specifications ---- as a rule should be decentralized

Reasons for Decentralization:

1) The operating manager is responsible for the effectiveness of his information
2) Designing of different types of subsystems requires different types of skills and knowledge.

Data Processing Implementation----can be centralized

Reasons for Centralization

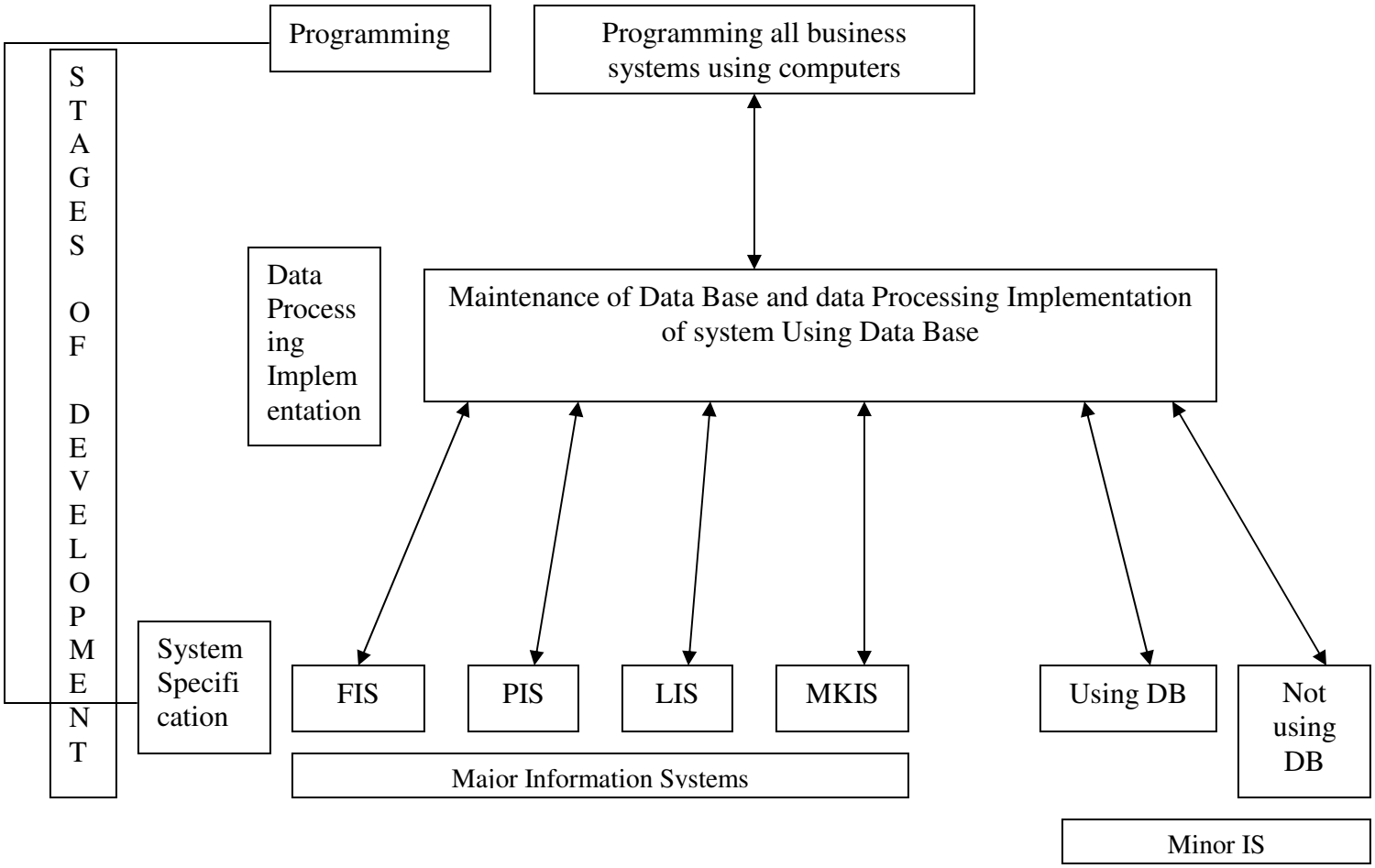
1) Economical to capture the information once, at the point where it first enters the company.
2) Storing, updating, and processing can be done efficiently.
3) The data processing part of an information system can be handled best by staff specialists because knowledge of equipment and data processing techniques is the primary requirement.
4) Operating management can delegate the responsibility for implementing the information system to staff groups once this system has been specified and as long as management can be assured of adequate service from the staff group.
5) Easy to maintain databases which can be used by the various automated system.

Programming----Centralized

Reasons for Centralization

1) Economical
2) Requires special knowledge of equipment and programming languages

Diagrammatical Representation of Computerized Data Processing



FIS – Financial Information System
PIS – Personnel Information System
LIS – Logistics Information System
MKIS – Marketing Information System
DB – Data Bases
IS -- Information system

Evaluation and Control of Data Processing

After MIS has been operating smoothly for a short time, an evaluation of each step in the design and of the final system performance should be made.

Evaluation should not be delayed beyond the time when the systems analysts have completed most of the debugging. The longer the delay the more difficult it will be for the designer to remember important details.

Evaluation should be done both by customers as well as designers.

The ***question*** which the ***designer*** should ask themselves is "If we were to start all over again, knowing what we know now, what would we do differently?

The ***question*** which the ***customers*** should ask themselves is "How the system now performs and how would we like it to perform"?

The ***Financial Analysts*** should consider the following points:

- Planned cost Vs actual cost of design
- Implementation and operation
- Identify cost savings and increased profits directly attributable to the MIS

Cost- Benefit Analysis for computerized MIS is difficult since any benefits are intangible and moreover, do not show results immediately.

The structure given below, however, when adapted will permit partial evaluation.

Level	Hierarchy in MIS	Change that is Measured
1.	Company profit/return on investment	Rupees
2.	Company's cost, revenues	Rupees
3.	Planning	• Specificity • Quantification • Degree to which plans are achieved • Time required to produce plans • Number of

	Control	alternative plans made available for consideration • Cost • Degree of control by exception • Selection of activities to be controlled • Forewarning of activities going beyond acceptable limits • Managerial time required for control • Automation of control of repetitive situation • cost
4.	Decisions	• quality of decisions • frequency of renewal of decisions by superiors in the organization • number of alternatives examined in arriving at decisions • Sophistication of 'what if' questions

		permitted. • Time required for decisions • Number of decisions • Automation of repetitive decisions • cost
5.	Information	• validity • accuracy • clarity • distribution • frequency • appropriateness of detail for each level of management • timeliness • format • availability on demand • selectivity of content • disposition method • retention time • cost
6.	System Characteristics	• no. of people required, equipment and facilities • frequency of breakdowns, inputs and outputs • no. of forms

		• no. of operations • no. of storage size and quality of data banks • flexibility • simplicity • degree of automation • user satisfaction • error rates • persistent problem areas • ease of manifestation and modification • unplanned for impact on company performance • savings • cost

The measurement of costs or benefits of an MIS is the measurement of change or difference between the old and the new. The measurement of change must be related to the basic goals of MIS, the principal activities that further these goals, or the many minor activities that further these goals.

Measure change in total output or better many changes accomplished throughout the system.

At systems level, judgment of broad concepts might be employed.

1. ***Systems Integrity***: How well are the subsystems integrated into the total system without redundancy? How flexible is the system? How easily may the system be expanded?
2. ***Operating Integrity***: How skilled are the people operating the system? What backup is there to prevent system breakdown in the event of loss of key personnel or equipment failure?
3. ***Internal Integrity***: How well does the system do what it is supposed to do? How valid are system outputs? How secure is the system against human error, manipulations, sabotage, or theft?
4. ***Procedural Integrity***: How good is the documentation of the system and procedures? Are procedures such that employees are motivated to follow them? How well are procedures followed in practice? What controls ensure that procedures are followed?

Anthony's Framework

Robert N. Anthony's has delineated a framework which distinguishes between different types of planning and control processes that typically occur in organizations. His thesis is that thinking of planning and control as two separate and homogeneous activities in an organization is not only meaningless but positively dyfunctional. Therefore, Anthony suggested that the area of management planning and control should be divided into three categories, resisting the "natural temptation for two main divisions: planning (roughly, deciding what to do), and control (roughly assuring that desired results are obtained)". The three categories suggested by Anthony are:

1. Strategic Planning
2. Management Control
3. Operational Control

Essentially, according to Anthony, planning and control activities are so closely interlinked that they make the separation of these activities undesirable and meaningless. Instead, according to him, it makes much more conceptual and practical sense to link together planning and control activities which are similar and intertwined.

Anthony's definitions of strategic planning, management control and operational control are as follows:

Strategic Planning: is the process of deciding on the objectives of the organization, the resources used to obtain these objectives, and the policies that are to govern the acquisition, use and disposition of these resources.

Management Control: is the process by which managers assure that these resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.

Operational Control: is the process of assuring that specific tasks are carried out effectively and efficiently.

Anthony's departure from the traditional concept of separate planning systems and control system is illustrated in the next figure.

It is useful to illustrate the foregoing definitions with some examples. Table 1 gives instances of planning and control activities in different functional areas classified according to these definitions.

Anthony's framework enables us to understand the characteristics of information needed to support the three types of planning and control processes. Table 2 enumerates these characteristics and highlights the substantial differences in information required for strategic planning, management control, and operational control.

Table 1

Planning and Control Activities

Functional Areas	Strategic Planning	Management Control	Operational Control
1.	Location of a new factory	Determining the product mix for a monthly production program	Scheduling specific jobs on specific machines in a shift
2.	Entering the export market	Media planning for advertising expenditures	Planning sales contracts to be made by a sales man in the next week
4.	Raising capital by issuing new shares	Determining maximum levels of credit for customers	Determining what action to take against non-payment by a specific customer
4.	Deciding about changes to be made to organizational structure	Determining who will be promoted to fill a vacant post at middle and lower levels in the organization	Determining who among the workers will be on each shift

Table 2

Information Characteristics

Information Characteristics	Strategic Planning	Management Control	Operational Control
1. Volume	Low	Intermediate	High
2. Level of aggregation	High	Intermediate	Low
3. Frequency of use of a particular type of data	Low	Intermediate	High
4. Currency requirements	Low	Intermediate	High
5. Accuracy	Low	Intermediate	High
6. Scope	Wide	Intermediate	High
7. Source	Significant amount from external source	Mostly internal	Entirely internal
8. Predictability of use *	Low	Fairly high	Very high
9. Validity with use**	High	Intermediate	Low
10 Distance of user(in organizational terms) fro sources within organization	Far	Fairly close	Close

* How far in advance can the information requirements for a decision be stipulated?

** For give decision, how much is the information considered necessary likely to vary from an individual to another

Simon's Framework

Another framework which is useful in structuring our understanding of an MIS is provided by H. Simon. Where as Anthony's framework is concerned with the ***objective*** of the decision-maker, i.e., what the manager is going to decide. Simon's framework examines the ***process*** of decision-making, i.e., how the manager makes decisions.

Simon breaks down the process of making a decision into three stages, these stages are shown below

Simon's Framework

Stage 1*: *Intelligence Here the decision-maker recognizes the problem.

Stage 2*: *Design At this stage, the decision-maker identifies alternative courses of action to solve the problem.

Stage 3*: *Choice At this stage, the decision-maker is concerned with the process by which one of the alternatives generated at stage 2 is chosen and pursued.

With this framework we can distinguish between three major classes of decisions:

i) ***Programmed Decisions*** are decisions in which ***all*** stages are handled by following a pre-set well-defined procedure. These are repetitive and routine decisions which arise often and are capable of being modeled mathematically in their entirety. The classic example would be billing.

ii) ***Non-Programmed Decisions*** are those where ***none*** of the stages is amenable to handling by well-defined, pre-specified procedure. (These decisions are novel and difficult to structure in logical mathematical terms. They have to be treated ***de novo*** whenever they arise.) An example would be the decision to set up a new factory or launch a new line of products.

iii) ***Semi-programmed Decisions*** are those in which at least one and no more than two of the above stages can be handled by a well-defined pre-set procedure. An

example of a well structured intelligence phase would be the diverse kinds of variance-analysis. Thus, comparison with a budget or standard is undertaken in a well-defined way to signal the need for a decision. Subsequent stages of design and choice, however, are not handled by a set of procedures.

iv) ***Programmed and Non-Programmed Decisions*** are also called structured and semi-structured decision situations. In fact, combining Anthony's and Simon's frameworks provides an illustration of different kinds of decision-making situations, as shown in Table 3

Table 3

Degree of structure in Different types of Decisions

Degree of Structure	Operations	Operational Control	Management Control	Strategic Control
Structured	Payroll	Accounts receivable	Budget analysis, short term forecast	
Semi-Structured	Stock accounting Dispatching	Inventory control Production scheduling	Product mix planning Long term forecast	Site location Merger; acquisitions
Ill-Structured	Crime detection	Cash management	Budget formulation	Product planning

Some Implications of Anthony's and Simon's Framework

The foregoing discussion on Anthony's and Simon's framework suggests the following guidelines pertaining to two key aspects of information systems developments:

1. The type of application that should be emphasized
2. The process of designing these systems

The guidelines are discussed below:

i) ***Need for Building Decision Support Systems:*** traditionally, MIS has catered to applications which are structured. It can, however, be argued that it is the semi-structured and ill-structured decisions that take up greater amount of managerial time. Computer applications should therefore be designed to support semi-

structured decision areas. (Now Decision Support system, DSS, now with help of model and data takes care of semi-structured and ill-structured situations)

ii) ***Matching Technology and Application:*** Anthony's framework suggests that an MIS designer should ensure synchronization between available technology and information needs for supporting different types of planning and control decision. For example, it is evident that operational control applications will require technology which can provide query facilities with reasonable response times. On the other hand, strategic planning applications will require technology which can access a variety of external sources, can run optimizing and simulation models, and can be used with friendly software.

iii) ***Tight Coupling Between Applications for Strategic Planning and Operational Control:*** Since the information characteristics required to support strategic planning decision are quite different from operational control, it is not always necessary to wait to build all operational systems before applications for management and strategic level can be developed. In fact, many of the transaction processing systems are large and complex, requiring many years of, effort for development and implementation.

iv) ***Different Roles Of Models in Strategic Vs Operational Systems:*** IN developing systems in order to support strategic planning, an analyst needs to elicit the model from an executive (part of the top management team) and, therefore, needs knowledge and experience of a wide variety of functional areas and models. Prototyping, as a methodology of designing such systems is most appropriate as all the specifications of an application system cannot be identified in advance. Whereas in operational control, the problem is usually generic, several researchers may have built general models to solve such problems. What is required is an adaptation of generalized models to a specific situation. The analyst works largely with technical personnel in a specific function. System design has to be developed through a formal methodology, and technical aspects and efficiency are the important concerns.