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**LESSON 1****Defining Needs**

Decisions are required to be taken in day to day life. No single task in our life can be done without decision making. For every assignment we undertake, there has to be a process of making choices. Whenever we are faced with choices, there is an inevitable need of selecting one particular course of action. Any task can be done in various ways, but doing it simultaneously through all possible alternatives is virtually impossible. This necessitates making a reasonable choice from all the options available.

An example can be taken for a person who wants to go to Islamabad. He can look at following options.

- Use any of the local bus service available
- Go by train
- Travel by air

As you can see, the decision to be made in this situation is faced with the availability of a set of combination of alternatives.

- Every decision we take in daily life requires some sort of information about the alternatives available. For instance, in the above example certain factors need to be considered before taking a decision.
  - How urgent it is to reach to Islamabad
  - How much time is available to accommodate travelling, since each mode of travelling will take different time to reach at the same destination?
  - Whether bookings are available for the desired day and time.
  - Is there any possibility of cancellation of booking or flight or bus service.
  - Which bus service or airline to chose from, since various airlines and bus services are having travelling facilities to Islamabad.
- Without the availability of relevant information, we may take a decision which is wrong or not to our benefit. For instance if the person does not have complete knowledge of facts he might not be able to take the right decision.
- Similar is the case with business. Businesses are run by organizations which are in-fact a group of people. As individuals have choices to choose from, organizations also face various alternatives in day to day operations, Decisions are made by individuals from the management.

**1.1 Need for information**

Information is required in day to day decision making. Without the availability of right quantity of information at the right time, the process of decision making is highly affected. For this reason various sources of information are used to extract information. Some of these are:

- Newspapers
- Internet
- Marketing Brochures
- Friends & Relatives

**1.2 Sources of Information**

Sources of information are generally categorized as primary, secondary or tertiary depending on their originality and their proximity to the source or origin. For example, initially, findings might be communicated informally by email and then presented at meetings before being formally published as a

primary source. Once published, they will then be indexed in a bibliographic database, and repackaged and commented upon by others in secondary sources.

The designations of primary, secondary and tertiary differ between disciplines or subjects, particularly between what can generally be defined as the sciences and the humanities. For example,

- The historian's primary sources are the poems, stories, and films of the era under study.
- The research scientist's primary sources are the results of laboratory tests and the medical records of patients treated with the drug.

Written information can be divided into several types.

- Primary Sources
- Secondary Sources
- Tertiary Sources

### 1.3 Primary Sources

Some definitions of primary sources:

1. Primary sources are original materials on which other research is based
2. They are usually the first formal appearance of results in the print or electronic literature (for example, the first publication of the results of scientific investigations is a primary source.)
3. They present information in its original form, neither interpreted nor condensed nor evaluated by other writers.
4. They are from the time period (for example, something written close to when the event actually occurred.
5. Primary sources present original thinking and report on discoveries or share new information.

Some examples of primary sources:

1. Scientific journal articles reporting experimental research results
2. Proceedings of Meetings, Conferences.
3. Technical reports
4. Dissertations or theses (may also be secondary)
5. Patents
6. Sets of data, such as census statistics
7. Works of literature (such as poems and fiction)
8. Diaries
9. Autobiographies
10. Interviews, surveys and fieldwork
11. Letters and correspondence
12. Speeches
13. Newspaper articles (may also be secondary)
14. Government documents
15. Photographs and works of art
16. Original documents (such as birth certificate or trial transcripts)
17. Internet communications on email, and newsgroups

### 1.4 Secondary Sources

Secondary sources are less easily defined than primary sources. What some define as a secondary source, others define as a tertiary source. Nor is it always easy to distinguish primary from secondary sources. For example,

- A newspaper article is a primary source if it reports events, but a secondary source if it analyses and comments on those events.

- In science, secondary sources are those which simplify the process of finding and evaluating the primary literature. They tend to be works which repackage, reorganize, reinterpret, summarize, index or otherwise "add value" to the new information reported in the primary literature.

Some Definitions of Secondary Sources:

1. Describe, interpret, analyze and evaluate the primary sources
2. Comment on and discuss the evidence provided by primary sources
3. Are works which are written after the fact with the benefit of hindsight?

Some examples of secondary sources:

1. bibliographies (may also be tertiary)
2. biographical works
3. commentaries
4. dictionaries and encyclopedias (may also be tertiary)
5. dissertations or theses (more usually primary)
6. handbooks and data compilations (may also be tertiary)
7. history
8. indexing and abstracting tools used to locate primary & secondary sources (may also be tertiary)
9. journal articles, particularly in disciplines other than science (may also be primary)
10. newspaper and popular magazine articles (may also be primary)
11. review articles and literature reviews
12. textbooks (may also be tertiary)

### 1.5 Tertiary Sources

This is the most problematic category of all.

Some Definitions of Tertiary Sources:

1. Works which list primary and secondary resources in a specific subject area
2. Materials in which the information from secondary sources has been "digested" - reformatted and condensed, to put it into a convenient, easy-to-read form.
3. Sources which are once removed in time from secondary sources

Some examples of tertiary sources:

1. Almanacs and fact books
2. Bibliographies (may also be secondary)
3. Chronologies
4. Dictionaries and encyclopedias (may also be secondary)
5. Directories
6. Guidebooks, manuals etc
7. Handbooks and data compilations (may also be secondary)
8. Indexing and abstracting tools used to locate primary & secondary sources (may also be secondary)
9. Textbooks (may also be secondary)

### 1.6 Changing Needs

When needs change, requirements for information change. Information needs of users are changing as a result of changes in the availability of information content in electronic form. Changing needs of the users determine the nature of the physical form in which information content is currently being made available for users' access and use in electronic information environments.

Information needs:

- Each user has a different type of information need depending on what he's trying to find and why he's trying to find it. If we can determine the most common information needs a site's users have, we can select the few best architectural components to address those information needs.
- For example, if a user is designing a staff directory, we can assume that most users are searching for items they already have information about. The user already knows exactly what he's looking for, he has the terms necessary to articulate that need, and he knows that the staff directory exists and that it's the right place to look. This type of information need would be best served by employing a search system. So resources should be invested in developing and maintaining a comprehensive search system.
- Another example: the site's users are often new or infrequent visitors. And perhaps the site's content scope is changing frequently. So the information architecture probably should be very good at supporting orientation. If that's the case, invest in a table of contents or some other IA component that's effective at orienting users and communicating what content is contained in the site.

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**LESSON 2****Areas Covered**

- Introduction to Organization and
- Role of Information in Organization, Management & Strategy

**What is Organization?**

Basically, an organization is group of people organized to accomplish an overall goal. Organizations can range in size from two people to hundreds of thousands -- some people might argue that organizations are even larger. Organizations have an overall goal (or mission) which is usually subdivided into various other goals (often called strategic goals) that, in total, will achieve the overall goal of the organization.

A structure through which individuals cooperate systematically to conduct business. It is a collection of people working under predefined rules and regulations to obtain a set of objectives. It is a stable formal social structure. It takes resources from the environment and processes them to produce outputs.

"Organization" is understood as planned, coordinated and purposeful action of human beings in order to construct or compile a common tangible or intangible product or service. This action is usually framed by formal membership and form (institutional rules). Organization is a permanent arrangement of elements. These elements and their actions are determined by rules so that a certain task can be fulfilled through a system of coordinated division of labour.

An organization is defined by the elements that are part of it (who belongs to the organization and who does not?), its communication (which elements communicate and how do they communicate?), and its rules of action compared to outside events (what causes an organization to act as a collective actor?).

By coordinated and planned cooperation of the elements, the organization is able to solve tasks that lie beyond the abilities of the single elements. The price paid by the elements is the limitation of the degrees of freedom of the elements.

**2.1 Need for Organization**

As the volume of business expands, the need for disciplined approach to managing operations is required. This results in formulation of organizational structures. The organizational structures are formulated in order to efficiently manage the business operations. This makes the structures a relative term to explain and define. Organizations have the freedom to chose / evolve the structures which best fits the management needs.

An organization's primary aim is to achieve the objective that it lays down for itself and in pursuance of which various actions are undertaken. Such objective could be to generate profits or specific socio-economic cultural objectives. What ever the objectives are, these activities interrelate and their occurrence generate a series of events which helps organization achieve its goal. The regular and timely recording of information is critical to the proper management of business operations.

**2.2 Data vs. Information**

Data represents facts of any kind. In the process of recording important particulars of any event, it is the discretion of the management, what should be recorded and how it should be presented. However when this data is processed or reformatted, it becomes information. Information is a subset of data which adds to the knowledge.

Information should be relevant so that it is valuable for the recipient. Although the processed form of information is more valuable than the raw form of data, still all information is not of value for every one. Distributing common information to every one may result in waste of time and confusion. Irrelevant information has no value.

### 2.3 Information Quality Checklist

The information can also be ranked in accordance with the qualities it has in it. The experts have devised certain criteria to evaluate the quality of information. These are stated below:

1. Is it clear who has written the information?
2. Who is the author? Is it an organization or an individual person? Is there a way to contact them?
3. Are the aims of the information clear?
4. What are the aims of the information? What is it for? Who is it for? Does the information achieve its aims?
5. Does the information do what it says it will? Is the information relevant to me?

List five things to find out from the information.

- .....
- .....
- .....
- .....
- .....

1. Can the information be checked?  
Is the author qualified to write the information? Has anyone else said the same things anywhere else? Is there any way of checking this out? If the information is new, is there any proof?
2. When was the information produced?  
Is it up to date? Can you check to see if the information is up to date?
3. Is the information biased in any way?  
Has the information got a particular reason for wanting you to think in a particular way? Is it a balanced view or does it only give one opinion?
4. Does the information tell you about choices open to you?  
Does the information give you advice? Does it tell you about other ideas?

### 2.4 Organization & Information Requirements

Organizations have various attributes which distinguish them from each other. No two organizations are similar in all respects. There have to have certain distinctive lines keeping them unique from each other. Information requirements keep varying in accordance with

- Size of organization
- Its structure
- The Culture it follows
- Decision Making Structures
- Interested parties both internal and external

An organization should consider the above mentioned requirements while devising a system which tailors for specific information needs.



**LESSON 3****Organization & Information Requirements**

Organizations have various attributes which distinguish them from each other. No two organizations are similar in all respects. There have to have certain distinctive lines keeping them unique from each other. Information requirements keep varying in accordance with

- Size of organization
- Its structure
- The Culture it follows
- Decision Making Structures
- Interested parties both internal and external

An organization should consider the above mentioned requirements while devising a system which tailors for specific information needs.

**3.1 Size of the Organization and Information Requirements****3.1.1 Small Organizations**

Small organizations usually have simple management structure. The need invariably grows from the limited scope and operations of management. Since tasks to be handled are usually limited and manageable, hence need for introducing more levels is not required. Since operations can be managed at the top level by one or two members of the senior management, officers from the lower level of management are not usually involved in decision making. Hence the final decisions are centrally taken.

Information flows and formats are easy to define and change. Since information requirements are not extensive, number of documents prepared and generated will also be few in number. Mostly the interested party itself is running the business, hence the management is centralised to few people.

**Examples of Information requirements of Small Organizations**

- Day to day transactions
- Daily Sale
- Cash management
- Receivables and Payables

**3.1.2 Medium Sized Organizations**

Medium Sized organizations are normally a family ownership run by brothers, father-son. There are many organizations existing these days which are being run by the family members. The prime concern may be the trust already fostered among the blood relations but this might give rise to informal relationship among them. Since all critical managerial positions are usually controlled by the family members, information is structured only to the extent of external reporting. The level of reporting that could meet the information needs of the clients is best suited for such an organization.

Medium sized organizations are run under direct supervision of the family members which rarely extends to segregation of duties and delegation of authority.

- Centralized decision making
- Above mentioned structure rarely changes with complexity and dynamism of environments.

### Information Requirements of Medium Sized Organizations

As size of the organization increases, the importance of planning for information also increases. The planning on long-term basis also helps in monitoring of information against planning

#### 3.1.3 Large Organizations

Usually such organizations are characterized by large scale of operations. Various criteria can be used for this purpose.

- Number of employees
- Amount of turnover
- Number of branches
- Profit size
- Value of assets
- Number of businesses the organization is working in

With such large size of organizations, management structure needs to be multi- tiered for efficient and strong control. This leads to formulation of many departments, management levels, designations, promotional opportunities and salary increments.

#### Example

##### Public companies

### Information Requirements of Large Organizations

With such a large structure, it is inevitable that the detailed planning should be made for proper management control, for both short term and long term.

Performance measurement against plans / targets

### Nature of the Business and Information Requirements

- Manufacturing Sector
- Service Sector
- Trading Sector

#### 1. Manufacturing Sector

Manufacturing process involves more than one sub-processes, detailed information is required before transferring materials for warehousing, manufacturing and sale to final consumer.

##### Information Requirements of Manufacturing Sector

Management is concerned with the day to day costs, production targets, quality of the product, delivery schedules, etc.

#### 2. Service Sector

Final product is intangible, so information is critical at various steps, e.g. preparation, delivery and customer

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satisfaction. Quality maintenance is an issue which requires structured reporting.

#### **Information requirements of Service Sector**

- Quality of service provided.
- Mode of delivery
- Customer Satisfaction
- Time Scheduling
- Resource Management

#### **Trading Sector**

Monitoring requires information for each product, e.g.

- Customer profiles
- Customer Comments
- Volume of sales
- Profitability
- Stock movements Manufacturing/Procurement Cycle
- Market needs

### **3.2 Nature of Business & Information Requirements**

As the size of organization and scale of operations change, information requirements need to be adjusted for better monitoring to keeping things in control.

**LESSON 4****Unique Attributes of Organization**

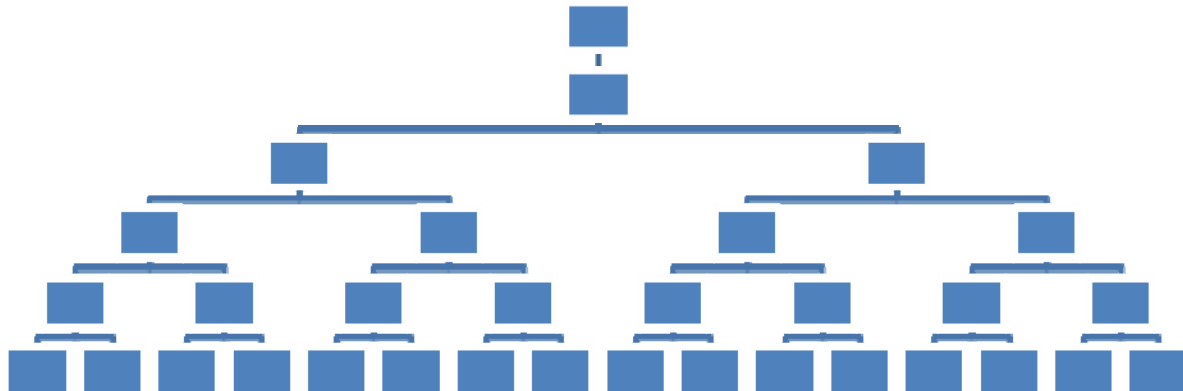
Organizations can be distinguished on the basis of various criteria. These are as follows.

- Organizational structure
- Culture of the Organizations
- Management Style
- Decision Making Style

**4.1 Organizational Structure Pyramid/Tall/Hierarchical****4.1.1 Hierarchical organization**

A **hierarchical organization** is organization structured in a way such that every entity in the organization, except one, is subordinate to a single other entity. This is the dominant mode of organization among large organizations; most corporations and governments are hierarchical organizations

- Low number of subordinates per supervisor
- Long chain of command
- Greater number of levels

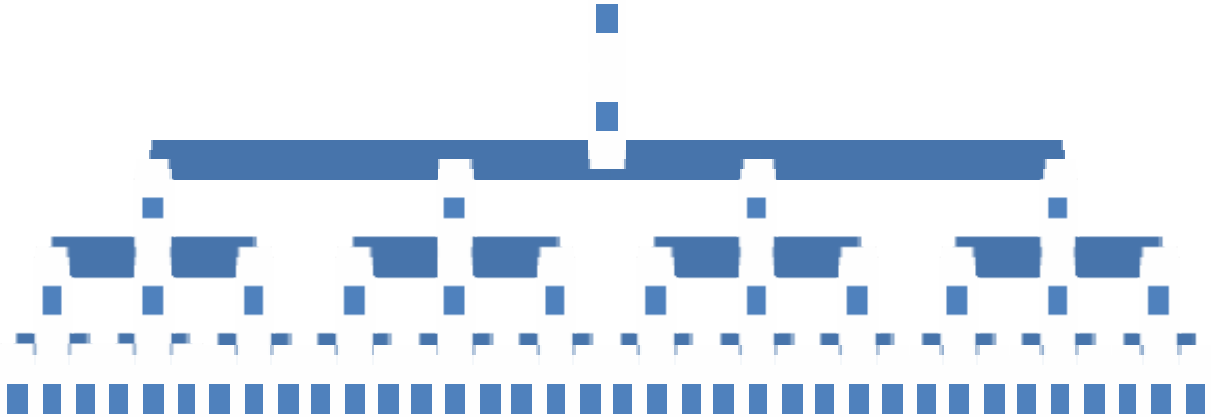
**4.1.2 Organizational Structure****Flat**

Flat organization refers to an organizational structure with few or no levels of intervening management between staff and managers. The idea is that well-trained workers will be more productive when they are more directly involved in the decision making process, rather than closely supervised by many layers of management.

This structure is generally possible only in smaller organizations or individual units within larger organizations. When they reach a critical size, organizations can retain a streamlined structure but cannot keep a completely flat manager-to-staff relationship without impacting productivity. Certain financial responsibilities may also require a more traditional structure. Some theorize that flat organizations become more traditionally hierarchical when they begin to be geared towards productivity.

Following are the characteristics of a flat organization.

- High number of subordinates per supervisor
- Short of chain of command
- Less number of levels
- Eliminates middle level managers
- Decentralizes authority to low level managers



### 4.1.3 Culture of the Organization

Organizational culture is the specific collection of values and norms that are shared by people and groups in an organization and that control the way they interact with each other and with stakeholders outside the organization. Organizational values are beliefs and ideas about what kinds of goals members of an organization should pursue and ideas about the appropriate kinds or standards of behavior organizational members should use to achieve these goals. From organizational values develop organizational norms, guidelines or expectations that prescribe appropriate kinds of behavior by employees in particular situations and control the behavior of organizational members towards one another.

Culture is set of Fundamental Assumptions that exist and grow with the organization. It's not publicly announced but spoken about within the organization. It is a combination of implicit values that keep the organization together. It is essential that the employees understand the culture-What drives the organization.

## 4.2 Management Styles

- Authoritative
- Participative
- Mixed

### 4.2.1 Authoritative

- An Autocratic or authoritarian manager makes all the decisions, keeping the information and decision making among the senior management. Objectives and tasks are set and the workforce is expected to do exactly as required. The communication involved with this method is mainly downward, from the leader to the sub-ordinate critics such as Elton Mayo have argued that this method can lead to a decrease in motivation from the employee's point of view. The main advantage of this style is that the direction of the business will remain constant, and the decisions will all be similar, this in turn can project an image of a confident, well managed business. On the

other hand, subordinates may become highly dependent upon the leaders and supervision may be needed. Decisions are taken centrally by the senior management themselves and are enforced at all levels.

#### 4.2.2 Participative

In a **Democratic** style, the manager allows the employees to take part in decision-making; therefore everything is agreed by the majority. The communication is extensive in both directions (from subordinates to leaders and vice-versa). This style can be particularly useful when complex decisions need to be made that require a range of specialist skills: for example, when a new computerized system needs to be put in place and the upper management of the business is computer-illiterate. From the overall business's point of view, job satisfaction and quality of work will improve. However, the decision-making process is severely slowed down, and the need of a consensus may avoid taking the 'best' decision for the business.

#### 4.2.3 Mixed

The approach is a combination of both authoritative and participative style. Input from employees is taken and respected, final decision is taken by the senior management keeping in view the views given by the employees.

#### 4.3 Decision Making Approach

- Structured

Procedures are predefined for solving routine repetitive problems

- Non-structured

When problems require individual judgment, evaluation and insight varying on case-to-case basis

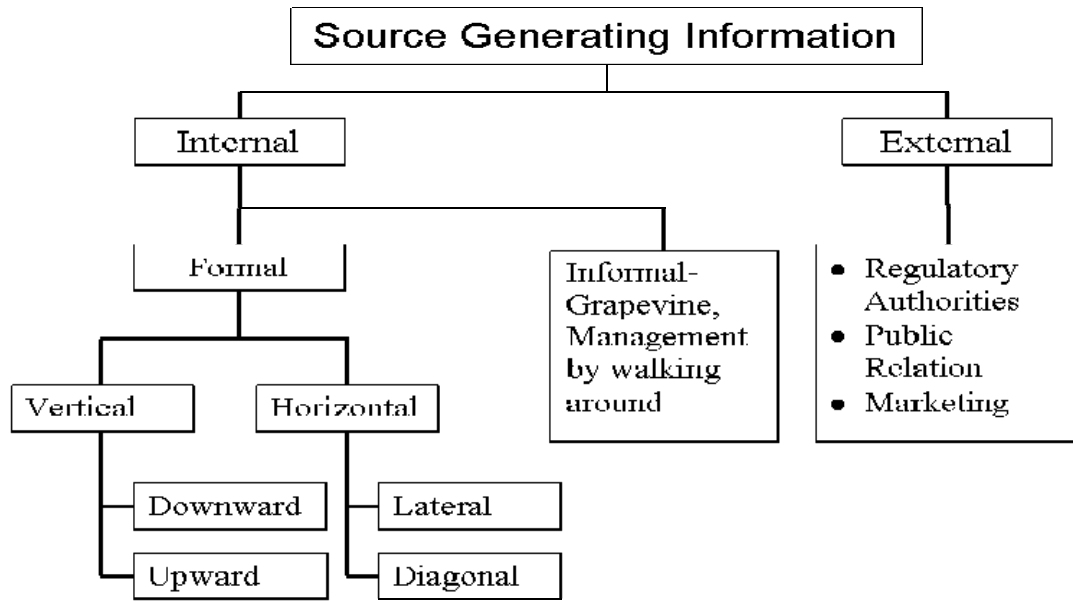
#### 4.4 Sources of information in Organizations

There can be sources of information both internal and external to the organization. Following is a list of important sources.

Internal	External
<ul style="list-style-type: none"> <li>• Staff meetings</li> <li>• Formal reporting systems</li> <li>• Project proposals</li> <li>• Research results</li> <li>• Employee Surveys</li> <li>• Persuasive interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Loan applications</li> <li>• Purchasing agreements</li> <li>• Advertisement</li> <li>• Distribution Contracts</li> </ul>

Table 4.1

#### 4.5 Direction of Information Flow



### Ideal Information Network in an Organization

- Periodically updated / continuously updated – the information should be updated so that whenever accessed, the user should be fully informed.
- Efficient Processing – data should not be kept unprocessed for long. Timely processing helps in effective decision making.
- Value driven – the information kept in a computerised system should add value to the user's knowledge.
- Audience Centred – every one should receive that part of information that is relevant to the user.

### Conclusion

- Availability of timely and accurate information helps in proper decision making and meeting the organizational goals.
- Information should be tailored in accordance with the organization's culture and structure.

**LESSON 5****Effect of Changes in Environment**

**Business Environment** is defined as “all elements that exist outside the boundary of the business (Organization) and have the potential to affect all or part of the organization

**5.1 Elements of Environment**

It is a collective reference made to the following factors

- Legal
- Ethics
- Economic
- Social
- Technological

**5.1.1 Legal**

Rules and Policies and Legal Laws established by government effect the Business Environment  
Change in tariff rate may increase or decrease operation of the business.

**Laws imposed to regulate business**

- **Companies Ordinance 1984:** It is the Law under which a company performs its business activities.
- **Import Export regulations:** Government announces Import & Export Policy at the time of annual budget. Goods which are manufactured in the country is encouraged by levying high duties on imported goods and encouraged export.
- **International trade agreements e.g.**
- European Union (EU): A number of regional agreements have been signed by the EC and Pakistan such as:
- **World Trade Organization (WTO):** The World Trade Organization (WTO) is an international, multilateral organization, which was created as a result of the Uruguay round of discussion in 1994 to harmonic world trade. Various agreements between member countries has resulted in lowering import tariffs, bringing down protective trade barriers setting up anti dumping procedures and settlement methods. However it has failed to achieve any headway in getting member countries to eliminate subsidies provided t other agriculture sector by nearly all member states. As a result the WTO is currently faced with the threat of failure. The WTO trade and services arrangements effectively replaced the general Agreement on Trade Tariffs (GATT).
- **South Asia Free Trade Agreement (SAFTA):** The South Asia Free Trade Agreement (SAFTA) was agreed to among the seven South Asia countries that form the South Asian Association for Regional Cooperation (SAARC): Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. SAFTA came into effect on 1 January 2006, with the aim of reducing tariffs for intraregional trade among the seven SAARC members. Pakistan and India are to complete implementation by 2012, Sri Lanka by 2013 and Bangladesh, Bhutan, Maldives and Nepal by 2015.

**5.1.2 Economic**

To make a profit without raising prices, the company turned to making simpler furniture designs and increasing its technological efficiency. Developments within the economy which may affect the business environment

- Inflation rates:



Inflation rate is an indicator of economic growth of a country. Inflation rate in Pakistan is 6.1 percent.

- Bank Interest Rate:
- Availability of capital in the capital, in the capital/money markets  
Capital/ Money market is access able for an Entrepreneur who starts business with his savings and with equity from capital/ money markets on favourable interest rate.
- Foreign Exchange rates between two currencies specifies how much one currency is worth in terms of the other. For example an exchange rate of 120 Japanese Yen to the Dollar means that ¥120 is worth the same as \$1. An exchange rate is also known as a foreign exchange rate, or FX rate.
- Consumer spending: Patterns of spending give a good picture of consumer behavior, showing various social, economic and marketplace trends at the household level. Consumer behavior is also revealed by decisions not to spend. For example, if enough people are involved, boycotting a company or a product (or even the threat of it) can be an effective way for consumers to make their opinions felt. Boycotting has brought about a number of changes in companies' social and business behavior, such as the development of certain voluntary codes. In fact, any consumer decision to stop buying a product can ultimately and substantially influence corporate strategies. New trends in the fast food industry's offerings are one example of the marketplace's responsiveness to consumers' willingness to walk away.
- Employment opportunities: Information Technology offers a variety of jobs. In the present era information technology is used in every field like, Banking, Medicine, Laboratories, Textiles, Scientific research etc.

### 5.1.3 Social

Changing demographic and social needs are impacting the business world. Corporations must address the issues pertaining to the changing needs and requirements to retain and enhance market positions. The internationalization of business brings greater pressure as variety of cultures, customs and practices need to be taken into account whilst conducting business. The employees are today more aware of their social needs whether these related to the work environment, behaviour, children education health, compensation or work hours. National interests and culture have to be considered while offering a particular product or service or exploiting the natural resources of a particular country.

This includes

- Demographic changes leading to changes in needs:
- Age Composition:
- Gender:
- Occupations
- Social norms
- Changing attitudes and perceptions
- Lifestyle
- Prosperity
- Availability of foreign brands/products

### 5.1.4 Technological

The most overwhelming change in the technology sector is rapid expansion of the internet as a place for doing business. The World Wide Web and other advances in information technology have changed the whole face of business.

- **To produce desired products,** It is necessary for a business to stay in market to produce the goods according to the desire of the consumers. Due to the change in technology day by day innovations has been taken place. Competitors by using the technology reducing the cost and improving the quality.
- **To solve a problem,:** There are varieties of problems facing a business in the contemporary world. Information technology is being used to overcome the business issues like, Marketing, Brand of the product, Quality of the product, Cost control, Organizational internal and external issues etc.
- **To fulfill a need:** Information system must fulfill the needs of the business. An organization needs information of its customers, product, market trend, employee information, payroll, manufacturing cost etc. In time information helps the organization launch its product in time to maximize profit.
- The way products are developed and offered to the customers keeps changing thus affecting the business environment in which the organization works

### Pressures/Challenges

The changes in business environment pose challenges on the organizations which need to be responded to. Following are the pressures

- **Competition for cheaper factors of production**  
Cheaper factor of production is a challenge for the survival of a company in competitive market. Factors of production are basic elements of reducing manufacturing cost. Cheap and skilled labour Availability of raw material, infrastructure.
- **Changing workforces**  
Lack of availability of skilled and experience force in market is a challenge for an organization. Continue change in work force is harmful for an organization.
- **Enhanced customer quality**  
For the enhancement customer quality consistently provide innovative products, with outstanding customer service and help their customers achieve operational excellence. An Organization ability to provide outstanding product quality, service support, and their ability to enhance product quality, achieve shorter delivery times, reduce scrap, rework and reduced life cycle costs
- **Technological Obsolescence**  
Technological obsolescence is the result of the evolution of technology: as newer technologies appear, older ones cease to be used. For example, new media for storing digital information rapidly replace older media and reading devices for these older media become no longer available. Newer versions of software constantly render older versions obsolete and the hardware required by this software also changes over time. Consequently, information which relies on obsolete technologies becomes inaccessible. Currently, it seems that the lifetime of digital storage media generally exceeds the life of the technology that supports it.
- **Information overload**  
In recent decades, technology has so enhanced our ability to gather data that the sheer volume of data now outstrips our capacity to deal with it. Informatics is taking this seemingly unmanageable flood of data and transforming it into information that helps solve key problems in fields like medicine, genetics, chemistry, Internet security and engineering

### 5.1.5 Corporate social responsibility

Corporate social responsibility (CSR) is an expression used to describe what some see as a company's obligation to be sensitive to the needs of not only all of the stakeholders in its business operations but more importantly the community at large. It has been defined as:

“The continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as the local community and society as large.”

Businesses are now seen as partners of the communities in which they may be located rather than simply as a profit making set up serving the needs of their stake holders.

Corporate social responsibility incorporates the principle of sustainable development along with “triple bottom line reporting” reflecting not only financial results but also social and environmental impact of the business.

The CSR may be looked after by an independent department reporting directly to the board or may be a part of the business development or human resource department.

### 5.1.6 Ethics

Corporate or business ethics have attained vital importance in today's world. The issue not only addresses matters such as how those charged with governance and managing businesses take decisions but importantly the employee conduct and behaviour the corporations responsibility in terms of its image, product, branding, trade, business practices and compliance with not only national and regional but also international laws.

The huge number of financial and corporate scandals has moved the regulators to take suitable action. In Pakistan all listed companies particularly are required to follow the code of corporate governance.

**LESSON 6****Systems vs. Procedures**

Procedure is a defined set of instructions aimed at describing how to proceed in achieving a pre-defined milestone/target. Systems have collection of predefined procedures related to each other in a sequenced logical manner in order to collectively achieve the desired results. The system & procedures in all kinds of environment are subject to internal controls and checks that are necessary to ensure the effectiveness of the same.

**6.1 Purpose of Systems & Procedures**

The basic purpose behind setting up systems and procedures is to make available information when required. But when procedures are organized in a logical manner to form systems, the value of information as an output of a system enhances. When technology is added to the system, scope of a system changes to include hardware, software and designs linked together in accordance with the procedures contained in that system to give a purposeful architecture.

**6.2 Data & Information**

Before defining what information systems are? I would like to once again differentiate between data and information. Data represents facts of any kind. Information is the processed form of data being verified and substantiated from various sources.

**Example**

100,000 is a figure which by itself does not add to the knowledge

But

When we say 100,000 sales orders, it does add to our knowledge, hence is information.

**6.3 Data & Information**

Generation of relevant information is the objective of every information system. Now we would move fwd with the definition & necessity of information systems.

**What are 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.

**6.4 Manual Vs Computerised Information Systems**

As advancement was made in every field of life, manual information systems were converted to computerized systems. In manual environment, the concept of transformation was difficult to apply, since input of data into records was by itself the output which also included simple computations. Concept of control mechanism grew stronger as computerized information systems emerged. Now the concept of Information system exists with the usage and benefits of Computers as an inevitable part.

**6.5 What is Computer based Information System (CBIS)?**

CBIS is an Information System that uses computer & telecommunications technology to perform its intended tasks. In CBIS, Information technology (IT) becomes a subset of the Information system.

The terms **Information System (IS)** and **Computer Based Information System (CBIS)** with the extensive use of computers in almost every field renders it inevitable to think of an IS as CBIS.

### **6.6 Why Information Systems?**

In modern age, there has been felt a growing need for the use of information systems. Let's take a look at what factors increased the importance of efficient information systems.

### **6.7 Emerging Global Economies**

High level of foreign trade has resulted in imports and exports which require inter linkage for smooth coordination. Core business functions (manufacturing, finance and customer support) have been distributed in different countries. Coordination

### **6.8 Transforming Industrial Economies**

Industrial economies have started merging as knowledge-and-information-based economies. Manufacturing activities being shifted to low wage countries. More opportunities are available in education, health care, banks, insurance firms and law firms. More knowledge and information intense products are being created. Higher commitment expected from customer e.g. overnight package delivery, world wide reservation systems.

### **6.9 Transformed Business Enterprise**

The structure of business enterprise have also changed, initially the organizations used to be Hierarchical, Centralized, Structured following a Fixed Set of SOP's. However, now the organizations are moving towards more Flatter, Decentralized and Flexible structures. Information Technology makes it convenient and efficient to promote this new culture.

### **6.10 Emerging Digital Firms**

Firms where all significant business process and relationships with customers and suppliers and employees are digitally enabled and key corporate assets are managed through digital firms. This results in rapid response with more flexibility to survive and getting more global.

**LESSON 7****Types of Systems****7.1 What are Systems?**

A system is a group of elements that are integrated with the common purpose of achieving an objective.

**Example**

Purchase & Sales System

**7.2 Components of a system**

Following are the important components of the system.

- Input elements  
Raw Data input to the computer system
- Process  
Computation, analysis, application of any model
- Output elements  
Results of computation or analysis
- Control mechanism  
Comparison of actual with expected
- Feedback system  
Corrective action
- Objectives  
Expected/Ideal output

**7.3 Types of Systems****7.3.1 Open-Loop System**

The determinant factor in an open loop system is that the information from the system not used for control purpose. This is done by using the output to generate feed back for control purposes.

- The output is not coupled to the input for measurement.
- Hence the components of open loop system do not include control and feedback mechanism due to non-existence of internally defined objectives. That is,
  - Input
  - Process
  - Output

**Example**

An information system that automatically generates report on regular basis and are not used to monitor input or activities.

**7.3.2 Closed Loop System**

- Is a system where part of the output is fed back to the system to initiate control to change Either the activities of the system or input of the system
- Has the ability to control the output due to existence of

- Control Mechanism
- Feedback System
- Objectives

**Example**

Budgetary control system in a company by which

- The results are communicated through feedback system
- Results are compared with the objectives/budget through controls mechanism

**7.3.3 Open Systems**

- A system that is connected to its environment by means of resource flows is called an open system.
- The environment exerts influence on the system and the system also influences the environment.

**Example**

- Business is a system where management decisions are influenced by or have an influence on suppliers, customers, society as a whole.
- Computerized system of a manufacturing entity, that takes influence from the society.

**7.3.4 Closed Systems**

- A system that is not connected with its environment
- Neither environment exerts any influence on the system nor does system influence the environment.

**Examples**

- An information system designed to control data in a research laboratory is a closed system.
- An information system designed to record highly sensitive information is a closed system so as
- To accept no input for amendment
- To give no output for disclosure

**Objective of Having Systems**

- To subject a predefined amount of input (tangible, intangible) to predefined set of instructions in order to achieve an expected quality and amount of output.
- Effective and efficient utilization of resources

**7.4 Level of Planning**

There are three levels

- Strategic
- Tactical / Functional
- Operational

**Strategic Planning**

Is the formulation, evaluation and selection of strategies for the purpose of preparing a long-term plan of action to attain objectives.

**Tactical/Functional Planning**

Is the process by which managers assure the resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives?

**Operational Planning**

It is the process of assuring that the specific tasks are being carried out efficiently and effectively.

•

**Functional Strategic Planning**

Commitment by Firm's executives requires strategic planning for the following functional areas.

- Manufacturing resources
- Financial resources
- Human resources
- Marketing Resources
- Information Resources

**7.5 Strategic Planning for Information Resources (SPIR)**

When a firm embraces SPIR the strategic plans for information services and the firm are developed concurrently. Business strategy and IT related strategy should go hand in hand. The IT related strategy should be driven by business strategy and the former should support the achievement what's being mentioned in the latter. Any inconsistencies or deviations between the two should be removed and avoided. The investment in IT is costly and inflexible. Such investment is also monitored and controlled by the IT strategy. Hence any investment not supporting the business strategy would be futile.

**Example****Business strategy**

Modify inventory system to fulfill orders quickly through relocating system to warehouse and efficient shelf picking.

**IS strategy**

To identify information resources needed for the successful implementation of business strategy.

**Information Value Chain**

Raw information is transformed at various points and value is added before passing onwards. Every step of processing should make the information stored more valuable.

**Example**

When customer order received, data punched into computerized system, which updates order list, customer records and store room records. When order has been served, customer orders are filed into records.



**LESSON 8****What are Systems?**

A system is a group of elements that are integrated with the common purpose of achieving an objective. Organization having common goal for the achievement are functionally interactive units. All systems have inputs, outputs, and feedback, and maintain a basic level of equilibrium. For example, in the human body the heart functions to support the circulatory system, which is vital to the survival of the entire body.

**Example****Purchase System**

A simple example can be given of a purchase and sales system. In a typical purchase system information related to purchase of materials is kept, for instance,

- Orders for the purchase of various materials
- Status of deliveries received against specific orders
- Changes in the order quantity, time, day or other information
- Quality inspection reports and whether they need to be communicated to the supplier
- Updated status report of stock
- Issues made out of the stock

All and more of information is required to be linked and provided in an organized way.

**8.1 Components of a system**

Every system comprises of basic components which in a coordination formulate a system. These are as follows.

- **Input elements**  
The information entered into a system. For instance raw data input to the computer system.
- **Process**  
Any specific treatment defined in the system to be performed on the data entered into the system, for instance, computation, analysis, application of any model.
- **Output elements**  
The results given by the system after the process has been performed on the data being input to the system.
- **Control mechanism**  
Every system is expected to generate some sort of standardized output. Hence actual output needs to be compared with what it is supposed to generate. This comparison of actual with expected output is done with the help of control mechanism.
- **Feedback system**  
Once the control mechanism has been devised, it needs to a reporting mechanism, which should respond with a corrective action, if required.
- **Objectives**  
We just mentioned that a control mechanism should compare actual output with expected/Ideal output. But before this is being done, there needs to be a list of specific objectives which define expected output.

**8.2 Types of Systems**

- Open System

- Closed System
- Open loop System
- Closed loop system

## Systems

Every system that is constructed is expected to generate some sort of output based upon the information fed into it. The output is expected to be used to evaluate system performance – whether the output complies with stated objectives of the system and generate instruction to change input to improve/change output. In this manner the system helps in establishing/re-defining:

- Objectives-What needs to be achieved
- Control Mechanism – Output Vs. Expected
- Feed back – Corrective Action

## Types of System

The first issue therefore is to define the environment where the systems are required to be operated and the second issue is to describe the system itself. Let us look at some examples.

- Book Store  
Open system – any and everyone is allowed to view and purchase the books available.
- School Library  
Closed system – entry to the library is restricted to the students only.

Thus in an open system we refer to the connection it has to its environment by means of inflows and outflows of resources between the environment and organization. When we refer to a closed system we talk of a system that is dependant on internal resources and data for decision making rather than external environment.

- **Example:**

**THE BOOK STORE may have:**

- An Open loop – if customer feedback is not taken for the purchase of books for the store OR
- A Closed loop – if Customer feedback/interest is taken into account when selecting the books to be purchased and displayed in the store.

**The SCHOOL LIBRARY may have:**

- An Open loop – if students' feedback is not taken for the kind of books to be stocked in the library.
- A Closed loop – if students' interest is the determinant criteria for the kind of books that are to be carried out in the library.

For many years the computer profession and business have formed a partnership which operated under what can be termed as open-loop architecture. Advances in data warehouse technology and the Internet have enabled what can be termed as closed-loop architecture for the comprehensive usage in business of computers.

## 8.3 Open Loop System

In open-loop architecture, business decisions made by management have an impact in the marketplace,

and the impact of that decision is measured only indirectly by the company's computer systems. For example, if a bank decides to raise interest rates, the results of the decision impact the lenders, the present and future borrowers. The results are measured indirectly as loan applications increase or decrease. Another example can be given of an insurance company which decides to offer a new kind of insurance. The market expresses its approval or disapproval by buying or not buying the new insurance offering.

By measuring the response within the open-loop architecture, the marketplace response is quantified. In every case of an open-loop business / computer architecture, the impact of the corporate decision is felt indirectly through the reactions of the marketplace and is measured indirectly by the computer systems that are used by the company. Such interactions between the decision process and the measurement of the effectiveness of the decisions made can be called an open-loop decision environment. In an open-loop decision environment, there is no direct relationship between a corporate decision and a consequence, although there certainly is an indirect relationship. A big challenge in an open-loop business/computer architecture is that of measuring the consequences of the decisions made by the company. This is due to the fact is that there is a time lag between the time the corporate decision has been made and the time when the marketplace gives its verdict on the decision.

Another difficulty is that in an open-loop environment, there may be factors other than the decision made by corporate management affecting the results achieved in the marketplace. Trying to measure precisely the effect of management's decisions is an imprecise science at best. Trying to quantify the impact of management's decisions in an open-loop environment is difficult in every case. For Example take the case of a soft-drinks company. It has no idea of the identity of its ultimate consumer. They deal through distributors who for them is the final customer and not the man on the street who actually buys the soft drink from the retailer. The feedback on the product, pricing or any other matter related to the product would be provided by the distributor and not the final consumer. Open-loop decision making is for mass marketing companies. Companies that really don't know who their customers are employ open-loop decision making.

#### 8.4 Closed Loop System

Feedback is an integral part of the closed loop system. The corrective action as a response to the output requires two other components

- Control Mechanism – Variance Analysis
- Objectives – Predefined expected output from the system

Closed loop system is a system where part of the output is fed back to the system to initiate control to change either the activities of the system or input of the system. In a closed-loop decision environment, the impact of decisions can be measured very precisely. In a closed-loop decision environment, management makes a decision, the computer system singles out exactly to whom the decision applies and a direct action is taken as a result of the decision. The response to the action can then be measured on a case-by-case basis. The results of the management decision can be measured quickly and directly.

As an example of a closed- loop decision environment, suppose a department store can use its data warehouse to determine who has made purchases of more than Rs. 15000 in the past year. Once that information is collected, those customers can be offered a personalized credit card. In such a manner, management can measure the effect of the decision quickly and very accurately.

Another example can be given where management selects all customers who have shown an interest in James Bond movies. The data about such an interest, is stored in a database. If those customers are offered a new James Bond t-shirt at a discount price, the results of the promotion can be accurately and quickly calculated.

With a closed-loop decision environment, there is the possibility of having very quick and very accurate feedback on the decision process. The ability to make this assessment is very valuable. Let us illustrate the usage of the systems through an every day example. Take any international sports event: Olympics, soccer, cricket, tennis, every event is commercialised. To catch the interest of every individual, highly integrated information systems are used. For instance

- To sell tickets
- To advertise
- Sports accessories
- To set up a system for commentators to extract information for instant analysis for viewers
- Comparative Scores
- Projected Scores
- Team Performances
- Match Performances

All of the above requirements are not possible without the availability of an information system which serves the information requirements of all the interested in a timely fashion. The system has to be intelligent system capable of performing necessary tasks and providing the requisite output.

### 8.5 Attributes of an IS/CBIS

The attributes an Information System should have, to be worthy of being used by an organization for meeting its information requirements. Although information requirements may vary from organization to organization, however common premise is quite the same for many.

- Efficient Processing, including query time
- Large Storage Capacity
- Reduced information Load
- Cross-functional boundaries
- Competitive Tool
- Electronic Document Management/Paper Free environment

Let's consider each of these one by one.

#### Efficient Processing

Every transaction affects our records in a number of ways. CBIS helps in updating every change being triggered in less time and with less effort.

#### Large Storage Capacity & Instant Access

Efficient and effective decision making requires two aspects

- Availability of processed corporate data – occurrence of every event relating to a company affects policy making and implementation, thus recording and processing of every data results in huge amount of information
- Instant access to right chunk of information presented in comprehensible format – both the above requirements are easy to handle when a well structured information system is in place.

#### Reduced Information Load

With such huge amounts of information available, managers can feel overloaded, hence taking more time in

decision making. CBIS/IS help to tailor loads of information w.r.t. every manager's requirements. The way information is presented can also save time for decision making. Hence, report formats can be tailored in accordance with the nature of problem being faced.

### **Cross-Functional Coordination**

There are various functions in an organization that need to be managed.

- Manufacturing
- Purchasing
- Warehousing
- Marketing
- Accounts
- Finance
- Human Resource

In every transaction, every department has its own share of responsibility. Thus uncoordinated effort by every department won't help in achieving the successful completion of transaction and meeting commitments. CBIS help in keeping an updated record for easy access by every department in an organization.

### **Example**

A customer order is received by Sales/Marketing department. Record for customer profitability and recovery pattern are also kept by sales dept.

- Manufacturing requires
  - Customer order in quantitative terms
  - Raw material availability for production
  - Time available for delivery
  - Procurement schedule
    - Accounts require an intimation the delivery is made along with the sales invoice
    - Customer wants the status of its/his/her order

### **Competitive Tool**

Businesses invest to earn profits or for other non-profit based objectives. There seems no point in pouring in Co.'s hard earned money on IS if they don't add to the quality and value of information. Hence CBIS/IS can and should work to enhance the competitive advantage for the organization.

### **Paper Free Environment**

- Information overload enhances paper work.
- Maintenance of records in hard form has always proven to be a cumbersome task.
- An IS/CBIS should be efficient enough to properly manage of documents electronically.
- Customer orders met through Virtual Private Networks and intranets (to be discussed later).
- Payments made through Electronic payment system.
- Report generation and record analysis gets convenient and easy.

**Conclusion**

Hence an Information System / Computer Based information system should help an organization in achieving the above mentioned goals. If put differently, an organization should not proceed with the implementation of an IS unless it helps in achieving the above goals.

**LESSON 9****Infrastructure**

Infrastructure, generally, is the set of interconnected structural elements that provide the framework for supporting the entire structure. It usually applies only to structures that are artificial. The term is used differently in a variety of fields; perhaps the single most well-known usage is in economics, where it refers to physical infrastructure such as buildings and roads.

The notion that a structure has an internal framework is popular especially in business organizations where a dependency on interconnected information technology systems has become as prevalent as a city's dependency on interconnected conveyance systems for power, people and things. Information infrastructure consists of the physical facilities services and management that support all computing resources in an organization. There are five major components of infrastructure

- Computer hardware
- General purpose software
- Networks & communication facilities
- Databases
- Information management personnel
- Each of these components is designed in such manner to collectively meet the needs and objectives of the organization.

The infrastructure will include

- The detailed configuration of the hardware
- Design of the operating system,
- Documentation of the operational and application software, and
- Documentation on how to technically manage and operate the entire system
- Infrastructure also includes the integration, operation, documentation, maintenance and management the components as defined in infrastructure.
- It is guideline to how specific computing resources are arranged, operated and managed.

**9.1 Architecture**

Architecture more specifically is related to defining the information needs and how these will be obtained through the various application software modules. Architecture is the “Blueprint” that provides the conceptual foundation for building information infrastructure and specific applications. It is a way of mapping information requirements and resources. Architecture covers following components:

- The business needs of the information
- Existing planned information infrastructure and applications in the organizations.

### 9.1.1 Information Architecture

In context of web design Information (Or design for related media Information). Architecture is defined by the Information Architecture Institute as

1. The structural design of shared information environments.
2. The art and science of organizing and labeling web sites, intranets, online communities and software to support usability.
3. An emerging community of practice focused on bringing principles of design and architecture to the digital landscape.

An alternate definition of Information Architecture exists within the context of information system design, in which information architecture refers to data modeling and the analysis and design of the information in the system, concentrating on entities and their interdependencies. Data modeling depends on abstraction; the relationship between the pieces of data is of more interest than the particulars of individual records, though cataloging possible values is a common technique. The usability of human-facing systems, and standards compliance of internal ones, is paramount.

The term information architecture describes a specialized skill set which relates to the management of information and employment of informational tools. It has a significant degree of association with the library sciences. Many library schools now teach information architecture.

### 9.2 Components/Sub-Systems of CBIS

Following are the components / subsystems of CBIS

- Transaction Processing System
- Management Information System
- Support Systems
- Office Automation System
- Decision Support System
- Knowledge System
- Executive Support System

Let's consider them one by one.

### 9.3 Transaction Processing System

This system is used to record transactions of routine and repetitive nature.

For Instance

- Defining the transaction recording structure
- Placing customer orders
- Billing customers
- Other basic business transactions



**Features**

- It is a repetitive number crunching system.
- Today the transaction processing systems are more sophisticated and complex but spirit is same, that is to record routine business transactions, irrespective of their complexity, so as to help in analysis and report generation at a higher level.
- Help to cater needs for operational level management.
- Rapid Response

Fast performance with a rapid response time is critical. Businesses cannot afford to have customers waiting for a TPS to respond, the turnaround time from the input of the transaction to the production for the output must be a few seconds or less.

**Reliability**

- Many organizations rely heavily on their TPS; a breakdown will disrupt operations or even stop the business. For a TPS to be effective its failure rate must be very low. If a TPS does fail, then quick and accurate recovery must be possible. This makes well-designed backup and recovery procedures essential.
- 

**Inflexibility**

- A TPS wants every transaction to be processed in the same way regardless of the user, the customer or the time for day. If a TPS were flexible, there would be too many opportunities for non-standard operations, for example, a commercial airline needs to consistently accept airline reservations from a range of travel agents, accepting different transactions data from different travel agents would be a problem.

**Controlled processing**

- The processing in a TPS must support an organization's operations. For example if an organisation allocates roles and responsibilities to particular employees, then the TPS should enforce and maintain this requirement.

**Data Processing Tasks**

- Major data processing tasks which a TPS is expected to perform are
- Data identification and Gathering – keying in the data or obtaining it directly from machines by providing suitable interface
- Data manipulation/Analysis – refers to transformation of data into information
  - Classifying
  - Sorting
  - Calculating
  - Summarizing
- Data storage – data is kept somewhere in a sequenced manner until when needed.
- Document Preparation – output for managers as reports or as input to other systems.
- Goals a TPS is supposed to achieve are predefined and highly structured, for instance

- Checking a customer's credit limit every time an order is received
- Checking inventory level before accepting an order
- Payroll generation on monthly basis

#### 9.4 Management Information System

MIRS makes information available to relevant users by producing pre-determined and pre-designed reports required by the management. Management information system helps middle level management planning, controlling and decision making. The data stored can be used or manipulated to produce differently defined reports from pre-defined reports. It can be presented graphically or pictorially. The reports generated by the MIS are used for analytical decision making by the management. The application software can construct projections, build scenarios, do what if analysis to enable better decision making.

##### For Example

MIS will use the TPS data to generate monthly and weekly summaries as per requirement (product, customer and salesperson). Major purpose is report generation. We would discuss major types of reports.

- Periodic reports – daily, weekly, monthly, annually, format is predefined and structured for convenience.
- Special – Management by Exception reports only when a special event occurs which needs to be monitored. For instance
- Report sequence to highlight- fast moving & slow moving
- Group the exceptions together – Aged accounts receivable
- Show variance from the norm – Sales analysis report

**LESSON 10****Support Systems**

Seeing the benefits of MIS for middle level managers, Computerised systems have been devised for other employees in the organization to help them complete their work efficiently and effectively.

**10.1 Support systems can be classified into two categories**

- Office automation systems
- Decision support systems

**10.1.1 Office Automation Systems**

Office automation system includes formal and informal electronic systems primarily concerned with the communication of information to and from persons both inside and outside the firm. It supports data workers in an organization.

**For Instance**

- Word processing
- Desktop publishing
- Imaging & Web publishing
- Electronic calendars – manager’s appt. calendars
- Email
- Audio & video conferencing – establishing communication between geographically dispersed persons.

**10.1.2 Decision Support Systems**

Before moving forward with the concept of decision support system, we would take a look at the definition of MIS

“An integrated man-machine system for providing information to support the operations, management and decision making functions in an organization.”

(Prof. Gordon Davis University of Minnesota)

Four Criteria for designing models and systems to support management decisions making were laid down by J.D.C. Little. These were

- Robustness
- Ease of Control
- Simplicity
- Completeness of relevant detail

Decision Support Systems was defined by Bill Inmon, father of data warehouse, as

“a system used to support managerial decisions. Usually DSS involves the analysis of many units of data in a heuristic fashion. As a rule, DSS processing does not involve the update of data”

Heuristic simply means a particular technique of directing one’s attention in learning, discovery or problem solving. It assists in non-routine decision making process due to powerful analytical abilities.

**For Instance**

For any scenario all the related factors with their ranges of variability are entered into DSS, which helps guide managers for any new scenario that emerges. DSS can stimulate innovation in decision making by helping managers to existing decision making procedures.

**An example of Decision Support System**

An outfit store maintains ready made garments and stitched clothes for various classes of society. Due to fluctuating changes in fashion trends, pre-seasonal planning becomes critical.

- A Planning and forecasting software can be used by management to
- Measure customer reactions to re-pricing
- When to initiate clearance sales for old stock
- Deciding about discount percentages
- When to order new stock for the season

**10.2 Functionalities of MIS and DSS**

Sr. No.	MIS	DSS
1	Provides information on monitoring and controlling the business.	Helps in non routine decision making.
2	Fixed and regular reports are generated from data kept in TPS.	Users are not linked with the structured information flows.
3	Report formats are predefined.	Greater emphasis on models, display graphics & ad hoc queries.
4	User is part of the system	DSS is a small part of users' actions.
5	Controlled by IT Dept.	Directly used by middle level managers

**Table 10.1****10.3 Types of DSS**

DSS, may either be

- Model Driven DSS
- Data Driven DSS

**10.3.1 Model Driven DSS**

**Model driven DSS uses following techniques**

- What-If analysis  
Attempt to check the impact of a change in the assumptions (input data) on the

proposed solution

e.g. What will happen to the market share if the advertising budget increases by 5 % or 10%?

- Goal Seek Analysis

Attempt to find the value of the inputs necessary to achieve a desired level of output. It uses “backward” solution approach

e.g. a DSS solution yielded a profit of \$2M. What will be the necessary sales volume to generate a profit of \$2.2M?

These are primarily stand alone systems isolated from major organizational information systems (finance, manufacturing, HR, etc). They are developed by end users and are not reliant on central information systems control. These systems combine

- Use of a strong model, and
- Good user interface to maximise model utility

They are not usually data intensive, that is very large data bases are usually not need for model-driven DSS. They use data and parameters usually provided by decision makers to aid in analyzing a situation.

### 10.3.2 Data Driven DSS

As opposed to model driven DSS, these systems use large pools of data found in major organizational systems. They help to extract information from the large quantities of data stored. These systems rely on Data Warehouses created from Transaction Processing systems.

- They use following techniques for data analysis
- Online analytical processing, and
- Data mining

### Components of DSS

There are two major components

- DSS data base – is a collection of current and historical data from internal external sources. It can be a massive data warehouse.
- Decision Support Software system – is the set of software tools used for data analysis. For instance
  - Online analytical processing (OLAP) tools
  - Data mining tools
  - Models

### Data Warehouse

- A data warehouse is a logical collection of information.
- It is gathered from many different operational databases used to create business intelligence that supports business analysis activities and decision-making tasks.
- It is primarily, a record of an enterprise's past transactional and operational information, stored in a database designed to favour efficient data analysis and reporting.

- The term data warehouse generally refers to the combination of many different databases across an entire enterprise.
- Data warehouses contain a wide variety of data that present a coherent picture of business conditions at a single point in time.
- Data warehouses are generally batch updated at the end of the day, week or some period. Its contents are typically historical and static and may also contain numerous summaries.

**LESSON 11****Data Mart**

Data warehouses can become enormous with hundreds of gigabytes of transactions. As a result, subsets, known as "data marts," are often created for just one department or product line. Data Warehouse combines databases across an entire enterprise. However, Data Marts are usually smaller and focus on a particular subject or department or product line.

Following are the common techniques through which a data warehouse can be used.

**11.1 Online Analytical Processing (OLAP)**

Decision support software that allows the user to quickly analyze information that has been summarized into multidimensional views and hierarchies. The term online refers to the interactive querying facility provided to the user to minimize response time. It enables users to drill down into large volume of data in order to provide desired information, such as isolating the products that are more volatile from sales data. OLAP summarizes transactions into multidimensional user defined views.

**11.2 Data Mining**

Data mining is also known as Knowledge-Discovery in Databases (KDD). Put simply it is the processing of the data warehouse. It is a process of automatically searching large volumes of data for patterns. The purpose is to uncover patterns and relationships contained within the business activity and history and predict future behavior. Data mining has become an important part of customer relationship management (CRM).

The data mining procedure involves following steps

- Exploration – includes data preparation which may involve filtering data and data transformations, selecting subsets of records.
- Model building and validation – involves the use of various models for predictive performance (i.e., explaining the variability in question and producing stable results across samples). Each model contains various patterns of queries used to discover new patterns and relations in the data.
- Deployment – That final stage involves using the model selected as best in the previous stage and applying it to new data in order to generate predictions or estimates of the expected outcome.

**Example of Data Mining**

Consider a retail sales department. Data mining system may infer from routine transactions that customers take interests in buying trousers of a particular kind in a particular season. Hence, it can make a correlation between the customer and his buying habits by using the frequency of his/her purchases. The marketing department will look at this information and may forecast a possible clientele for matching shirts. The sales department may start a departmental campaign to sell the shirts to buyers of trousers through direct mail, electronic or otherwise. In this case, the data mining system generated predictions or estimates about the customer that was previously unknown to the company.

**Concept of Models Used in Decision Support System (DSS)**

“A model is an abstract representation that illustrates the components or relationships of a phenomenon.”

Models are prepared so as to formulate ideas about the problem solutions that is allowing the managers to evaluate alternative solutions available for a problem in hand.

### 11.3 Types of Models Used in DSS

- Physical Models
- Narrative Models
- Graphic Models
- Mathematical Models

#### 11.3.1 Physical Models

- Physical models are three dimensional representation of an entity (Object / Process). Physical models used in the business world include scale models of shopping centres and prototypes of new automobiles.

The physical model serves a purpose that cannot be fulfilled by the real thing, e.g. it is much less expensive for shopping centre investors and automakers to make changes in the designs of their physical models than to the final product themselves.

#### 11.3.2 Narrative Models

The spoken and written description of an entity as Narrative model is used daily by managers and surprisingly, these are seldom recognized as models.

For instance

All business communications are narrative models

#### 11.3.3 Graphic Models

These models represent the entity in the form of graphs or pictorial presentations. It represents its entity with an abstraction of lines, symbols or shapes. Graphic models are used in business to communicate information. Many company's annual reports to their stockholders contain colourful graphs to convey the financial condition of the firm.

#### For Instance

Bar graphs of frequently asked questions with number of times they are asked.

#### 11.3.4 Mathematical Models

They represent Equations / Formulae representing relationship between two or more factors related to each other in a defined manner.

#### Types of Mathematical Models

Mathematical models can further be classified as follows, based on

- Influence of time – whether the event is time dependant or related
- Degree of certainty – the probabilities of occurrence of an event



- Level of optimization – the perfection in solution the model will achieve. Hence use of right model in decision support software is critical to the proper functionality of the system.

### Group DSS

When people responsible for decision making are geographically dispersed or are not available at a place at the same time, GDSS is used for quick and efficient decision making. GDSS is characterized by being used by a group of people at the same time to support decision making. People use a common computer or network, and collaborate simultaneously.

An electronic meeting system (EMS) is a type of computer software that facilitates group decision-making within an organization. The concept of EMS is quite similar to chat rooms, where both restricted or unrestricted access can be provided to a user/member.

### DSS vs. GDSS

DSS can be extended to become a GDSS through

- The addition of communication capabilities
- The ability to vote, rank, rate etc
- Greater system reliability

## 11.4 Knowledge / Intelligent Systems

Before we proceed with defining these systems, first we should have clear concept of Knowledge Management. The set of processes developed in an organization to create, gather, store, maintain and apply the firm's knowledge is called Knowledge Management. Hence the systems that aid in the creation and integration of new knowledge in the organization are called knowledge systems.

### There are two questions

#### Who are they built for?

This refers to defining the knowledge workers for whom the knowledge system is being built. The term refers to people who design products and services and create knowledge for an organization. For instance  
Engineers  
Architects  
Scientists

- Knowledge systems are specially designed in assisting these professionals in managing the knowledge in an organization.

#### What are they built for?

Every knowledge system is built to maintain a specific form of knowledge. Hence it needs to be defined in the start, what the system would maintain. There are major types of knowledge.

- Explicit knowledge – Structured internal knowledge e.g. product manuals, research reports, etc.
- External knowledge of competitors, products and markets
- Tacit knowledge – informal internal knowledge, which resides in the minds of the employees but has not been documented in structured form.

Knowledge systems promote organizational learning by identifying, capturing and distributing these forms of knowledge

## 11.5 Knowledge Support Systems (KSS) / Intelligent Systems

These systems are used to automate the decision making process, due to its high-level-problem-solving support. KSS also has the ability to explain the line of reasoning in reaching a particular solution, which DSS does not have.

### Intelligent Systems

Knowledge systems are also called intelligent systems. The reason is that once knowledge system is up and running, it can also enable non experts to perform tasks previously done by experts. This amounts to automation of decision making process i.e. system runs independently of the person making decisions.

### Artificial Intelligence

“Artificial intelligence is the ability of a machine to replicate the human thought processes. The way humans proceed to analyze a problem and find appropriate solutions, similarly computers are geared up to follow human logic to solve problems.”

These knowledge-based applications of artificial intelligence have enhanced productivity in business, science, engineering, and the military. With advances in the last decade, today's expert systems clients can choose from dozens of commercial software packages with easy-to-use interfaces.

The most popular type of intelligent systems is the Expert System.

### Expert System

An expert system is a computer program that attempts to represent the knowledge of human experts in the form of Heuristics. It simulates the judgment and behaviour of a human or an organization that has expert knowledge and experience in a particular field.

Examples are

- Medical diagnosis,
- Equipment repair,
- Investment analysis,
- Financial, estate and insurance planning,
- Vehicle routing,
- Contract bidding

### Heuristics

Heuristic is the art and science of discovery and invention. The word comes from the same Greek root as "eureka", which means "I have found it". A heuristic is a way of directing your attention fruitfully. It relates to using a problem-solving technique, in which the most appropriate solution is found by alternative methods. This solution is selected at successive stages of a program for use in the next step of the program.

## 11.6 Components of an Expert System

There are four main components of Expert systems

- User Interface: to enable the manager to enter instructions and information into an expert system to receive information from it.
- Knowledge Base: it is the database of the expert system. It contains rules to express the logic of the problem.
- Inference engine: it is the database management system of the expert system. It performs reasoning by using the contents of the knowledge base.
- Development engine – it is used to create an expert system.

### **Neural Network**

Hardware or software that attempt to emulate the processing patterns of the biological brain. It is a device, modeled after the human brain, in which several interconnected elements process information simultaneously, adapting and learning from past patterns.

### **Neural Network vs. Expert System**

Expert systems seek to model a human expert's way of solving problems. They are highly specific to seeking solutions. Neural networks do not model human intelligence. They seek to put intelligence into the hardware in the form of generalized capability to learn.

### **Fuzzy Logic**

The word Fuzzy literally means vague, blurred, hazy, not clear. Real life problems may not be solved by an optimized solution. Hence allowance needs to be made for any imperfections which may be faced while finding a solution to a problem. Fuzzy logic is a form of algebra employing a range of values from "true" to "false" that is used in decision-making with imprecise data, as in artificial intelligence systems. It is a rule based technology that tolerates imprecision by using non specific terms/ imprecise concepts like "slightly", "quite" and "very". to solve problems. It is based on the Possibility theory, which is a mathematical theory for dealing with certain types of uncertainty and is an alternative to probability theory.

### **Executive Support Systems (ESS)**

This Computer Based Information System (CBIS) is used by senior managers for strategic decision making. The decisions at this level are non-routine and require judgment and evaluation. They draw summarized information from internal MIS and Decision Support Systems. These systems deal with external influences on an organization as well.

- New Tax laws
- Competitors
- Acquisitions, take-overs, spin offs etc.

They filter, compress and track critical data so as to reduce time and effort required to obtain information useful for executives. They are not designed to solve specific problems. They are generalized to be capable of dealing with changing problems. Since executives have little contact with all levels of the organization, ESS uses more graphical interface for quick decision making.

### **ESS vs. DSS**

ESS implies more of a war room style graphical interface that overlooks the entire enterprise. A decision

support system (DSS) typically provides a spreadsheet style "what if?" analysis capability, often for only one department or one product at time.

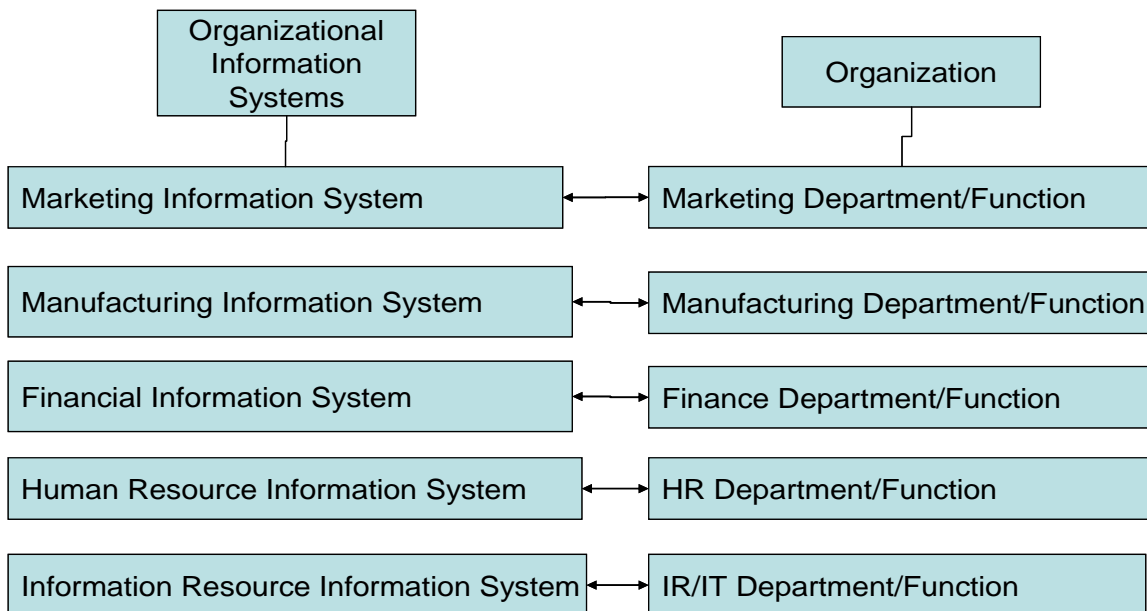
## LESSON 12

### CBIS from Functional View Point

CBIS can be divided into subsystems based on how the users are grouped in the organization. This grouping of users is in terms of related tasks that are performed. These conceptual systems are mirror images of physical systems that are present. These systems are collectively called Organizational Information systems (OIS).

#### 12.1 Organizational Information Systems (OIS)

The term OIS views organization as a combination of process oriented groups whose information needs are related but independent. All functional systems should work together for problem solving since each system specialises in specific domain of information.



#### 12.2 Marketing Information Systems (MKIS)

MKIS is a type of Information System that helps the firm to achieve following objectives:

- Identification of customers for firm's products and services.
- Development of those products and services to meet customers' needs
- Promotion of the products and services, and
- Provision of after sale customer support

#### Types of Marketing Information

Every information system is designed to capture some sort of information. Information requirements need to be defined before the systems are made. While designing marketing information system, following types of information should be designed.

- Marketing Intelligence – information flowing from environment into the environment
  - Internal Information – gathered within the firm
  - Marketing Communication – Info flowing from firm to external environment
- An MKIS help in proper management and dissemination of all three kinds of information.

### 12.3 Benefits of Marketing IS

MKIS helps organizations in efficient channel management. Following can be identified as some of the benefits of MKIS.

1. Customer profiles need to be maintained focusing on their habits and spending patterns. MKIS helps in maintaining these profiles.
2. Information on what competitors have been upto is also a critical marketing information. This should not be taken as espionage on competitors.
3. Forecasts of demand is also a critical part of marketing analysis. MKIS helps in achieving this as well.
4. Field sales can also be monitored where sales agents are used to market products.
5. Customers can be quickly updated based on their information kept in MKIS.
6. Dealers involved in sale of product can also be monitored to help enhance revenue.s

### 12.4 Management Levels in MKIS

MKIS should cater for information requirements at each level, for instance

#### Strategic Level

1. Formulation of new sales products, and identifying new sales opportunities.
2. Planning support for new products and services
3. Monitoring competitors

#### Knowledge Level

1. Market analysis based on demographics and customer behaviour

#### Management level

1. Sales performance analysis is required to monitor how to enhance sales and address related issues.
2. Sales staff analysis is important to see how much of the sales portion has been contributed by each of the employees.

#### Operational Level

1. Taking comments from customers for measuring satisfaction is a responsibility of the managerial level.
2. Tracking sales, processing orders and customer support

### 12.5 New Dimensions in MKIS

Through extensive use of computers in marketing field, newer concepts are emerging in marketing field, which are revolutionising the way customers were dealt with.

- Customer Relationship management (CRM)
- Sales Force Automation (SFA)
- Call Centres

#### Customer Relationship Management

- Businesses increasingly talk about fostering relationships with their customers. This is important because some modern businesses have literally millions of customers. Hence keeping personal touch with every individual customer is getting difficult to achieve.
  - Companies are clearly eager to nurture relationships with their customers. Businesses need to understand the extent to which consumers want to engage with their brands. For some businesses there is
    - Either a strong natural need – banks
    - Or an emotional attachment – Fashion retailer, car manufacturer

### Benefits of CRM

- Maintains and enhances customer base
- Encourages customer loyalty
- Gaining more customers' wallet-share
- The more effective a company's customer retention and defection management strategy, the less they need to plug the gap with new customers, who are expensive to recruit.
- CRM help in establishing communication to encourage customers to share information about their
  - Habits,
  - Tastes and preferences
  - Interests in Co's brand extension initiatives
- CRM is a business strategy that goes beyond increasing transaction volume.
- Its objectives are to increase profitability, revenue, and customer satisfaction.
- To achieve CRM, a company wide set of tools, technologies, and procedures promote the relationship with the customer to increase sales.
- Thus, CRM is primarily a strategic business and process issue rather than a technical issue.

### Reasons for adopting CRM

- Customers now prefer to execute transaction in an electronic environment through online-trading. Also the establishment of customer services centers has also removed the inconvenience to access vendor's physical locations.
- Due to absence of physical contact, companies are curious to keep a soft touch in an efficient manner. This requires keeping a customer-wise online track of past correspondence and transactions.
- CRM reduces cost of sales and distribution by
  - Targeting advertising to customers to increase the probability that an offer is accepted.
  - Using web applications to decrease the number of direct sales people and distribution channels needed
  - Managing customer relationships rather than manage products (a change in marketing)
- CRM minimize customer support costs by
  - Making information available to customer service representatives so they can answer any

query

- Automating the call centre so that representatives have direct access to customer history and preferences and therefore can cross-sell

## 12.6 Key CRM Tasks

- Customer Identification -- Identifying customer through
  - Marketing channels,
  - Transactions,
  - Interactions overtime,
- Customer Differentiation – Segregating customers, with respect to.
  - Their lifestyles
  - Attitudes
  - Perception about Co.'s products
- Customer Interaction – Efforts made to retain customers for long-term profitability and relationship.
- Customization / Personalization  
“Treat each customer uniquely” is the motto of the entire CRM process. Through the personalization process, the company can increase customer loyalty.

## 12.7 CRM Issues

- **Customer Privacy**  
Customer privacy is an important issue in CRM. CRM deals with large amounts of customer data through various touch points and communication channels. The individual firm is thus caught in an ethical dilemma – collecting as much information as possible but still respecting limits for personal privacy.
- **Software issues**  
There is little standardized technologies and protocols for CRM implementation in the market. Vendors publish new versions of CRM software as frequently as they can thus adding to client's expenses. CRM software requires highly integrated environment for high productivity, which is rarely available.

## Sales Force Automation

It automates some of the company's critical sales and sales force management functions, for example,

- Customer account management,
- Forecasting sales,
- Sales administration,
- Keeping track of customer preferences,
- Sales staff performance.

SFA empowers the sales force to close deals at the customer's office and to configure marketing strategies at home. SFA is providing tools for very highly evolved sales organizations, organizations that are basically

marketing machines.

## 12.8 Call Center

Due to its direct contact with customers, call center is widely gaining popularity. It refers to a department within a company or a third-party organization that handles telephone sales and/or service. Call centers use automatic call distributors (ACD's) to route calls to the appropriate agent. In addition to a call centre, collective handling of letters, faxes, and e-mails at one location is known as a contact centre. As computers gain more and more involvement in marketing field, presence of a highly efficient and integrated call center has become inevitable. Call centers should have direct access to every customer's track record so as to help them handle queries in an efficient manner. Modern day call centers, record the telephonic conversation with the customers, extract a summary of it, and display it every time the customer calls so as to help attendant review entire record.

### Call Center-Challenges

Call centre agents are challenged daily to navigate disparate, non-integrated applications as they attempt to resolve customer service requests. The call centre should offer an integrative solution so that customers can be responded efficiently. Call center should help cut long processing times which add to customer frustration and dissatisfaction with the company.

### Manufacturing Information Systems

It is an information system which deals with the

- Planning, development and maintenance of production facilities
- Establishment of Production goals
- Availability of production materials
- Scheduling

### Management Levels in Manufacturing Information System

#### Strategic level

1. Locating new plant which can save cost
2. Investment in new manufacturing technology

#### Knowledge Level

1. Distribute knowledge to drive the production process
2. Innovating new forms of manufacturing processes

#### Management level

1. Monitoring production costs and resources

#### Operational Level

1. Status of production tasks



**LESSON 13****Organizational Structure**

Departments are structured based on the set of related responsibilities. The set of responsibilities being discharged set the tone and structure of that department. The complexity and diversity of these responsibilities also affect how departments are set in an organization.

Existence of Functional departments in every organization vary with the nature of industry and the nature of products/services being offered

Certain departments may not exist in an organization, for instance financial sector (banking, leasing companies) and travel agencies do not incorporate the concept of manufacturing as they belong to the services sector.

Let's take a look at different departments in different industry segments in order to better understand the concept.

**13.1 Financial Sector**

The departmental structures are different in banking and financial sector. This in turn becomes the basis of design and development of functional information systems. Banks commonly have following departments

- Treasury
- Advances
  - Trade Finance
  - Corporate Finance
  - Consumer Banking
- Deposits
- Customer Services
  - Lease
  - Credit Card
  - Debit card
- Operations

Requirements of Information Systems and procedures of financial analysts, investment houses, brokerage houses, leasing companies will depend on their differing functions and needs.

**13.2 Air Line Industry**

Various departments may be

- Flight Operations department
  - Flight scheduling department
  - Cockpit crew department
  - Cabin Crew department
- Engineering department – engine maintenance
- Ground Support – air craft handling department
- Catering
- Internal audit

- Accounts & Finance
- Sales – ticketing, E-ticketing, agents
- Marketing
- Store – engines, maintenance and repair accessories

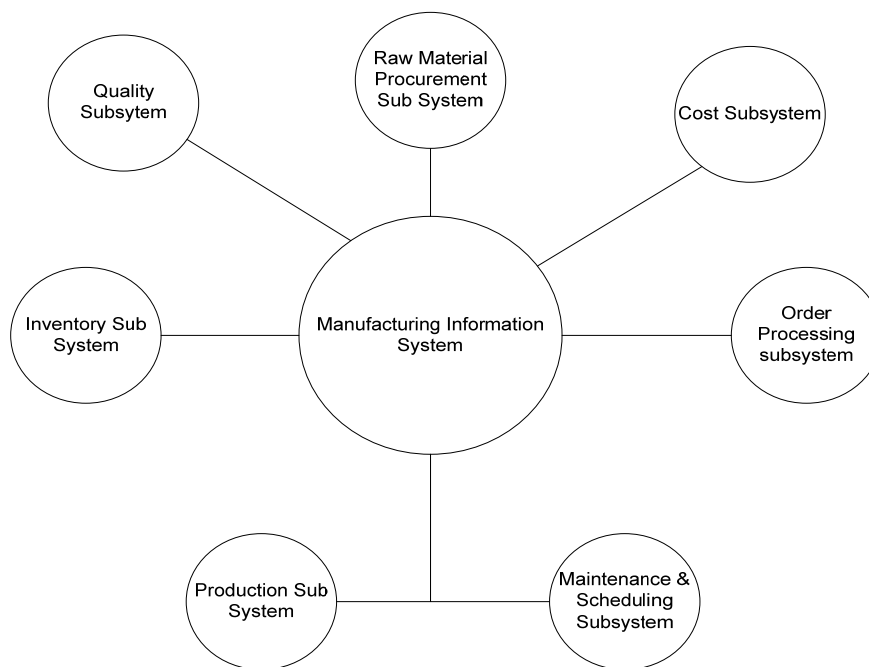
These departments and their needs determine the design of information systems they require.

As shown in the above two examples, the constitution of departments in both banking institutions and air travel industry vary to a large extent.

### 13.3 Manufacturing Information System

The information needs were and are always there. Information systems used to exist when computerised environments were not available. Automation has enhanced the availability of information.

Every industry has its own departmental structure which gives rise to a different set of sub-systems as part of the information system. Here we would consider the sub-systems of a manufacturing system only. Following are the sub-systems of an information system.



#### Raw Material Procurement Sub-System

This is the commencement of the manufacturing process. Some might think of procurement as a simple purchasing process like any other commodity but the spirit of having an all-embracing raw material procurement sub-system is simply more than that.

### Parameters of Raw-material Procurement

Like with every system, there has to be a list of minimum specifications which every system or subsystem has to cover. Purchasing logistics of an entity critically affect time to market and other quality related issues. Issues like selection of suppliers, choice between local purchase or import and delivery time taken by the supplier. All these concerns are met and dealt with in the purchase subsystem. The complexity of the purchase subsystem should depend on types of raw materials required, number of suppliers to deal with and complexity of the terms of purchase agreements for long term.

With higher customer expectations, every organization wants to efficiently manage its suppliers and other internal processes. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. A procurement system should help in improving the supply chain of the organization.

### 13.4 Inventory Sub System

Inventory subsystem focuses on maintaining records and movements on inventory levels and usage. This control of inventory is critical to the organization since money lock-in of raw materials purchase represents substantial investment. Timely production of finished goods require availability of right quantity of material, maintenance of right stock levels, determination of lead times and flex times and exchange of information with supplier at the right time. An inventory subsystem helps us to address these issues. Inventory subsystems are critical where the organization is following Just in Time approach – a philosophy which encourages zero tolerance for stock levels and placing orders exactly when they are needed for manufacturing.

Proper logistic management is important for the timely and quality production. Various factors which can play critical role are

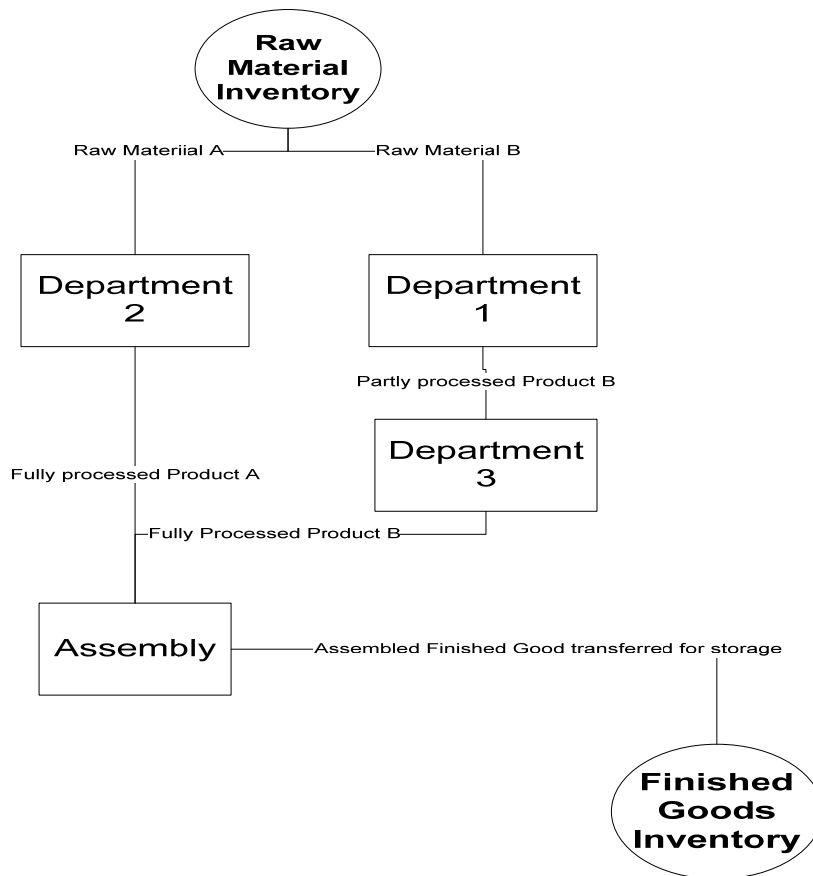
- Who to purchase from – supplier selection
- When to purchase – time of delivery or raw materials
- How much to purchase – Ideal stock levels
- An efficient inventory subsystem helps us to deal with these issues in a time saving manner.

### 13.5 Production Sub System

It can be seen as the most critical part of the entire manufacturing sub system. Basically it tracks the flow of the job through the entire production process. It also records change in form of goods or transfer of goods from one place to the other.

#### Example

Consider a manufacturing entity working with three processing departments and one assembly department. As raw materials pass through the processes, the sub system records the relevant information at specific points or locations until the finished goods are transferred to stock room.



### 13.6 Maintenance & Scheduling Sub System

For efficient production, the machines should be timely available. Many a times, the machine is under repair and is not available to be used for production. Without this subsystem, there is a possibility of customer's orders not being met on time. Certain issues that can be very important are

- Deciding delivery time in accordance with availability of machines.
- Any foreseen machine-down-time.
- Any major overhauling / tuning / replacement expected may result in unavailability of machine. An overhauling schedule should be kept so that the production of finished goods is not halted.
- Avoiding duplication of jobs for the same machine.

### 13.7 Quality Sub system

This subsystem ensures the production made and end product being delivered to the customer are conforming the quality standards set by the company. Quality covers aspects for the organization like better quality raw materials and what is being purchased is according to organization's standards and improved finished goods in accordance with the customer specification.

The question now arises is why do we need a quality sub-system? It is defined and demanded by customer, it has to be achieved by management, it is a firm wide responsibility and these subsystem provide the firm's managers with information that reveals the extent to which the firms products are achieving the quality goals.

### **13.8 Total Quality Management (TQM)**

TQM is a set of management and control activities which focus on quality assurance. The quality of the products and services is enhanced and then offered to consumers. An organizational undertaking to improve the quality of manufacturing and service, it focuses on obtaining continuous feedback for making improvements and refining existing processes over the long term. There are certain Graphical tools used to implement and promote TQM. For instance

- Histogram
- Pareto Analysis
- Cause & Effect Diagram

#### **Costing Sub System**

Costs are incurred more frequently in a manufacturing entity. Monitoring these costs on regular basis requires instituting a formal cost subsystem. Cost sub systems are responsible for generation of cost reports which represent cost break ups on various bases, for instance

- Machine usage basis
- Product basis
- Department wise

#### **Order Processing Sub System**

This subsystem deals with following issues.

- Status of orders placed with suppliers
- Status of departmental requisitions
- Quality of materials received
- Any other issues related to suppliers

Order processing subsystem gives a snapshot of statuses of various orders placed, at any given time.

### **Management Levels in Manufacturing Information Systems**

Manufacturing Information System should cater for information requirements at each level, for instance

#### **Strategic level**

3. Locating new plant which can save cost
4. Investment in new manufacturing technology

#### **Knowledge Level**

3. Distribute knowledge to drive the production process
4. Innovating new forms of manufacturing processes

#### **Management level**

2. Monitoring production costs and resources

## Operational Level

2. Status of production tasks

### 13.9 Planning Productions/Operations

This function in many firms is supported by IT. The major areas of planning and their computerised support are as follows.

- Materials Requirement Planning (MRP)
- Manufacturing Resource Planning (MRP II)
- Automated Software
  - Computer Aided Design (CAD)
  - Computer Aided Manufacturing (CAM)
  - Computer Integrated Manufacturing (CIM)

#### 13.10 Materials Requirement Planning (MRP)

Material procurement needs to be planned in compliance with the production Schedule. Initially companies used to do plan it manually through a document termed as “Material Requirement Plan”. Material Requirements Planning (MRP) is software based production planning and inventory control system for material procurement and scheduling.

It helps meeting three objectives:

- Ensure materials and products are available for production and delivery to customers.
- Maintain the lowest possible level of inventory.
- Plan manufacturing activities, delivery schedules and purchasing activities.

MRP helps in getting the right material and physical resources together at the right place and at the right time to meet the customer’s requirements. This helps in achieving on time delivery, High Quality, at the best price.

#### 13.11 Manufacturing Resource Planning (MRP II)

An expanded version of MRP that integrates finance, accounting, accounts payable, and other business processes into the MRP system. It also includes production scheduling function, and inventory control functions. It is an integrated computer system that connects the regular MRP to other functional area, especially finance and human resources. It is made up of a variety of functions, each linked together:

- Business planning
- Sales and operations planning
- Production planning
- Master scheduling
- Material requirements planning
- Capacity requirements planning

#### Benefits of MRP II

MRP II involves the entire company

- Management business rules for strategic planning can be set, and enforced by MRP II.
- Sales and Marketing can incorporate sales goals that fit material and capacity constraints.
- Relationships can be developed with vendors to improve purchasing just in time.
- Inventory shortages can be seen before they happen, with communications to customers to get approval of substitutions that will get a part that does the same thing, on schedule.

- Accounting and finance departments get accurate costs, and predict cash flow.

### Automated Tools

IT has been used successfully in cutting the time required for the design of products, services or processes. Some of these applications are

- Computer Aided Design (CAD)
- Computer Aided Manufacturing (CAM)
- Computer Integrated Manufacturing (CIM)

#### 13.12 Computer Aided Design (CAD)

“It is a system that enables drawings to be constructed on a computer screen and subsequently stored, manipulated and updated electronically.”

The ability to rotate or create movement in the design allows testing for clearances and frequently reduces the cost of prototyping the products. The technology is used for a wide variety of products in such fields as architecture, electronics, and aerospace, naval, and automotive engineering. Although CAD systems originally merely automated drafting, they now usually include three-dimensional modeling and computer-simulated operation of the model. Rather than having to build prototypes and change components to determine the effects of tolerance ranges, engineers can use computers to simulate operation to determine loads and stresses. For example, an automobile manufacturer might use CAD to calculate the wind drag on several new car-body designs without having to build physical models of each one. In microelectronics, as devices have become smaller and more complex, CAD has become an especially important technology. Among the benefits of such systems are lower product-development costs and a greatly shortened design cycle. While less expensive CAD systems running on personal computers have become available for do-it-yourself home remodeling and simple drafting, state-of-the-art CAD systems running on workstations and mainframe computers are increasingly integrated with computer-aided manufacturing systems.

#### 13.13 Computer Aided Manufacturing (CAM)

Computer-aided manufacturing (CAM) is a form of automation where computers communicate work instructions directly to the manufacturing machinery. The technology evolved from the numerically controlled machines of the 1950s, which were directed by a set of coded instructions contained in a punched paper tape. Today a single computer can control banks of robotic milling machines, lathes, welding machines, and other tools, moving the product from machine to machine as each step in the manufacturing process is completed. Such systems allow easy, fast reprogramming from the computer, permitting quick implementation of design changes. The most advanced systems, which are often integrated with computer-aided design systems, can also manage such tasks as parts ordering, scheduling, and tool replacement.

It is a system that uses computer aided techniques to control production facility. Some of these techniques are

- Computer-aided process planning – Use of computer to control activities and functions to prepare a detailed set of plans and instructions to produce a machine or part. -- Machines
- Computerised Numerical control (CNC) – refers specifically to the computer control of machine tools for the purpose of (repeatedly) manufacturing complex parts in metal as well as other materials. e.g. drills, wood routers use this technology.
- Robotics programming – The science or study of the technology associated with the design, fabrication, theory, and application of robots. – Automobile industry.

### 13.14 Computer Integrated Manufacturing (CIM)

Integrated computerized manufacturing system combining all the elements of computer aided design (cad) and computer-aided manufacturing (cam). This is an interactive computer system usually installed on a local area network linking several related departmental functions such as design, engineering, production, and marketing. The concept of CIM insures rapid high-quality product development and manufacturing through real-time coordination of all related functions. See also computer aided design (cad).

Computer-integrated manufacturing (CIM): It is the total integration of Computer Aided Design / Manufacturing and also other business operations and databases. It is concept/philosophy about the implementation of various integrated computer systems in factory automation.

### 13.15 Computer Integrated Manufacturing (CIM) Goals

#### **CIM has three basic goals**

- Simplification of all manufacturing technologies and techniques
- Automation of as many of the manufacturing processes as possible by integration of many information technologies like
  - Flexible Manufacturing Systems – a form of flexible automation in which several machine tools are linked together by a material-handling system controlled by a central computer. It is distinguished from an automated production line by its ability to process more than one product style simultaneously.
  - Computer aided Engineering (CAE) -- the application of computer software in engineering to analyze the robustness and performance of components, assemblies, products and manufacturing tools.
  - Just in time (JIT) – A Japanese idea that inventory is manufactured (or acquired) only as the need for it arises or in time to be sold (or used). A major goal is to cut down on inventory investment.
- Integration and coordination of all the manufacturing aspects through computer hardware and software.



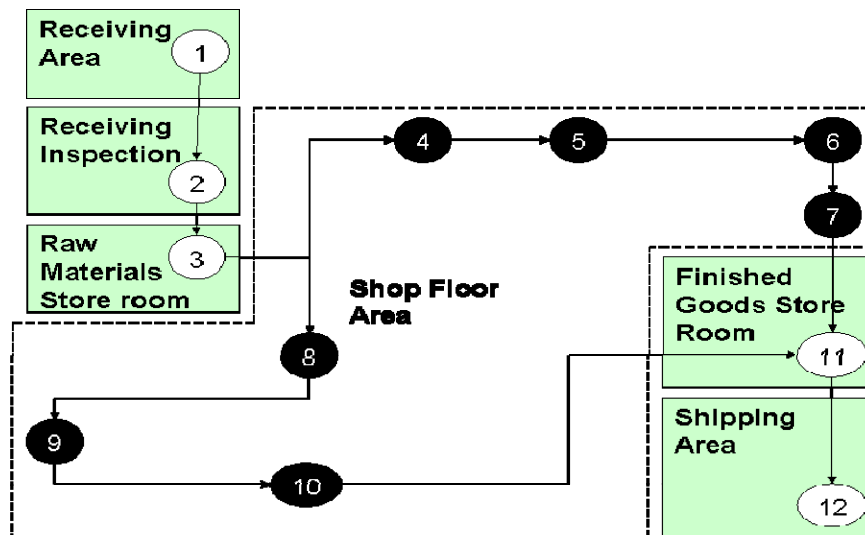
**LESSON 14****Marketing**

No information system can exist in an organization without being linked with other functional information systems. This linkage is important for the over all smooth functionality of the information system since it allows easy transformation and usage of information.

- **Marketing**  
Production subsystem needs to be linked with the marketing system so as to produce right amount of product.
- **Human resource system**  
Most of the human resource is involved in the manufacturing process. Since factory premises has to be working continuously, availability of relevant labour is critical.
- **Accounts and Finance**  
Accounts should have a control over various recording points in the entire process from procurement to finished good store room. This would help both in recording transactions for financial statements and approving and arranging for cash payments.

Accounting information system (AIS) is linked to all the information systems in an organization. This is important because the data required for proper book keeping and generation of transactional reports is extracted from all over the organization. For instance sales information can be sought only from marketing information system and stock information is available in manufacturing information system.

Here we would consider an example to see how AIS records internal data describing manufacturing operations – this requires use of data collection terminals at the manufacturing facility. It also records external data describing firms transactions with its suppliers.



The figure shows twelve data collection terminals located at the factory area. Raw materials are received from suppliers, and receipt data is entered into the terminal. Quality control inspection is conducted and results are recorded at terminal two. Acceptance into and release from the raw materials room is logged in to the terminal three. Terminals four to ten are used by production employees to record start and completion of each step of production. Terminal eleven records the entry into the finished goods store room. Shipping to customers is recorded at terminal 12.

### 14.1 Accounting & Financial Information Systems

Accounting and financial information systems cater for the needs of Accounts & Finance Department. These are responsible for managing financial assets in order to maximise return, like

- Cash
- Stocks
- Bonds
- Other investments
- Financial liabilities
- Capitalization of the firm through acquisition of new financial assets

It also produces the periodic and annual financial statements.

#### Importance of Accounting & financial Information Systems

Every transaction that an organization undertakes has a financial impact, to be recorded and reported by the accounts & finance department. Hence there is a share of interest for every department in reports and information produced by this system. Financial Information Systems like other information systems should cater for information requirements at each level, for instance.

##### Strategic level

1. Investment goals
2. long range forecasts for firm's financial performance
3. Acquisition of financial resources and goals

##### Knowledge Level

1. Analytical tools to design the right mix for investment
2. Portfolio updates
3. Market information analysis

##### Management level

1. Control over firm's financial resources
2. Investment management
3. Budget management
4. Tax management
5. Profitability & Performance Evaluation

##### Operational Level

1. Cash flow statements through various transactions
2. Inventory and debtors management
3. Creditors Management

### 14.2 Human Resource Information Systems

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It is an information system that combines many human resources functions, including benefits administration, payroll, recruiting and training, and performance analysis and review into one package. It helps in

- Building database of employees
- Keeping track for new positions or vacancies
- Keeping master records for each employees
- Performance evaluations and training assessments

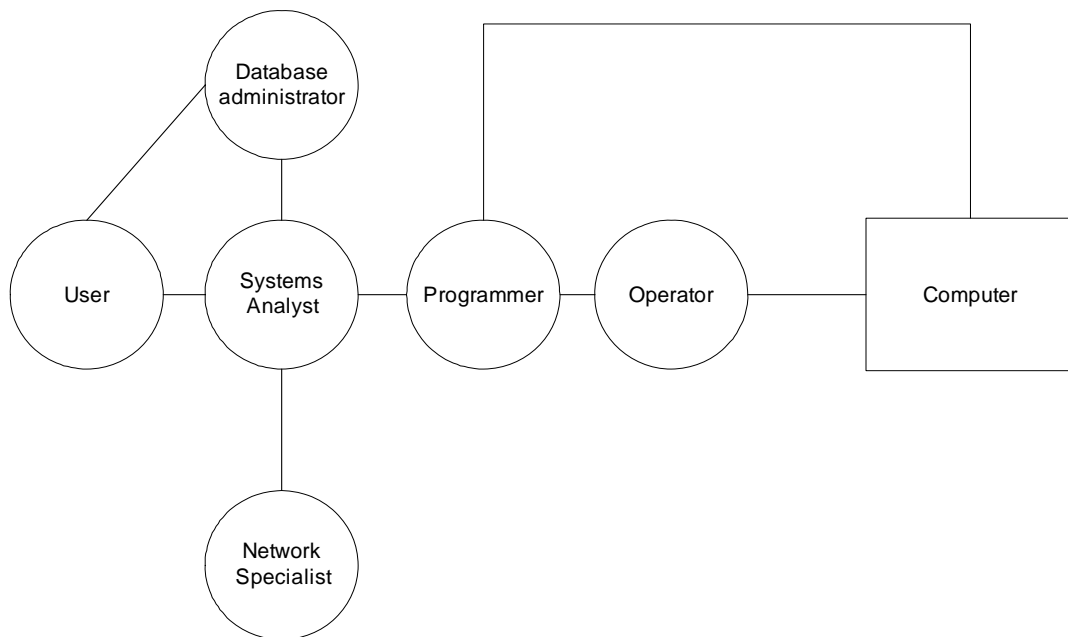
### 14.3 IT Department

Information by itself is proving to be the most critical resource for organizations. Such is the criticality that other resources of the organization cannot be managed without it. This has lead to the evolution of information systems to efficiently manage the information resource of the organization. This system is usually employed by the Information Services department which is the major functional area of the organization.

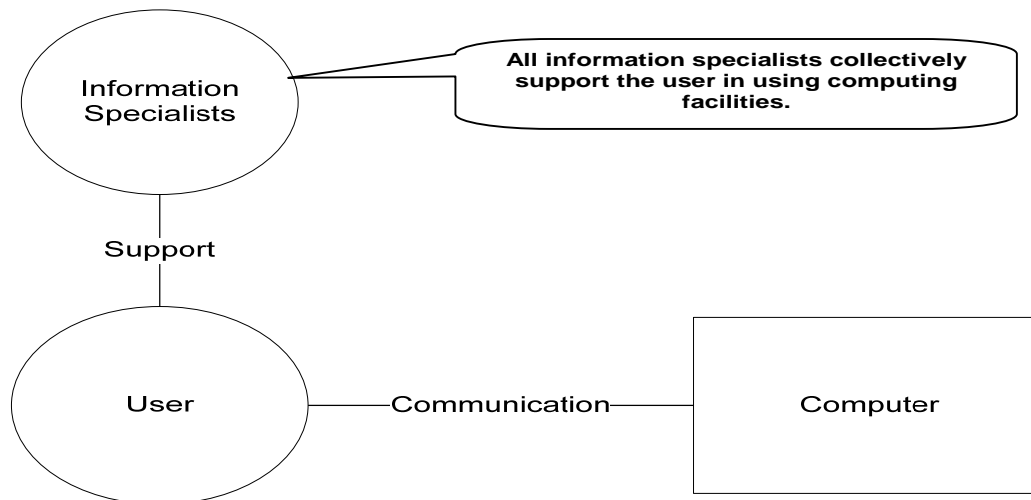
#### 14.3.1 Evolution of the IT Department

IS department function has been evolving based on the needs of user departments

- Traditional Computing -- Initially User was not directly linked with using the computing facilities and the IT workforce was involved in assisting user to achieve his computer related goals.



- End User Computing – As the computer users become more literate, much of the work was done by users themselves and IT department took over as a support function.



**LESSON 15****Decision Making**

There are some of the critical decisions that top managers face every day. How to decide whether to sell or spin off a business? Should the supplier relationships be renegotiated? What can be done to improve decision-making competency throughout your organization?

To capture maximum value, executives not only must make the right decisions, but also must negotiate skillfully. Since most business decisions involve other parties, it is essential for managers to understand their individual role as it relates to other decision makers, as well as how to use this knowledge to create the strongest possible negotiating position.

Hence, keeping in mind the importance of decision making for managers, information systems are also designed in a way to help them out to control operations and perform their managerial responsibilities more effectively.

Decision making is the cognitive process of selecting a course of action from among multiple alternatives.

Cognitive process is the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment.

- Every decision-making process produces a final choice. It can be an action or an opinion.
- It begins when we need to do something but we do not know what.
- A decision-making is a reasoning process which can be rational or irrational, and can be based on explicit assumptions or tacit assumptions.

**15.1 Types of Problems**

Nature of problem determines the approach to decision making to be followed to solve it. There are three broad categories.

- **Structured:** Well-structured problems are constrained problems with convergent solutions that engage the application of a limited number of rules and principles within well-defined parameters.
- **Unstructured:** Problems possess multiple solutions, solution paths, fewer parameters which are less manipulate able, and contain uncertainty about which concepts, rules, and principles are necessary for the solution or how they are organized and which solution is best.
- **Semi-structured** – a gray area lies between the structured and unstructured range. Here part of the decision can be specified allowing for certain factors out of control.

**Types of problems**

A newly formed organization may be taken as an unstructured organization due to lack of defined organizational structure, operating procedures. The question that a problem is structured or unstructured is not dependant on the organization being structured or unstructured. Even a highly structured organization can face novel and unprecedented problems.

**Example-Daily Life**

- **Unstructured** – Mr. A thinks that he has to wake up at any time in the morning,
- **Structured** – Mr. A is a soldier and he has to wake at 6 in the morning when army bugle is played/blown. This procedure will be followed no matter what.
- **Semi Structured** – Waking up is subject to a clock alarm (procedure), but it can be turned off as waking up at that time is also subject to some sort of individual judgment.

### Example – Business

Bank has a policy that two persons, Mr. A & B would open the bank 30 min before bank timings, so that bank should be open for public dealing at 9 a.m. No other situation has been forecast in the policy.

- **Structured** – Staff shall be in the bank by 8:00 a.m. to ensure opening for public dealing at 9 a.m. This procedure will be followed no matter what.
- **Semi Structured** – Branch Manager is informed a day earlier that Mr. A will be unable to make it the next day. Rest is left at the discretion of branch manager's judgment to decide who else is to be made responsible to open the branch in the morning.
- **Unstructured** – Employees start reaching before 9 a.m. but branch is not open. The decision taken by employees there and then would be totally unstructured due to the novelty of the situation arose.

## 15.2 Type of Decisions

All problems require decision making, however the nature of problem determines how it should be approached. The decision making process There are three types of decisions

- Structured
- Non-structured
- Semi Structured

### Structured decisions

Where problem is recurring and repetitive, the common factors can be identified in order to identify a particular course of action. Due to which defined set of procedure can be devised for their solution. Hence,

- Procedures for obtaining the best solution are standardized
- Objectives are clearly defined
- Clearly specified inputs and outputs

### Un-structured decisions

When problems are non routine, critical and novel in nature, they require individual judgment, evaluation and insight varying on case-to-case basis. There is no well understood or agreed upon procedure for handling these problems. For such situations, predefined policy cannot be devised. However, once the problem has been figured out, a policy may be devised to handle the problem in future. This can make the problem look like as structured one giving regard to the role of individual judgment.

### Semi-structured Decisions

The term is used to refer to the grey area of decisions which lie between the two extremes. Some (but not all) structured phases and often solved using standardized solution procedures and human judgment.

In small organizations decisions are usually transferred from form top to bottom. In large organizations the decision are usually taken based on meeting of all departmental heads. The fact is that whether decisions are taken by single person or all in a formal meeting is not the sole determinant of a decision being structured or unstructured. Rather it simply shows the complexity of the problem.

### 15.3 Decision-making process

- Intelligence – searching for conditions in the environment that call for decisions
- Design – inventing, developing, and analyzing possible courses of action
- Choice – selecting a course of action from those available
- Implementation – implementing the selected course of action
- Monitoring – checking the consequences of the decision made after implementation

#### Phases for Decision Making – Example

Any deviation from the norm should be reported as an exception for managers' attention. As it is the case with "Debtors Aging Analysis". (Debtors Aging analysis is the stratification of trade receivables in accordance of period of time since they have been due.)

**Intelligence:** Identifying the problems occurring in an organization. MIS is the primary source for the managers to be aware of red-alerts.

**Design:** Once the debtors have been analyzed on the basis of pattern of collection, options can be generated to improve collection rates. For example

- Offering early payment discounts.
- Devising various collection strategies for
- various classes of customer based on
- Collection period
- Discounts rates
- Strengthening sales department for collecting revenue through negotiation and settlement.

**Choice:** Now a selection has to be made which single strategy or combination of strategies should be implemented.

- Here a DSS system can be used to simulate the consequences of each alternative generated.
- The diversity and complexity of the alternatives generated would determine how extensive the DSS system should be.

**Implementation:** Now the stage comes of communicating the policy approved to the interested and relevant: for example

- Conducting training sessions of sales department or issuing an office memorandum.
- Communicating and convincing customers of the new credit terms so as to avoid confusion.
- Once again MIS will be used to record and report the results/effects of the policy.

**Monitoring:** Once the decision has been implemented, the effects and responses should be monitored. The quality of decisions can be judged only once after they have been implemented. Monitoring helps in evaluating the quality of decisions that have been made. This may include the following:

- Quantifying the speed in the process of recovery.
- Discount costs being born by the organization.
- Customer response in accepting the entire policy.
- Once again MIS will be used to record and report the results / effects of the policy.

<b>Phases</b>	<b>Example</b>
Intelligence	Debtor's aging report
Design	Devise a discount or training policy
Choice	Select a discount/training policy
Implementation	Implement the discount/training policy
Monitoring	Evaluate recovery patterns, relevant costs involved.



**LESSON 16****Phases of decision-making**

There are five phases of the decision making process, the details of these phases have already been discussed in detail. These five phases will be elaborated in the form of an example for better understanding.

**16.1 Phases of decision-making process are:**

- **Intelligence** – searching for conditions in the environment that call for decisions
- **Design** – inventing, developing, and analyzing possible courses of action
- **Choice** – selecting a course of action from those available
- **Implementation** – implementing the selected course of action
- **Monitoring** – checking the consequences of the decision made after implementation

**Phases Example**

Assume that a multinational company is considering opening a branch in Pakistan. Identify typical activities that would be performed in each phase (intelligence, design, choice, and implementation) of the decision to open or not to open a branch.

**16.2 The Intelligence Phase**

Scan the environment to identify problem situations or opportunities. Conditions that call for decisions are identified. Typical Activities include:

- **Country Risk based on following**
  - Country credit rating
  - Transparency
  - Corruption
- **Facilities for one window operation (levels of bureaucracy)**
  - SRO Culture
  - Govt. Policy
  - Law & Order
  - Exchange rates

For instance, international banks while entering into country make assessment of exposure and thus limit the maximum number of transactions the bank can undertake.

- a) What are the possible advantages, disadvantages, and risks?
- b) How much resources will be diverted from other activities?
- c) When should we start? And so forth.

**16.3 The Design Phase**

Possible courses of actions are invented, developed, and analyzed.

Typical Activities include:

- Select criteria for assessing the alternatives (e.g., ROI, market share, etc.)
- Create alternatives: invest now, invest later, do not invest
- Analyze levels and timing of investment
- Information flow for decision making
- Prepare a feasibility study
- How will the choice be made, by whom, and when?

#### 16.4 The Choice Phase

A course of action is selected out of the available alternatives as devised in the design phase. Typical Activities include:

- Get information
- Final evaluation
- Sensitivity analysis

#### 16.5 The Implementation Phase

Implement the selected course of action. Typical Activities include:

- Follow the implementation plan
- Deal with resistance to change and necessary approvals and authorizations
- Conduct training
- Transfer resources

#### 16.6 Rational Individual Models of Decision Making

Since individuals in total make up organization, hence it is reasonable to build information systems which facilitate the individual decision making. These are:

- Rational Man (Comprehensive Model)
- Bounded rationality
- Muddling (Successive Comparison)
  - Psychological (Cognitive Types)

The basic assumption of all these models is the human beings are rational.

- An individual has goals and objectives.
  - Alternative course of actions can be followed to achieve these goals.
  - Every alternative has a utility and payoffs which helps him to rank the alternatives.
- There is an impact or consequence for every alternative being followed.

##### Rational Man Model

- In a rigorous rational model, it is presumed that the individual is rational enough to accurately rank all the alternatives.
- However, in the real world of humans, specifying all of the alternatives and consequences is impossible.

- Information systems based on this model need to be based on availability of perfect and complete information on all alternatives so as to ensure certainty.
- Real life situations need to be given room for chances which this model does not provide for.

### **Rational Man Model – Example**

1. In a pharmaceutical drug company, the preparation and testing of life saving drug is a critical phase, and choice of a perfect alternative is inevitable. Hence the information system devised to support it should be such that it can record and monitor even the slightest variations.
2. In an ammunitions factory, the testing and quality control of various bullet, shells, missiles, bombs, etc is a sensitive issue. Since chances of error are quite high, the system from selecting and discarding should be with high sensitivity level.

### **Bounded Rationality**

Keeping in view the high level of perfection and completeness required by the rigorous rational model, certain adjustments were made in this model. The purpose was to seek a sufficing instead of an optimizing outcome. Bounded rationality focuses on the fact that Individuals prefer to avoid new uncertain alternatives and rely on tried and-true rules (SOP's). According to this model, individuals bound the rational behavior of choosing the best alternative by choosing a sufficing alternative. That is why it is termed as bounded rationality. Information systems based on this model are close to reality in terms of considering alternatives which are most commonly available. Quick decision making can be encouraged through this model.

### **Bounded Rationality -- Example**

Cost benefit analysis is a must in choosing an alternative in a decision making model. Where an alternative being given is difficult to implement in terms of costs involved, the management might chose a less than perfect alternative hence SUFFICING INSTEAD OF OPTIMISING.

### **“Muddling Through”**

This model is closer to reality as compared to the above two goals. This model has introduced the concept of incremental decision making, which decisions are taken by choosing policies most likely the previous ones. For this purpose the information systems need to be intelligent and include knowledge based systems to help accumulate and use knowledge.

### **Psychological (Cognitive Types)**

This refers to the underlying personality dispositions toward the treatment of information, the selection of alternatives and evaluation of consequences. • The model proposes that human beings are value maximizes and in that sense are rational. But humans differ in how they maximize the value.

### **Psychological (Cognitive Types)**

There are two types of cognitive type of decision making.

- **Systematic** – problem is approached in a structured way in terms of some formal method.
- **Intuitive** – problem is approached with multiple methods using trial and error to find a solution.

Of both the above methods, one should be selected based on the problem at hand. Information systems should follow a systematic and intuitive pattern based on the problems or cases it is supposed to deal with. MIS and DSS can be seen as having a systematic approach towards problem solution. The concept of heuristics, fuzzy logic, etc, is devised to follow the intuitive patterns.

### **16.7 Organizational Models in Decision Making**

Organizations are thought to have singular goals controlled by senior level decision makers who are completely informed. How organization makes decisions as a whole, following are certain models.

- Bureaucratic
- Political
- Garbage Can

#### **Bureaucratic model**

Whatever organizations decide is a result of Standard Operating Procedures, evolved over time. In general organizations do not chose or decide in a rational sense, instead they chose a specific set of SOP's. Radical policy changing is discouraged at all costs.

#### **Empire Building**

Empire building is a business term that refers to a common problem in larger organizations, in which managers attempt to gather more administrative and financial power. Power can only be shared in an organization with key employees in terms of their responsibilities & functions. Such employees are the key players in the decision making process. Hence decisions taken in an organization are a result of collective efforts of the leaders involved. This model is also termed as Political Model.

#### **Garbage Can Model**

This model states that organizations are not rational. Decisions made are largely on accidental basis. Hence wrong solutions may be applied to wrong problems in an organization and critical mistakes may occur. Information systems should be designed to support and assist in relevant decision making, instead of making unrelated and wrong decisions.

#### **System Design & Decision Making**

The purpose of elaborating the concept of decision making in the context of IS was to make you realize the importance of the fact that, Information system must support the managers for timely and effective decision making. While designing the information system, output, in terms of suitable reports is essential to analyze, highlight and bring to attention situations that may require decision making. The top manager looks for value addition to his/her knowledge of business operation.

**LESSON 17****Planning for System Development**

The management should prefer to have a plan for IT development so as to help it to take various software development projects in a structured way. At the very start, planning is done by the management regarding following issues

- Scope of software development – certain selected areas or the entire organization.
- How to get the project done – in-house committee or hired consultants.
- How much resource and time commitment can be made.
- Any written policy on which model is needed to be followed for software development.

IT planning provides a structured means of addressing the impact of technologies, including emerging technologies, on an organization. Through the planning process, relevant technologies are identified and evaluated in the context of broader business goals and targets. Based on a comparative assessment of relevant technologies, the direction for the organization can be established. Business planning is an accepted responsibility of management. Plans provide a direction and framework for action. Plans enunciate business goals and the actions that need to be initiated to achieve those goals including related benefits, resources and timeframes.

Increasingly, information technologies not only support but, also may drive or enable business strategies. In this context information technologies are an integral part of the business planning process itself. If such potential is evident after the completion of the business plan, then the business plan must be revisited and, if appropriate, revised.

**17.1 Phases of IT planning**

Although information technology plans are unique, the planning process and the underlying activities are similar.

- **Orientation** -- This start-up phase is required to establish the scope of the plan and the methodology and techniques to be applied
- **Assessment** -- Major steps in this phase are
  - Confirm business direction and drivers;
  - Review technology trends; outline future requirements;
  - Inventory existing information systems; and
  - Develop an assessment of what is needed.
  - In the concluding step of this phase there should be a well-developed assessment of the current and future business needs,
- **Strategic Plan** -- This phase commences with developing the vision and desired future positioning of information technology within the organization.
- **Tactical Plan** -- The selected strategies are divided into a series of projects which are scheduled for implementation depending upon relative priorities and resource availability. The planning process is

concluded by recommending a monitoring and control mechanism.

### What is System Development?

System development refers to the structuring of hardware and software to achieve the effective and efficient processing of information. Information systems are developed keeping in view the needs to be met. There can be two reasons for system development.

- A manual information system is to be computerised.
- An already computerised information system is to be replaced with a system that addresses the growing and changing needs of the organization or the old system has become too slow or there are newer more efficient and user friendly development tools are available.

In both the above mentioned situations, the phases followed for system development would be the same. The extent of system study, analysis & design may depend on the fact whether the existing system is manual or computerised. To develop systems, various development models or techniques are deployed. Let us understand why these development models are used.

### 17.2 Models Used for System Development

Initially software development consisted of a programmer writing code to solve a problem or automate a procedure. Nowadays, systems are so big and complex that teams of architects, analysts, programmers, testers and users must work together to create the millions of lines of custom-written code that drive our enterprises. To manage this, a number of models for system development have been created. The most famous of these models is the system development lifecycle model (SDLC) or Lifecycle Models.

### 17.3 Systems Development Life Cycle

System Development Life Cycle (SDLC) is the overall process of developing information systems through a multi-step process from investigation of initial requirements through analysis, design, implementation and maintenance. SDLC is also known as information systems development or application development. SDLC is a systems approach to problem solving and is made up of several phases, each comprised of multiple steps. It describes the stages a system passes through from inception until it is discarded or replaced. SDLC provides

- Structure
- Methods
- Controls
- Checklist

### Project lifecycle vs. SDLC

The systems development life cycle is a project management technique that divides complex projects into smaller, more easily managed segments or phases. Segmenting projects allows managers to verify the successful completion of project phases before allocating resources to subsequent phases. Although System development can be seen as a project in itself, but the attribute that makes system development different from regular projects is that a project has a definite end and it is unlikely that ongoing maintenance will be included in the scope of the project but this falls in the definition of SDLC.

### 17.4 Types of System Development Life-Cycle Model

The concept of system development lifecycle model has been explained in various shapes and forms. The concluding form follows the same spirit except for minor differences.

### **Waterfall model / Classic lifecycle/ Linear Sequential Model**

The waterfall model is a software development model (a process for the creation of software) in which development is seen as flowing steadily downwards (like a waterfall) through the various phases

### **Incremental Models**

In incremental models, software is built not written. Software is constructed step by step in the same way a building is constructed. The products is designed, implemented, integrated and tested as a series of incremental builds, where a build consists of code pieces from various modules interacting together to provide a specific functional capability and testable as a whole.

### **Iterative Models**

In these models customer feed back is taken at each phase and project is modified accordingly – if need be. Prototypes are used in these models.

### **Need Assessment**

Information systems are usually developed on need-basis, that is, problems and opportunities arise and render system development necessary. In this phase the stakeholders must attempt to come to some understanding of the nature of the problem or opportunity they are addressing. Issues which can be considered in this phase are. Is the problem

- Well structured/Structured -- constrained problems with convergent solutions, limited number of rules and principles within well-defined parameters.
- Unstructured -- multiple solutions, fewer parameters, and contain uncertainty about which concepts and rules.

Should formal terms of reference be prepared and approved by the steering committee or project committee? This depends on the size, impact and cost of the system being prepared. The TOR usually covers following aspects.

- Investigation on existing system
- Definition of system requirements
- Specifying performance criteria for the system
- Detailed cost budget
- Draft plan for implementation

If the problem is decided to be addressed and the level of acceptance that exists among the stakeholders on the need of change. The level of technological uncertainty the proposed solution to the problem/opportunity has. The most critical phase is the agreement of the stakeholders on the definition of problem and parameters of solution.

### **Entry and Feasibility Study**

The purpose of this phase is to obtain a commitment to change and to evaluate whether cost effective solutions are available to address the problem or opportunity that has been identified. Following examples can be considered to explain this situation.

- Say a problem has been recognized by a group of users. They believe they can design and implement a solution themselves using a high level language. Their proposed system will have little impact on others within the organization, nor will it be material from the viewpoint of the overall organization. In this situation, the users are already motivated to bring about change. Thus activities to accomplish successful entry are minor or unnecessary.
- On the other hand, consider a solution where potential solutions will have a widespread impact on the overall organization. Activities to accomplish successful entry are now critical. Information systems professionals must seek to establish themselves as legitimate change agents among the stake holders. Moreover they must seek to foster among the stakeholders a commitment to change. If potential solutions will have a significant impact on task and social systems, a spirit of collaborative analysis and evaluation among stakeholders must be developed.

Once the entry is successful, a preliminary study can be carried out to evaluate the feasibility of the new system. A Feasibility study team should be constituted

- Draw representatives from the departments affected by the project
- At least one person must have a detailed knowledge of computers and systems design (called system analyst).
- At least one person should have a detailed knowledge of
  1. The organization
  2. How current system operates
  3. Information needs of the system
  4. Defects in the existing system
- Consultants from the outside



**LESSON 18****Systems Development Life Cycle**

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3. Controls
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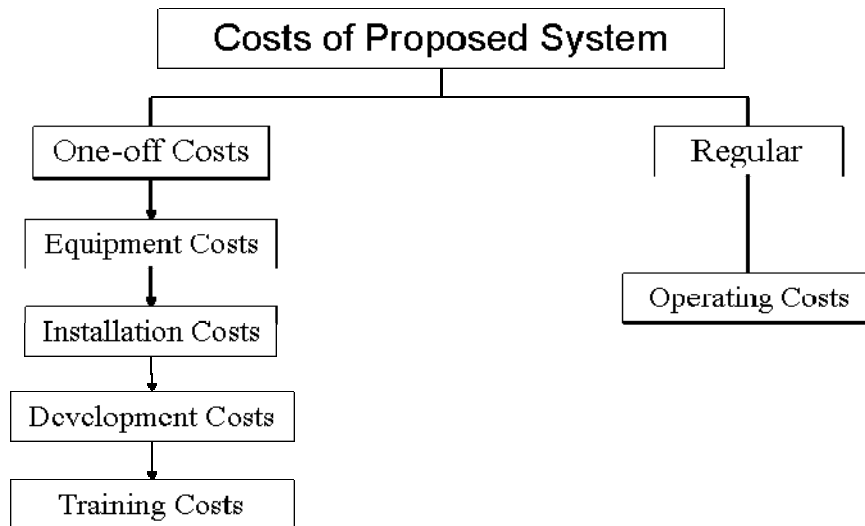
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  - How current system operates
  - Information needs of the system
  - Defects in the existing system
- Consultants from the outside

### Key Areas of Feasibility

Following aspects/criteria can be covered in a feasibility study.

- **Technical Feasibility** – is the available technology sufficient to support the proposed project? Can the technology be acquired or developed?
  - Response times – time between request and execution
  - Volume of transactions which can processed within the given time
  - Capacity to hold files or records of a certain size
  - Number of users supported without execution
- **Operational Feasibility** – compliance and adjustability with the way organization works with attitude to change or chains of command.
  - Can the input data be collected for the system?
  - Is the output usable?
- **Economic feasibility** – Do the benefits of the system exceed the costs?  
It should be the BEST OPTION among those under consideration for the same purpose.
- **Behavioural feasibility** – What impact will the system have on the user's quality of working life?
  - Reduction in job stress
  - Job satisfaction
  - Quality of output by employees

### 18.3 Costs of Proposed System



#### 18.4 Benefits from the proposed system

When a system is being introduced, management should consider the impact and amount of proposed benefits. The purpose of this activity is to consider and

- Better decision making
- Savings
  - Possible in staff costs through increase of efficiency and not necessarily through redundancies.
  - In costs of running the department through more organized and efficient computerisation.
- More sales revenue
- Efficient use of staff time
- Customer satisfaction
- Better planning of resources required for operations e.g. inventory ordering, fixed asset utilization.

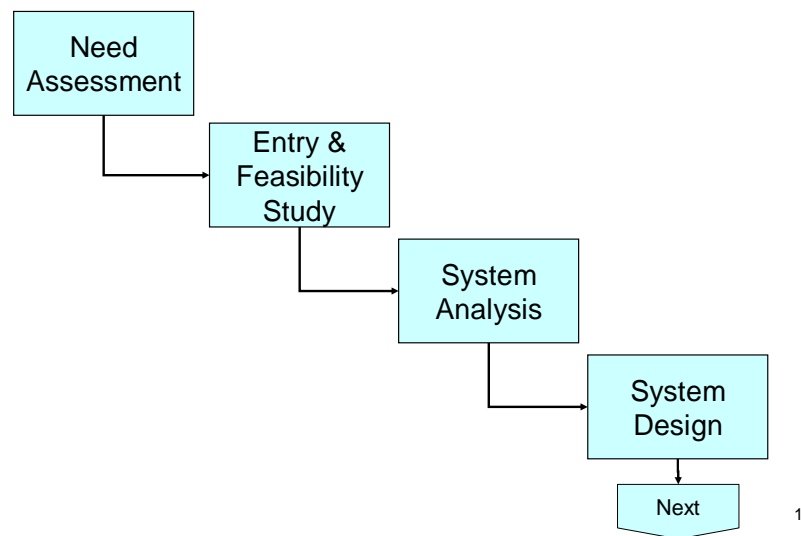
#### 18.5 Classic lifecycle Model / Waterfall Model

Waterfall model is the earliest of software process models. Cascade of phases, the output of one is input to the next. The waterfall model is a software development model (a process for the creation of software) in which development is seen as flowing steadily downwards (like a waterfall) through the various phases. Various phases of waterfall model are

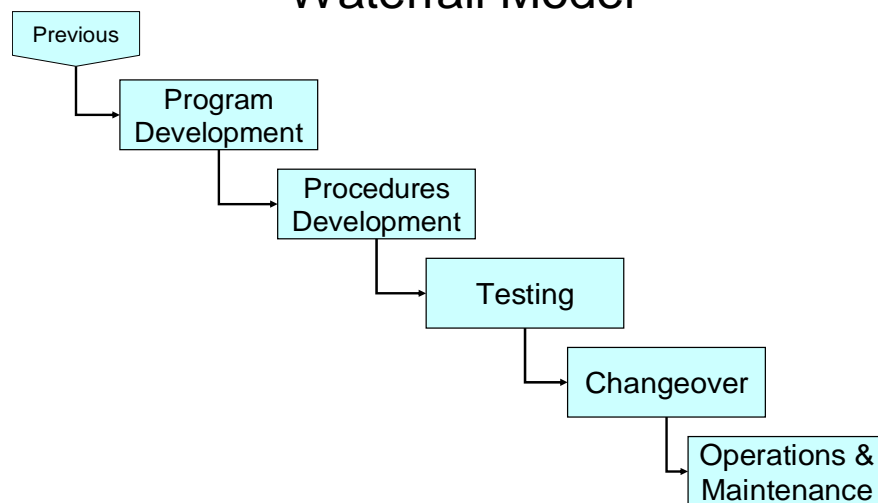
- Need Assessment
- Entry and feasibility study
- Analysis of the existing system
- Information processing systems design – This also includes
  - Formulation of strategic requirements
  - Organizational & job design

- Program Development – this includes
  - Application software acquisition & development
  - Hardware/system software acquisition
- Procedures development
- Testing
- Conversion
- Operating & maintenance

## Waterfall Model



## Waterfall Model



Two phases need assessment and feasibility study, have already been explained in detail. Now let's take a look at other phases one by one.

### 18.6 Analysis of Existing system

Once feasibility has been drawn up, next stage comes for analysis of existing system. Even if the existing system is to be replaced the designers must study the existing system as this improves the quality of the work. For example

The new system may change the way employees are rewarded. In such a case the redistribution of rewards may have to be carefully negotiated. Concerns of employees cannot be ignored. Analysis is a two-part episode. Studying organization's history, structure, culture – this would help to understand

- The social & task systems
- The way systems are coupled
- Willingness of stakeholders to change (Change Management to be discussed later)

The greater the impact of the new system, greater time should be spent in understanding the present organization. Analysis of existing product & information flows. This includes the use of various tools for documenting the existing system. What these tools are will be discussed in detail in later Lessons.

### System Design

System design includes the desired features and operations in detail, including screen layouts, business rules, process diagrams other documentation. It involves converting the informational, functional, and network requirements identified during the initiation and planning phases into unified design specifications. This includes

- Formulation of strategic requirements
- Organizational & job design
- Elicitation of detailed requirements
- Design of the information flow
- Design of database
- Design of user interface
- Physical design
- Design of hardware & software platform

#### Formulation of Strategic Requirements

The overall goals and objectives the system must accomplish. Forms can be accomplished in any form, for instance:

- A vague goal – increase in the wealth of shareholders
- A specific goal – reduce staff turnover by 30%

Strategic requirements for the new system are identified based on perceived deficiencies of existing system. Trying to fit people and organizations into information systems has been major reason for failure. If strategic requirements are clear, stakeholders are better placed to consider and evaluate alternative designs.

### Organizational & Job Design

---

Change in the strategic requirements will necessitate the change in the following for the parts of the organization being affected

- Organizational structure
- Job descriptions for new or change in existing ones

Trying to fit people and organizations into information systems has been major reason for failure. So change in both the above is important. If uncertainty surrounds the tasks to be accomplished in the proposed system, loose organic organizational structures and job designs might be successful. Such promote creativity and innovations. If organization is dominated by top management and culture is autocratic, employees might be unwilling to accept the high level of responsibility.

### **18.7 Elicitation of Detailed Requirements**

#### **Designers must understand**

- What information an IS must provide
- The data that must be captured to produce this information

Two approaches can be followed

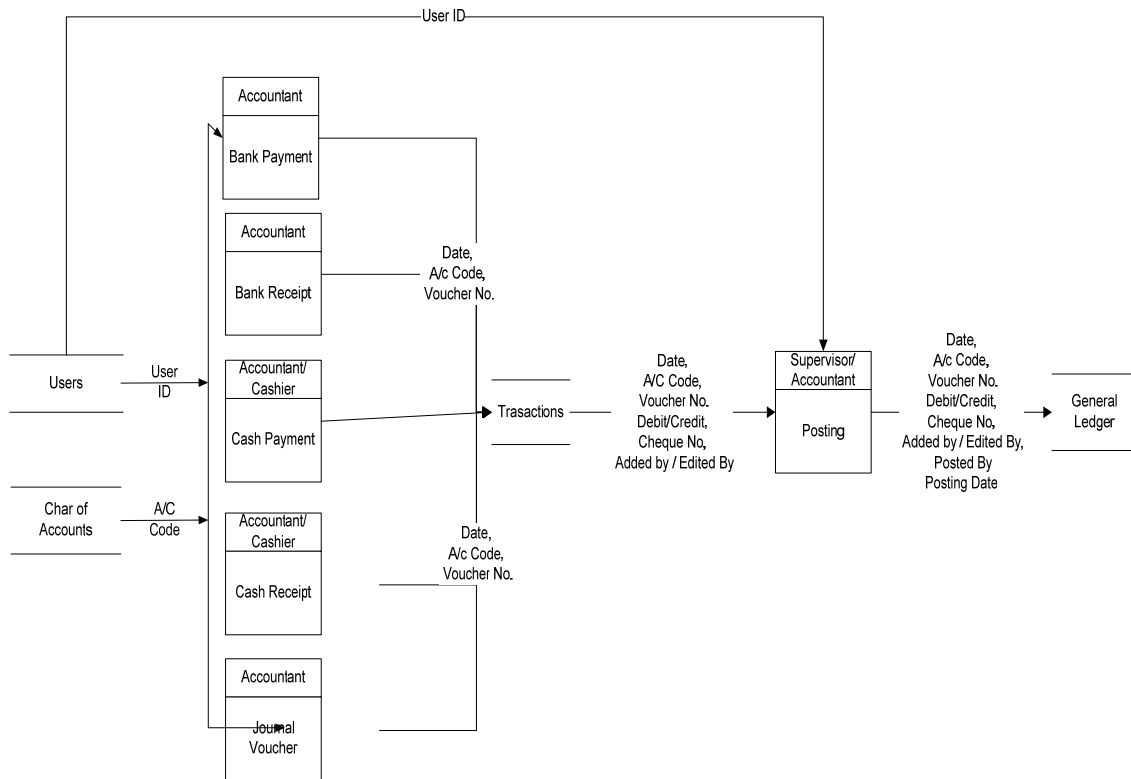
- Ask the stakeholders what they require – helps when they are clear about the requirements on the basis of past experience or good understanding.
- Analysis & experimentation – Where the ones bearing interest are not clear or have no past experience, onus falls on the designer to work out the requirements.

**LESSON 19**

**System Design**

System design can be explained and presented in narrative form. But the benefits of diagrammatic view cannot be understated. This helps to give a snapshot of what the entire system looks like. Various diagrammatic tools can be used while designing the system.

As an example consider the following DFD which indicates a simple process of recording transactions and posting into general ledger





User/Accountant uses chart of accounts to access the relevant accounts in order to prepare different vouchers according to requirements. The purpose behind this entire activity is to record various transactions. The next step is posting of all these transactions in the system. This process updates the general ledger.

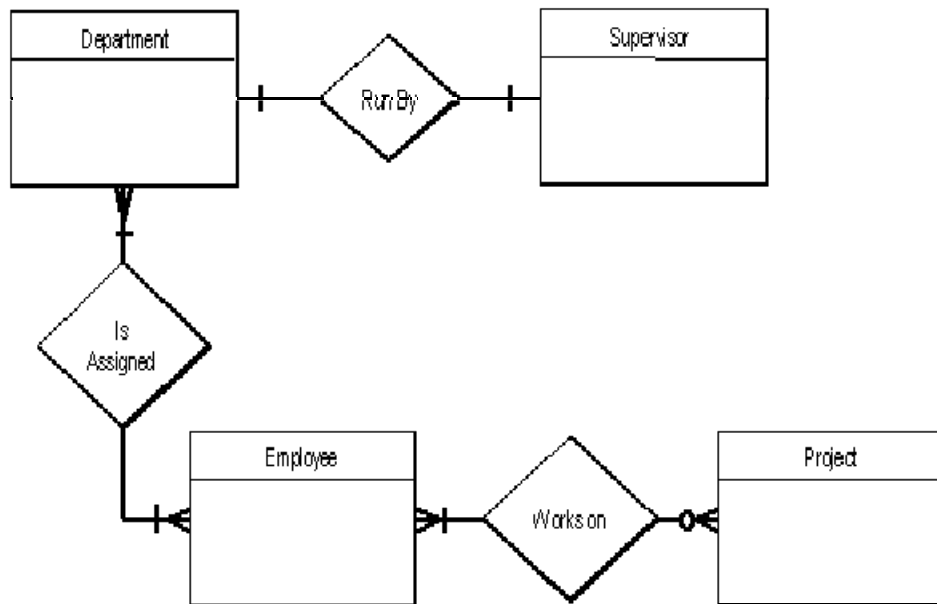
### 19.1 Entity Relationship Diagram (ERD)

Another diagrammatical tool used in system design is ERD. ERD as shown below indicates simple relationships. These relationships can be read as follows.

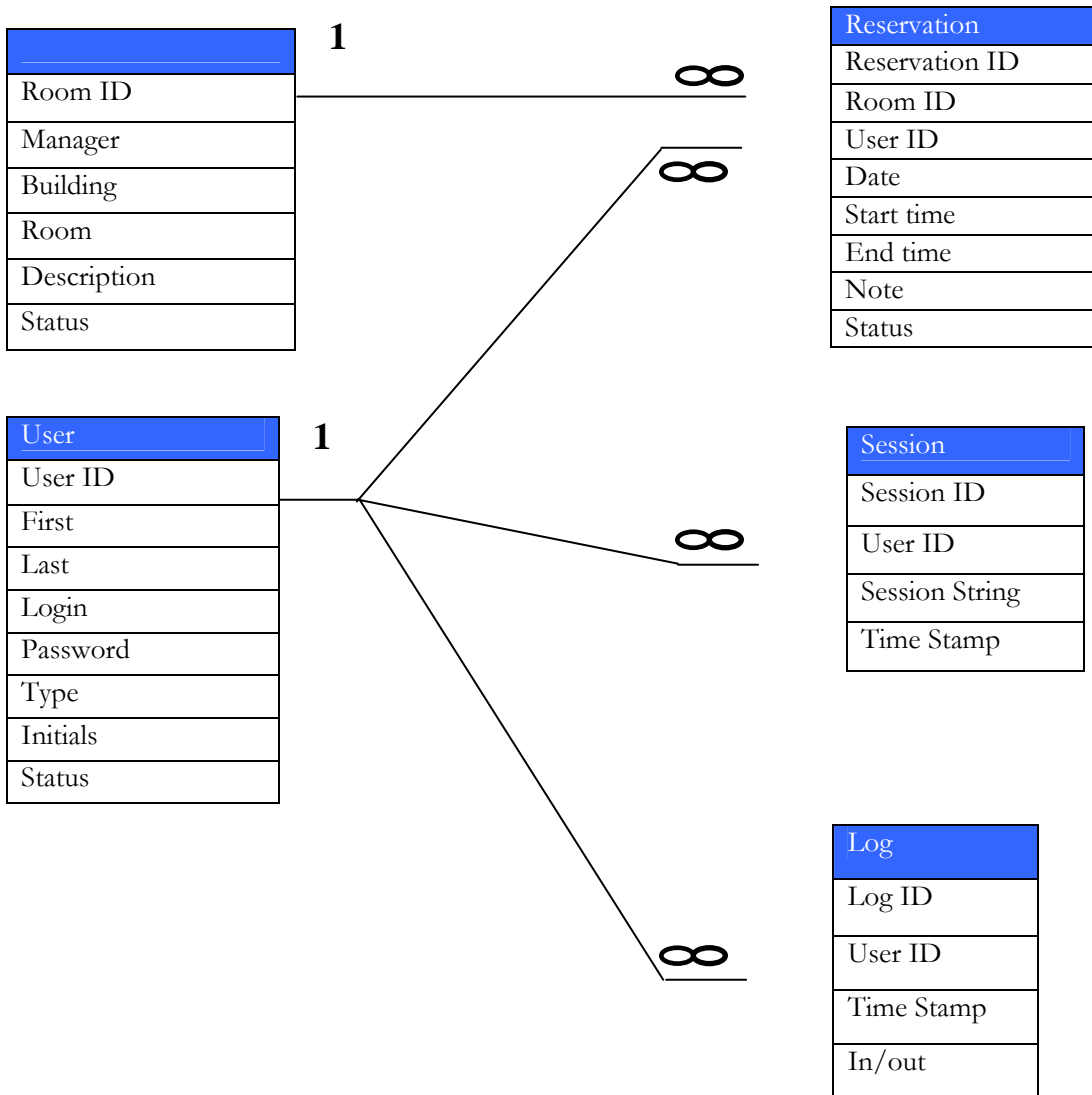
- One department has one supervisor
- A department may have more than one employees

Or

- An employee may be in more than one departments
- An employee may not be working on any project but a project must have at least one employee working on it



This is another form of ERD used to show the relations between various fields in files used to record specific data.



The above figure shows a hotel booking system. Various records have been kept for each entity. However each entity shares a relationship with for logical purpose. For instance, the field for room ID has been kept in reservation for access to further data. User information has been kept separate, however link has been made to reservation, session and logs by making user ID common to all three tables. Such kind of relationship helps in keeping

### 19.2 Design of the information flow

It is a major step in the conceptual design. Following aspects should be covered

- Flow of data & information and transformation points
- The frequency and timing of flows
- The extent of formality in these flows – input forms, report formats.

### 19.3 Design of data base

It involves determining scope and structure:

- Scope – Whether the database is local or global. If interdependence of organizational units is high, the data base has to be global in order to prevent sub-optimization of sub units. As it becomes global, the cost of maintenance enhances.
- Structure – refers to the ways data is stored in partitions and sequences. Various design methodologies can be used for devising a suitable structure in accordance with the needs of the organization and the new system.

### 19.4 Design of the User Interface

This phase involves determining the ways the information system will interact with the users. Some elements are

- Source Documents to capture raw data
- Hard-copy output reports
- Screen layouts
- Inquiry screens
- Interrogation languages for the data base
- Graphics and colour displays
- Voice output to guide users or answer queries
- Screen layouts for manipulation by a light pen or mouse
- Icons for pictorial representations

The design process begins with stratifying system users and then identifying their needs. e.g.

- New users dealing with system infrequently,
- Experts dealing regularly

### 19.5 Physical Design

The logical design is converted to physical design in this phase. The physical design involves breaking up the logical design into units, which in turn can be decomposed further into implementation units such as programs and modules.

#### Design of the Hardware/ Software Platform

New system requires new software and hardware not currently available in the organization.

For example

- User workstations might have to be purchased to support an office automation system.
- A minicomputer might have to be purchased to provide extra processing resources to the new system.

### 19.6 Program Development

The development phase involves converting design specifications into executable programs. Once the analysis and design is complete, the software is either developed according to the needs or most suitable is purchased. Similarly the specifications of the hardware are seen and acquisition is made according to the situation. Primary procedural programming activities include

- The creation and testing of source code
- The refinement and finalization of test plans
- Writing and reviewing program modules or components
- Integration of Completed components with other components to ensure the components properly interact. The process continues as component groups are progressively integrated and as interfaces between component groups and other systems are tested.

### 19.7 Procedures Development

In this phase, following documents are prepared.

- Technical manual – This is meant for the Data Base Management and highlights the system infrastructure, inputs-outputs of the system and flows of system processes. Documents include
  - DFD's (Data Flow Diagrams)
  - ERD's (Entity Relationship Diagram)
  - Use cases, test cases
- **User manual**  
It defines the operations of the system in layman's terms i.e.
  - Getting started with the software
  - Operating the software
- These manuals are generally function related.

### 19.8 Testing

The purpose of this phase is to identify as far as possible any errors and deficiencies in the system prior to its final release into production use. For instance errors in

- User interface
- Procedure manuals
- Job design
- Organizational structure design

In reality all system features cannot be checked at the outset. For instance, users might realize that the system has inadequate procedures manual only after the system has been properly implemented.

### Change Over

This phase comprises of those activities undertaken to replace the new system in operation from the

existing system. Following ways of change over can be undertaken

- Abrupt change over – stop the existing system abruptly to shift over to new one
- Phased change over – Both are run but output of both the systems is used since functions performed are different.
- Parallel change over – Both systems are run simultaneously for a period of time and output of either of the systems is used. Functions performed by both are same.

### 19.9 Operations & Maintenance

The new system is run as a production system and is periodically modified to adjust for better functioning. Following can be various forms of errors.

- Removal of coding/logic errors – Logic errors discovered in the system are corrected.
- Modifications / system rewrite – Changes in the system environment may necessitate system modifications.
- Perfective maintenance – Changes might be made to improve processing efficiency.

### 19.10 Evaluating Waterfall

#### Arguments for water fall

- Waterfall model places emphasis on documentation (such as requirements documents and design documents) as well as source code.
- Other methodologies which save time in software development can de-emphasize documentation. In such methodologies project knowledge is stored mentally by team members. Should team members leave, this knowledge is lost, and substantial loss of project knowledge may be difficult for a project to recover from. Extreme Programming is an example which will be discussed later.
- Waterfall model is preferred for its simple and arguably more disciplined approach. The model itself progresses linearly through discrete, easily understandable and explainable "phases" and is thus easy to understand
- It also provides easily mark able "milestones" in the development process. It is perhaps for this reason that the waterfall model is used as a beginning example of a development model in many software engineering texts and courses.

#### Arguments against water fall

- It is argued that it is impossible to get one phase of a software product's lifecycle "perfected" before moving on to the next phases and learning from them.  
For example clients may not be aware of exactly what requirements they want before they see a working prototype and can comment upon it - they may change their requirements constantly, and program designers. This is an example of iterative model (to be discussed later)
- Waterfall model advocates more reliance on fixed, static requirements. Designers may not be fully aware of future implementation difficulties when writing a design for an unimplemented software product. That is, it may become clear in the implementation phase that a particular area of program functionality is extraordinarily difficult to implement.
- Another problem is that the waterfall model assumes that the only role for users is in specifying requirements, and that all requirements can be specified in advance. Unfortunately, requirements grow

and change throughout the process and beyond, calling for considerable feedback and iterative consultation. Thus many other SDLC models have been developed. The choice of phases differs in various standards and organizations.

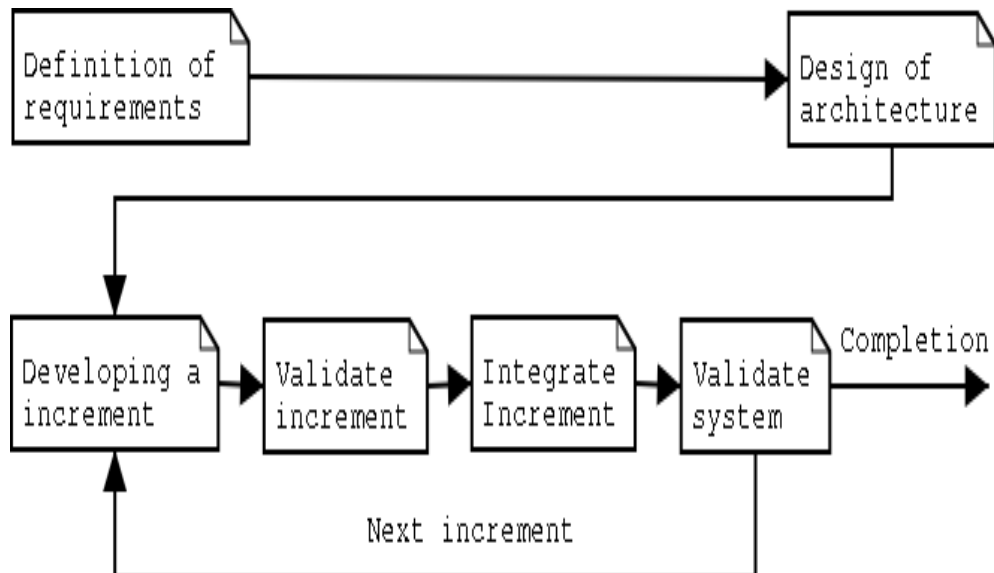
## LESSON 20

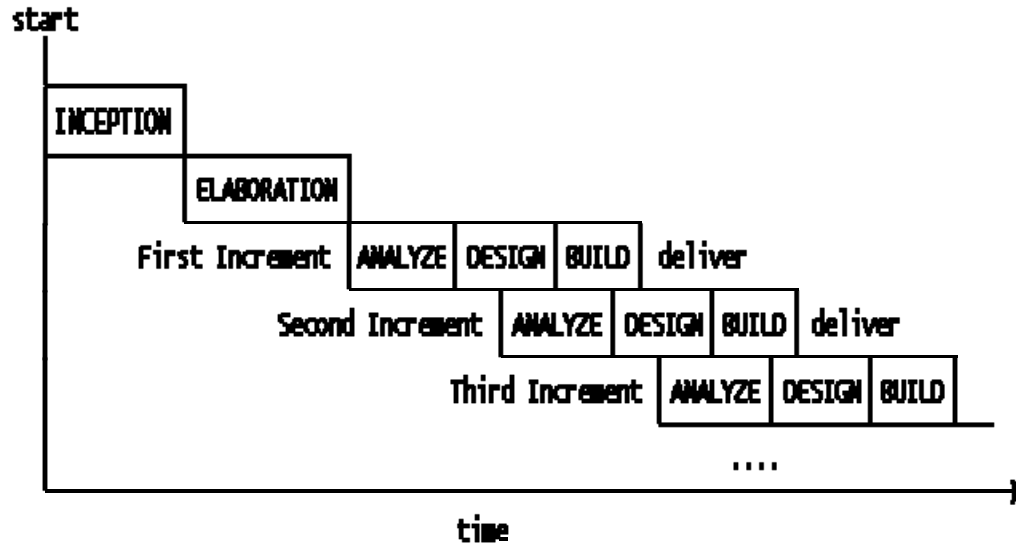
### Incremental Model

The incremental model is a method of software/ Information System development where the model is designed, implemented and tested incrementally until the product is finished. It involves both development and maintenance. This model combines the elements of the waterfall model with the philosophy of prototyping.

**Example** -An example of this incremental approach is observed in the development of word processing applications where the following services are provided on subsequent modules:

- Basic file management, editing and document production functions
- Advanced editing and document production functions
- Spell and grammar checking
- Advance page layout





The first increment is usually the core product which addresses the basic requirements of the system. This may be either be used by the client or subjected to detailed review to develop a plan for the next increment. This plan addresses the modification of the core product to better meet the needs of the customer, and the delivery of additionally functionality. More specifically, at each stage

- The client assigns a value of functionality to each module not yet implemented
- The developer estimates cost of developing each module
- The resulting value-to-cost ratio is the criterion used for selecting which module is delivered next

Essentially the module with the highest value-to-cost ratio is the one that provides the client with the most functionality (value) for the least cost. Using this method the client has a usable product at all of the development stages. Modules are also selected on the basis of the customer requirements and needs apart from the value to cost ratio.

### 20.1 Characteristics of the Incremental Model

- The system development is broken into many mini development projects
- Partial systems are successively built to produce a final total system.
- Highest priority requirements tackled early on.
- Once an incremented portion is developed, requirements for that increment are frozen.

### 20.2 Incremental Model-Evaluation

#### Benefits

- Working functionality is produced earlier – computation of value to cost ratio
- Reduces risks of change in user requirements
- Provides clients flexibility in decision making.
- Risk management is incremental
- Smaller scope for change in user requirements

## Criticism

- Larger picture cannot be seen until the entire system is built
- Difficult to break down the total system at early stage of product development to determine reasonable increments

## Iterative Models

Iterative models are an approach for developing systems based on producing deliverables frequently/repetitively. Each iteration, consisting of requirements, analysis & design, implementation and testing, results in the release of an executable subset of the final product. These subsets grows incrementally from iteration to iteration to become the final system. The Procedure itself consists of three basic steps.

- The Initialization step -- creates a base version of the system. The goal for this initial implementation is to create a product to which the user can react.
- **The Iteration step** -- The iteration step involves
  - The redesign and implementation of a task from project control list. The goal for the design and implementation of any iteration is to be simple, straightforward, and modular, supporting redesign at that stage or as a task added to the project control list.
  - The analysis of the current version of the system. The analysis of an iteration is based upon user feedback and the program analysis facilities available. It involves analysis of the structure, modularity, usability, reliability, efficiency, and achievement of goals. The project control list is modified in light of the analysis results.
- **The Project Control List** -- To guide the iteration process, a project control list is created that contains a record of all tasks that need to be performed. It includes n
  - New features to be implemented, and
  - Areas of redesign of the exiting solution.The control list is constantly being revised as a result of the analysis phase.

## 20.3 Iterative Models – Evaluation

### Harms

The Iterative Model can lead to "scope creep," since user feedback following each phase may lead to increased customer demands. As users see the system develop, they may realize the potential of other system capabilities which would enhance their work.

### Benefits

- In fact, the context of multiple iterations provides advantages in the use of measuring various aspects of product development, such as
  - Effort to date
  - Changes,
  - Defects,
  - Logical, physical, and dynamic attributes,
  - Environmental considerations.



- The customer can tell how product characteristics like size, complexity, coupling, and cohesion are increasing or decreasing over time.
- One can monitor the relative change of the various aspects of the product or can provide bounds for the measures to signal potential problems and anomalies.

#### 20.4 Incremental vs. Iterative

These sound similar, and sometimes are equated but there is a subtle difference:

- Incremental: add to the product at each phase
- Iterative: re-do the product at each phase

#### Example

Building a House

- Incremental: Starts with a modest house, keep adding rooms and upgrades to it.
- Iterative: The design/construction map of the house is amended and improved and repeated until all the requirements are fulfilled.

**LESSON 21****Spiral Model**

SPIRAL is an iterative approach to system development. The spiral lifecycle model is a combination of the classic waterfall model and aspects of risk analysis. This model is very appropriate for large and complex Information Systems. The spiral model emphasizes the need to go back and reiterate earlier steps a number of times as the project progresses. It's actually a series of short waterfall cycles, each producing an early prototype representing a part of the entire project. It is a circular view of the software lifecycle as opposed to the linear view of the waterfall approach. It can incorporate other models in its various developmental phases.

There are usually four distinct phases of the spiral model software development approach.

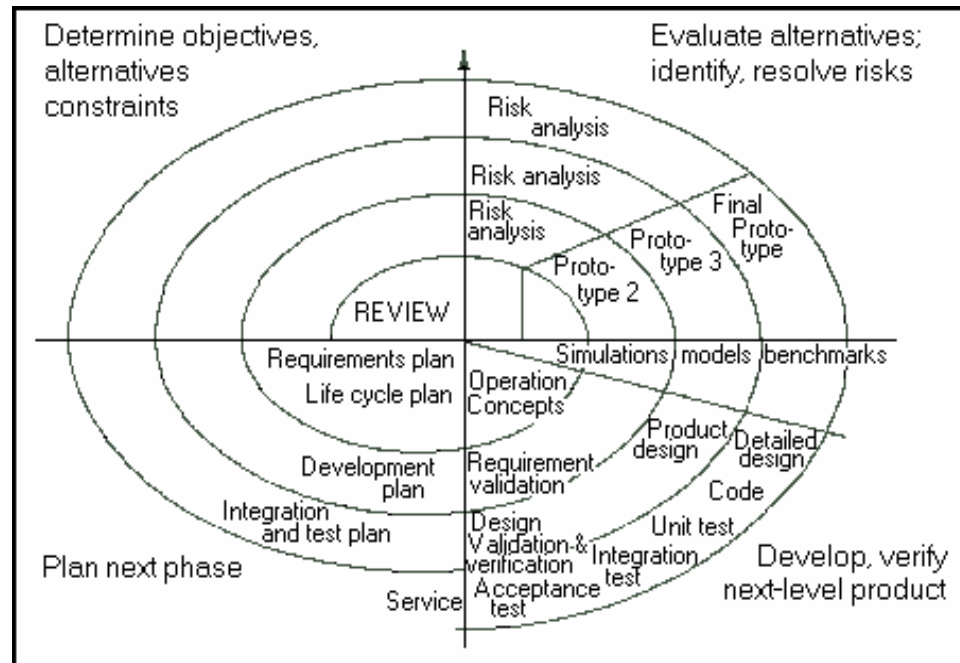
**21.1 Determine objectives, alternatives, constraints.**

- The new system requirements are defined, after a comprehensive system study of the various business processes, in as much detail as possible. This may and usually does involve interviewing internal and external users, preparation of detailed flow diagrams showing the process or processes for which the IS is to be developed, the inputs and outputs in terms of how the data is to be recorded/ entered and the form in which the results are to be presented. Controls and checks desired to be implemented in the transactional processing procedures are also examined as they are to become an integral part of the development. Alternative strategies, in terms of IS development issues, to meet the determined need requirements are examined as well as constraints observed when defining the system and need requirements are also reviewed and appropriately addressed.
- **Evaluate alternatives, identify and resolve risks – This involves.**
  1. **Risk analysis** – it includes addressing any factors which may risk the successful completion of the entire project of IS development including alternative strategies and constraints. Issues pertaining to the possibility of the IS development not meeting, for example, user requirements, reporting requirements or the capability of the IS development team or the compatibility and functionality of the hardware with software. The Risk analysis and suggested solutions to mitigate and eliminate the Risks would thus become a part of the finalized strategy to undertake IS development.
  2. **Prototyping** – Based upon the finalized strategy and the preliminary design, the first prototype of the new system is then developed. This is usually a scaled-down version of the system, and represents an approximation of the characteristics of the final product.
- **Develop, verify next-level product**

The prototype prepared is tested against benchmarks based on customer expectations and evaluated risks to verify the various aspects of the development. Refinements and rectifications of the prototype are undertaken until customer satisfaction is achieved before development of the next-level of the product.
- **Plan next phase**

The preceding steps are iterated until the customer is satisfied that the refined prototype represents the final product desired. The final system is constructed based on the refined prototype. The final system is thoroughly evaluated and tested. Routine maintenance is carried out on a continuing basis to prevent large-scale failures and to minimize downtime.

The various stages discussed above are shown pictorially below:



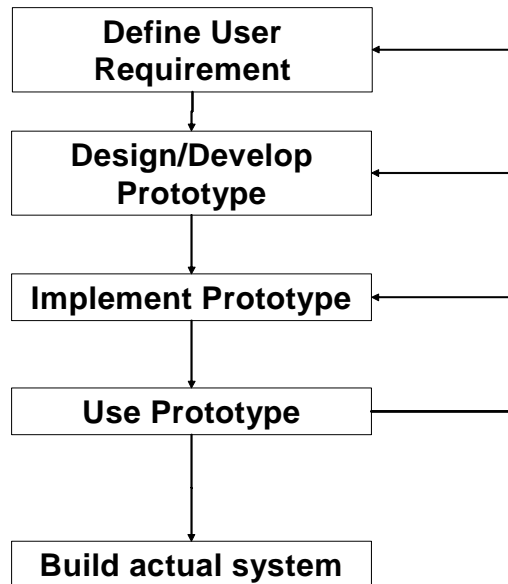
- **Strengths:**
  - Good for large and complex projects
  - Customer Evaluation allows for any changes deemed necessary, or would allow for new technological advances to be used
  - Allows customer and developer to determine and to react to risks at each evolutionary level
  - Direct consideration of risks at all levels greatly reduces problems
- **Weaknesses:**
  - Difficult to convince some customers that the evolutionary approach is controllable
  - Needs considerable risk assessment
  - If a risk is not discovered, problems will surely occur

## 21.2 Prototyping

“Prototyping is the process of quickly putting together a working model in order to test various aspects of the design to gather early user feedback.”

The working model made during this process is called “Prototype”. Prototyping is often treated as an integral part of the development process where it is believed to reduce project risk and cost.

The various steps form a logical flow as depicted below:



As it is quite obvious from the logical flow shown above the prototype is refined and tested as far as possible in the design, development, implementation and usage stages before actually being declared fit for the development of the actual system or the final version. If at any stage it is determined in the tests that the expected results are not being achieved the design can be re-considered or major modifications may result in the original design. It is also possible that if alternative routes or strategies are available more than one prototype may be developed to determine which particular proto-type may provide the best possible route for achievement of the Objectives. Alternatively, various versions of the same proto-type may be made in a process of incremental development where each prototype is influenced by the performance of previous designs. When the prototype is sufficiently refined and meets the functionality, robustness, control and other design goals, the product is ready for production.

Prototyping software approach is of particular use in software that is to be developed for use by the public at large, for example software for computer games, word processing, as well as specialists using architectural software, engineering software for design of aircrafts, automobiles etc.

### Why prototypes are used?

In many fields, there is great uncertainty as to whether a new design will actually do what is desired. New designs often have unexpected problems. A prototype is built to test the function of the new design before starting production of a product. Building the full design is often expensive and can be time-consuming. A prototype allows manufacturers to rapidly and inexpensively test the parts of the design that are most likely to have problems, solve those problems, and then build the full design.

### 21.3 Advantages of Prototype

- Prototypes may be easily changed or even discarded.
- Prototyping may improve communication between and among developers and customers
- Users may be more satisfied with systems developed using prototyping.
- A prototype may provide the proof of concept necessary to attract funding.
- Early visibility of the prototype may help management assess progress.
- Prototypes may demonstrate progress at an early stage of development.

- Prototypes may provide early training for future users of the system.
- Prototyping may prevent unpleasant surprises by calling attention to incomplete or inconsistent requirements, or to missing functionality.
- Prototyping may produce some useful deliverables even if the project runs out of time or money.
- Prototyping may reduce misunderstandings between and among developers and customers.
- Prototyping may save on initial maintenance costs because, In effect, customers are doing "acceptance testing" all along the way.
- Systems produced through prototyping may be judged easier to learn and easier to use.

#### **21.4 Risks of Prototyping**

- Prototyping may encourage an excess of change requests.
- Working prototypes may lead management and customers to believe that the final product is almost ready for delivery.
- The excellent (or disappointing) performance characteristics of prototypes may mislead the customer.
- Customers may not be prepared to provide the level or frequency of feedback required for iterative prototyping.
- Early prototypes may be of low fidelity, dismissed as toys.

**LESSON 22****System Analysis**

System analysis can be defined simply as: “The study of business problem domain to recommend improvements and specify the business requirements for the solution.”

**Or alternatively as:**

“A problem solving technique that decomposes a system into its component pieces for the purpose of studying, how well those component parts work and interact to accomplish their purpose.”

**Both the definitions highlight following important points:**

- System analysis helps to create an understanding of the business processes, their linkage with one another, the parameters governing the data flow within the business, the controls and checks built into the processes and the reporting needs in a business where a problem exists or for which the software needs to be designed.
- System analysis creates the understanding and lays out the necessary relationships that will assist in defining a solution to the problem or the design of the proposed software that will meet the user needs.

These two points may be understood as providing a means for undertaking the following tasks:

- A technique to map the system under study.
- To drill down into the various aspects of the business process without losing sight of the complete system.
- To understand the Workability/Functionality of the subsystems and their role in achieving the objectives of the system as well as controls and checks in place.
- To establish the relationship or Level of interaction of each system with other components of the system.

**22.1 Computerized vs. Manual environment**

Information systems are designed and developed for both types of environments. System analysis is done in both situations covering business processes and flow of documents which include:

- Documents being prepared to record transactions
- Point of Origin of the data and documents
- Who is responsible for originating
- Destination/filing point/ultimate storage
- Relationships between various divisions of the business in terms of data being received and recorded from different transactions, financial and non-financial
- Controls devised to ensure accuracy, integrity and reliability of data
- Reports generated, frequency and distribution thereof to various users

The difference between the manual and computerized environment arises due to the following reasons, quite simply because of the different nature of the environments:

- **Logical access control** issues in computerized environment.
- **Duplication of clerical work** generally observed in a manual environment is eliminated in

the computerized environment.

- Automatic generation of specified reports: In a computerized environment as opposed to manual data compilation.
- Data integrity is more fully secured in a computerized environment with addition or authorized changes in data being automatically updated for all purposes through a single button effort as opposed to making changes or updating in each register or record affected by the same in a manual environment.
- Drill down function to conduct analysis of recorded data is available in a computerized environment as opposed to undertaking a manual analysis of all data.
- Flexibility of presenting data in desired or different format including using specified data to be shown graphically is available in computerized environment.
- Data Security and confidentiality can be assured to a higher degree in a computerized environment.

## 22.2 Systems Analyst

“These are knowledge workers who facilitate the development of information systems and computer applications by bridging the communications gap that exists between non-technical system users, and System designers and developers.”

### Why do we need Systems Analysts?

Systems analysts work as a link between Business people, & Computer Programmers. Business People may define the business to be computerized, i.e. establish scope of computerization. However, they may not fully understand the capabilities and limitations of modern information technology.

Computer programmers apply information technology to build information systems which solves these problems but need not fully understand the business usages they are computerizing or supporting.

Systems Analysts due to their expertise in development, knowledge of business processes, awareness of industry best practices, bridge the gap by translating the scope of computerization into how the systems will handle the transactional flows and the relationship between the various aspects of the business for the programmers whilst keeping the overall objectives and requirements, both corporate and IT related in perspective.

## 22.3 System Design

System Design maybe defined as “A problem solving technique that re-assembles a system’s components back into a complete system. This may involve adding, changing deleting pieces relative to the original system” or alternatively as “the process or art of defining the hardware and software architecture, components, modules, interfaces, and data for a computer system to satisfy specified requirements.”

Once the existing system is analyzed and user requirements established they need to be either incorporated into the existing computerized system or assist in the development of a new system.

The major components of system design are:

- Designing usable and complete input
- Designing well defined and usable output with flexibility to redefine presentation of outputs in any form.
- Designing file or database

- Designing user interface (input screen as it would be seen by the user)

### Designing usable and complete input

This includes the design of input forms to record data. The input forms should be accurate, easy to use, consistent and simple. Preferably the input forms should not differ too greatly from the manual input forms being used by a business, as this can help in the change management process. All Primary parameters pertaining to the various input forms must be defined as part of the input design e.g. basic information pertaining to various entities suppliers, customers, employees and chart of accounts. There are cases where the definitions were incomplete resulting in an inability to produce a report on the basis of an undefined parameter. Thus great care and diligence is required when undertaking this task.

### Designing well defined output

Various considerations need to be kept in mind while defining parameters for desired output. These should generally focus on:

- Assuring purposeful output
- Providing output as defined and required by users
- Providing appropriate information
- Assuring distribution of output as per client specified requirements.
- Minimizing throughput time and Query time.
- Ensuring that output is available in client required mode.

Many business managers due to lack of knowledge are not able to visualize their future reporting needs or even define the end to end output requirements or linkages as they assume that these will be produced magically by the computer. Unfortunately, the unexpressed wishes cannot be turned into reality unless someone at the design and development stage had specified these needs and the same have been accordingly parameterized. In situations where this is not done output designing becomes an open ended process, which is neither time or cost beneficial for the organization.

### Designing file or database

This serves following purposes:

- Data accessibility is ensured to the user is ensured as and when required.
- Data consistency – data updates in master file will automatically update the data in the whole system.
- Data is efficiently processed & stored.
- Data integrity that is Correctness of data is ensured. This does not mean that incorrect amounts entered into the computer will be automatically corrected by because the computer only records what is entered but if there is an error in entering pre-defined parameters these would be corrected or thrown up as an error. Further, the data processed according to the pre-defined procedures every time around without any change unless an error has been caused to the program handling the data.

## 22.4 Designing user interface

The design of what the user sees on the screen, that is, the interface, while entering data should be such that



the user is familiar with. The information should be entered in a logical sequence e.g., if a user wants to add an employee to the employee's master file, the information may be entered in the following sequence:

- Employee ID, which can either be
  - Generated automatically by the system, or
  - Entered manually by the user
- Name
- Address
- Contact information
- Next of kin
- Grade
- Designation
- Salary Details

**LESSON 23****Benefits of Good System Design**

- Better understanding by the developer of the system. A properly designed system helps in elaborating and understanding refined aspects of system.
- System development becomes efficient. An error free designed system saves development time since it helps in understanding without discussion.
- A well designed system also helps in early detection of problems in critical areas, if any.
- Better quality of reporting formats. Modifications can be made easily in the system.
- Little maintenance is required in the operations phase.

**23.1 System Analysis & Design Methods**

Two approaches are followed for system analysis and design

- Structured analysis and design – Which includes various tools, such as.
  - Flowcharting
  - Data Flow diagram
  - ERD
  - Object oriented analysis and design

**23.2 Structured Analysis and Design**

Structured analysis and design follows a set of good practices and generally accepted standards. Proper documentation of the system is made by following standard rules.

**23.3 Flow Chart**



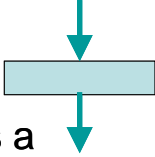


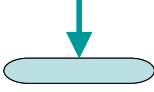
"A schematic representation of a sequence of operations as in a manufacturing process or computer program."




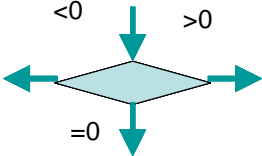
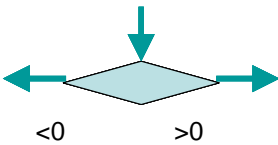
**Introduction**



Flowchart is the most commonly used design and analysis technique. The diagrammatic presentation gives a quick understanding of the business processes and flows.


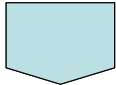
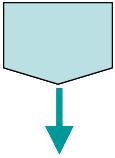
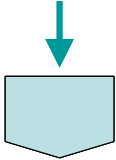

**Symbols**

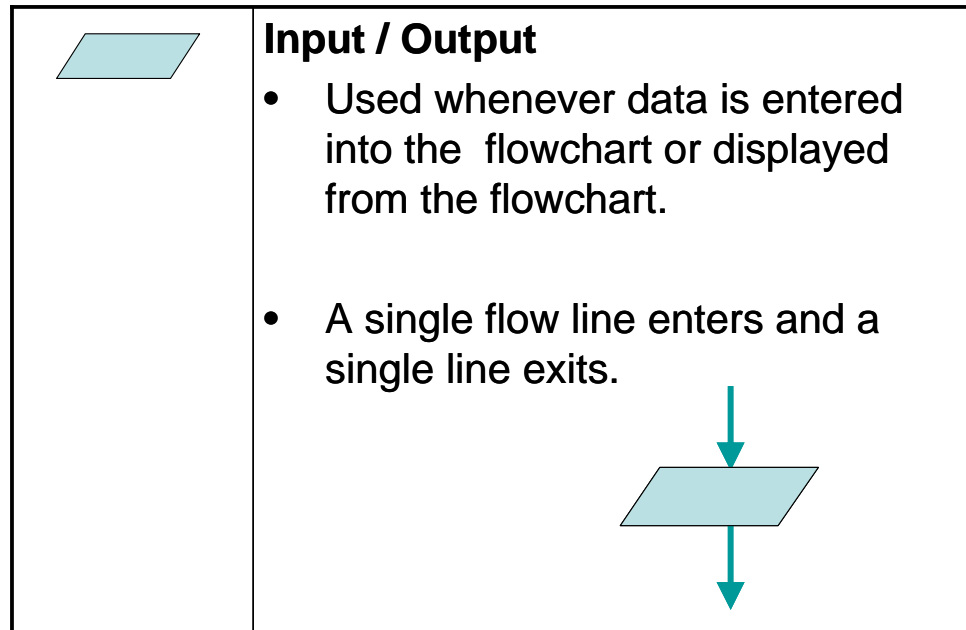
Although there are many symbols used proposed by various standards, but we would discuss some of the most commonly used symbols. Understanding symbols representing functions, flows, etc may be more readily understood by those who have some knowledge of the symbols. From a technical or academic point of view, we have to know what symbols are used for various functions, etc.

	<p><b>Arrow</b></p> <p>The usual direction of the flow of a procedure or system is from left to right or top to bottom.</p> <p>          or          </p> <p>Ensure that the flowchart has a logical start and finish.</p>
	<p><b>Terminator</b></p> <p>Only one flow line is used in conjunction with terminator symbol.</p> <p>   </p>

	<p><b>Process</b></p> <p>Only one flow line should come out from a process symbol.</p> <p>  </p>
	<p><b>Decision</b></p> <p>Only one flow line should enter a decision symbol, but two or three flow lines, one for each possible answer, should leave the decision symbol</p> <p>   </p>

	<p><b>Connectors</b></p> <p>If the flowchart becomes complex, it is better to use connector symbols to reduce the number of flow lines. Avoid the intersection of flow lines if you want to make it more effective and better way of communication.</p>
	<p><b>Predefined Process</b></p> <p>This represents a named process consisting of one or more operations or program steps specified elsewhere</p>

	<p><b>Single Document</b></p>
	<p><b>Off-Page Connector</b></p> <p>Use to connect remote flowchart portion on different pages. One flow line enters or exits.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>
	<p><b>Input / Output</b></p> <p>Used whenever data is into the flowchart or displayed from the flowchart. A single flow line enters and a single line exits.</p>



### Good Practices

Like every other methodology, flow charts also have a set of recommended practices for flow charts:

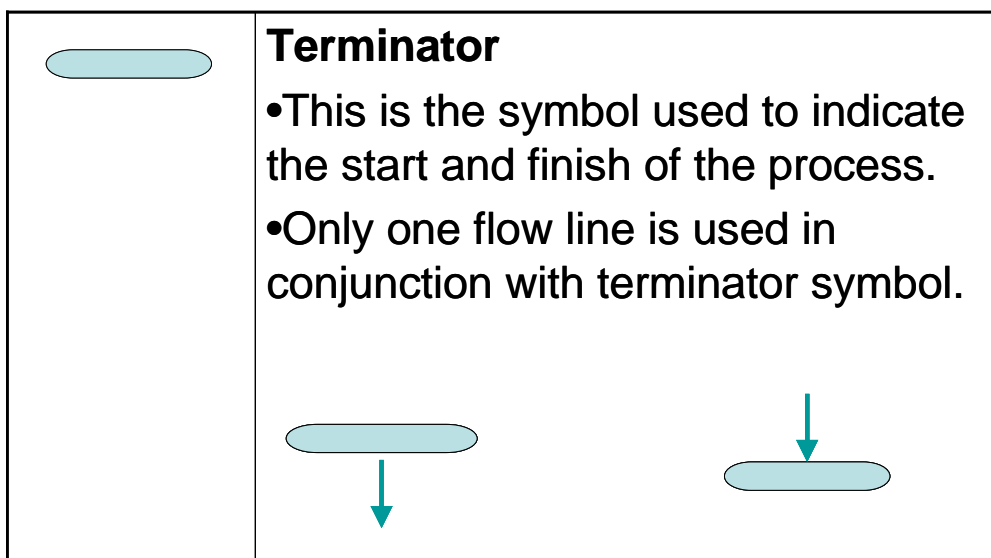
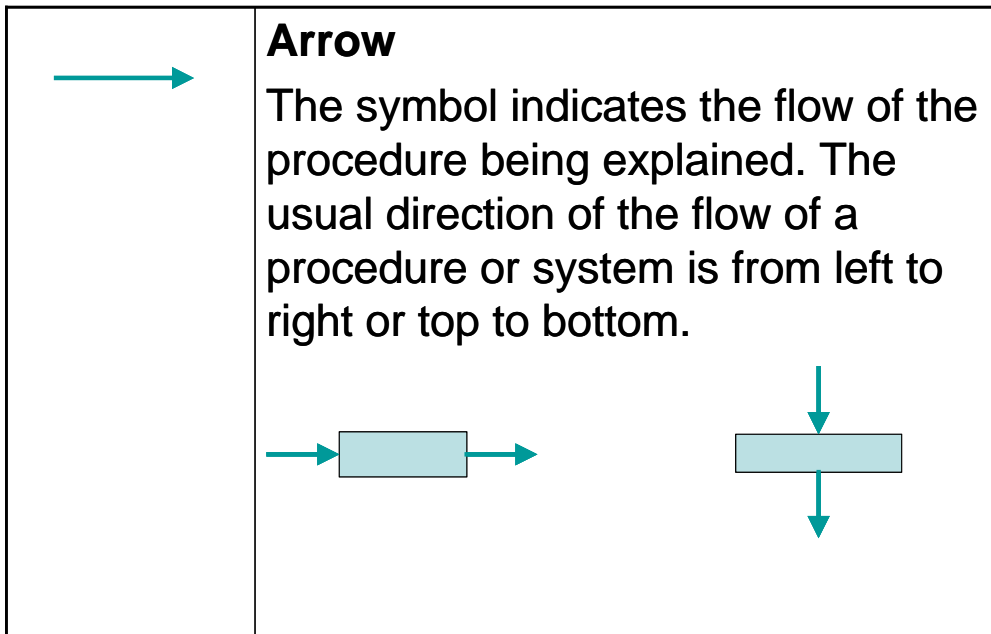
- In drawing a proper flowchart, all necessary steps that are a part of process should be listed out in logical order.
- The flowchart should be clear, neat and easy to follow. There should not be any room for ambiguity in understanding the flowchart.
- It is useful to test the validity of the flowchart.

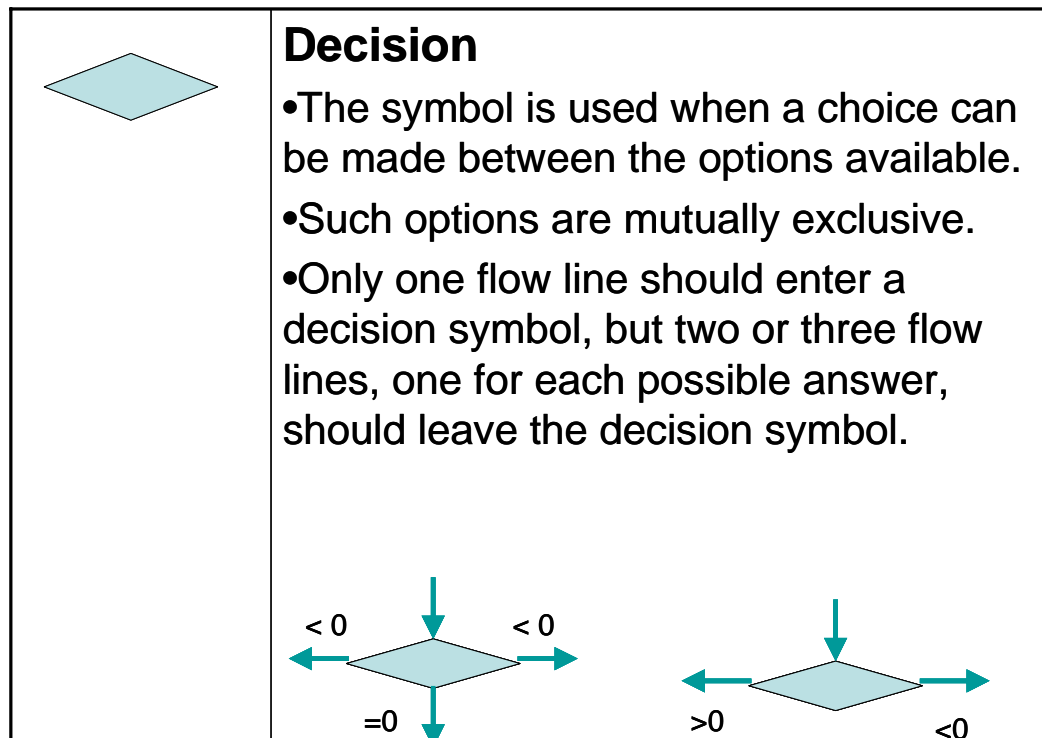
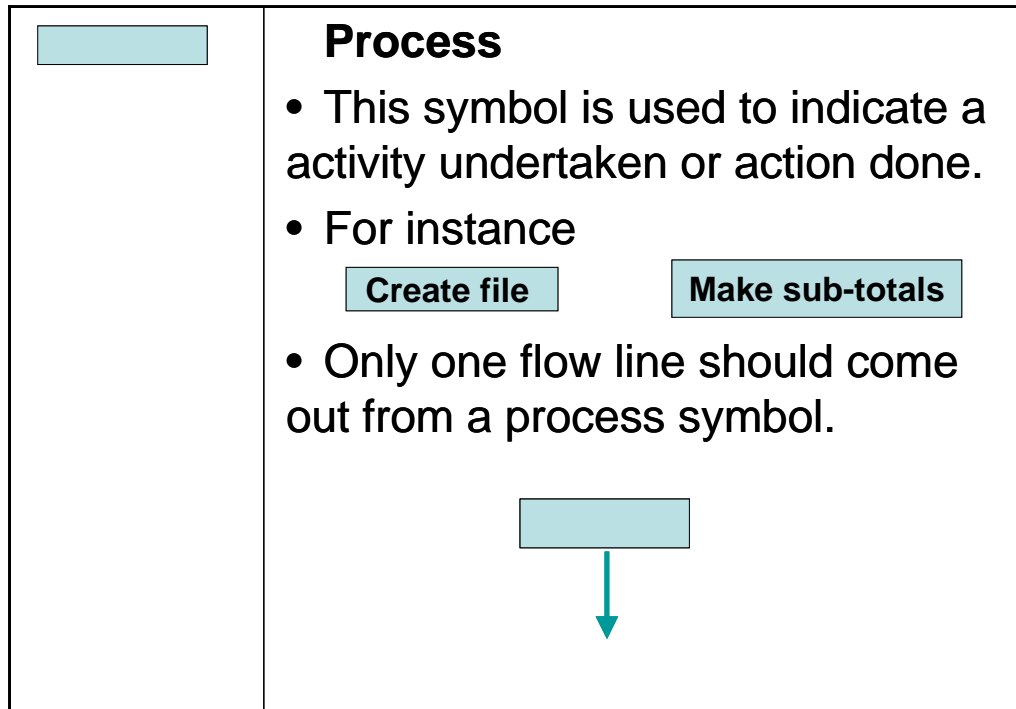
**LESSON 24**

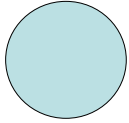
## Symbols used for flow charts

**24.1 Symbols**

The symbols have already been briefly stated in the previous Lesson. Following would explain these symbols in detail.







## Connectors


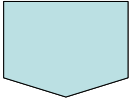
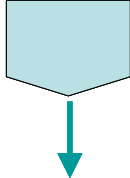
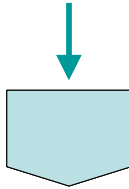
- If the flowchart becomes complex, it is better to use connector symbols to reduce the number of flow lines.
- Avoid the intersection of flow lines if you want to make it more effective and better way of communication.


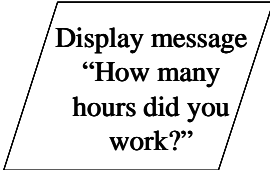

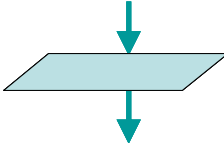


## Predefined Process

- Where two or more steps are repeated in a standard sequence, they collectively are presented through this symbol.
- This represents a named process consisting of more than a couple of operations or steps which must have been identified separately.



	<p><b>Single Document</b></p> <p>Refers to a hard copy being created as a result of a process.</p>
	<p><b>Off-Page Connector</b></p> <p>Use to connect remote flowchart portions on different pages. Only one flow line enters or exits.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>

	<p><b>Input / Output Operation</b></p> <ul style="list-style-type: none"> <li>The symbol is used whenever the system receives an input or generates an output.. E.g.</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><b>Input Operation</b></p> </div> <div style="text-align: center;">  <p><b>Output Operation</b></p> </div> </div> <ul style="list-style-type: none"> <li>A single flow line enters and a single line exits.</li> </ul> <div style="text-align: center;">  </div>
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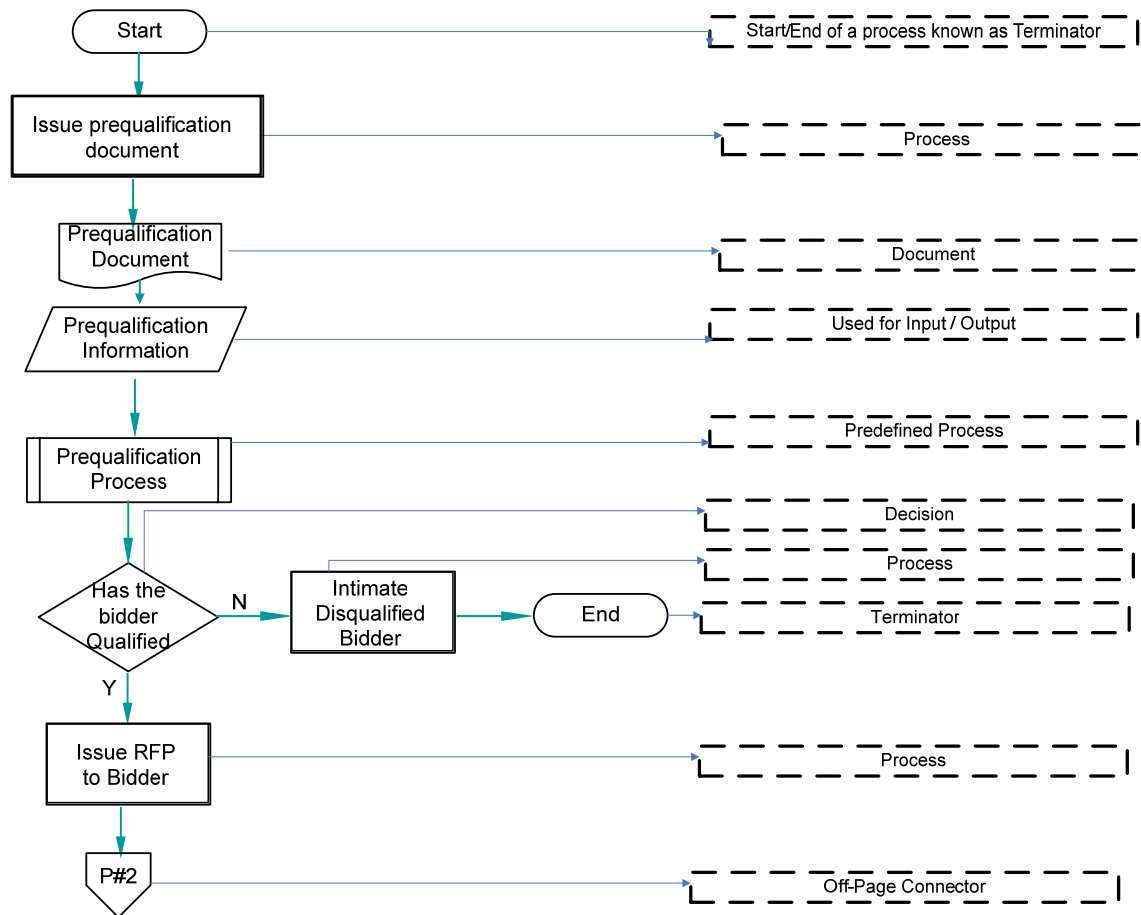
**24.2 Good Practices**

Recommended practices for flow charts:

- Ensure that the flowchart has a logical start and finish.

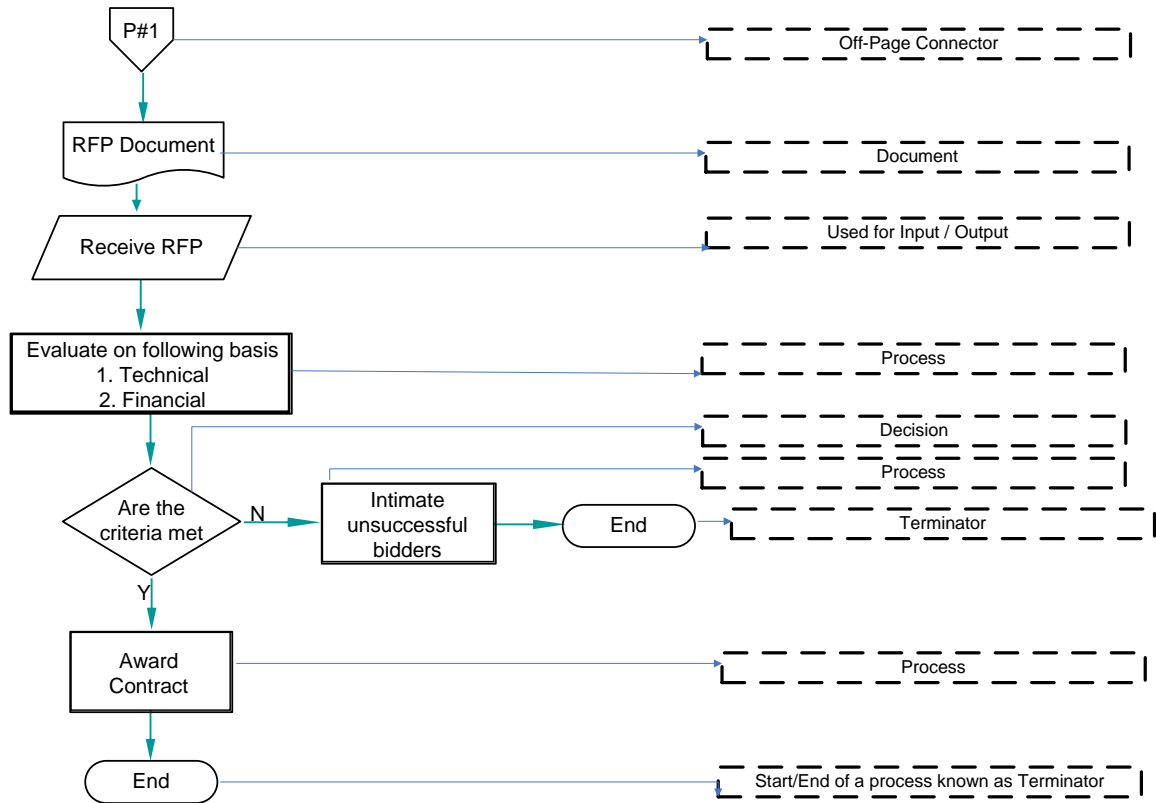
- In drawing a proper flowchart, all necessary steps that are a part of process should be listed out in logical order.
- The flowchart should be clear, neat and easy to follow. There should not be any room for ambiguity in understanding the flowchart.
- It is useful to test the validity of the flowchart.

Following can be seen as a comprehensive example of how the symbols of flow charts as defined above are used.



As shown in the above diagram, the bidding process starts with issuing prequalification document. The purpose is to seek preliminary information so as to decide whether the bidder qualifies for submitting a bid. Where the information does not support the criteria, the bidder is not further allowed to proceed. Other wise, the Request for Proposal is issued to the bidder.

Since the process cannot be summarized in one page, it is continued to the next page by using an off page connector.



On the next page, another off page connector is used to give reference of the page from which it is being continued. The process continues with issuance of RFP document and receiving the filled RFP document. An evaluation is made of the bidders on technical and financial bases. In case the criteria are not met, the unsuccessful bidders are intimated and process for this class ends. Where the criteria are met, contract is awarded. The process termination is shown by using the terminator symbol.

**Advantages**

- The benefits of flowcharts are as follows:
- Communication – Flowcharts are better way of communicating the logic of a system to all concerned. Flowcharts are more focused on decision making and activities relating thereto taken in a set of relevant processes.
- Proper documentation – Program flowcharts serve as a good program documentation, which is needed for various purposes.

**Advantages**

- **Efficient Coding:** The flowcharts act as a guide or blueprint during the systems analysis and program development phase.
- **Proper Debugging:** The flowchart helps in locating and correcting errors (Also called debugging).
- **Efficient Program Maintenance:** The maintenance of operating program becomes easy with the help of flowchart.

**24.3 Data Flow Diagram**

"A data flow diagram (DFD) is a graphical representation of the "flow" of data through an

information system."

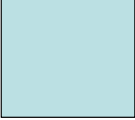

The purpose of data flow diagrams is to provide a linking bridge between users and systems developers. The data flow diagrams are:

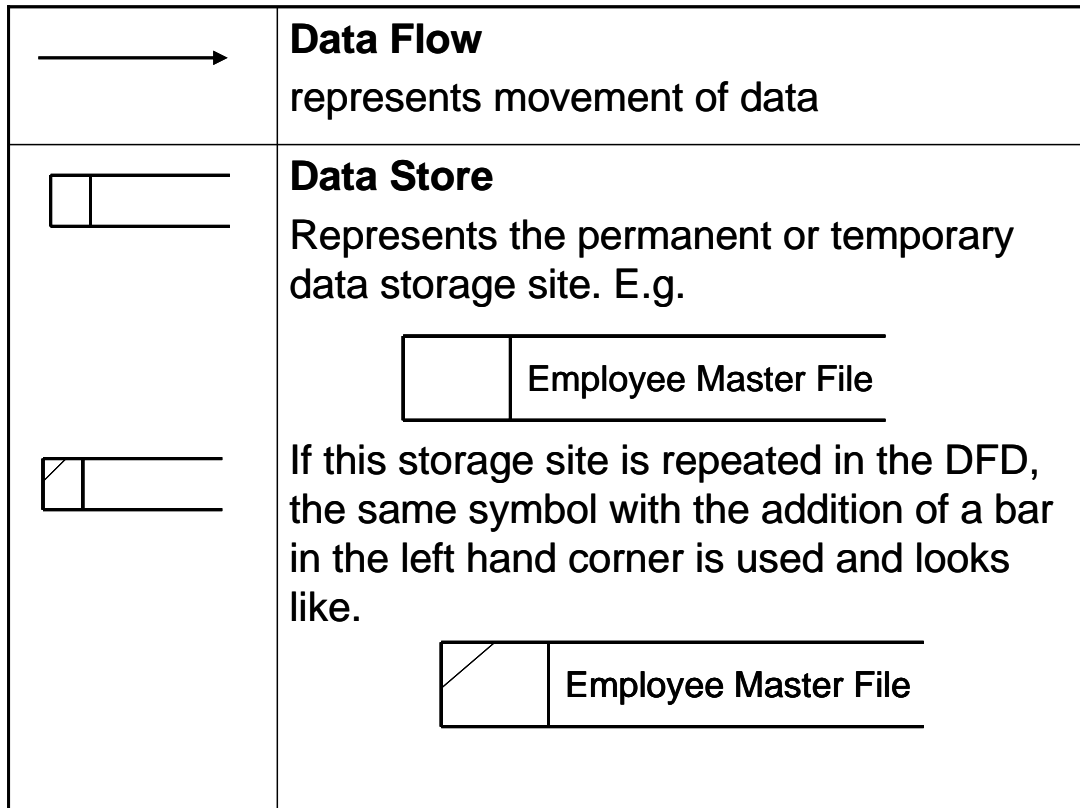
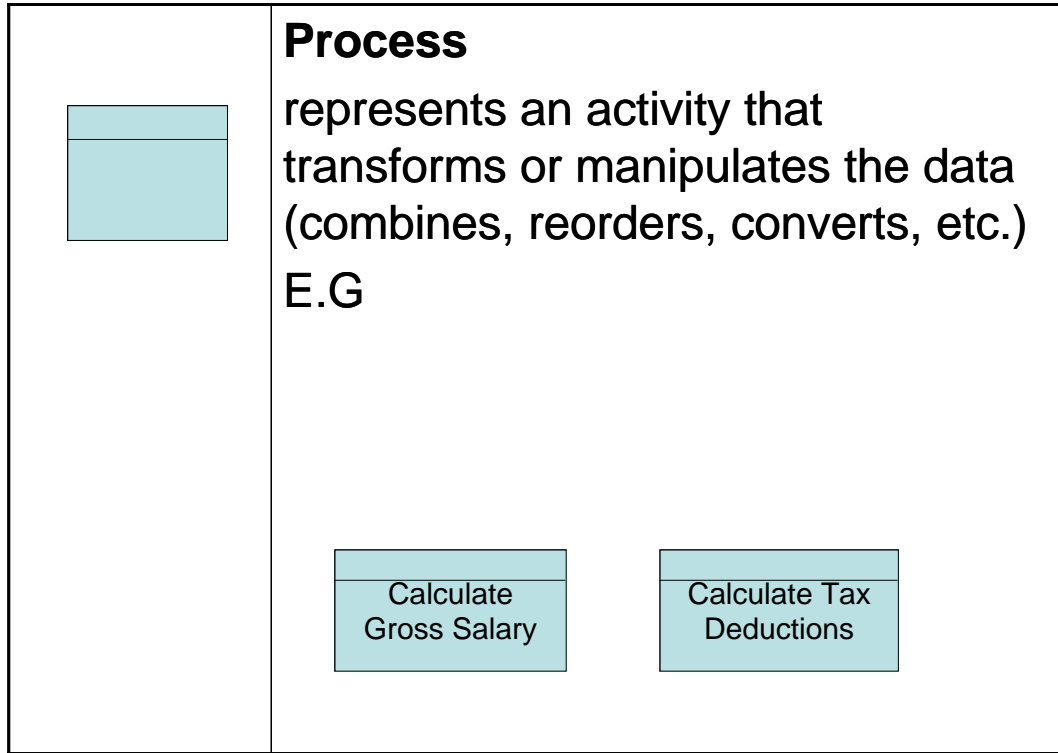
- Graphical, eliminating thousands of words;
- Hierarchical, showing systems at any level of detail; and

They have less jargon, allowing user understanding and reviewing.

Data flow diagrams facilitate users to understand how the system operate. DFD's also help developers to better understand the system which helps in avoiding delays in proper designing, development, etc. of projects.

Following are the symbols of used in the making of flow charts.

  	<p><b>Entity</b></p> <p>represents sources of data received by the system or destinations of the data produced by the system.</p> <p>E.g.</p> <p>Customers, suppliers, purchase department</p> <p>If the entity is repeated in the DFD, the same symbol with the addition of a bar in the left hand corner is used and looks like.</p>
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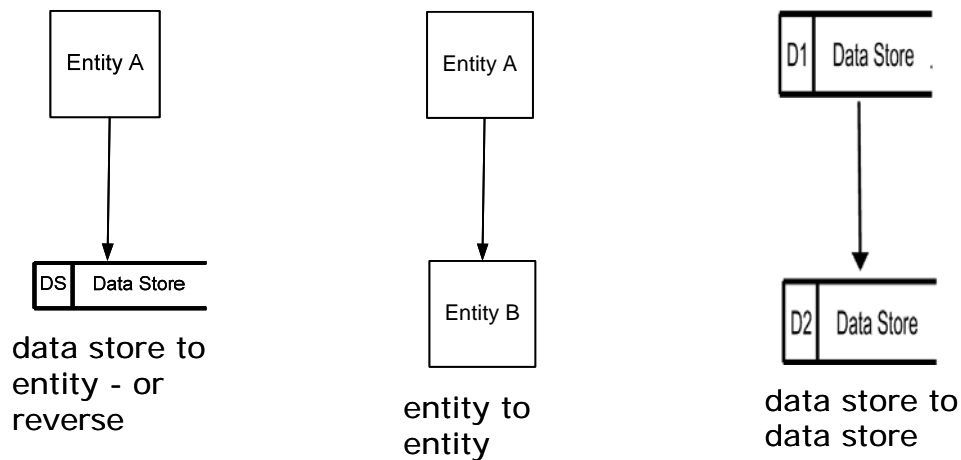


**LESSON 25****Rules for DFD's**

The DFD as an analytical tool follows certain rules. These rules help in achieving the level of standardization.

- There should be no black holes, gray holes, miracles.
- Do not leave things unlabeled
- the DFD should not include data flows that are unassociated with the process.

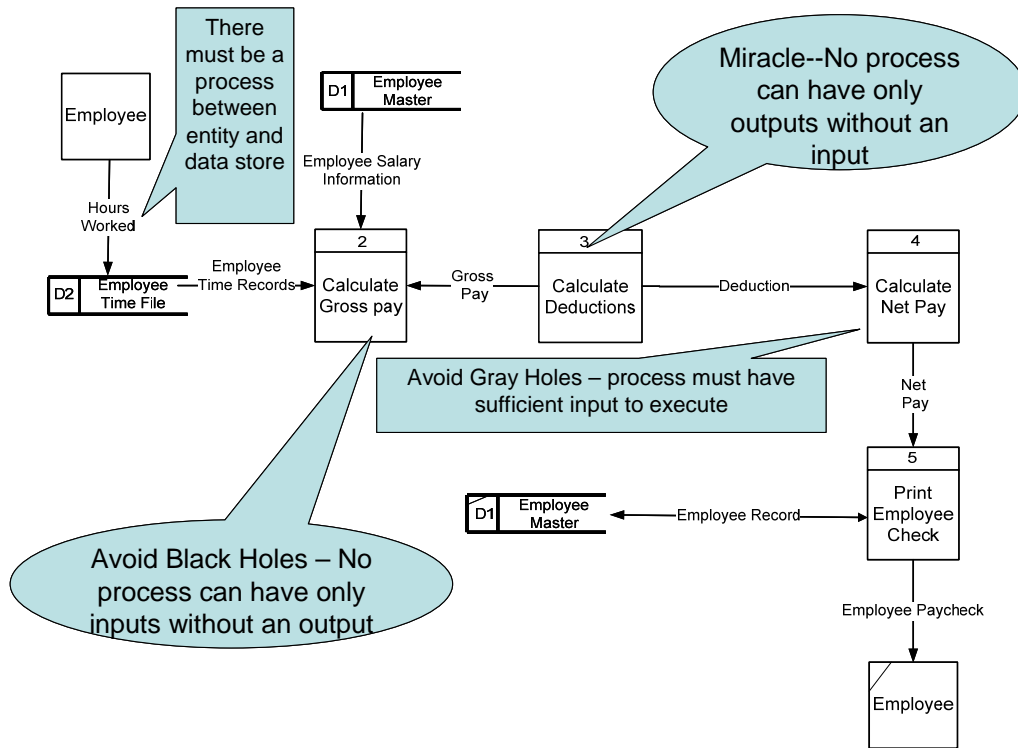
Data Flows cannot be without a process or function being involved in the flow. Below are given three diagrams that indicate bad practices. There has to be a process in between these three diagrams.



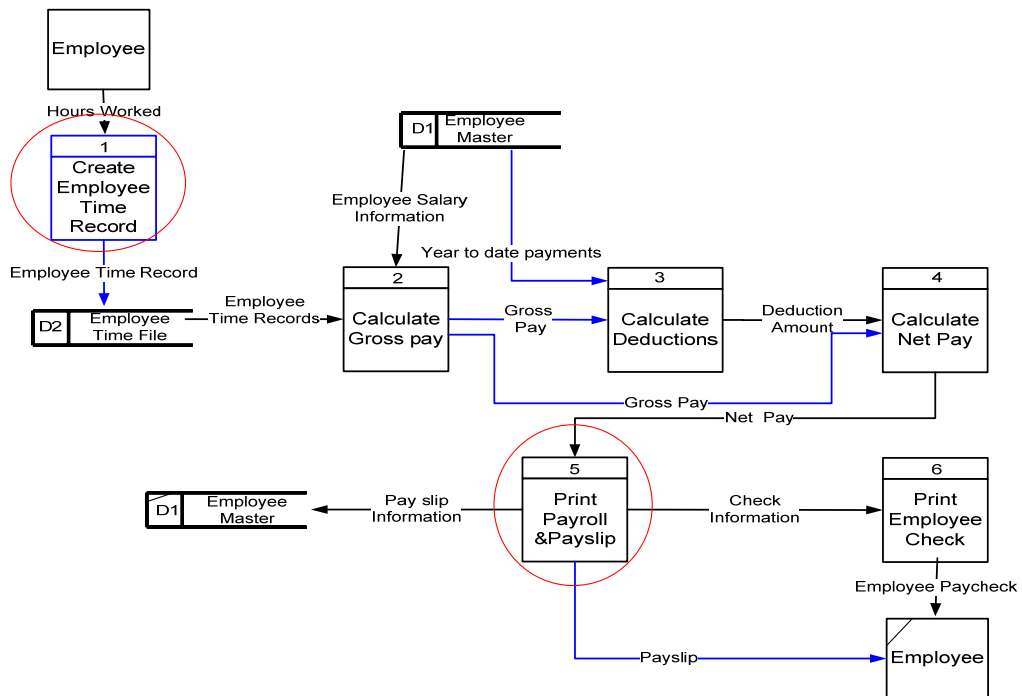
For a better understanding of data flow diagram, two diagrams are drawn for the same process. The diagram A includes some errors/ violation of rules usually used and diagram B is the amended picture how the correct DFD should look like.

The process covered in these diagrams is as follows.

- The number of hours employees have worked is recorded and employee time record is created stored in employee time file.
- Employee salary information is taken from employee master file which is used along with time records to calculate gross pay.
- The leads to the calculation of deductions leading to computation of net pay.
- Payrolls slips are printed used for
  - Record purpose in the employee master file.
  - Preparation of checks
- Paychecks and a copy of pay slip is given to the employees.



The diagram shows the violation of rules along with the relevant explanation. Below we have corrected the diagram.



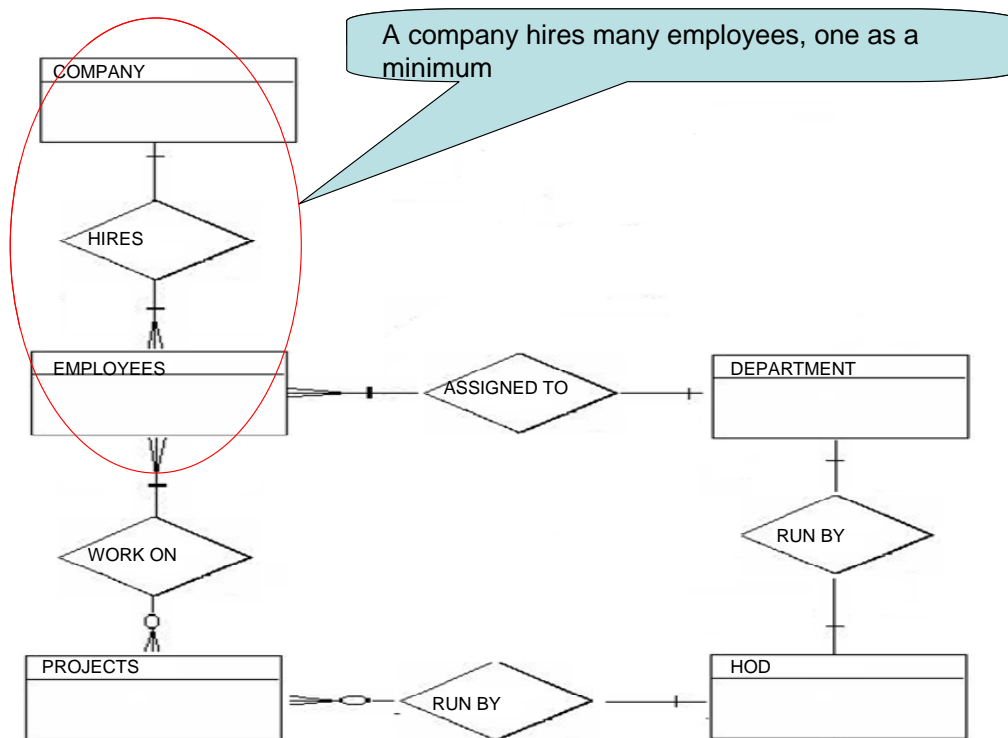
**Following corrections have been made:**

- A process of creation of employee time record has been added between employee and employee time file.
- Directions of processes have been corrected among employee master file and processes of gross and net pay calculation.
- The presentation of payroll printing process has been improved.

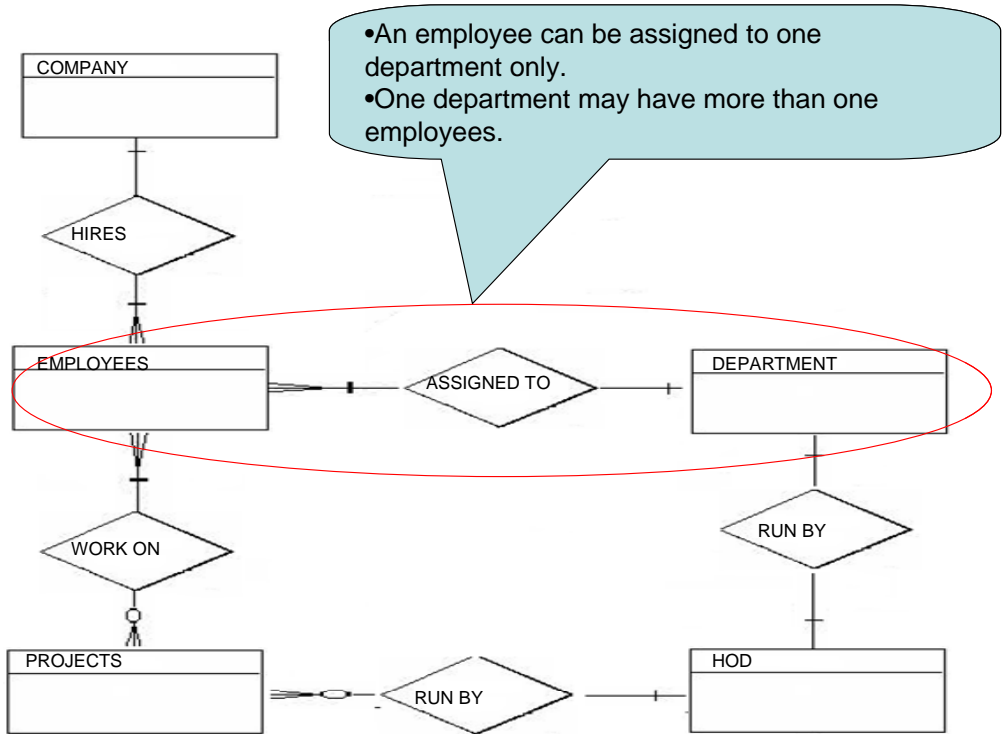
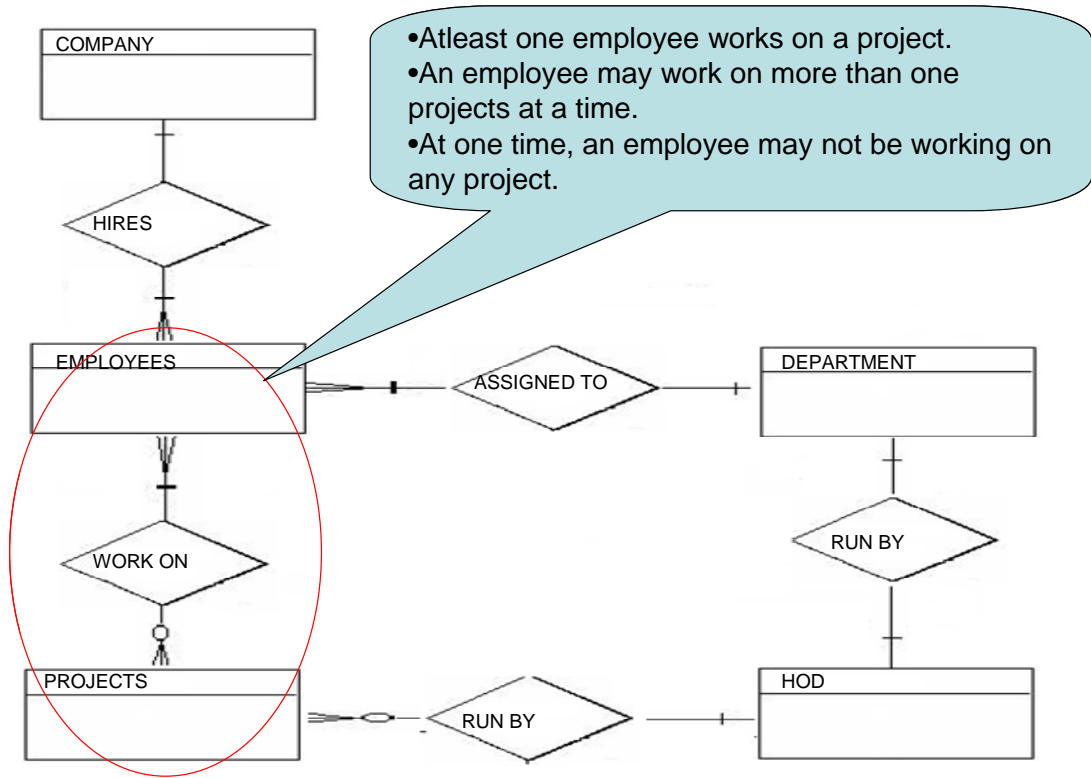
**25.1 Entity Relationship Diagram**

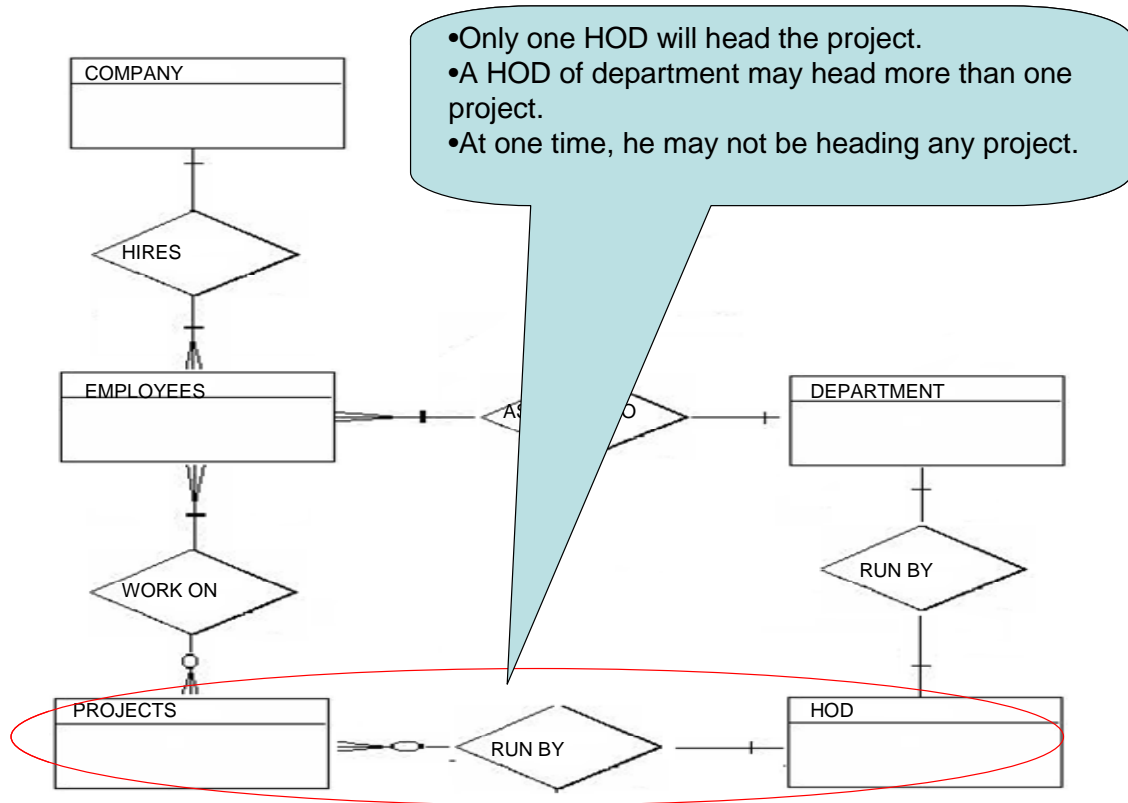
"The entity-relationship diagram (ERD) is a data model or diagram for high-level descriptions of conceptual data model, and it provides a graphical notation for representing such data models in the form of entity-relationship diagrams."

E-R Diagram (E-R model) facilitates database design by allowing the specification of an "enterprise schema" which represents the overall logical structure of a database. The E-R Diagram (E-R model) is extremely useful in mapping the meanings and interactions of real-world enterprises onto a conceptual schema.



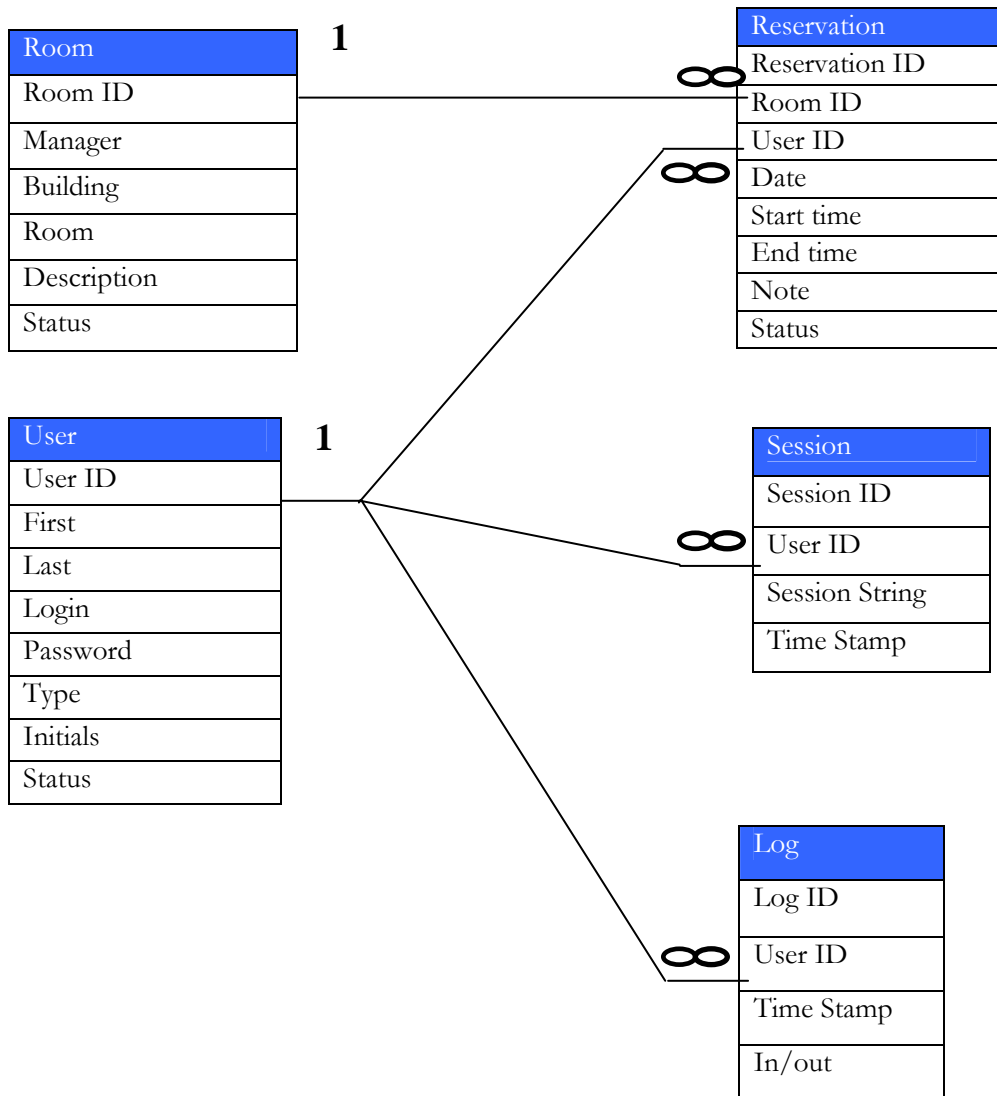






Another ERD

Above we have seen a common example of how a company, its employees, the head of departments, various projects being worked on are interlinked. ERD can be drawn with a different perspective as well.



The above figure shows a hotel booking system. Various records have been kept for each entity. However each entity shares a relationship with for logical purpose. For instance, the field for room ID has been kept in reservation for access to further data. User information has been kept separate, however link has been made to reservation, session and logs by making user ID common to all three tables. Such kind of relationship helps in keeping

## 25.2 Entity

An entity is an object that exists and is distinguishable from other objects. An entity is described using a set of attributes. For example specific person, company, event, plant, crop, department, section, cost center.

### Entity Set & attributes

- An entity set is a set of entities of the same type that share the same properties
  - All entities in an entity set have the same set of attributes, i.e. common characteristics e.g. names, addresses, date of birth, etc.
  - Each entity set has a distinct attribute by which it can be easily identified, e.g. NIC no., employee no.

#### Example

- Bird is an entity
- The class of birds is an entity set
- The color of birds is an attribute

### 25.3 Value Sets

Each attribute has a Value Set (domain) i.e. defined parameters or the range in which value of the attribute may fall, e.g.

For Example:

Range of age allowed for employees is between 18 and 60, we can specify the value set of the age attribute of the EMPLOYEE to be the numbers between 18 and 60.

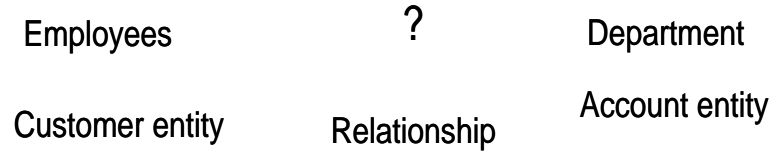
#### Attribute Types

There are four types of attributes

- **Single / composite :**
  - Single – a single value completely defines the attributes. E.g. The figure 27 represents the age (attribute) of a person (entity)
  - Composite – More than one values are required to explain the attribute e.g address includes house no., street no., postal code, etc for its complete explanation.
- **Single / multi-valued:**
  - a. Single – as explained above
  - b. Multi-valued – Where an attribute can have more than one value. E.g. An individual may have qualification. This is an attribute. If a person possesses more than one qualification
- **Null :** is a blank read as zero value. E.g. the various categories of graduation degrees (B.A., B.Com., BSc, etc) will apply to graduates and not to non-graduates and would be read as “Not Applicable”.
- **Derived :** is information provided on the basis of a unique attribute e.g. customer ID, Employee ID, Student ID. Relevant dependant information can be obtained/derived through the said attribute.

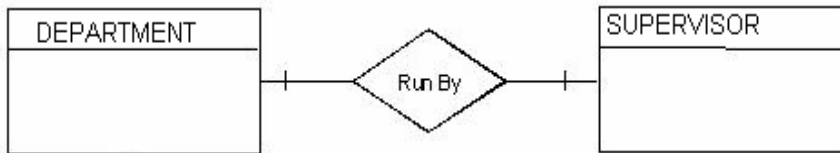
### 25.4 Relationships

A relationship is an association among entities. There has to be a relationship between two entities.

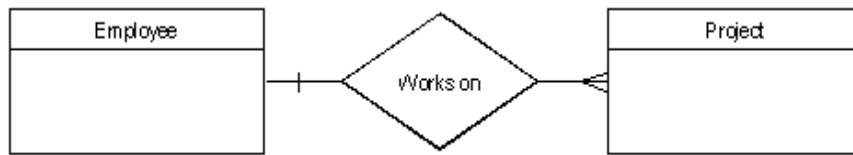


**Types of Relationship**

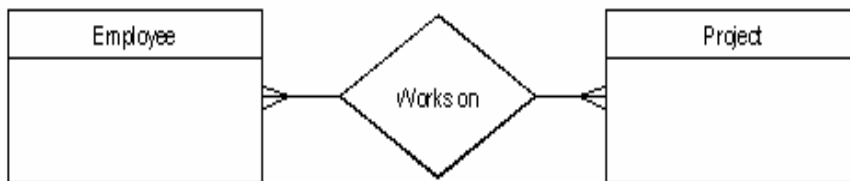
One to One– e.g one supervisor controls one department.



Many to One – e.g. More than one employee works in one department



Many to Many– More than one employees can work on more than one projects.



**Total and partial participation**


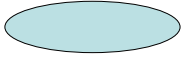
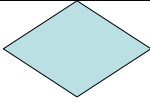

Total Participation – if ALL entities in an entity set “A” are related to the entity set “B”. For example, all employees work for same department or section of the department. Every employee has to be a part of a department. No employee can exist in an organization without being part of a department.

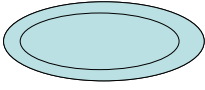
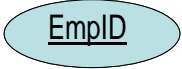
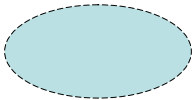
Partial Participation: if SOME (not all) entities in an entity set “A” are related to the entity set “B”. For example, employees work on various projects undertaken by the organization. It is not essential that each employee should work on every project.

**LESSON 26**

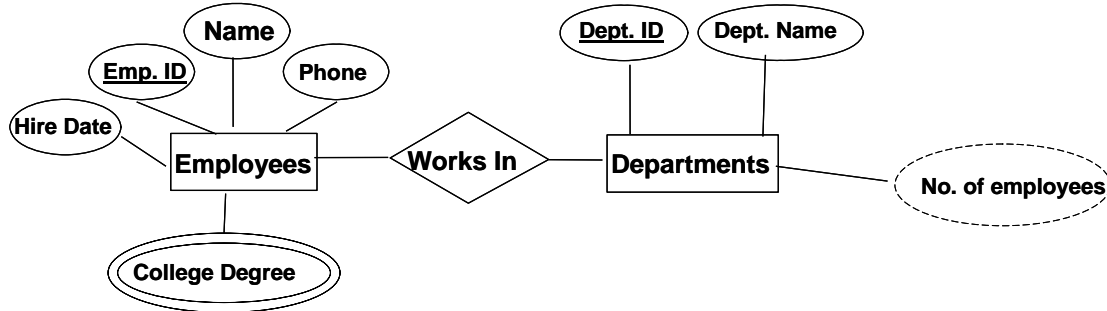
## Symbols

Entity Relationship Diagram as a technical tool also has predefined set of symbols. The purpose behind all this is to have standardization in the use of technique in varied situations. Some major symbols commonly used are as under.

	<b>Entity</b> (a real world object)
	<b>Attributes</b> (of an entity)
	<b>Relationship</b> (between two entities)
	<b>Lines</b> link attributes to entity sets, entity sets to relationship sets (also represent roles)

	<b>Double ellipses</b> represents multi-valued attributes
	<b>Primary key</b> attributes are underlined.
	<b>Dashed ellipses</b> represent derived attribute.

### ERD Example



The diagram shows a primary relationship is between two entities, employee and the department. The relationship is of an employee working in a department. The figure also shows information available for each of these entities.

### Object Oriented Analysis and Design (OOAD)

The concept of object oriented analysis and design focuses on problems in terms of classes and objects. This concept combines aspects of both entity relationship diagram and data flow diagrams. The object oriented analysis and design tool has been devised to support the object oriented languages, for example C++ and Java. The roots of the concept of object orientation evolved in late 60's with the emergence of first language "SIMULA 67" as the first object oriented language. Object oriented methodologies do not replace traditional approaches (such as data flow, process flow, and state transition diagrams); they are important new additions to the toolkit.

#### 26.1 Why need Object-Orientation?

There are certain positive points which are becoming stronger reasons for the increased use of this technique.

- Object orientation helps in increasing abstraction and event-driven programming
- The widespread use of Graphical User Interface (GUI) encourages use of object orientation.
- Software can be developed on modular basis
  1. Easier to maintain
  2. Easier to upgrade
  3. Easier to test
  4. Easier to develop incrementally
- Reusable Software – The software developed using object oriented approach can be easily reused due to independence/uniqueness of the objects i.e. an independent accounting module built in object oriented environment can be made a part of a complete ERP solution without developing it again from scratch for ERP.

#### 26.2 Object Oriented Analysis

The concept of analysis has been defined from different perspectives in different approaches to system development.

"The development activity consisting of the discovery, modeling, specification and evaluation of requirements,"

Donald Firesmith (Dictionary of Object Technology, 1995),

### **In OOAD analysis has been defined in a different manner**

"The discovery, analysis and specification of requirements in terms of objects with identity that encapsulate properties and operations, message passing, classes, inheritance, polymorphism and dynamic binding."

#### **Object oriented Design**

The concept of design has been defined from different perspectives in different approaches to system development.

"Systems design is the process or art of defining the hardware and software architecture, components, modules, interfaces, and data for a computer system to satisfy specified requirements."

In OOAD analysis has been defined in a different manner. According to Firesmith

"The design of an application in terms of objects, classes, clusters, frameworks and their interactions is called OOAD Analysis."

### **Basic Concepts**

Following are the basic concepts related to this technique.

#### **An object is defined as**

"an abstraction of something in a problem domain, reflecting the capabilities of the system to keep information about it, interact with it, or both."

Coad and Yourdon (1990)

An object is any abstraction that models a single concept.

#### **Another Definition of object**

"A concept, abstraction, or thing with crisp boundaries and meaning of the problem at hand. Objects serve two purposes. They promote understanding of the real world and provide a practical basis for computer implementation."

Rumbaugh et al. (1991)

### **Components of object**

According to Booch, there are three components of object. Objects have state, behavior and identity.

- Identity: Who is it?  
Each object has unique identity.
- Behavior: What can it do?  
What an object can do, how it can respond to events and stimuli.



- State: What does it know?  
The condition of an object at any moment, affecting how it can behave

Real-world objects share two characteristics: They all have state and behavior.

For example,

- Dogs have state (name, color, breed, hungry) and behavior (barking, fetching, wagging tail).
- Bicycles have state (current gear, current pedal cadence, two wheels, number of gears) and behavior (braking, accelerating, slowing down, changing gears).

Objects –

Object	Identity	Behaviour	States
<b>A person.</b>	'Ahmad'	Speak, walk, read, eat, talk, think.	Studying, resting, qualified, working.
<b>A shirt.</b>	white denim shirt	Shrink, stain, rip.	Pressed, dirty, worn.
<b>A sale.</b>	Transaction no. 060501 & date June 12, 2006	Company: Generate income. Customer: Earn Bonus points/Rebates	Invoiced, mode of payment: cash/credit
<b>A bottle of ketchup.</b>	Tomato, garlic, chilli ketchup	Adds tang to the meal	Unsold, opened, empty, spilt in transit

### Examples

Software objects are modeled after real-world objects in that they too have state and behavior. We might want to represent real-world dogs as software objects in an animation program or a real-world bicycle as software object in the program that controls an electronic exercise bike.

### Classes

A class is defined as

“The purpose of a class is to specify a classification of objects and to specify the features that characterize the structure and behavior of those objects.”

A class is any uniquely identified abstraction, that is, model of a set of logically related objects that share the same or similar characteristics. The purpose of a class is to specify a classification of objects and to specify the features that characterize the structure and behavior of those objects.

An object is an instance of some class. All objects are instances of some class. Instance also carries connotations of the class to which the object belongs.

For example, computers are the domain/Class which can be divided into following sub-classes:

- Laptop computer
- Desktop computer
- Palmtop

In the sub-sub-class of laptops, we may identify various laptop models or brands which may then have a further division on a model-wise basis.



**LESSON 27****Object Oriented Analysis and Design**

There are some terms important to explaining the concept object oriented analysis and design.

**26.1 Object**

An object can be defined as “A concept, abstraction, or thing with crisp boundaries and meaning of the problem at hand. Objects serve two purposes, they promote understanding of the real world and provide a practical basis for computer implementation.”

Rumbaugh et al. (1991)

**26.2 Classes**

A class is defined as “The purpose of a class is to specify a classification of objects and to specify the features that characterize the structure and behavior of those objects.”

**Attributes & Methods**

Attributes are the characteristics of object / class and methods are the operations related to the object / class.

In order to explain concepts of Class, Object, Attribute, Method, etc, let's consider an example. A company may be interested in creating a database for better customer relationships. For this purpose the company may plan to create a database in the following manner.

**Example**

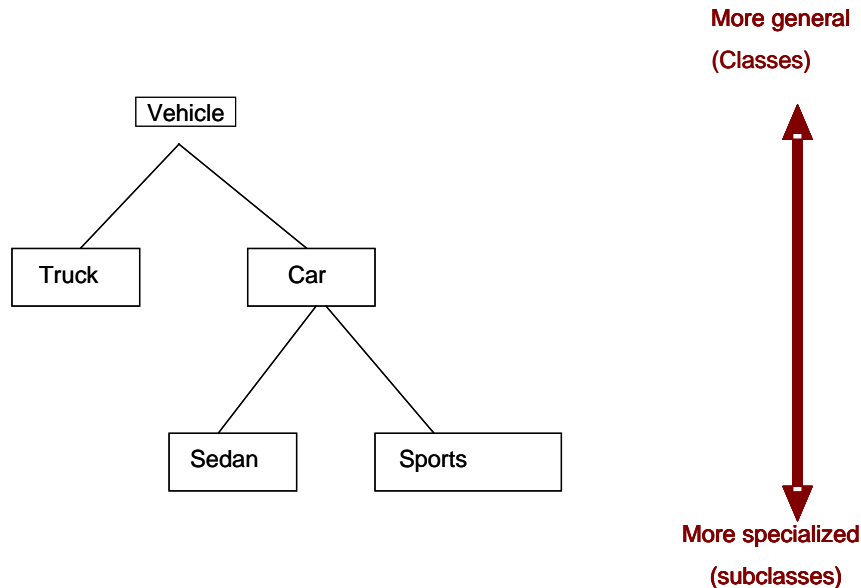
<b>Class</b>	<b>Customers</b>
<b>Object/Instance</b>	<b>A particular customer</b>
<b>Attribute (Characteristics of the object)</b>	<b>Name, Address, etc.</b>
<b>Methods (Operations related to the objects)</b>	<b>Add, update, delete, validate, etc.</b>

**26.3 Inheritance**

Inheritance is usually identified by the phrase "is a kind of." For example, the term “automobile ” is a generalization of “van”, “car“, “truck”, and many others. Conversely, we can say that since cars are automobiles so they inherit all the properties common to all the automobiles e.g. engine, steering, etc. but capacity and type of engine, size of steering will be different from each class, based on these differences sub-classes are created. Two concepts are used in relation to inheritance; generalization and specialization.

Classification is hierarchical in nature, a vehicle may be classified as truck or car, a car may further be Sub-

classified as hatchback or sedan or sports or SUV. Moving up the hierarchy is terms as generalization and down the hierarchy is referred to as specialization.



A real customer such as “ABC Company” is an object/instance of the class of customers. If you have different kinds of customers, such as domestic, commercial and industrial, you can create three new classes of customers that are derived from of the Customer class. These derived classes use inheritance to gain access to all of the common customer class attributes and methods. Special attributes which are unique to each class can also be defined.

### Message-Passing

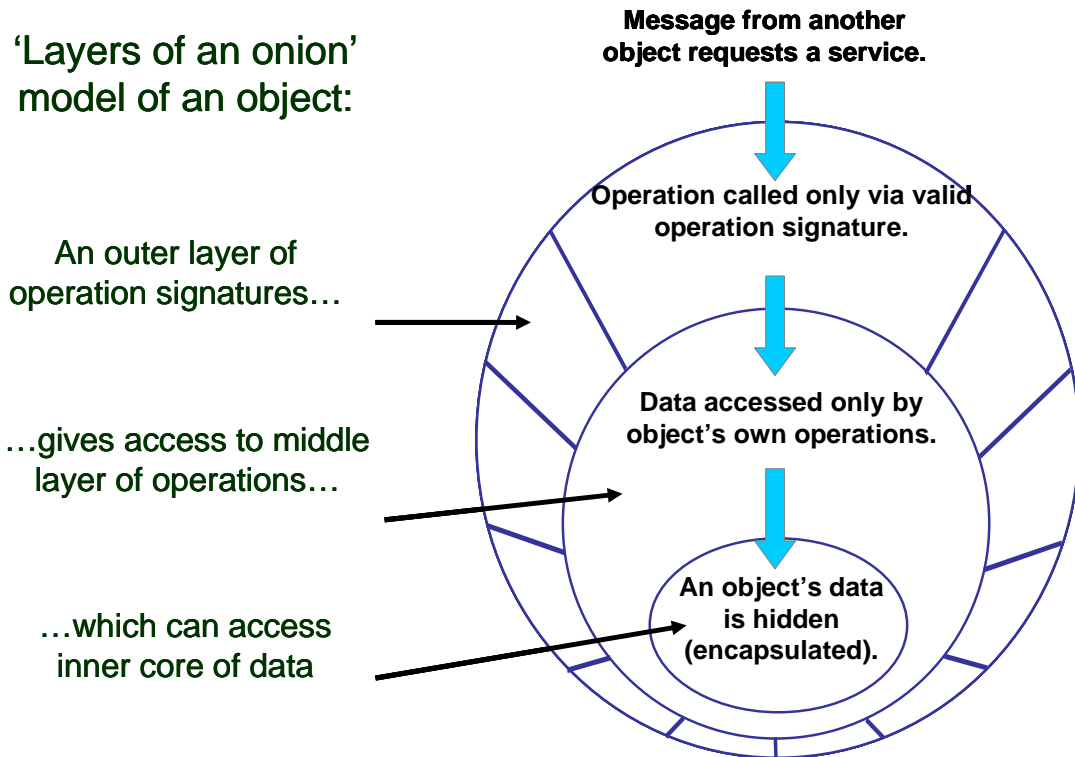
Several objects may collaborate to fulfil each system action. For example, “Record CD sale” is a process, which could involve a CD stock item, a sales transaction, a sales assistant, etc. These objects involved in the process of CD sale communicate by sending each other message.

### 26.4 Encapsulation

Encapsulation means information hiding. For instance, when the Play Button is pressed, the tape is played. However the actual process of how the tape is played is not visible. Another example can be given of banking software. The banking software contains an option of computation of profit, when the option is activated the amount is computed as and when required, however, the actual steps when performed remain invisible to the user.

### 26.5 Polymorphism

Following example will help understand the concept in a better manner.



Hence based on the example given above, the concept can be defined. Polymorphism is derived from Greek language meaning "having multiple forms". Polymorphism is the characteristic of being able to assign a different meaning or usage to something in different contexts - specifically, to allow an entity such as a variable, a method, or an object to have more than one form.

## 26.6 What is Business Process Reengineering?

"Reengineering is the fundamental rethinking and redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed."

(Hammer & Champy, 1993)

The focus of this technique or method is to smooth the procedures and approaches undertaken by various departments of an organization to achieve their respective objectives. The term rethinking refers to the idea of firstly studying and then analyzing all or any of the processes to any extent depending on the need and objective of change. The objectives to be achieved according to this definition are to qualitatively enhance the efficiency and quality of delivery and production of goods and services. to achieve qualitative improvement in the handling of production, procedural and customer related matters.

The concept of business process reengineering can be understood in the following manner.

"The analysis and design of workflow and processes within and between organizations"

(Davenport and Short, 1990).

The definition adds another aspect to the definition. It extends the concept of BPR by studying the links of various procedures used by and between organizations. A number of processes undertaken within the organization may have links with external organizations either as input or output. For example, raw material purchases from suppliers are an integral part of planning, production and sales. Hence making the supplier

more efficient to deliver on time becomes critical, industrial customers placing regular huge volume orders in accordance with their own plans. You as the supplier need this information to input into your own planning.

### **Competitive Advantage**

One of the main goals of introducing BPR is to provide a competitive edge to the business and that can only be achieved by providing a better product in a timely fashion to the customers in accordance with their needs.

For Example, a petroleum company might be faced with issues such as, the product is being tampered with before delivery to points of sale, and the gasoline is not being delivered on time to the points of sale, the issues to be dealt at the dealer-owned-petrol pumps. Question: Why should it be worried, if at all?

The company may after the process review resolve the above stated issues such as redefining the design of the containers/tanker, installing tracking devices on the delivery vehicles, setting up Company owned points of sale, eliminating storage depots and ensuring timely direct deliveries to POS, etc.

While use of BPR helps an organization in gaining competitive advantage in the use of processes, effectiveness and efficiency should also be kept in mind.

### **Effectiveness**

By effectiveness, it is meant that how effective is the manner in which the product or service is offered to the customer? This may include packaging, advertising, creating customer loyalty, timely availability in the market, understanding customer needs & requirements related to the particular product or service being offered.

### **Efficiency**

The concept relates to not only how efficiently a quality product is manufactured, packed, stored and delivered to customers/points of sale but also how quickly are customer complaints responded to, in what manner are they removed, what is the cost of not doing so as to be compared to the cost of not doing so, and how it can be made more efficient. Efficiency is not just about being efficient at the production floor level but the decision making at management level also has to be efficient. Customer might not be able to see all of the process but he can see the efficiency coming out of it.

### **Major steps in BPR**

Senior managers may begin the task of process alignment by a series of BPR steps. These steps develop a self-reinforcing cycle of commitment, communication, and culture change. The steps may include gaining commitment to change through the formulation of the top team, developing a shared vision and mission of the business and of what change is required, defining the measurable objectives, which must be agreed by the team, as being the quantifiable indicators of success in terms of the mission, identify the Critical Success Factors (CSF's) based on the mission of the organization.

Following steps should be followed to implement BPR.

- Break down the CSF's into the key or critical business processes and gain process ownership.
- Break down the critical processes into sub-processes, activities and task and form the teams around these.
- Re-design, monitor and adjust the process-alignment in response to difficulties in the change process.

**LESSON 28****Critical Success Factors (CSF)**

Critical Success Factor (CSF) is a business term for an element which is necessary for an organization or project to achieve its mission. For example, for an international package delivery system, CSF's can be identified such as safe transport of customer consignments, timely delivery of consignment, online status confirmation system to inform customers and proper packaging and handling.

Critical Success Factors differ from organization to organization. While approving any project, the management may evaluate the project on the basis of certain factors critical to the success or failure of the project. For instance:

- Money factors: positive cash flow, revenue growth, and profit margins.
- Acquiring new customers and/or distributors
- Customer satisfaction – No. of complaints, after sales service
- Quality – Customer feed back on the product.
- Product / service development -- what's new that will increase business with existing customers and attract new ones?
- Intellectual capital – enhancing production techniques and acquiring knowledge relating to advancement in hardware/machines, equipment, processes.
- Strategic relationships -- new sources of business, products and outside revenue, sub contracting.
- Employee development and retention –
- Sustainability
- Corporate social responsibility
- Corporate Governance

**27.1 Sources of Critical Success Factors**

Critical Success Factors have to be analyzed and established. CSF's may be developed from various sources. Generally four major sources of identifying CSF's are

- Industry CSFs resulting from specific industry characteristics;
- CSF's resulting from the chosen competitive strategy of the business e.g. quick and timely delivery may be critical to courier service business
- Environmental CSFs resulting from economic or technological changes; and
- Temporal CSFs resulting from internal organizational needs and changes.

**27.2 CSF vs. Key Performance Indicator**

A critical success factor is not a key performance indicator or KPI. Critical Success Factors are elements that are vital for a strategy to be successful. A KPI measures the achievements.

The following example will clarify the difference. A CSF for improved sales may be adopting a new sales strategy through better and regularly arranged display of products in the shop windows. However, the KPI identified would be the increased/decreased Average Revenue Per Customer as a result of the strategy.

Key Performance Indicators directly or indirectly measure the results of implementation of Critical Success Factors. KPI's are measures that quantify objectives and enable the measurement of strategic performance.

**Computing Environments**

Availability of information to various users also depends on how the information is processed, at what location the information is processed and where and to whom it is available after being processed. This leads us to the issues like processing information at one location or different locations. Organizations work with various computing environments for proper use of information system

- Stand Alone Processing
- Centralised Environment
- Distributed Environment
- Web Based Environment

#### Stand Alone Processing

Stand-alone, self-contained computer is usually a microcomputer that is not connected to a network of computers and can be used in isolation from any other device. The processing activities undertaken on such a computer are usually termed as stand-alone processing.

Stand alone environment may exist in some organization, but is not the generally followed practice in today's business environment. Therefore we will not be discussing this environment.

### 27.3 Centralized vs. Distributed Processing

Centralized Processing is performed in one computer or in a cluster of coupled computers in a single location. Centralized processing was the architecture that evolved from the very first computers; however, user access was via dumb terminals that performed none of the primary processing. Today, centralized computers are still widely used, but the terminals are mostly full-featured desktop computers.

Distributed processing refers to any of a variety of computer systems that use more than one computer, or processor, to run an application. More often, however, distributed processing refers to local-area networks (LANs) designed so that a single program can run simultaneously at various sites. Most distributed processing systems contain sophisticated software that detects idle CPUs on the network and parcels out programs to utilize them. Another form of distributed processing involves distributed databases, databases in which the data is stored across two or more computer systems. The database system keeps track of where the data is so that the distributed nature of the database is not apparent to users.

Distributed processing is a programming paradigm focusing on designing distributed, open, scalable, transparent, fault tolerant systems. This paradigm is a natural result of the use of computers to form networks. Distributed computing is decentralized and parallel computing, using two or more computers communicating over a network to accomplish a common objective or task. The types of hardware, programming languages, operating systems and other resources may vary drastically. It is similar to computer clustering with the main difference being a wide geographic dispersion of the resources.

As the terms can explain, processing can be done at one location in case on centralized or at different locations in case of distributed processing. The question arises is how both types of processing are different from each other.



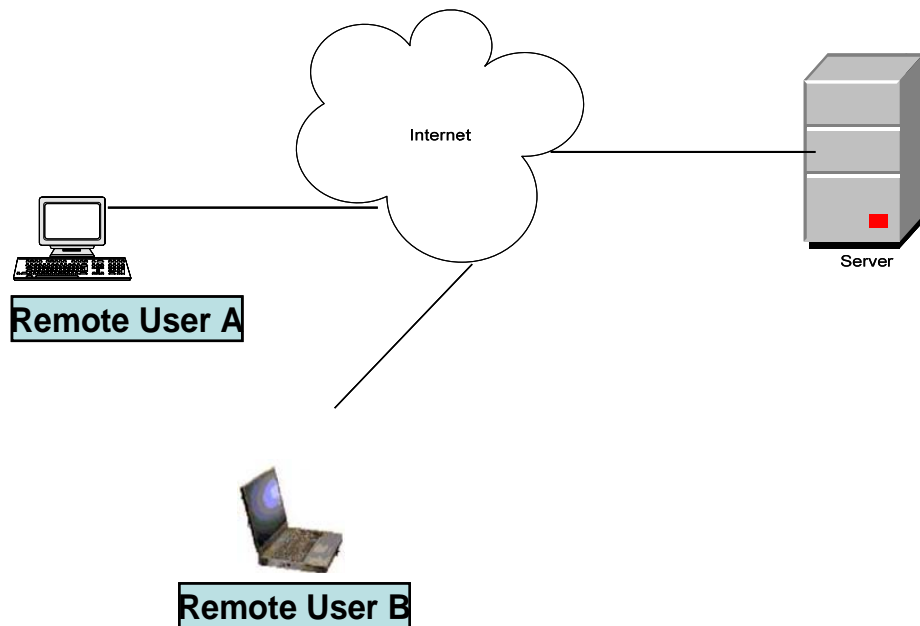
<b>Aspect</b>	<b>Centralized</b>	<b>Distributed</b>
<b>Processing</b>	<b>Processing managed at one server</b>	<b>On multiple machines</b>
<b>Computing Power</b>	<b>Low (since processing managed at one machine)</b>	<b>High (since more than one machines are involved)</b>
<b>Data processing capability</b>	<b>Limited (Depends upon the central machine)</b>	<b>Flexible (can be increased by distributing the task on multiple machines)</b>
<b>System Management</b>	<b>Controls Integrated but limited to central server</b>	<b>Controls integrated but distributed to the various servers</b>
<b>Security</b>	<b>High (Physical and Logical Controls)</b>	<b>High (Physical and Logical controls distributed to all servers, therefore requiring high level of security management)</b>

#### 27.4 Web based Environment

The typically refers to the use of web, internet and browser based applications for transactions execution. In Web based environment, clients connect to the application through Broad-band or base band/dial up connection. Application is located on the enterprise server which is accessed by the client through the internet connection. Access may be given to single application software or the entire operating system. Web based environment can be combined with and applied to both centralized or decentralized to optimize the performance.

Web based architecture can be used, either to give access to the company employees to the information system e.g Virtual Private Networks (VPN) in case of banks or to give access to any body and every body to company's information system.

Following example can explain the concept in a better fashion. Two users A & B present at remote locations or we can say outside the organization may want to access the server located within the organization. They may get connected with the internet and access the server located in the organization. The server needs to be online as well so as to be accessed by A & B through any of the means (broad band, base band, wi-fi, or satellite). Hence data can be transmitted and retrieved using the internet. Availability of connection of proper bandwidth allowing appropriate internet connection speed is critical to both transmission and retrieval. Due to this reason, companies have taken dedicated lines to enjoy uninterrupted service.



## 27.5 Internet

An interconnected system of networks that connects computers around the world via the TCP/IP protocol. Companies contact Internet service providers for availability of connection which allows them to be a part of internet. An intranet is a private enterprise owned communication network that uses Internet Protocols, network connectivity, and public telecommunication system to share organization's information or operations with its employees, and to enable the employees to communicate with each other.

The Internet's technological success depends on its principal communication tools, the Transmission Control Protocol (TCP) and the Internet Protocol (IP). They are referred to frequently as TCP/IP. A protocol is an agreed-upon set of conventions that defines the rules of communication. TCP breaks down and reassembles packets, whereas IP is responsible for ensuring that the packets are sent to the right destination.

Data travels across the Internet through several levels of networks until it reaches its destination. E-mail messages arrive at the mail server (similar to the local post office) from a remote personal computer connected by a modem, or a node on a local-area network. From the server, the messages pass through a router, a special-purpose computer ensuring that each message is sent to its correct destination. A message may pass through several networks to reach its destination. Each network has its own router that determines how best to move the message closer to its destination, taking into account the traffic on the network. A message passes from one network to the next, until it arrives at the destination network, from where it can be sent to the recipient, who has a mailbox on that network.

**LESSON 29****Security of Information System**

The information systems are vulnerable to modification, intrusion or malfunctioning. Hence they need to be secured from all these threats by devising a sound security system.

“Information assets are secure when the expected losses that will occur from threats eventuating over sometime are at an acceptable level.”

**28.1 Security Issues**

Some losses will inevitably occur in all environments. So eliminating all possible losses is either impossible or too costly. Level of losses should be specified. The level of losses decided should be linked with a time period in which the occurrence would be tolerated. The definition mentions threats, which can be either

- Physical, (e.g. Theft, rain, earthquake, disasters, fire) or
- Logical (e.g. intrusion, virus, etc)

**Examples of intrusion**

The security might be required to stop unauthorized access to the financial system of a bank from executing fraudulent transactions. The purpose of intrusion may not only be to damage the database of the company but may be limited to stealing customer list for personal use transferring money illegally. An employee before leaving the company may have to be stopped from data manipulation, though he is having authorized access to the system.

**Management's responsibility**

Executive management has a responsibility to ensure that the organization provides all users with a secure information systems environment. Importance for security should be sponsored by the senior management. This would make employees/users of IS, feel the importance of secure environment in which the IS works and operates un-tampered.

**Importance of Security**

Sound security is fundamental to achieving this assurance. Furthermore, there is a need for organizations to protect themselves against the risks inherent with the use of information systems while simultaneously recognizing the benefits that can accrue from having secure information systems. Thus, as dependence on information systems increases, security is universally recognized as a pervasive, critically needed, quality.

**28.2 Security Objective**

Organization for Economic Cooperation & Development, (OECD) in 1992 issued “Guidelines for the Security of Information Systems”. These guidelines stated the security objective as

“The protection of the interests of those relying on information, and the information systems and communications that delivers the information, from harm resulting from failures of availability, confidentiality, and integrity.”

The security objective uses three terms

- Availability – information systems are available and usable when required;
- Confidentiality – data and information are disclosed only to those who have a right to know it;

and

- Integrity – data and information are protected against unauthorized modification (integrity).

The relative priority and significance of availability, confidentiality, and integrity vary according to the data within the information system and the business context in which it is used.

### 28.3 Scope of Security

The concept of security applies to all information. Security relates to the protection of valuable assets against loss, disclosure, or damage. Valuable assets are the data or information recorded, processed, stored, shared, transmitted, or retrieved from an electronic medium. The data or information must be protected against harm from threats that will lead to its loss, inaccessibility, alteration or wrongful disclosure.

### Types of Information Assets

The question is what needs to be protected in an Information systems environment? In a manual environment, usually the records kept in hard form are the main information assets to be safeguarded against various threats. In computerized environments the sensitivity of the record being kept is enhanced. Information Assets can be classified as follows:

### 28.4 Security Policy

The organization that is concerned with protecting its information assets and information system should devise a security policy to be communicated formally to all concerned in an organization. The security policy should support and complement existing organizational policies. The thrust of the policy statement must be to recognize the underlying value of, and dependence on, the information within an organization.

### Contents of Security Policy

Security policy is a critical document which should be designed to include almost all aspects of security issues.

- The importance of information security to the organization;
- A statement from the chief executive officer in support of the goals and principles of effective information security;
- Specific statements indicating minimum standards and compliance requirements for specific areas:
  - Assets classification;
  - Data security;
  - Personnel security;
  - Physical, logical, and environmental security;
  - Communications security;
  - Legal, regulatory, and contractual requirements;
  - System development and maintenance life cycle requirements;
  - Business continuity planning;
  - Security awareness, training, and education;
  - Security breach detection and reporting requirements; and
  - Violation enforcement provisions
    - Definitions of responsibilities and accountabilities for information security, with appropriate separation of duties;
    - Particular information system or issue specific areas; and
    - Reporting responsibilities and procedures

Now the question that arises is how a security policy is to be devised. The organizations interested in raising the security levels of their information system undergo what is commonly termed as “Security Program” or “Security Review”. This can be seen as a first attempt to devise a formal security policy for the organization.

### **28.5 Security Program**

“A security program is a series of ongoing regular periodic reviews conducted to ensure that assets associated with the information systems function are safeguarded adequately.”

The first security review conducted is often a major exercise

#### **Conducting Security Program**

There are certain steps which need to be undertaken for conducting a security program.

#### **Preparation of Project Plan**

In this phase the review objectives of the security program are specified. The scope of the work to be done needs to be defined at the outset. Since there are possibilities of getting bogged down into the unnecessary details? This would help avoid too much of unnecessary work which may be undertaken with little benefit ahead.

#### **Major components of the project plan**

- Objectives of the review: There has to be a definite set of objectives for a security review e.g. to improve physical security over computer hardware in a particular division, to examine the adequacy of controls in the light of new threat to logical security that has emerged, etc.
- Scope of the review: if the information system is an organization wide activity, what needs to be covered has to be defined, e.g. scope will determine the location and name of computers to be covered in the security review, etc.
- Tasks to be accomplished – In this component, specific tasks under the overall tasks are defined e.g. compiling the inventory of hardware and software may be one of many specific tasks to be undertaken for security review.
- Organization of the project team – A team is organized based on the needs of the security review.
- Resources budget – What resources are required for conducting security review.
- Schedule for task completion – Dates by which the tasks should be completed along with the objectives to be achieved.

### **28.6 Identification of Assets**

Identifying assets is the primary step in determining what needs to be protected. The classification of information assets is already stated above. Unless the assets are defined, the related risks cannot be determined that easily.

#### **Ranking of Assets**

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The assets identified earlier should be given a rank according to the importance they have. Following are the critical issues

- Who values the asset? – Various interested groups (end user, programmer, etc) may be asked to rank the assets in accordance with the criticality of usage and importance to them and to the organization e.g
  - a scale between 0 to 10 can be used for this purpose.
  - Degrees of importance may be defined as very critical, critical, less critical, etc.
- How the asset is lost? – a customer master file might be accidentally damaged but the impact of being stolen would be higher.
- Period of obsolescence – within what time the asset becomes of no use without being used. As time passes by, assets keep losing value which also affects the security review.

### **Threat Identification**

“A threat is some action or event that can lead to a loss.”

During this phase, various types of threats that can eventuate and result in information assets being exposed, removed either temporarily or permanently lost damaged destroyed or used for un-authorized purposes are identified.

**LESSON 30****Threat Identification**

“A threat is some action or event that can lead to a loss.”

Various types of threats may exist that could, if they occur result in information assets being exposed, removed either temporarily or permanently, lost, damaged, destroyed, or used for un-authorized purposes are identified. Susceptibility to threats, whether logical or physical are a major risk factor for the data base and information system of an organization. These risks are to be identified and steps that include physical and logical controls need to be instituted and monitored on a regular basis. Security measures can be designed only if we know what kind of threats or risks are to be guarded against. Obviously, we would also have to determine the frequency of the known and the unknown risks or threats.

Threats and risks are usually used synonymously. These are always there and cannot be avoided but should be managed to minimize losses and maximize returns. Each level of management and each operational area perceives risk differently and communicates these perceptions in different terms.

**29.1 Types of Threats**

- **Physical threat** – This refers to the damage caused to the physical infrastructure of the information systems, e.g.
  - Fire
  - Water
  - Energy Variations
  - Structural damage
  - Pollution
  - Intrusion
- **Logical** – This refers to damage caused to the software and data without physical presence.
  - Viruses and worms
  - Logical intrusion

**Likelihood of occurrence of Threat:**

Having identified the threats, they need to be ranked on the basis of their probability of occurrence. Sometimes analysis on occurrence of threat is easily available. For example, the insurance company might be having a study of occurrence of fire incidents in a city for the purposes of fire insurance; however, the extent of threat resulting from a new virus may not yet have been identified or become known to the users, etc. In such a situation where no past data or reliable source of probability occurrence is available, users can be asked to give the best estimate of how frequently the threat is possible to occur. Usually, higher the value of the information asset identified, higher are the chances for it being susceptible to vulnerability, for example, an ERP software built up to a high integration level, may need to be provided with high level of security against potential threats.

**29.2 Control Analysis**

The goal of this step is to analyze the controls that have been implemented or are planned for implementation by the organizations to minimize or eliminate the likelihood of occurrence of threat. To derive an overall likelihood rating that indicates the probability that a potential vulnerability may be exercised within the construct of the associated threat environment. Security controls encompass the use of

technical and non-technical methods. Technical methods are safeguards that are incorporated into computer hardware, software and firmware such as controls mechanisms, identification and authentication mechanisms, encryption methods, intrusion detection software, etc. Non technical controls are management and operational controls such as security policies and operational procedures and personnel, physical and environmental security. The control categories for both technical and non technical control methods can be further classified as either preventive or detective. These two sub-categories are explained as follows

- Preventive controls inhibit attempts to violate security policy and include controls as access control enforcement, encryption and authentication
- Detective controls warn of violations or attempted violations of security policy which include such controls as audit trails, intrusion detection methods.

### Likelihood Determination

To derive an overall likelihood rating that indicates the probability that a potential value may be exercised within the construct of the associated threat environment, the following governing factors must be considered.

- Threat-source motivation and capability
- Nature of the vulnerability
- Existence of effectiveness of current controls

### 29.3 Impact analysis

The next major step in measuring level of risk is to determine the adverse impact resulting into a successful exercise of vulnerability. Before beginning the impact analysis, it is necessary to obtain the following necessary information.

- System mission
- System and data criticality
- System and data sensitivity

The information can be obtained from existing organizational documentation, such as the mission impact analysis report or asset criticality assessment report. A business impact analysis report or asset criticality assessment report. The adverse impact of a security event can be described in terms of loss or delay of any or all of the three security goals.

- Loss of integrity: System and data integrity refers to the requirement that information should be protected from improper modification. Integrity is lost if unauthorized changes are made to the data or IT system by either intentional or accidental loss of system or data. Violation of integrity may be the first step in a successful attack against availability or confidentiality. For all these reasons, loss of integrity reduces assurance of an IT system.
- Loss of availability: If a mission-critical IT system is unavailable to its end user, the organization's missions may be affected. Loss of system functionality and operational effectiveness.
- Loss of confidentiality: System and data confidentiality refers to the protection of information from unauthorized disclosure. The impact of unauthorized disclosure of confidential information can range from the jeopardizing of national security. Unauthorized, unanticipated, or unintentional disclosure could result in loss of public confidence embarrassment or legal action against the organization.

### 29.4 Risk Determination/Exposure Analysis

This phase relates to analyzing how much the information assets are exposed to various threats identified and thus quantifying the loss caused to the asset through this threat. This phase relates to analysis of both physical and logical threats and comprises of four steps. Four steps are usually followed while analyzing the



exposure.

- Figure out whether there are any physical or logical controls in place
  - Employees are interviewed
  - Walk through's are conducted
- How reliable are these controls
  - Check whether the firewall stops a virus from entering the organization's system
  - Check whether the antivirus installed stops the virus from execution
  - We cannot start an earthquake to see if the building can absorb shocks or not
- What is the probability that occurrence of threat can be successful against these controls
  - Compare assets identified with threats identified to see if controls exists
  - Estimate the probability of occurrence based on past experience and future apprehensions/expectations
- How much loss can occur due to the threat being successful
  - scenarios are written to see how an identified potential threat can compromise control

Risk identification is often confused with risk mitigation. Risk mitigation is a process that takes place after the process of risk assessment has been completed. Let's take a look at various risk mitigation options.

- Risk assumption: To accept the potential risk and continue operating the IT system or to implement controls to lower the risk to an acceptable level.
- Risk Avoidance: To avoid the risk by eliminating the risk cause and e.g. forgo certain functions of the system or shut down the system when risks are identified.
- Risk Limitation: To limit the risk by implementing controls that minimize the adverse impact of a threat's exercising a vulnerability e.g. use of supporting preventive and detective controls.
- Risk Planning: To manage risk by developing a risk mitigation plan that predicts implements and maintains controls.
- Research and acknowledgement: To lower the risk of loss by acknowledging vulnerability or flaw and researching controls to correct the vulnerability.
- Risk Transference: To transfer the risk by using other options to compensate loss such as purchasing insurance.

### 29.5 Occurrence of threat

When a threat occurs, there can be following consequences.

1. Controls against the threat exists
  - Controls can help stop the occurrence of the threat.
  - Threat occurs but damage is avoided by the controls
  - Threat circumvents controls and causes damage
2. Controls against threat do not exist.
  - Threat has not yet been identified
  - Threat has been identified but the consequent loss is considered as minor
  - Threat occurs, whether identified or not and causes damage to the system.

Threat can cause damage whether controls exist or not.

Cumulative amount of loss can be a major threat to the system. There is no international standard on acceptable level of losses. Materiality of every loss, howsoever determined by management must be written and backed up by the approval of those who are in charge of the IT Governance. Review of these matters will be undertaken when a security audit is done in order to ascertain the comfort level the can draw from the security policy of the organization.

### 29.6 Computing Expected Loss

In fourth step of the exposure analysis, the amount of expected loss is computed through following formula

$$A = B \times C \times D$$

1. A = Expected Loss
2. B = Chances (in %) of threat occurrence
3. C = Chances (in %) of Threat being successful
4. D = Loss which can occur once the threat is successful

### Control Adjustment

This phase involves determining whether any controls can be designed, implemented, operated. The cost of devising controls should not exceed the expected potential benefit being en-cashed and the potential loss being avoided. The controls that could mitigate or eliminate the identified risk appropriate to the organization's operations are provided. The goal of the recommended controls is to reduce the level of risk to the IT system and its data to an acceptable level. Following factors should be considered in recommending controls and alternative solutions to minimize or eliminate identified risks.

- Effectiveness of recommended options
- Legislation and regulation
- Organizational policy
- Operational Impact
- Safety and reliability

The control recommendations are the results of the risk assessment process and provide the risk mitigation process during which the recommended procedural and technical security controls are evaluated, prioritized and implemented.

It should be noted that not all possible recommended controls can be implemented to reach and to determine which ones are required and appropriate for a specific organization, a cost analysis, should be conducted for the proposed recommendations of controls to demonstrate that the costs of implementing the controls can be justified by the reduction in the level of risk. In addition, the operational impact and feasibility of introducing recommended option should be evaluated carefully during the risk mitigation process.

The above decision takes into account consideration of following factors:

5. Personal judgment of the situation
6. Any information gained on desired/non-existing controls during the previous phases
7. Seek demands of users for an ideal control environment.

Existing controls should not be totally discarded while adjusting controls. They can either be terminated totally, due to the threats not being there any more or existence of better controls or modification for betterment, this phase should consider the security to be cost effective, and integrated.

**LESSON 31****Control Adjustment**

This phase involves determining whether any controls can be designed, implemented, operated. The cost of devising controls should not exceed the expected potential benefit being enquired and the potential loss being avoided. The above decision takes into account consideration of various factors like personal judgment of the situation, any information gained on desired/non-existing controls during the previous phases, seeking demands of users for an ideal control environment.

Existing controls should not be totally discarded while adjusting controls. They can either be terminated totally due to the threats not being there any more and existence of better controls either modified for betterment. This phase should consider the security to be cost effective, and integrated.

**31.1 Security to be cost effective****IT Guideline on security issued by IFAC states:**

“Different levels and types of security may be required to address the risks to information. Security levels and associated costs must be compatible with the value of the information.”

An organization should consider various factors to make security cost effective. These factors include criticality of information assets, devising safeguards, cost of implementation of safe guards, an optimum balance between the harm arising from a security breach and the costs associated with the safeguards.

**Level of integration of security**

There should be harmonization of security systems with information systems. This would help achieving consistency in the security framework. Where information systems have some level of integration, the security system should have a corresponding level of integration by accepting the level of communication and interaction which is allowable in the IS itself.

**31.2 Roles & Responsibility**

For security to be effective, it is imperative that individual roles, responsibilities are clearly communicated and understood by all. Organizations must assign security related functions in the appropriate manner to nominated employees. Responsibilities to consider include:

1. **Executive Management** — assigned overall responsibility for the security of information;
2. **Information Systems Security Professionals** — responsible for the design, implementation, management, and review of the organization’s security policy, standards, measures, practices, and procedures;
3. **Data Owners** — responsible for determining sensitivity or classification levels of the data as well as maintaining accuracy and integrity of the data resident on the information system;
4. **Process Owners** — responsible for ensuring that appropriate security, consistent with the organization’s security policy, is embedded in their information systems;
5. **Technology providers** — responsible for assisting with the implementation of information security;
6. **Users** — responsible for following the procedures set out in the organization’s security policy; and
7. **Information Systems Auditors** — responsible for providing independent assurance to management on the appropriateness of the security objectives.

### 31.3 Report Preparation

It is the final phase. The report documents the findings of the review and makes recommendations. The critical part is to get the management accepted the importance of exposures identified. It is the responsibility of the security administrator to prove the possibility and benefits of the safeguards being recommended.

#### Meaning of threat

In literal terms, an expression of an intention to inflict pain, injury, evil, or punishment, and an indication of impending danger or harm. Threat in day to day life is defined as an unwanted (deliberate or accidental) event that may result in harm to an asset. Often, a threat is exploiting one or more known vulnerabilities.

#### Identification of threats

Threats can be identified on the basis of nature of Threat which can either be accidental-natural occurrences/force major, or deliberate-intentional act of harm or on the basis of sources of threat which can either be internal-threat caused within the organization, or external-threat from some one outside the organization.

### 31.4 Types of Threat

#### Threats can be divided in to two broad categories

##### 1. Physical threat

This refers to the damage caused to the physical infrastructure of the information systems. Examples are natural disasters (Fire, earth quake, flood), pollution, energy variations and physical Intrusion.

##### 2. Logical

This refers to damage caused to the software and data without physical presence. Examples are viruses and worms, logical intrusion commonly referred to as hacking.

#### Physical threats

The risks of physical damage render the computer hardware becomes useless due to the damage caused to it by natural disasters (Fire, earth quake, flood), pollution-Dust, energy Variations. Reasonable measures should be taken to avoid undesirable consequences. Frequency/Probability of such past occurrences should be established for suitable remedial measures to be taken.

#### Energy Variations

They can disrupt not only the hardware but also the operational systems and applications systems. The total power needs of an organization need to be carefully assessed and provided for. Power supply must be monitored to ascertain the range of voltage fluctuations and take suitable steps to upgrade voltage control equipment.

Energy variations can be of various types.

**Surges or spikes** – sudden increase in power supply

**Sags or brown outs** – sudden decrease in power supply

**Black outs** – Total Loss of power or power failure whether scheduled or un-scheduled

There can be various remedies to avoid the damages caused by the power variations. Un-interruptible power supplies (UPS) can be used to help avoid the turning on and off of electrical equipment. Voltage regulators and circuit breakers can also be used to avoid undesirable results.

The design of security system must also provide for the total loss of power. Certain systems should not fail and should keep working in case of total loss. Power doors can be deactivated manually, should the staff want to exit manually. Alarms and fire extinguisher systems should not fail in the even of total power loss.

**LESSON 32****Unauthorized intrusion**

Intrusion can be both either physical or logical. In physical intrusion, the intruder physically could enter an organization to steal information system assets or carry out sabotage. For example the Intruder might try to remove hard disks. In case of logical intrusion, the intruder might be trying to have an unauthorized access to the system. The purpose could be damaging or stealing data, installation of bug or wire tapping -- Spying on communication within the organization.

**32.1 Physical Access Vs. Logical access**

In computer security, being able to physically touch and interact with the computers and network devices amounts to physical access. It lets someone insert a boot disk in the machine and bypass normal operating system controls. Physical access enables people to install unauthorized snooping equipment such as keystroke loggers. However, interact with data through access control procedures such as identification, authentication and authorization.

**Logical Threat**

This refers to damage caused to the software and data without any physical damage to the computers. Consequently there can be a situation where the damage of data or software may render the hardware itself unusable. For example the virus or bug being installed to corrupt data or software might create BAD SECTORS on the hard drive, leading to its preferable removal from the computer.

**Examples of logical Threat**

Payroll data or details of draft corporate budget may be perceived as highly sensitive and unauthorized access to it may be considered as a logical threat. A person tapping the communication line to have a sniff-around on the organization's communications being transferred through the communication line.

**32.2 Viruses**

It is Software used to infect a computer. After the virus code is written, it is buried within an existing program. Once that program is executed, the virus code is activated and attaches copies of itself to other programs in the system. Infected programs copy the virus to other programs. It may be benign (gentle) or have a negative effect, such as causing a program to operate incorrectly or corrupting a computer's memory. The term virus is a generic term applied to a variety of malicious computer programs that send out requests to the operating system of the host system under attack to append the virus to other programs.

**Attacking Targets**

Generally, viruses attack four parts of the computer.

- Executable program files
- The file-directory system, which tracks the location of all the computers files
- Boot and system areas, which are needed to start the computer
- Data files

**Viruses vs. Worms**

A Worm is a program which spreads over network connections. This is unlike a virus and does not physically attach itself to another program. Worm typically exploits security weaknesses in operating systems configurations to propagate itself to the host systems.

### **Virus vs. Bug**

Bug is an internal malfunction of the software. It is an unintentional fault in a program. It is an incorrect functioning of a particular procedure in a program. This is caused by improper application of programming logic. For example, free trial versions of soft wares are available on line. these beta versions are not tested fully and often contain bugs that can disrupt the system. Incorrect definition of a formula or linkage can give incorrect results. Virtually all complex programs contain virus. Incorrect/ unvalidated / unedited data entry is not a programming fault or a bug. The process of removing bugs from a software is termed as debugging. Virus is the external threat which is not a malfunction of the software. However, a bug in the software can create a virus.

### **32.3 Sources of Transmissions**

Virus or worms are transmitted easily from the internet by downloading files to computers web browsers. Other methods of infection occur from files received through online services, computer bulletin board systems, local area networks. Viruses can be placed in various programs, for instance

1. Free Software – software downloaded from the net
2. Pirated software – cheaper than original versions
3. Games software – wide appeal and high chances
4. Email attachments – quick to spread
5. Portable hard and flash drives – employees take disks home and may work on their own personal PC, which have not been cleaned or have suitable anti-viruses installed on them.

### **32.4 Types of Viruses**

Although viruses are of many types, however broad categories have been identified in accordance with the damage they cause. Some of these categories have been stated below

- Boot Sector Viruses
- Overwriting viruses
- Dropper
- Trojans

#### **Boot sector Virus**

The boot sector is part of computer which helps it to start up. If the boot sector is infected, the virus can be transferred to the operating system and application software.

#### **Overwriting Viruses**

As the name implies, it overwrites every program/software/file it infects with itself. Hence the infected file no longer functions.

#### **Dropper**

A dropper is a program not a virus. It installs a virus on the PC while performing another function.

#### **Trojan horse**

A Trojan horse is a malicious program that is disguised as or embedded within legitimate software. They may look useful or interesting (or at the very least harmless) to an unsuspecting user, but are actually harmful when executed. Examples are

- **Logic bomb** – Trojan horses are triggered on certain event, e.g. when disc clean up reaches a certain level of percentage
- **Time bomb** – Trojan horse is triggered on a certain date.

### **Virus and worm controls**

There are two ways to prevent and detect viruses and worms that infect computers and network systems. One category of controls is called management controls which means by having sound policies and procedures in place. The other category is called and technical Controls by technical means, including antivirus software. Both types complement each other and are of little benefit and effect without the other.

### **32.5 Management procedural controls**

Following are various examples of management and procedural controls.

- Build any system from original, clean master copies. Boot only from original diskettes whose write protection has always been in place.
- USB port enabled devices should not be used until it has been scanned on a stand-alone machine that is used for no other purpose and is not connected to the network.
- Antivirus software should update virus definitions frequently.
- Have vendors run demonstrations on their personal machines.
- Scan before any new software is installed, as commercial software occasionally is supplied with a Trojan horse.
- Insist that field technicians scan their disks on a test machine before they use any of their disks on the system.
- Ensure all servers are equipped with an activated current release of the virus-detection software.
- Ensure bridge, router and gateway updates are authentic.
- Exercise an effective back up plan.
- Educate users so they will heed these policies and procedures. For example many viruses and worms today are propagated in the form of e-mail attachments.
- Review antivirus policies and procedures at least once a year.
- Prepare a virus eradication procedure and identify a contact person.

### **32.6 Technical controls**

Technical methods of preventing viruses can be implemented through software. The following actions can reduce the risk of infection to hardware and operating systems,

- Use boot virus protection (i.e., built-in, firmware-based virus protection).
- Use remote booting, local hard drive of the system is not used for the boot up process. Use a hardware-based password.
- Use write-protected tabs on diskettes.

- Ensure insecure protocols are blocked by the firewall from external segments and the internet.



**LESSON 33****Antivirus software**

Use of antivirus software is another very important technical control against the spread of virus.

**33.1 Scanners**

They scan the operating system and application software for any virus based on the viruses they contain. Every virus has a different bit pattern. These unique bit patterns act as an identity for the virus and are called signatures. These signatures are available in virus definitions. Every scanner contains in it certain virus definitions which in fact are signatures (bit patterns) for various kinds of virus. The scanner checks or scans the operating system and other application software installed on the hard drives. While scanning, it checks the bit patterns in all software against the bit patterns contained in the virus definitions of the scanner. If they found similar, they are labeled as virus.

**33.2 Active monitors**

This software serves the concurrent monitoring as the system is being used. They act as a guard against viruses while the operating system is performing various functions e.g connected to internet, transferring data, etc. It blocks a virus to access the specific portions to which only the operating system has the authorized access. Active monitors can be problematic because they can not distinguish between a user request and a program or a virus request. As a result, users are asked to confirm actions, including formatting a disk or deleting a file or a set of files.

**33.3 Behavior blockers**

Focus on detecting potentially abnormal behavior in function of operating system or request made by application software. Focus on detecting potentially abnormal behavior in function of operating system or request made by application software, such as writing to the boot sector, or the master boot record, or making change to executable files. Blockers can potentially detect a virus at an early stage. Most hardware-based antivirus mechanisms are based on this concept.

**33.4 Logical intrusion**

The skills needed to exploit logical exposures are more technical and complex as compared to physical exposures. Generally a similar term used in relation to logical intrusion is hacking.

In the 1990's dotcom boom encouraged many organizations to use internet for executing transactions. Initially internet used was more oriented to providing information to the general public. With the enhanced focus of the organizations to reduce operational costs, and increase sales, the use of internet started increasing.

Today many commercial transactions can be performed on internet. Whether we are looking at retail sales, booking airline tickets, banking, property management, staff management, shipping or host of other applications, the whole world is trading and managing goods and services via web based systems. This not only helped organizations to earn higher volumes of dollars, but also exposed to undesirable threats. Customers and criminals are finding it convenient to have an access to the information system of the organization.

Organizations presuppose that an online system is inherently safer than a high-street store. For instance, A couple of guys walk up to the counter of a pharmacy at 2 a.m. in the morning, show a knife and ask for money in the cash register and they walk away with the cash. Compare above

situation with this one. Two guys walk into the online store of a retail seller through a BACK DOOR (A hole in the security of a system deliberately left in place by designers or maintainers. They Access the database and steal the credit information of all the customers. There is no video, no witness and no record. Neither of the above mentioned scenarios is rare. Intrusion into the information system is simply not restricted through the internet. Intrusion can be made through LAN or by actually sitting on the targeted terminal or computer. A person making an intrusion is generally termed as intruder. However, he can be classified according to the way he operates. Possible perpetrators include:

- Hackers
- Hacktivists
- Crackers

### **Hackers**

A hacker is a person who attempts to invade the privacy of the system. In fact he attempts to gain an authorized entry to a computer system by circumventing the system's access controls. Hackers are normally skilled programmers, and have been known to crack system passwords, with quite an ease. Initially hackers used to aim at simply copying the desired information from the system. But now the trend has been to corrupt the desired information.

### **Hacktivists**

This refers to individuals using their skills to forward a political agenda, possibly breaking the law in the process, but justifying their actions for political reasons.

### **Crackers**

There are hackers who are more malicious in nature whose primary purpose or intent is to commit a crime through their actions for some level of personal gain or satisfaction. The terms hack and crack are often used interchangeably.

Its very common for hackers to misuse passwords and Personal identification number, in order to gain unauthorized access.

### **Passwords**

“Password is the secret character string that is required to log onto a computer system, thus preventing unauthorized persons from obtaining access to the computer. Computer users may password-protect their files in some systems.”

### **Misuse of passwords**

A very simple form of hacking occurs when the password of the terminal under the use of a particular employee is exposed or become commonly known. In such a situation access to the entire information system can be made through that terminal by using the password. The extent of access available to an intruder in this case depends on the privilege rights available to the user.

### **33.5 Best Password practices**

- Keep the password secret – do not reveal it to anyone
- Do not write it down – if it is complex, people prefer to save it in their cell phone memory, or write on a piece of paper, both of these are not preferred practices.

- Changing password regularly – Passwords should be associated with users not machines. Password generation program can also be used for this purpose.
- Be discreet – it is easy for the onlookers to see which keys are being used, care should be taken while entering the password.
- Do not use obvious password – best approach is to use a combination of letters, numbers, upper case and lower case. Change passes word immediately if you suspect that anyone else knows it.

A personal identification number (PIN) is a secret shared between a user and a system that can be used to authenticate the user to the system. Typically, the user is required to provide a non-confidential user identifier or token (such as an debit card) and a confidential PIN to gain access to the system. Upon receiving the User ID and PIN, the system looks up the PIN based upon the User ID and compares the looked-up PIN with the received PIN. If they match, then the user is granted access. If they do not match, then the user is not granted access. PIN's are most often used for ATMs. They are also sometimes used for online systems instead of alphanumeric passwords, which may compromise security.

If the organization is linked to an external network, persons outside the company may be able to get into the company's internal network either to steal data or to damage the system. System can have fire walls, which disable part of the telecoms technology to prevent unwelcome intrusions into the company but a determined hacker may be able to bypass even these.

### **33.6 Firewall**

Firewall is the primary method for keeping a computer secure from intruders. A firewall allows or blocks traffic into and out of a private network or the user's computer. Firewalls are widely used to give users secure access to the Internet as well as to separate a company's public Web server from its internal network. Firewalls are also used to keep internal network segments secure; for example, the accounting network might be vulnerable to snooping from within the enterprise. In the home, a personal firewall typically comes with or is installed in the user's computer. Personal firewalls may also detect outbound traffic to guard against spy ware, which could be sending your surfing habits to a Web site. They alert you when software makes an outbound request for the first time. In the organization, a firewall can be a stand-alone machine or software in a server. It can be as simple as a single server or it may comprise a combination of servers each performing some type of firewall processing.

**LESSON 34****Types of Controls**

Implementation of controls is a critical security feature of information systems. They block and detect various forms of intrusion and protect various components of the entire information systems, are these telecommunication lines or computer software's and hard wares.

1. **Access Controls** – Controlling who can access the system.
2. **Input Controls** – Controls over how the data is input to the system.
3. **Communication Controls** – Controls over the transfer of data between LAN, WAN or internet.
4. **Processing Controls** – controlling the processing of data
5. **Database Controls** – Securing the most important asset of the organization
6. **Output controls** – controlling the privacy of the data.

**34.1 Access Controls**

These controls establish the interface between the would-be user of the computer system and the computer itself. These controls monitor the initial handshaking procedure of the user with the operating system. For example when a customer enter the card and the pin code in an automatic teller machine (ATM), the access controls are exercised by the system to block unwanted or illegitimate access.

The identity of the user needs to be established before granting access. The user should be given access to the nature and kind of resources he is entitled to access. Actions taken by users to have access beyond the limits defined should be blocked and recorded.

**Why Access Controls?**

Access controls have gained critical importance in the modern computing age for two significant reasons.

- Widespread deployment of distributed systems has resulted in many users being disbursed physically. e.g. through Web based systems, local Area Networks, wide Area Networks
- The rapid growth of E-Commerce systems has resulted in substantial work being undertaken to identify and authenticate the parties.

**34.2 Cryptography**

In literal terms, cryptography means science of coded writing. It is a security safeguard to render information unintelligible if unauthorized individuals intercept the transmission. When the information is to be used, it can be decoded. "The conversion of data into a secret code for the secure transmission over a public network is called cryptography."

**Encryption & Decryption**

Cryptography primarily consists of two basic processes. These processes are explained through a diagram.

- Encryption – the process of converting data into codes (cryptograms)



- Decryption – the process of decoding the code arrived at data actually encrypted



The above processes give rise to two forms of data

- Clear text – it is the data to be encrypted.
- Cipher text – it is the code created out of data after encryption



As shown in the above diagram, the original text, or "plaintext," is converted into a coded equivalent called "ciphertext" via an encryption process.

Identification & Authentication

Access controls focus on the correct identification of the user seeking permission to access the system. There can be various sources of identifying and authenticating the user.

- What a user remembers – name, birthdate, password
- What a user possesses – badge, plastic card
- What a user is – personal characteristics

### 34.3 Biometrics

Identification of an individual through unique physical characteristics is proving to be quite safe and secure for allowing access. The study of personal characteristics has been extensively used for identification purposes. Biometrics can be defined as study of automated methods for uniquely recognizing humans based upon one or more intrinsic physical or behavioral traits.

#### Scope of Biometrics

Most commonly, following personal physical characteristics are covered,

- Finger print
- Hand print
- Voice Print
- Facial profiling – measuring distance between various points on face
- Iris/retinal recognition – eye patterns

In addition to the aforesaid access controls, there may be

1. Input controls – controls over correct data entry
2. Communications controls – controls over transporting data safely through local area networks (LAN's) or wide area networks (WAN's).

3. Processing controls – Controls over the integrity of processing instructions being executed by the operating system and application software's.
4. Database controls – implemented to maintain the integrity of the database.
5. Output controls – controls over providing right content to the users.

The construction of effective security system should take into account the design and implementation of all the above controls.

Processing instructions carried out by the operating system and application software should be monitored by implementation of controls. If the processing controls are not effectively implemented, we could have undesirable situations arising. For example, in case of an operating system, while connecting to a website, a concealed link may be activated at the same time to transfer specified or all information. In case of an application software designed to compute interest at month end may contain unauthorized instruction to transfer pennies or cents or paisas to a particular account. Hence care needs to be taken that calculations are accurate and any rounding up or down is adequately explained and carried out, data is processed correctly as expected, control totals reconcile and processing errors are logged, researched and corrected timely and sufficient audit trail to trace from source to output and vice versa.

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## Audit trails and logs

An audit trail is a logical record of computer activities/usage/processing pertaining to an operating or application system or user activities. An information system may have several audit trails, each devoted to a particular type of activity. All these audit trails are primarily extracted from the audit log recorded on chronological basis. The audit log is maintained only for the list of activities specified for which the log is to be maintained. The information can be recorded varies including but not limited to

1. **Time stamp for the log in/out time**
2. **Terminal in use**
3. **Files accessed**
4. **Transactions performed**
5. **Amendments made**

Audit trails can provide a means to help accomplish several security-related objectives, including individual accountability, reconstruction of events (actions that happen on a computer system), intrusion detection, and problem analysis, as well as evidence of the correct processing regimes within a system

**There are typically two kinds of audit records:**

**(1) An event-oriented log** ---- this usually contain records describing system events, application events, or user events. An audit trail should include sufficient information to establish what events occurred and who (or what) caused them.

**(2) A record of every keystroke**---- often called keystroke monitoring. Keystroke monitoring is the process used to view or record both the keystrokes entered by a computer user and the computer's response during an interactive session. Keystroke monitoring is usually considered a special case of audit trails.

### 35.1 Documentation

Audit trails and logs are a form of documentation which helps in reviewing various activities undertaken by various users. Any alterations and modifications made in the documentation should be logged as well for monitoring the integrity. Documentation may include program code of application softwares, technical manuals, user manuals and any other system-related documentation. This would help to see that data is not modified on the instructions of the users. Log of all amendments should be supported by proper authorization by responsible officers.

#### Accountability through audit trails

Audit trails are technical mechanism that helps managers maintains individual accountability. Users can be identified by the log being maintained. Users are informed of what the password allows them to do and why it should be kept secure and confidential. Audit trails help to provide variants from normal behavior which may lead to unauthorized usage of resources. For example

- Audit trails can be used together with access controls to identify and provide information about users suspected of improper modification of data (e.g., introducing errors into a database).
- An audit trail may record "before" and "after" images, also called snapshots of records.

This helps in audit evaluation work.

### 35.2 Audit trails and types of errors

Audit trail analysis can often distinguish between operator-induced errors (during which the system may have performed exactly as instructed) or system-created errors (e.g., arising from a poorly tested piece of replacement code). For Example a system fails or the integrity of a file (either program or data) is questioned, an analysis of the audit trail can reconstruct the series of steps taken by the system, the users, and the application. Knowledge of the conditions that existed at the time of, for example, a system crash, can be useful in avoiding future mishaps.

#### Intrusion detection

Intrusion detection refers to the process of identifying attempts to penetrate a system and gain unauthorized access. If audit trails have been designed and implemented to record appropriate information, they can assist in intrusion detection. Intrusion detection system can be made part of the regular security system to effectively detect intrusion. Real time intrusion detection is technical and complex to achieve but reasonable extent can be attained. Real-time intrusion detection is primarily aimed at outsiders attempting to gain unauthorized access to the system.

#### Variance detection and audit trails

Trends/variance-detection tools look for anomalies in user or system behavior. It is possible to monitor usage trends and detect major variations. The log can be detected and analyzed to detect the irregularity. For example, if a user typically logs in at 9 a.m., but appears at 4:30 a.m. one morning, this may indicate either a security problem or a malfunctioning of the system clock, that may need to be investigated. The log can be sorted/filtered for all log ins before 9 a.m. from that particular terminal.

Audit trails and logs have significant importance in conducting audit of information system in a computerized environment. Where computer equipment becomes a major component of information management, auditing through the computer gets more delicate and sensitive. Audit trail and logs help in auditing through the computer as against auditing around the computer.

### 35.3 Definition of Audit

In accounting and finance terms, audit is a process which includes an examination of records or financial accounts to check their accuracy, an adjustment or correction of accounts an examined and verified account. However the concept is a bit different in case of information systems. An examination of systems, programming and datacenter procedures in order to determine the efficiency of computer operations.

### 35.4 IS audit

Information systems include accounting and finance function as a critical part of the entire system. Hence, these days audit of information systems as whole incisively focuses on finance and accounting aspect as well. For example, all banks and financial institutions have soft wares supporting interest computations. During the audit of IS, the integrity of the source code/program instructions have to be checked and assurance obtained that these have not been tampered with or altered in any manner.

An information technology (IT) audit or information systems (IS) audit is an examination of the controls within an entity's Information technology infrastructure. When transactions are



executed and recorded through computers, the lack of physical audit trail requires implementation of controls with the Information systems so as to give the same result as controls are implemented in a manual information system IS audit focuses more on examining the integrity of controls and ensuring whether they are properly working. Obtained evidence evaluation can ensure whether the organization's information systems safeguard assets, maintains data integrity, and is operating effectively and efficiently to achieve the organization's goals or objectives.

### 35.5 Parameters of IS audit

Regarding Protection-of-Information-Assets, one purpose of an IT audit is to review and evaluate an organization's information system's availability, confidentiality, and integrity by answering questions such as:

1. Will the organization's computer systems be available for the business at all times when required? (Availability)
2. Will the information in the systems be disclosed only to authorize users? (Confidentiality)
3. Will the information provided by the system always be accurate, reliable, and timely? (Integrity)
4. Besides, the availability, confidentiality and integrity of information systems receiving IT auditor consideration; it has been suggested by other authors that information system utility, possession and authenticity also be considered by answering questions such as:
5. Will the organization's computer system provide useful information when required? (Utility)
6. Will the physical aspects of the organization's computer systems be protected from the threat of theft? (Possession)
7. Will the information provided by the system always be genuine, original without unauthorized change? (Authenticity)

### 35.6 Risk Based Audit Approach

This approach to audit proceeds with following steps

1. Understanding the business process
2. Understanding the control structure built in the system
3. Understanding of inherent risks (risks which are covered through instituting) controls, which can occur in the absence of controls e.g.
  - Political legal factors affecting the business,
  - Nature of industry the organization exists
4. Risk assessment
5. Categorization of risks identified

As in the case of other audits, an IS audit can also be streamlined based on this approach. The purpose of ensuring a high level of IS security and conducting effective IS audit, presupposes risk assessment which helps in implementation of security policy. Risk management is the core line of this entire IT/IS audit. It is a very important concept, now we would discuss this concept in detail.

**LESSON 36****Risk Management**

Risk Management is the process of measuring, or assessing risk and then developing strategies to manage the risk. In general, the strategies employed include transferring the risk to another party, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk. Risk management is a general concept which can encompass various aspects or issues to be catered for. For example risk management against natural disasters, financial risk management, knowledge risk management, relationship risk management. No matter what aspect of risk is being covered the general approach is quite the same. Here since we are more focused on study of information systems, we would try to relate more to the risks related to proper working of information systems.

Managing the security risks associated with reliance on information technology is a continuing challenge. Many private organizations, have struggled to find efficient ways to ensure that they fully understand the information security risks affecting their operations and implement appropriate controls to mitigate these risks. In recent years, systems have become more susceptible to virus because computers have become more interconnected and, thus, more interdependent and accessible to a larger number of individuals.

**Incorporating Risk management in SDLC**

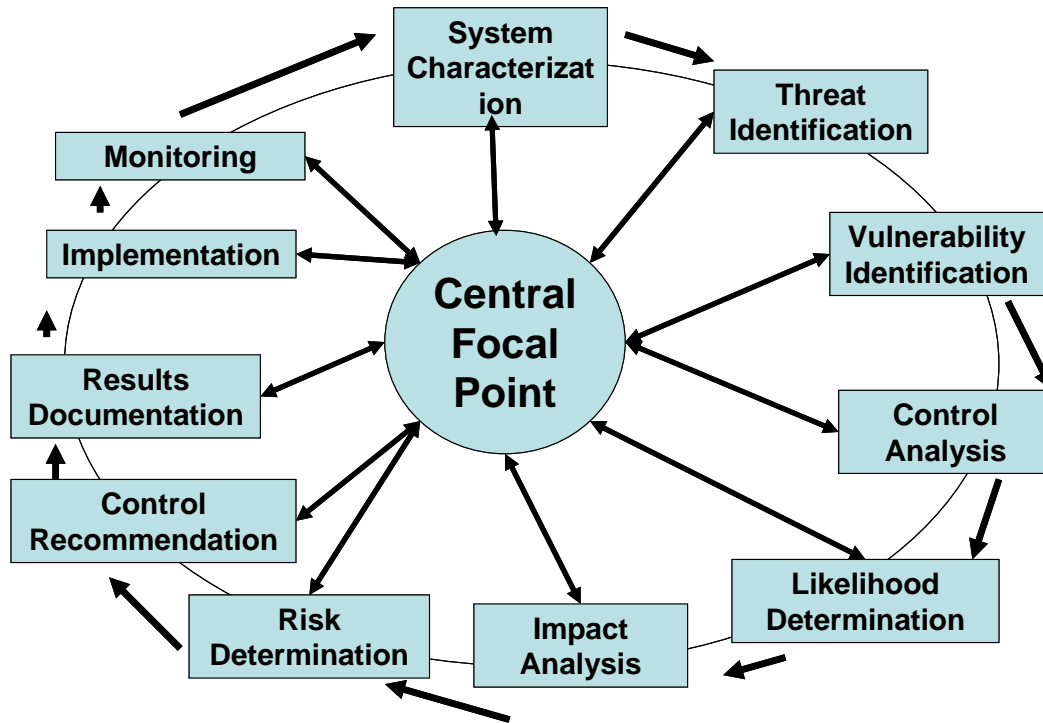
For each phase of SDLC, the process of risk management is no different. Rather it is iterative process which can be performed at each major phase. Every step of development has its own risks which need to be handled and addressed separately. Hence managing risk in SDLC means managing risk of each phase of life cycle.

**36.1 Phases of Risk Management**

Following are various phases of SDLC

- System Characterization
- Threat Identification
- Vulnerability Identification
- Control Analysis
- Likelihood Determination
- Impact Analysis
- Risk Identification
- Control Recommendation
- Results Documentation
- Implementation
- Monitoring

This can also be presented as a separate diagram.



### 36.2 What is focal Point?

A corporate-level facilitator may serve as a focal point for assessments throughout the company, including those pertaining to information security because of familiarity with the tools and the reporting requirements. Each business unit in an organization may have a designated individual responsible for the business unit's risk assessment activities. The computer hardware and software company, may also create a team for the purpose of improving the overall risk assessment process and reviewing results of risk assessments in the hardware and software systems from the perspective of offering a better, reliable and risk free product.

### 36.3 System Characterization

In assessing risks for an IT system, the first step is to define the scope of the effort. The resources and information that constitute the system are identified. The system related information is documented which includes.

1. Hardware
2. Software
3. System Interface
4. Data & Information
5. People (Who support and use IT)
6. Systems Mission (Processes performed by IT system)

**Additional information that may help in characterizing the system are:**

1. Functional requirements of IT system
2. Users of system (technical support and application users)
3. System Security Policy
4. System Security Architecture

**As an output to this phase we would get:**

1. System Boundary
2. System function
3. System and Data criticality – System’s value to the organization
4. System and data sensitivity – Level of protection required to maintain system, data integrity, confidentiality and availability.

Following methods can be used to gather information on the IT system within its operational boundary.

1. Filling up Questionnaire
2. On-site interviews
3. Document Review
4. Use of automated scanning tools

**36.4 Steps in threat identification**

Following steps are followed in this phase

1. Threat source identification – sources vary from being human to natural threats
2. Motivation and threat actions – Reasons why someone should instigate a threat and what actions he can take in such instigation are discovered.

**Examples**

Threat Source	Motivation	Threat Actions
Hacker, cracker(already discussed)	Challenge Ego Rebellion	•Hacking •System intrusion •Computer Crime
Terrorist	Blackmail Destruction Exploitation	•System tampering •Assault on an employee

Information is used as an input to determine and identify what kind of threats the system is exposed to history of system attack, data from intelligence agencies. The out put of this phase is a threat statement identifying and defining threats.

**36.5 Vulnerability Assessment**

Vulnerability is a weakness that can be accidentally triggered or intentionally exploited. This phase helps in building up a list of weaknesses and flaws that could be exploited by the potential threat sources.

**Example**

<b>Vulnerability</b>	<b>Threat Source</b>
<b>Terminated employees' system ID's are not removed from the system</b>	<b>Terminated Employees</b>
<b>Organization uses water sprinklers to suppress fire and tarpulins to protect hardware</b>	<b>Fire, negligent persons</b>

Following information is used as an input

1. Reports of prior risk assessments
2. Any audit comments
3. Security requirements
4. Security test results

The out put of this phase is a list of potential vulnerabilities.

## Control Analysis

This phase includes assessment of controls already been implemented or planned, probability that they can be broken, assessment of potential loss despite such controls existing. Controls are also classified as non-technical controls also called management controls and technical controls – software, hardware controls. The output of this step is current or planned controls used for the IT system to measure the likelihood of vulnerability being exercised and reduce the impact of loss.

### 37.1 Likelihood Determination

- This phase determines that a potential vulnerability could be exercised by a given threat-source. Following table will help us to define and understand the likelihood definitions.

Likelihood level	Likelihood Definition
High	The threat source is highly motivated and sufficiently capable and controls to prevent the vulnerability from being exercised are ineffective
Medium	The threat source is motivated and capable but controls are in place that may impede the successful exercise of the vulnerability.
Low	The threat source lacks motivation or capability or controls are in place to prevent or at least significantly impede the vulnerability from being exercised.

The input to this phase is

- Threat source motivation
- Threat capacity
- Nature of vulnerability
- Current Controls

The output to this phase is a likelihood rating to be used further in the risk assessment process.

### 37.2 Impact Analysis

This phase determines the adverse impact resulting from a successful threat exercise of vulnerability. Following information is required before conducting an impact analysis.

1. System mission e.g. the process performed by IT system.
2. System and data criticality e.g. the system's value or importance to an organization
3. System and data sensitivity

The information can be obtained from existing organizational documentation.

Impact needs to be measured by defining certain levels. E.g. high medium low as qualitative categories or quantifying the impact by using probability distribution.

- Mission Impact Analysis
- Assess criticality assessment
- Data criticality
- Data sensitivity

The output of this phase is impact rating.

### 37.3 Risk Determination

The purpose of this step is to assess the level of risk to the IT system. The determination of particular threat can be expressed as a function of

1. The likelihood of a given threat-source's attempting to exercise a given vulnerability (system flaw)
2. The magnitude of the impact should a threat source successfully exercise a vulnerability
3. The adequacy of planned or existing security controls for reducing or eliminating risk.

This phase also presumes the definition of risk levels in order to classify the risks. This is more of a discretionary act on part of the management. Levels can be defined as high medium low and allocating various probability ranges. Risk levels are made to compare them with the ranges of impact.

		Level of Impact		
		Low Rs. 10,000	Medium Rs. 50,000	High Rs. 100,000
Threat Likelihood	Low – 10%	10,000 x10% = 1,000	5,000	10,000
	Medium – 30%	3,000	15,000	30,000
	High – 60%	6,000	30,000	60,000

Once the risk of loss has been determined using probability of occurrence and level of impact, such risk amounts may then be classified at the discretion of management.

1. Risk scale Low if loss is less than Rs. 1,000
2. Risk scale medium if loss is less than > Rs. 1,000 but < Rs. 5,000
3. Risk scale high if loss is less than > Rs. 5,000

#### The inputs of to this phase are

1. Likelihood of threat exploitation
2. Magnitude of impact
3. Adequacy of planned and current controls

The output is the determination of risk and associated risk levels.

### **Control Recommendations**

In this phase, controls that could mitigate or eliminate the identified risks appropriate to the organization's operations. The control recommendations are the results of the risk assessment process. The control recommendations is actually the risk mitigation process.

### **37.4 Results Documentation**

In this phase, results should be documented in a report or briefing.

### **Example-Risk Management**

The IS security manager carries out a risk assessment. The company employs 18 computer terminals in a two-storey building, containing typical office furniture and equipment. The focus of the security manager is to see how the computer assets can be protected against possible threats. The approach followed by the manager may include searching the web pages, organizational leaflet and more general publications, to learn where hazards can occur. He may walk around the office observing what might pose a risk. He may choose to talk to supervisors and staff to learn from their more detailed knowledge of areas and activities, and to get concerns and opinions about IT-related issues.

After the initial information seeking phase, the manager then wrote down how computer equipment could be harmed by the hazards and how. For each hazard, the manager recorded what controls, if any, were in place to manage these hazards. She then compared these controls to the good practice guidance commonly available on web or followed by other organizations. Putting the risk assessment into practice, the manager decided and recorded who was responsible for implementing the further actions and when they should be done. When each action was completed it was ticked off and the date recorded.

At an office meeting, the security manager will discuss the findings with the staff and gave out copies of the risk assessment. The manager decided to review and update the assessment at least annually, or straightaway when major changes in the workplace occurred. This example of risk assessment is intended to show the kind of approach we expect a small business to take. Every business is different and there is a need to think through the hazards and controls required in that particular business.

### **37.5 Implementation**

Once the controls for managing risk have been devised, reported and accepted, the next phase is to prepare for implementation. Making controls part of the information systems is a challenging task as it requires the display of a sense of ownership and priority to the task in hand by the management who act as the drivers for the implementers and the users.

### **37.6 Monitoring and evaluation**

Once the controls have been implemented, their effectiveness needs to be monitored. An evaluation should also be made on regular basis to see no. of threats neutralized, threats not properly dealt with and the threats identified but not taken action against. Analyses like these can be conducted so as to determine, whether the cycle needs to be repeated.



**LESSON 38****Risk Management**

Managing the companies risk is gaining more and more importance. Companies are getting more aware of the fact that risks should be foreseen and addressed before they could prove havoc for the organization in any regard.

**38.1 Corporate Culture and Risk Management**

As it goes, “The ultimate risk is not taking the risk”. Recognizing and managing risk should be an important part of the corporate culture. IS related risk management is a one level deeper into the over all corporate risk strategy. Assuming that most of the business processes have become computer and technology dependent to whatever extent actually used, a secure IS supported with a sound risk management strategy must be available to the organization.

**38.2 Constituents of Risk Management**

Usually the following constitutes the risk management process.

- Audit trails
- Passwords – already been discussed
- Environmental and Physical Security
- Securing Web based transactions
- Implementation of security in IS

The objective of the entire risk management process is that no one should hamper the working of the smooth working of IS. Risk management in a newly computerized environment and that in an ongoing operation will have to be viewed differently. The scope of risk should be defined by the organization; only then mitigation strategies can be undertaken. The organization should have a business continuity plan and should also know how to use it.

**38.3 Risk management**

Risk management in a newly computerized environment and that in an ongoing operation will have to be viewed differently. In an ongoing operation, risk management itself cannot be done without evidence collection and evidence of risks. Where the organization is desiring to implement a new system, careful thought needs to be given to see how potential risks can be managed. Security and risk management policies can be developed as the system expands and greater evidence of actual threats begins to become available.

**Audit Trails**

Establishing clear audit trails is an absolute must as much as managing physical environmental risks. They help in identifying the start and execution of transaction from the cradle to the grave. Audit logs to be kept should also record the errors occurring and possible actions should be taken to mitigate risks. Maintaining audit logs also helps in drilling down for investigation purposes. Exception report can also be prepared from these audit logs.

**38.4 Business Continuity Planning**

Part of the Risk management process is to ensure that the organization has a well considered business continuity plan. This becomes extremely essential in on-line environments where customer, supplier interaction is high e.g. ATM, on-line supply or purchase orders. In online environment, a critical need arises for an efficient recovery plan to minimize the discontinuation time and to perform back up activity.

“Business Continuity Planning (BCP) is a methodology used to create a plan for how an organization will resume partially or completely interrupted critical functions within a predetermined time after a disaster or disruption.”

**BCP can also be defined as**

“BCP is the process where by the institutions ensure the maintenance and recovery of operations including services to customers when confronted with adverse events such as natural disasters, technology failure, human error and terrorism.”

The Senior management and the board of Directors are responsible for identifying, assessing, prioritizing, managing and controlling risks. They should ensure that necessary resources are devoted to creating, maintaining and testing the BCP. The effectiveness of the BCP depends on management commitments and ability to clearly identify what makes business processes work. BCP is not limited to the restoration of the IS technology and services or data maintained in electronic form. Without a BCP that considers every single business unit including personnel workspace and similar issues.

An organization may not resume serving its customers at acceptable level. Business Continuity Planning is a process designed to reduce the organization’s business risk arising from operational dysfunction. These operations are critical and necessary for the survival of the organization. The operations which are critical may be either manual or automated.

The planning of operations also include human/material resources supporting these critical function/operations and assurance of the continuity of the minimum level of services necessary for critical operations. BCP methodology is scalable for an organization of any size and complexity. The plan can be made for an organization with operations of any type. Any type of organization may create a BCP manual, and arguably every organization *should* have one in order to ensure the organization's longevity. A business continuity plan is much more than just a plan or the information system. A business continuity plan identifies what the business will do in event of disaster.

**38.5 Components of BCP**

The business continuity plan includes:

1. The disaster recovery plan that is used to recover a facility rendered inoperable, including relocating operation into a new location.
2. The operations plan that is to be followed by the business units while recovery is taking place.
3. The restoration plan that is used to return operations to normality whether in a restored or new facility.

**Business Continuity Planning vs. Disaster Recovery planning**

Business continuity planning:

Where will employees report to work, how will orders be taken while the computer system is being restored, which vendors should be called to provide needed supplies. For Example, in a web based environment where operations are active 24/7, there should be such an arrangement that the system, in case of crash, shifts over to a back up system to provide uninterrupted service.

**Disaster Recovery Planning:**

This typically details the process IT personnel will use to restore the computer systems. Disaster recovery plans may be included in the business continuity plan or as a separate document all together. Business continuity plan may not be comprehensively available in a non-critical environment but Disaster Recovery Plan should be there at least to manage and help organization to recover from disasters. A subcomponent of business continuity plan is the IT disaster recovery plan. IS processing is one operation of many that keep the organization not only alive but also successful, which makes it of strategic importance.

**38.6 Phases of BCP**

The BCP process can be divided into the following life cycle phases:

- Creation of a business continuity and disaster recovery policy.

- Business impact analysis.
- Classification of operations and criticality analysis.
- Development of a business continuity plan and disaster recovery procedures.
- Training and awareness program.
- Testing and implementation of plan.
- Monitoring.

#### Business Continuity and Disaster Recovery Policy

A business continuity and disaster recovery policy should be proactive and encompass preventive, detective and corrective controls. The business continuity plan is the most critical corrective control. It is dependent on other controls, being effective, in particular incident management, and media backup.

### 38.7 Incident Management:

An incident is any unexpected event, even if it causes no significant damage. Incident and crises are dynamic by nature. They evolve, change with time and circumstances, and are often rapid and unforeseeable. Because of this, their management must be dynamic, proactive and well documented. Depending on an estimation of the level of consequential damage to the business, all types of incidents should be categorized. Incidents may vary from causing no damage to serious impacts on the continued functioning of the business. Hence they should be documented, classified, and followed up on until corrected or resolved. This is a dynamic process, as a major incident may deescalate momentarily and yet later expand to become a major crisis.

#### Media Back up

Taking back up on regular basis of business transactions and other data from the IS is very critical to an effective BCP.

### 38.8 Business Impact Analysis (BIA)

In this phase, identification of the potential impact of uncontrolled non specific events on the institutions business processes and outcomes. Consideration of all departments and business functions not just data processing and estimation of maximum allowable downtime and acceptable level of data and financial losses. To perform this phase successfully, one should obtain an understanding of the organization, key business processes, and IT resource used by the organization to support the key business process. The criticality of the information resources (e.g. applications, data, networks, system software) that support an organization's business processes must be established with senior management approval. Various approaches to perform a BIA can be followed, for instance, questionnaire, interview group of key users and discussions with IT staff and end users together.

#### Classification of operations and criticality analysis

During this phase, risks and threats are analyzed. Impacts of these risks on the system are also computed. For instance

- The Risk: The system will suffer a serious disruption over the next five years:
- Chance of Occurrence: 10% or 0.1
- Assessed impact of disruption: Rs. 10 million x 0.1 percent = Rs. 10000 over five years

Based on these assessed impacts, the risks are ranked so that suitable recovery strategies can be developed.

### 38.9 Recovery Strategies

There are various strategies for recovering critical information resources. The strategy is considered to be appropriate if cost of implementation is acceptable, recovery time taken by the strategy is acceptable, cost and recovery time are also reasonable compared to the impact and likelihood of occurrence as determined in the business impact analysis.

**Types of recovery Strategies**

Disaster recovery must meet two requirements. First, The minimum application and application data requirements. Second, the time frame in the application and applications data requirements must be made available. Following are the various recovery strategies.

1. Cold Site
2. Hot Site
3. Warm Site
4. Reciprocal agreement
5. Third Party arrangements

**Cold sites**

If an organization can tolerate some downtime, cold sites backup might be appropriate. A cold site has all the facilities needed to install a information system raised floors, air conditioning, power, communication lines and so on. The cold site is ready to receive equipment, but does not offer any components at the site in advance of the need. Activation of site is may take several weeks depending on the size of information processing facility.

**Hot sites**

If fast recovery is critical, an organization might need hot-site backup. All hardware and operations facilities will be available at the hot site. In some cases, software, data, and supplies might also be stored there. Hot sites are expensive to maintain. They usually are shared with other organizations that have same hot site needs.

**Warm sites**

They are partially configured, usually with network connections and selected peripheral equipment, such as disk drives, tape drives and controllers, but without the main computer. Sometimes a warm site is equipped with a less powerful CPU, than the one generally used. The assumption behind the warm site concept is that the computer can usually be obtained quickly for emergency installation and since, the computer is the most expensive unit, such a arrangement is less costly than a hot site. After the installation of the needed components the site can be ready for service within hours; however, the location and installation of the CPU and other missing units could take several days or weeks.

**Reciprocal Agreement**

Two or more organization might agree to provide backup facilities to each other in the event of one suffering a disaster. This backup option is relatively cheap, but each participate must maintain sufficient capacity to operate another's critical systems. Reciprocal agreements are often informal in nature.

**Third Party arrangements**

Apart from having a give-and-take relationship with other organizations, an agreement may also be signed with third party vendors so as to outsource the disaster recovery process. The responsibility of the site development lies completely with the third party. The shift in responsibility can help organization to stop worrying of the recovery site all the time.

**38.10 Development of Business Continuity and Disaster Recovery Plans**

In this phase, a detailed business continuity and disaster recovery plan should be developed. It should address all issues involved in interruption to business processes, including recovering from a disaster. The various factors that should be considered while developing the plan are:

- Pre disaster readiness covering incidence response management to address all incidence affecting business processes and analysis
- Evacuation procedure
- Procedure for declaring a disaster

- Circumstances under which a disaster should be declared. All interruptions are not disasters, but a small incident if not addressed in a timely or proper manner may lead to a disaster. For example, a virus attack not recognized and contained in time may bring down the entire IT facility.

### **Development Of Business Continuity And Disaster Recovery Plans**

The various factors that should be considered while developing the plan are:

- The clear identification of the responsibilities in the plan
- The clear identification of the person responsible for each function in the plan
- The clear identification of contract information.
- The step by step explanation of the recovery option
- The clear identification of the various resources required for recovery and continued operation of the organization.
- The step by step application of the constitution phase.

Training and awareness program

Now the employees need to be made aware of the policies which have been devised. Initially the program will be an organization wide activity. Subsequently all new recruitments should be trained under the program

### **Testing and implementation of plan**

Since BCP is a plan devised for any emergency situation emerging, employees should be made to face mocked situations so as to be prepared what to do when an emergency comes up. Certain issues may need to be resolved even if there is no undesirable situation. For example, where an organization opts for hot site strategy, basic equipment should be available all the time and ready to be used in the case of emergency.

#### **38.11 Monitoring**

Once the plan has been tested and implemented, it needs to be monitored and updated on regular basis for following reasons.

- Changes in business strategy may alter the significance of critical application or deem additional applications as critical.
- Changes in the software or hardware environment may make current provisions obsolete or inappropriate
- Incidents emerging and affecting the organizations business continuity issues.
- Reassessing the risks, their impact and likelihood of occurrence
- Identifying any newly emerged risks and including them in the BCP
- Training of the new recruits as and when they are employed.

**LESSON 39****Web Security**

The nature of the internet makes it vulnerable to attack. Estimates claim that there are over 300 million computers connected via the Internet. Originally designed to allow for the freest possible exchange of information, it is widely used today for commercial purposes. This poses significant security problems for organizations when protecting their information assets. For example, hackers and virus writers try to attack the Internet and computers connected to the Internet. Some want to invade others' privacy and attempt to crack into databases of sensitive information or sniff information as it travels across Internet routes.

**The concept of Web**

The Internet Protocol is designed solely for the addressing and routing of data packets across a network. It does not guarantee or provide evidence on the delivery of messages. There is no verification of an address. The sender will not know if the message reaches its destination at the time it is required. The receiver does not know if the message came from the address specified as the return address in the packet. Other protocols correct some of these drawbacks.

**39.1 Web Security Threats**

There is two major classes of security threats

- Passive Attacks
- Active Attacks

**39.2 Passive attacks**

This class of network attacks involves probing for network information. These passive attacks can lead to actual active attacks or intrusions/penetrations into an organization's network. By probing for network information, the intruder obtains network information as that can be used to target a particular system or set of systems during an actual attack.

Types of Passive attacks

Examples of passive attacks that gather network information include the following:

- Network Analysis
- Eavesdropping
- Traffic Analysis

**39.3 Active Attacks**

Once enough network information has been gathered, the intruder will launch an actual attack against a targeted system to either gain complete control over that system or enough control to cause certain threats to be realized. This may include obtaining unauthorized access to modify data or programs, causing a denial of service, escalating privileges, accessing other systems. They affect the integrity, availability and authentication attributes of network security.

**39.4 Types of Active attacks**

Common form of active attacks may include the following:

- Masquerading – involves carrying out unauthorized activity by impersonating a legitimate

user of the system.

- Piggybacking – involves intercepting communications between the operating system and the user and modifying them or substituting new messages.
- Spoofing – A penetrator fools users into thinking they are interacting with the operating system. He duplicates logon procedure and captures pass word.
- Backdoors/trapdoors – it allows user to employ the facilities of the operating system without being subject to the normal controls.
- Trojan Horse – Users execute the program written by the penetrator. The program undertakes unauthorized activities e.g. a copy of the sensitive data.

### 39.5 Threat Impact

It is difficult to assess the impact of the attacks described above, but in generic terms the following types of impact could occur:

- Loss of income
- Increased cost of recovery (correcting information and re-establishing services)
- Increased cost of retrospectively securing systems
- Loss of information (critical data, proprietary information, contracts)
- Loss of trade secrets
- Damage to reputation
- Degraded performance in network systems
- Legal and regulatory non-compliance
- Failure to meet contractual commitments

### 39.6 Methods to avoid internet attacks:

#### 1. Define the problem

The start of handling the problem would be to know the problem or the security threat seeking management's attention. Only then can the people be appointed to address the threat. Greatest concern about network attacks is finding the right people to handle daily network security operations. It's critical that you have key people with the right experience and background. There's no magic bullet, it doesn't come because we buy nice software and put it in our budget and have a nice appliance somewhere. It's got to be through the use of people. They have to be well-trained.

#### 2. Consolidate standards and purchasing power

Internet attacks, as discussed can be from various sources. The attackers tend to be more creative by identifying new weaknesses in the systems. All major threats the management feels the information systems is vulnerable to should be consolidated. This would help in identifying standards and security products which can help in securing the system against that particular set of internet attacks. There are instances where the organizations end up buying more than one security products to address the same security threat, thus increasing investment.

### **3. Think risks**

The network attackers are getting smarter every day. Organizations and people want their data to be protected. Businesses must operate within a similar risk management culture. A comprehensive risk based approach starting from identifying risks may be a better solution.

### **4. Fix configurations**

Configuration management is going to be very important. Without configuration standards, applying software security tools becomes too costly. If a laptop is misconfigured or doesn't have the right security software, the next step should be to deny network access to that laptop until it meets the standard. Enforcing safe software configurations is especially critical on mobile devices that use wireless connections to access agency networks. With good configuration management practices, agencies can provide centrally managed security and still protect handheld and mobile devices.

### **5. Better people mean more secure networks**

The shortage of trustworthy people with IT security skills is a chronic problem that is unlikely to ever disappear. Enough engineers and computer scientists should be trained in computer security skills getting people with the right technical background to do the work has been the biggest need of all.

### **6. Identify problems early and react fast**

The most common approach to computer and network security is to wait for an attack and then go after it. The organization's management needs to be more proactive with embedded security services to get ahead of significant threats before they can pull the company off its routine operations.



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**LESSON 40****Factors Encouraging Internet Attacks**

Generally, Internet attacks of both a passive and active nature occur for a number of reasons, including availability of tools and techniques on the Internet or as commercially available software that an intruder can download easily. For example, to scan ports, an intruder can easily obtain network scanners, various password cracking programs are available free or at a minimal cost. Lack of security awareness and training among an organization's employees. No matter how perfect a system is made by removing all possible vulnerabilities, there are still chances that weaknesses exist and the system can be intruded at any given time. Inadequate security over firewalls and operating systems may allow intruders to view internal addresses and use network services indiscriminately.

**40.1 Internet Security Controls**

Information Systems can be made secure from the threats discussed last slides. There is not a single control available to cater for the risk of vulnerabilities associated with web (Internet). Some of the solutions are:

- Firewall Security Systems
- Intrusion Detection Systems
- Encryption

**40.2 Firewall Security Systems**

Every time a corporation connects its internal computer network to the Internet it faces potential danger. Because of the Internet's openness, every corporate network connected to it is vulnerable to attack. Hackers on the Internet could break into the corporate network and do harm in a number of ways: steal or damage important data, damage individual computers or the entire network, use the corporate computer's resources, or use the corporate network and resources as a way of posing as a corporate employee. Companies should build firewalls as one means of perimeter security for their networks. Likewise, this same principle holds true for very sensitive or critical systems that need to be protected from entrusted users inside the corporate network.

Firewalls are defined as a device installed at the point where network connections enter a site; they apply rules to control the type of networking traffic flowing in and out. The purpose is to protect the Web server by controlling all traffic between the Internet and the Web server.

To be effective, firewalls should allow individual on the corporate network to access the Internet and at the same time, stop hackers or others on the Internet from gaining access to the corporate network to cause damage. Generally, most organizations can follow any of the two philosophies

- **Deny-all philosophy** -- which means that access to a given resources will be denied unless a user can provide a specific business reason or need for access to the information resource.
- **Accept All Philosophy** -- under which everyone is allowed access unless someone can provide a reason for denying access.

System reports may also be generated to see who attempted to attack to system and tried to enter the firewall from remote locations.

Firewalls are hardware and software combinations that are built using routers, servers and variety of software. They should control the most vulnerable point between a corporate network and the Internet, and they can be as simple or complex as the corporate security policy demands. There are many types of firewalls, but most enable organization to:

- Block access to an organization sites on the Internet
- Limit traffic on an organization's public services segment to relevant addresses.
- Prevent certain users from accessing certain servers or services.
- Monitor communications between an internal and an external network
- Monitor and record all communications between an internal and the outside world to investigate network penetrations or detect internal subversion.
- Encrypt packets of data that are sent between different physical locations within an organization by creating a VPN over the Internet.

Firewalls encrypt packets that are sent between different physical locations within an organization by creating a VPN over the Internet. The capabilities of some firewalls can be extended so that they can also provide for protection against viruses and attacks directed to exploit known operating system vulnerabilities. Remote Location server protected by fire walls and IDS further complemented by IPS (Intrusion Prevention system) – Defining Specific ranges of IP addresses that may access the location with defined rights.

### 40.3 Intrusion Detection Systems (IDS)

Another element to securing networks is an intrusion detection system (IDS). IDS is used in complement to firewalls. An IDS works in conjunction with routers and firewalls by monitoring network usage anomalies. It protects a company's information systems resources from external as well as internal misuse.

#### Types of IDS includes:

- Signature-based: These IDS systems protect against detected intrusion patterns. The intrusive patterns they can identify are stored in the form of signatures.
- Statistical-based: These systems need a comprehensive definition of the known and expected behaviour of systems.
- Neural networks: An IDS with this feature monitors the general patterns of activity and traffic on the network and creates a database.

Signature-based IDSs will not be able to detect all types of intrusions due to the limitations of detection rules. On the other hand, statistical-based systems may report many events outside of the defined normal activity but which are normal activities on the network. A combination of signature- and statistical –based models provides better protection. IDS is used as part of the network. It may be used in the form of hardware and software or a software may only be installed on the server. An IDS is located in between firewall and corporate network and works in compliment with the firewall. However it can also be installed before the fire wall. IDS helps to detect both on-site unauthorized access through network based IDS, and remote unauthorized access through the use of host based IDS Biometrics may also be used However biometrics helps to prevent only on site illegal access. A log can be maintained in an IDS to detect and observe attempts of intrusions made and those successful. IDS is more concerned with recording and detecting intrusions. For blocking intrusions, an other system called Intrusion Prevention System (IPS) is used which takes input from IDS. IDS reports the IP addresses that are attacking the

organizational network.

#### 40.4 Components of an IDS

An IDS comprise of following components:

- Sensors that are responsible for collecting data. The data can be in the form of network packets, log files, system call, traces, etc.
- Analyzers that receive input from sensors and determine intrusive activity
- An administrative console – it contains intrusion definitions applied by the analyzers.
- A user interface

#### Host-based IDS

The HIDS reside on a particular computer and provide protection for a specific computer system. They are not only equipped with system monitoring facilities but also include other modules of a typical IDS, for example the response module. HIDS can work in various forms.

1. Systems that monitor incoming connection attempts. These examine host-based incoming and outgoing network connections. These are particularly related to the unauthorized connection attempts to various protocols used for network communication such as
  - TCP (Transmission Control Protocol) or
  - UDP (User Datagram Protocol) ports and can also detect incoming portscans.
2. Systems that examine network traffic that attempts to access the host. These systems protect the host by intercepting suspicious packets and scanning them to discourage intrusion.
  - Network Traffic – data travel in the form of packets on network
  - Packet – a specific amount of data sent at a time

#### Network Based IDS

The network-based type of IDS (NIDS) produces data about local network usage. The NIDS reassemble and analyze all network packets that reach the network interface card. For example, while monitoring traffic, The NIDS's capture all packets that they see on the network segment without analyzing them and just focusing on creating network traffic statistics. HoneyNet (s) – does not allow the intruder to access actual data but leaves the intruder in a controlled environment which is constantly monitored. Monitoring provides information regarding the approach of the intruder.

#### Components of IDS

An IDS comprises on the following:

- Sensors that are responsible for collecting data. The data can be in the form of network packets, log files, system call traces, etc.
- Analyzers that receive input from sensors and determines intrusive activity.
- An administration console
- A user interface.

#### Features of IDS

The features available in an IDS includes:

- Intrusion Detections
- Gathering evidence on intrusive activity
- Automated response (i.e. termination of connection, alarm messaging)

- Security policy
- Interface with system tools
- Security policy management

### Limitations of IDS

An IDS can not help with the following weaknesses :

- Incorrectness or scope limitation in the manner threats are defined
- Application-level vulnerabilities
- Backdoors into application
- Weakness in identification and authentication schemes

### 40.5 Web Server Logs

The major purpose of enhancing web security is to protect web server from attacks through the use of internet. While doing that Logging is the principal component of secure administration of a Web server. Logging the appropriate data and then monitoring and analyzing those logs are critical activities. Review of Web server logs is effective, particularly for encrypted traffic, where network monitoring is far less effective. Review of logs is a mundane activity that many Web administrators have a difficult time fitting into their hectic schedules. This is unfortunate as log files are often the best and/or only record of suspicious behavior. Failure to enable the mechanisms to record this information and use them to initiate alert mechanisms will greatly weaken or eliminate the ability to detect and assess intrusion attempts.

Similar problems can result if necessary procedures and tools are not in place to process and analyze the log files. System and network logs can alert the Web administrator that a suspicious event has occurred and requires further investigation. Web server software can provide additional log data relevant to Web-specific events. If the Web administrator does not take advantage of these capabilities, Web-relevant log data may not be visible or may require a significant effort to access.

### Web Trust

Under the web trust approach, a WebTrust Seal of assurance is placed on the site to show potential customers that a CPA or CA has evaluated the website's business practices and controls. The purpose is to determine whether they are in conformity with the Web Trust Principles. The *WebTrust* Principles and Criteria are intended to address user needs and concerns and are designed to benefit users and providers of electronic commerce services. Your input is not only welcome, it is essential to help ensure that these principles and their supporting criteria are kept up-to-date and remain responsive to marketplace needs. Web trust principals broadly cover following aspects:

1. Business Practices Disclosures – The entity discloses how it does business with its electronic commerce.
2. Transaction integrity – the website operator maintains effective controls and practices to ensure that customer's orders placed using electronic commerce are completed and billed as agreed.
3. Information protection – the entity maintains effective controls and practices to ensure that private customer information is protected from uses not related to entity business.

### 40.6 Web Security audits

Going online exposes an entity to more hazards than otherwise. This requires implementation of

effective controls and checks to secure both the company's online data from undesired manipulation, and the customer's information and orders. The organization may hire an audit firm to offer these services and check the integrity of the website. Web audits help in gaining a web rating which enhances the credibility of the audits. There are different levels of audits, tailored to your needs and your budget. Among the issues we can carefully review on your site, resulting in a detailed report with recommendations:

- performance, page load time
- graphics optimization
- navigation usability, consistency
- browser compatibility
- content formatting consistency
- accessibility compliance with ADA guidelines and Section 508 Standards
- broken links
- page errors, script errors
- search engine ranking
- interface layout

#### 40.7 Digital Certificates

- The digital equivalent of an ID card is also called "digital IDs," digital certificates are issued by a trusted third party known as a "certification authority" (CA) such as VeriSign and Thawte.
- For example, CBR requires a NIFT class 2 digital certificate in order to facilitate filing return electronically
- NIFT itself is an affiliate of Verisign Inc. working as certification authority in pakistan.
- The certificate is valid for one year.
- The certificate is attached to email every time a message is attached and sent to recipient.
- The CA verifies that a public key belongs to a specific company or individual (the "subject"), and the validation process it goes through to determine if the subject is who it claims to be depends on the level of certification and the CA itself.

The process of verifying the "signed certificate" is done by the recipient's software, which is typically the Web browser. The browser maintains an internal list of popular CA's and their public keys and uses the appropriate public key to decrypt the signature back into the digest. It then recomputes its own digest from the plain text in the certificate and compares the two. If both digests match, the integrity of the certificate is verified. Companies like VeriSign and thawte provide a variety of security and telecom services like digital certificates.

**LESSON 41****E-Commerce**

Electronic Commerce (e-commerce or EC) describes the buying, selling, and exchanging of products, services, and information via computer network, primarily the internet. Some people view the term commerce as describing transactions conducted between business partners. E-business is a broad definition of EC, not just buying and selling, but also servicing customers, collaborating with business partners, and conducting electronic transactions within an organization.

**41.1 Why E-Commerce?**

Due to rapid expansion in business, and time pressures from customers, Efficiency in delivering products and information there to and addressing complaints is of paramount importance. Use of internet or web services can be a very effective tool in achieving this goal. It helps to achieve various business goals in the fastest possible way, e.g. sharing production schedules with suppliers, knowing customer demands for future in advance. These days almost all businesses have E-commerce, from fast food chains to automobile manufacturers. Online orders can be placed along with online payment made. All this is possible with the use of E-commerce. According to Lou Gerstner, IBM's former CEO,

“E-business is all about time, cycle, speed, globalization, enhanced productivity, reaching new customers, and sharing knowledge across institutions for competitive advantage.”

**What does E-Commerce do?**

E-commerce is what happens when one combines the broad reach of the Internet with the vast resources of traditional information technology systems. It uses the web to bring together customers, vendors, and suppliers in the ways never before possible. E-commerce presents abundant opportunities. Companies around the world already buy and sell over the Internet. They connect with customers, suppliers and each other. They do the business on the web, and consequently, they do more business. There are challenges like security, scalability and reliability. They are real but they are surmountable. E-commerce is about web-enabling your core businesses processes to improve customer service, reduce cycle time, get more results from limited resources, and actually sell things.

In the age of global competition, e-commerce can play a critical role in helping organizations to boost sales at high margins due to the high economies of scale. It is something which is becoming need of the day.

**41.2 E-Commerce vs. E-Business**

Since both the terms are quite commonly used interchangeably, the scope is often confused likewise. All e-commerce is part of e-business. Not all e-business is e-commerce. E-business means using the internet and online technologies to create operating efficiencies, and therefore increase value to the customer. It is internally focused. Think swift integration of planning, sourcing, manufacturing, management, execution, and selling using IT infrastructure. Example, FedEx is a company incorporating e-business programs to improve efficiencies throughout the supply chain. For instance, moving the invoicing process online reduced costs as well as officers' time spent on paperwork. Now this would be seen as E-business not e-commerce. Concerns for e-business usually are which are broader than:

1. Has e-business increased your effectiveness?
2. Were our processes faulty before we moved them online?
3. Are we gaining efficiencies in specific areas?
4. Have relationships with suppliers or customers improved?
5. Are our web-enabled systems assisting in decision making, or just providing access to information?
6. Does our e-business strategy fit with our overall corporate strategy?

If there is a direct financial transaction involved with the electronic process using Internet technologies it is e-commerce. If there is a non-financial transaction with an electronic process using Internet technologies it is e-business. Any transaction with an electronic process using Internet technologies is e-business. For example, ordering a book on Amazon.com is e-commerce and e-business. Creating a map with directions from your home to the post office on google maps is e-business (no e-commerce involved). The above confusion is quite similar to what exists between Marketing and sales. Sales is part of Marketing. Marketing includes other activities, such as Advertising which is not Sales. The most prevalent of E-Commerce models can be classified as

1. Business to Consumer (B2C)
2. Business to Business (B2B),
3. Business to Employee (B2E),
4. Consumer to Consumer (C2C) and
5. E-Government
  - Government to Citizens/Customers (G2C)
  - Government to Business (G2B)
  - Government to Government (G2G)

### 41.3 Business to Consumer (B2C)

All elements of physical shopping experience are present in the B2C Model. There is a store represented by a website known as store front. Potential customers browse through the storefront using web browser (like Netscape or Internet Explorer). If they like a product, they select it by adding it to your Shopping Cart. If the customer wants additional information from the vendor, he would do so by either investigating relevant links on product specifications, or by sending message through a 'contact us' or email section of the website. Finally, once you have selected your product, you pay for it using any of several payment methods, the most common of which is a credit card. When the average citizen interact with a company through a website, buying shoes or books online or making inquires of products and services, we are doing so through the Business to Consumer model. The B2C model is similar to a customer visiting a store or shop, browsing at products on display, inquiring from the shopkeeper about a particular product, and then selecting and paying for the product or service. One of the major differences between a traditional shopping experience and B2C e-commerce Model is that all of this is done electronically, remotely through the internet, without you having to leave the comfort of your house or office. Customers and suppliers can be 10,000 miles apart, in different cities or countries, or even different continents, and yet do business as if they were located in same city or on the same street. Since the internet never sleeps or closes customer can do business 24- hours of the day, 365-days of the year. Bad weather, strikes or labor problem will not prevent the customer from visiting the store and placing their orders.

The real reason that B2C is flourishing in technologically advanced societies is that it has broken down 'physical' barriers to doing business. This has allowed even small, less financially sound and

often suspicious entities, to represent and partner with brand name companies. Resultantly, when you visit a storefront on the web, you are not certain whether the vendor (whose site you are going to shop at) is in 'control' of the entire business cycle. In most cases, the storefront owner is just a small link in the complicated supply and distribution network that has been made possible through the Internet. Should the relationship between any of the intermediaries fall apart, the customers may not have too many options to address his complaints.

### **Business to Business (B2B)**

Traditionally, because transactions between business partners is conducted by mailing or faxing documents like Purchase Orders, Delivery Note or Invoices. Business to Business (B2B) is a model to e-commerce where businesses conduct commerce amongst themselves over the Internet/Intranet. What this entails is two or more business partners entering into agreements, whereby instead of using paper documents to complete a transaction cycle, they do so through electronic means, sharing data over secure Internet or Intranet connections. While the volume in terms of number of transactions through this e-commerce model is smaller than that generated worldwide through B2C, the monetary turnover through B2B is significantly higher, especially on a per-transaction basis.

### **Example – B2B and B2C**

A car manufacturer company receives an order for delivery of a car through internet. The payment is also made by the consumer through the internet using his credit card. On receiving the order the company may have to order manufacturing of the unit and certain principal parts may not be available. In such a case, an online purchase order may be sent to all the vendors where ever they are located to seek the relevant parts. Hence the consumer, the vendor and the manufacturer all are linked through e-commerce.

### **Example – B2B**

A car manufacturer (like Pak Suzuki for example) can mail or fax a purchase order formatted per its company's requirements, to a steel supplier (like Pakistan Steel Mills), and conduct a purchase transaction. Under the B2B Model however, industry standards (such as Electronic Data Interchange) are used for transmitting data related to commercial transactions between the manufacturer and the supplier. Pak Suzuki, therefore, will be required to pre-format its purchase order data as per the standard, while Pakistan Steel Mills will setup their systems to accept the PO data per the expected standards. Any deviation from these standards could make the transaction null and void.

### **41.4 Electronic Data Interchange (EDI):**

EDI is a set of standards for structuring information to be electronically exchanged between and within businesses, organizations, government entities and other groups. The standards describe structures that emulate documents, for example purchase orders to automate purchasing. The term EDI is also used to refer to the implementation and operation of systems and processes for creating, transmitting, and receiving EDI documents.

### **Business to Employee (B2E)**

Companies are finding many ways to do business with their own employees electronically. They disseminate information to employees over the intranet. For example, they also allow employees to manage their fringe benefits and take training classes, electronically. In addition, employees can buy discounted insurance, travel packages, and ticket to events on the corporate intranet, and they can



electronically order supplies and material needed for their work. And many companies have electronic corporate stores that sell a company's product to its employees, usually at a discount.

### **Consumer to Consumer (C2C)**

An increasing number of individuals are using the Internet to conduct business or to collaborate with others. Auctions are so far the most popular C2C e-commerce activity. Some other C2C activities are:

1. Classified: Individuals used to sell items by advertising in the classified section of the newspaper. Today, they are using the Internet for this purpose. *Some classified services are provided for free.*
2. Personal Services: A variety of personal services are offered on the Internet, ranging from tutoring and astrology to legal and medical advice. Personal services are advertised in the classified areas, in personal web pages, on Internet communities' bulletin, and more. Be very careful before you buy any personal services. You need to be sure of the quality of what you buy.
3. Peer-to-Peer and file exchange: An increasing number of individuals are using the P2P services of companies. Individuals can exchange online digital products, such as music and games.

### **41.5 E Government**

E-Government / electronic government / digital government, or online government. The terms refer to government's use of information and communication technology (ICT) to exchange information and services with citizens, businesses, and other arms of government. E-Government may be applied by legislature, judiciary, or administration, in order to improve internal efficiency, the delivery of public services, or processes of democratic governance. The primary delivery models are

1. Government-to-Citizen or Government-to-Customer (G2C)
2. Government-to-Business (G2B) and
3. Government-to-Government (G2G).

### **Government to Citizen (G2C)**

Government-to-Citizen (abbreviated G2C) is the online non-commercial interaction between local and central Government and private individuals. Many government entities in Pakistan are making it more convenient for the citizens to interact with them. For example

1. CBR offering services regarding ([www.cbr.gov.pk](http://www.cbr.gov.pk))
  - Online verification
  - Sales tax registration status
  - Online availability of tax returns
2. NADRA registration system ([www.nadra.gov.pk](http://www.nadra.gov.pk))
  - NIC registration process
  - Bill Payment Kiosks
  - Guidance notes
  - Contact information
  - Complaints section for applicants

### **Government to Business (G2B)**

Government-to-Business (abbreviated G2B) is the online non-commercial interaction between local and central government and the commercial business sector. The basic difference between the G2C setup and G2B set up is that government is dealing with private individuals (citizens) in

case of G2C and commercial sector in case of G2B. For Example, trade development authority of Pakistan, formerly Export Promotion Bureau (EPB). ([www.epb.gov.pk](http://www.epb.gov.pk)), providing

- Facilitation for exporters
- Exporters' database
- Guidance on regulations
- Registration and complaints procedures

### **Government to Government (G2G)**

Another category of electronic commerce is government to government E-Commerce. G2G form refers to Procurement transactions between government to government agencies.

### **41.6 Other Forms of E-Commerce**

Intra-business E-Commerce – E-Commerce can be done not only between business partners, but also within organizations. Such activity is referred to as intra-business EC or, in short intra-business. E-Commerce between and among units within the business – large corporations frequently consist of independent units, or strategic business units (SBUs), which “sell” or “buy” materials, products and services to and from each other. Transactions of this type can be easily automated and performed over the intranet. An SBU can be considered as either a seller or a buyer. An example would be company-owned-dealership.

### **E-Learning**

E-Learning is the online delivery of information for purposes of education, training, knowledge management, or performance management. It is a web - enabled system that makes knowledge accessible to those who need it, when they need it – anytime, anywhere. E-learning is useful for facilitating learning at schools.

### **Conflicts within click-and-mortar organization**

When an established company decides to sell direct online, on a large scale, it may create a conflict within its existing operation. Conflict may arise in areas such as pricing of products and services, allocation of resources (e.g. advertising budget) and logistics services provided to the online activities by the offline activities (e.g. handling of returned items purchased online). As a result of these conflicts, some companies have completely separated “clicks” (the online portion of the organization) from the “mortar” (the traditional brick and mortar part of the organization). This may increase expense and reduce the synergy between the two.

### **41.7 M-Commerce**

Electronic commerce has gradually shifted to a modern form in the name of Mobile commerce. M-Commerce (mobile commerce) refers to the conduct of e-commerce via wireless devices. These devices can be connected to the Internet, making it possible for users to conduct transactions from anywhere. The employees need to collaborate and communicate with office employees and to access corporate data, rapidly and conveniently. Such a capability is provided by m-commerce. Two main characteristics are driving the interest in m-commerce: mobility and reachability. *Mobility* implies that the Internet access travels with the customers. M-commerce is appealing because wireless offers customers information from any location. This enables employees to contact the office from anywhere they happen to be or customer. *Reachability* means that people can be contacted at any time, which most people see as a convenience of modern life. These two characteristics – mobility and reachability break the geographical and time barriers. As a

result, mobile terminals such as PDA or cell phone with Internet access can be used to obtain real-time information and to communicate from anywhere, at any time.

### **Security Concerns**

With all its benefits, e-commerce is still faced with a lot of concerns from security point of view. Physical details of the products are not available in case of internet shopping than in case of walking around. In case they are available, they need to be accurate and supported with images of the product. That is lack of physical feel of the product should be electronically supported. Once you enter your personal information and credit card details on a vendor website, you have no control on where that information is going, or to whom it is being transmitted to or shared with. Although the links are secured for privacy purposes but information may be leaked out deliberately by any of the connected parties e.g. supplier. Although there are means of increasing security of digitally transmitted transaction data (such as using encryption technology and digital certificates), the threat of hackers getting at your personal information is always a real one – perhaps not from your computer, but may be from vendors or his business partners systems.

### **41.8 E-Business Opportunities**

E-business through the Internet offers significant opportunities to businesses. These opportunities are similarly available to the competition and hence also represent concomitant risks.

**Competition:** Through the creation of a website, a business can compete locally in traditional industries, as well as regionally, nationally and globally. The Internet permits the entity to effectively target niche markets or areas of specialty and service broad markets in a cost-effective manner. The Internet also permits both economies of scale to become a high-volume global supplier with low costs and economies of scale through product specialization.

Even businesses that decide not to actively participate in e-business will still be affected, because customers may embrace e-business and seek new sources of supply through the Internet, or suppliers may demand e-business capabilities and only deal with e-enabled enterprises.

With the exception of certain national and international retailers and suppliers, traditional marketing has been locally or regionally focused. Until recently, marketing efforts have been focused on traditional media, such as television and newspapers for consumer products and trade magazines or trade shows for industrial products. Through the Internet, marketing can be targeted to selected customers based upon customer registration information, past purchase history or other criteria.

Through the Internet, e-business can offer new and innovative marketing alternatives, such as:

- streaming video to demonstrate products or services.
- detailed catalogues and user manuals to identify products, sub-components and parts – such as pictures, part numbers and prices – to alleviate tedious manual searches for specific items.
- cross-selling of products and services – e.g., when a tap is purchased through the Internet, the provision of detailed installation instructions and a list of other products required (washers, Teflon tape, valve sealing, and tools, such as pipe wrenches, etc.)
- In many cases, an e-commerce company will survive not only based on its product, but by having a competent management team, good post-sales services, well-organized business structure, network infrastructure and a secured, well-designed website. Such factors include.

**Cost Reduction:** E-business facilitates implementation of new business models, including supply

chains, service and support arrangements and the creation of cost-effective alliances. It also offers profit-enhancing changes through cost reduction, such as:

1. **virtual warehousing** – e.g., upon the receipt of a customer order, the vendor orders the goods from the manufacturer and has them shipped directly to the customer. The vendor can carry less or no inventory, and thereby reduce warehouse, insurance and financing costs for inventory while being able to offer a greater selection of products.
2. **vertical integration** – e.g., upon the receipt of an order, by means of website connections, the vendor automatically arranges shipping, delivery, installation and after sales service through an expanded geographically based network of alliance partners. All members of the alliance benefit from membership and all participate in the “one-stop-shopping” convenience of the alliance partner integration available through the web.
3. **electronic delivery of goods and services** – certain goods, such as greeting cards, music, textual materials, architectural drawings and computer software may be delivered electronically to customers globally, which thereby reduces delivery and insurance costs and increases the timeliness of delivery.
4. **automated order processing** – customers and suppliers can execute electronic transactions efficiently based upon Internet standards similar to the EDI standards and even access or update each other’s data files to allow inquiries on the status of orders, including links with shippers and customs brokers, etc.
5. **Classic business approaches**--- generally do not fit well with the new e-business models as described in the third section of this paper. These new models are increasingly centred on the customer or consumer. For example, many customers now expect goods and services to be delivered 24 hours a day from anywhere in the world. The ability to meet customers, discuss their needs with them, demonstrate products, and perform other activities that traditional businesses use to differentiate their services may no longer be available to the same degree.

#### 41.9 E-Business IT Risks

Since e-business invariably involves the use of the Internet through IT, the most important risks associated with e-business are IT risks. However, it should be recognized that IT risks are inextricably related to the risks associated with the opportunities mentioned. The following IT risks can be distinguished: IT infrastructure, IT application, and IT business process risks.

IT infrastructure risks relate to the adequacy of the IT infrastructure for information processing. For example, hardware may be susceptible to malfunction. IT infrastructure risks are addressed by a security concept geared to the needs of the entity and by technical and organizational controls defined on this basis. Typical IT infrastructure risks include:

1. Inappropriate physical security measures that do not prevent theft, unauthorized access or improper disclosure of information
2. Vulnerability to overheating, water, fire and other physical risks
3. Inadequate or improper emergency plans and procedures
4. Absence of adequate back-up procedures
5. Inconstant monitoring of firewalls to detect attempted break-ins
6. Inadequate PKI (Private Key Infrastructure)

IT business process risks arise where analyses of security and information processing do not extend to entire business processes, but merely to parts thereof. Such risks may arise from: lack of data flow transparency, inadequate integration of systems, or deficient reconciliation and control procedures in interfaces between subprocesses arising from the exchange of data between two subsystems within business processes. In this situation, there is a risk that IT controls, such as access rights or data back-up procedures, will only be effective for the subprocesses, but not for the aggregated processes.

**Typical IT business process risks in an e-business environment include:**

- Transaction data are not transmitted completely or accurately from the e-business sub-system to the accounting application
- Safeguards only protect a sub-system from unauthorized or unapproved transactions and thereby allow transaction data to be modified by one of the downstream IT sub-systems
- Improper or inadequate access control mechanisms may make it difficult or impossible to effectively manage access controls for all IT sub-systems integrated into the e-business process
- Access protection that responds to a single IT application integrated into the business process could be bypassed deliberately by manipulating the upstream or downstream IT sub-systems.
- Backup measures are only effective for the e-business sub-system and hence for the sub-process, but not for the entire IT business process.
- The design and implementation of interfaces between the e-business sub-system and downstream IT sub-systems may not be appropriate.

**Legal Risks**

Management of an enterprise is responsible for ensuring that e-business operations are conducted in compliance with applicable laws and regulations. Entities should be aware of variations in applicable laws and regulations across national boundaries, despite the best efforts of international rule-making bodies. Entities operating in global markets are often not up-to-date with respect to legal issues and governmental oversight in multiple jurisdictions. Without an understanding of regulations and the law as it is applied in different jurisdictions, enterprises may become subject to fines and adverse judgements and may incur other costs, such as legal fees, to defend the enterprise. Some of the relevant legal issues include protection of intellectual property, including patent, copyright, and trademark laws, enforceability of contracts with Internet service providers, ownership of software by a software vendor or the right of a software vendor to sell software licenses.

Commercial legal risks also arise in connection with contract law and the purchase and sale of goods and services through the Internet across national boundaries. In particular, there may be problems in determining the appropriate jurisdiction for legal actions with respect to cross-border Internet transactions. Furthermore, where the applicable jurisdiction for the transaction is unclear, the requirements for entering into a contract may also be unclear, for these may vary in certain respects among jurisdictions. Therefore in some situations, the question may arise as to whether there is a legally binding contract.

In addition, it should be noted that certain commercial activities that are not regulated in one jurisdiction may be regulated in another. Management is responsible for ensuring that regulated activities are performed in compliance with the laws in those jurisdictions in which those activities are conducted.

Furthermore, risks in relation to tax law compliance may also arise from e-business activities. In particular, it is often unclear in which jurisdiction taxes may become payable in connection with to cross-border transactions (i.e., income or corporate tax and sales tax). A related issue is the documentation requirements for order processing and invoices in order to comply with tax legislation.

Management is also responsible for ensuring the privacy of personal information obtained as part of the enterprise's e-business activities. To help ensure privacy of personal information, management can establish controls to limit the risk of breaches of web security.

**Summary**

E-business is a growing need of today, and organizations who want to earn a greater market share will have to give serious thoughts to becoming online.

**LESSON 42****Supply Chain Management****Introduction**

The business in the globalization age is more about enhanced efficiencies, increased productivity resulting in lower costs of production, quick and effective decision making increased outreach and customer/client satisfaction and sharing knowledge across institutions. This enables a business to become a more effective player in the free and extremely competitive global market. Globalization encompasses the concept of moving beyond the geographical boundaries of a country and using technological advances to maximum advantage for the business. The internet and Web technologies have brought new dimensions to doing and managing business. E-Commerce we have talked about. Obviously every business has some inherent risks. So does E-Commerce. For example, privacy, legality, taxation are issues that pose a challenge for a good E-business environment although measures both legislative and operational have been taken and continue to be devised. As far as Management Information Systems for businesses are concerned these too have undergone a major change particularly with the availability of Internet. Gone are the days of the stand alone systems which looked at each aspect of the business separately. Today we are talking of end to end solutions for businesses. In other words business imperatives have driven us to re-define the scope of the coverage/ extant of management information systems. The Buzzword for some time now is “ ENTERPRISE RESOURCE PLANNING.” (ERP).

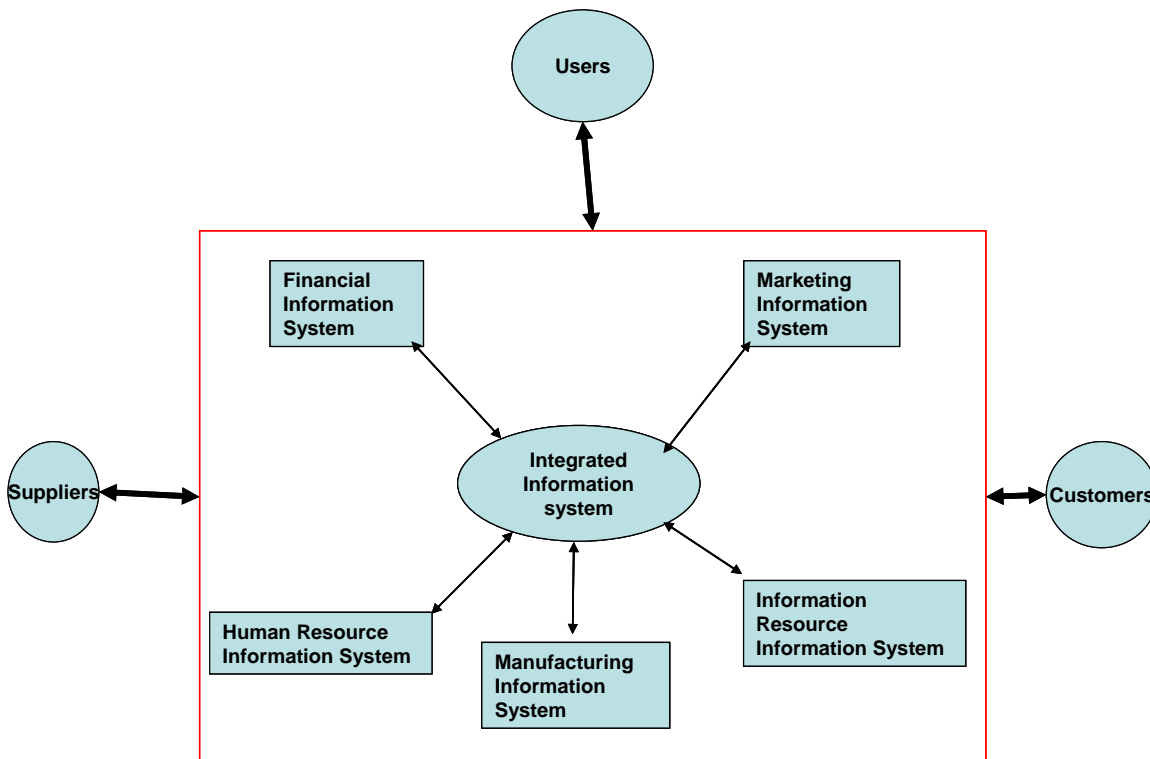
The stand alone systems scope required a singular approach to each aspect of the business. Why? Perhaps at that time the security issues could not be handled in any other way. Perhaps it was much cheaper to employ people to consolidate and produce MIS for all aspects, time taken being of little or no consequence. Perhaps this is what technology allowed us. Packaged or customized software was now available. We move on and find ourselves with an enhanced scope which requires all aspects of the business to be integrated. This meant that issues/transactions of each department which had always impacted other departments had to be integrated in such fashion that the resulting MIS was complete in all respects. Thus was laid the foundation of the Customized Integrated software development and packages. The use of the web and internet expanded the scope further requiring on line transfer of data and real time functionalities.

This lead to a further increase in the scope where we started demanding an analysis of the data as an integral part of the software used by a business regardless of its size. It also created a new demand for bringing the entire supply chain into the perspective as well as the Consumer. The result of the enhancement of scope lead to the Customized integrated software approach becoming an Enterprise Resource Management Software of which MIS was an integral part. Since then we have re-defined the scope to include Planning, Supply Chain and Customers resulting in what is today referred to as the ERP. Certain software developers around the world then decided to produce generic versions of ERP for various industries which could be installed straight off without having to spend time on the development process of a customized integrated software. Obviously the generic versions required that your business systems and processes must be aligned exactly in accordance with its design. This gave rise to the concept of BPR. The versions were too expensive to be modified and it was deemed that it would be cheaper to re-align the business processes.

BPR was not simply of redesigning certain input forms but involved changed practices of working. It involved change in human thought and approaches to their routine, mundane tasks. This raised issues of Change Management. Since the ERP generic models need to be implemented this work is also required to be undertaken and involves training of the staff and transfer/conversion of data in the legacy system. Thus it is not a simple straight forward proposition but involves detailed and phased approach towards successful implementation at considerable cost. The ERP approach, essentially meant for a highly computerized Society, assumes that for it to be used from one end of the business to the other everyone is connected and uses computers. Therein lies a major challenge to make such a system a success in a developing country, like Pakistan, and raises questions in terms of financial viability and suitability. Perhaps it is time to go back and look at the integrated approach.

### 42.1 Integrating systems

Let's take a look what an integrated information system looks like.



As seen in the above picture all systems are interfaced with one another, the input in one system automatically updating the data in the other relevant system. We thus observe simultaneous Data sharing between various systems and simultaneous execution of different business processes. For Example, a confirmed sales order received by the sales department from the customer will once entered into the sales system automatically provide data input to stores/packing/ shipping and possibly the production systems. Thus ensuring that all relevant departments are notified of ready for necessary action simultaneously.

### 42.2 Methods of integration

Information systems can be integrated in the following ways.

- Connect Existing modules/system



- Use Supply Chain Management (SCM) Software
- Use ERP Software

### **Connect Existing Modules/system**

The basic concept is to maximize the use of existing systems and minimize the changes in them. Good integration allows the addition of new applications to existing ones and the connection of systems to intranets and the internet. This approach extends the life of applications and saves tremendous amounts of money. However, connecting existing system may be difficult and expensive in many cases. Old systems were built and developed over a number of years encompassing technologies and platforms of various specifications.

### **42.3 Using SCM Software**

Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. In literal terms, supply chain refers to the flow of materials from their sources (suppliers) to the company and then inside the company for processing. Today the concept is much broader, including flow of materials, information, payments, and services from suppliers to factories and warehouses to end customers. This reduces uncertainty and risks in the supply chain thereby positively affecting inventory levels, cycle time, business processes.

### **42.4 Components of Supply Chain**

The concept of supply chain can be divided into three major parts.

- Upstream supply chain segment – includes the organization's first-tier suppliers (manufacturers and assemblers). The major activities are purchasing and shipping.
- Internal supply chain segment – includes all the processes to transform inputs to outputs.
- Downstream supply chain segment – includes distributing, delivering to customer and final consumption of the product.

### **Example**

For a car manufacturer industry the above three segments can be shown as follows.

<b>Upstream Segment</b>	Vendors to the manufacturers. Sub- Vendors or Suppliers to the Vendors or Suppliers to the manufacturer.
<b>Internal Segment</b>	Manufacturing plants, Assembly plants, Packaging, warehouses, dealers.
<b>Downstream Segment</b>	Banks, transportation companies, distributors, wholesalers, retailers.

#### 42.5 Types of Supply Chains

Supply chain may exist in various forms depending on the need of the business:

1. Made to Store – Focuses on tracking customer demand in real time, so that the production process can restock the finished goods inventory.
2. Continuous Replenishment – focuses on constant replacement of inventory by working closely with suppliers. Applicable to environments with stable demand patterns.
3. Built to order – Focuses on careful management of component inventories and delivery of needed supplies along the supply chain. A solution to this potential inventory problem is to utilize many common components across several production lines and in several locations.

#### Challenges to supply chains

There are usually two major sources of challenges to supply chains.

1. The uncertainties faced
  - a. Demand forecast
  - b. Competition
  - c. Weather conditions
  - d. Technological development
2. The need to coordinate several activities
  - a. Business partners are misunderstood
  - b. Departments are not well connected

**LESSON 43****Enterprise Resource Planning**

Following are various modes of integration:

1. Connect Existing modules/system
2. Use Supply Chain Management (SCM) Software
3. Use ERP Software

The material on first two modes is available in the handouts of lecture 42. The third way of integrating is using an ERP software. Before we start of with what ERP is, I would like to touch a previously discussed linkage between IT and business objectives.

**43.1 Business Objectives and IT**

The goals set by the business strategy are always of supreme importance. Some of these goals are meeting customer requirements, reaching customer where he is --- online, scattered locations, achieving distinctive competence and winning brand loyalty. IT function in an organization is set up in order to support the business goals set at all levels of the organization. IT objectives should be flexed according to the business needs of the organization. This helps in efficient use of IT resources for the achievement of business objectives.

**Text in above clips related to IT objectives**

Technology for the sake of it serves no purpose. It needs to be driven by objectives and these need to be cleared ahead of time if any organization wants to embark on the journey of advancement in technology. So we were very clear and we have been very clear in our business objectives and tools that are required for advancement e.g. equipment, technology. So that objectives which are profitable can be constantly managed. The objective of any business is to operate in a manner to create value, to create value for itself and for the company. There are of course other subsidiary objectives like social responsibility. And I fully concur that whatever the available technology that must be used in an economic manner so that it can create value for the company as a whole.

**Gist of the clips**

The corporate objectives define the IT objectives. The IT objectives should be of help in achieving business objectives as IT is tool being used for the purpose of achieving the corporate objectives. It is not as end by itself. Technology for the sake of technology is futile.

**43.2 Using ERP Software**

ERP is an abbreviation for *Enterprise Resource Planning*. In this three word term, resource and planning may seem as least relevant, but the most relevant part is “Enterprise” since the software aims to take an enterprise level view of the entire organization. ERP can be defined as

“ERP (enterprise resource planning) is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders.”

There are some reasons attracting companies to take up ERP.

1. Planning the operations

2. Integrated customer related information – order tracking with customer database, inventory and shipment at different locations.
3. Standardized HR information – A company with multiple business units will require a comprehensive and all-encompassing method of locating employees and communicating with them.
4. Integrated financial information and analysis
5. Monitoring the operations including those of sub-vendors and manufacturers
6. Standardization analysis of financial and non financial information for decision making control/regulation.
7. We will now listen to the views of the State Bank Of Pakistan's CIO on the subject.

### **Gist of the clips**

The CIO, State Bank is talking about how they came to the decision of having an integrated system to help the institution provide a modern environment for not only conducting its business but also by using the latest in technology, achieve the corporate objectives through better speedier accumulation of data, analysis, thereof to assist in the regulatory function. The system being used by them not only had to cater for data relating to the central bank's own activities but also data of all commercial banks in Pakistan. This necessitated a system of data warehousing.

### **43.3 ERP Compared to integrated Software**

The concept of ERP is that of an integrated software. An integrated software can be defined as a software package that combines many applications in one program. Previously, the user needed various utilities to operate the program and provide suitable interfaces. Today these utilities are an integral part of the software. Thus the receipt of a confirmed customer order should provide the start of a number of activities that are essential to complete and deliver the order. There is no need to separately enter data for each of the other related activities. Integrated packages can move data among several programs utilizing common commands and file structures. In effect, there are multiple applications using the same data simultaneously. An integrated package is recommended when identical source information is to be used for varying purposes and activities.

Most of the software modules can be integrated to provide a complete picture. Generally, customized integrated software/lays stress on meeting the needs of an organization without causing change or too much change in the business processes. ERP's on the other hand incorporate industry best practices. Thus ERP's are a generic solution requiring business process changes. The presence of best industry practices makes ERP a highly generic software. ERP though can be customized for a business, but at very high costs. Hence the benefits are better earned in implementing the ERP as a generic software and spending time realigning the business processes and synchronize with it.

### **Gist of the clips**

Once the decision to adopt the ERP route is made and a product selected, it is imperative to establish what is demanded by the software, what is the requirement the business and how the two above can be reconciled for the benefit of organization. Thus a gap analysis is conducted and the realignment of the existing procedures with the requirements of the ERP have to be undertaken. There may be some element of customization of the ERP, but it is generally minimal. Stress is therefore on the realignment of the business process.

**Text in the clips (Packages)**

When we compare an ERP with an integrated software, an ERP offers much more than just being an integrated software. The reason behind it is that it has been developed after studying hundreds of different industries and based on best practices. ERP standardizes in itself the best practices that are available.-and practiced the world over. So a customized integrated software may be serving the needs of the organization very well. There business information flows and efficiencies adopting good practices of the best ERP is indeed very helpful. An ERP gives you the flexibility to add on new functionalities and modes of doing business.

**Text in the clips (State Bank)**

The concept of ERP started in Early 90's when we had MRP-I and MRP-II which purely focused on manufacturing side. Then later on, the financials were added to it. Then the rest of the business i.e. sales, inventory, receivables, payables all were added as part of the software. ERP is across the enterprise, that is why they call it Enterprise Resource Planning System. The other thing is that it has a central database. What ever you are dealing with, be it sales or manufacturing, the data base is the same. So the paradigm of the way you use the system is the same. The look and feel is the same, though the training issues should be taken care of. The programming and parameterization of the system is quite similar across the board and those benefits don't come in if let us say we are having integration at a limited scope. There are interfaces for each module which help to reconnect with other modules, so if we don't have a system implemented across the board, benefits don't start coming in as expected.

**Gist of the clips**

Standardization of processes based on best practices makes an ERP a more effective tool. The generic characteristic of an ERP with all-inclusive tools turns it into an effective means of doing business efficiently.

**43.4 Evolution of ERP**

The current form and version of ERP has evolved over time. It took nearly four decades for the ERP model to mature. Let's take a look at the brief history of ERP development.

Timeline	System	Description
1960s	Inventory Management & Control	<ul style="list-style-type: none"> <li>➤ Inventory Management and control is the combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse.</li> <li>➤ The activities of inventory management include               <ul style="list-style-type: none"> <li>○ identifying inventory requirements,</li> <li>○ setting targets, providing replenishment techniques and options,</li> <li>○ monitoring item usages, reconciling the inventory balances, and reporting inventory status.</li> </ul> </li> </ul>
1970s	Material Requirement Planning (MRP)	<ul style="list-style-type: none"> <li>• Materials Requirement Planning (MRP) utilizes software applications for scheduling timely material procurement.</li> <li>• MRP generates schedules for the operations and raw material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels and the lot sizing procedure for each operation.</li> </ul>
1980s	Manufacturing Requirements Planning (MRP II)	<ul style="list-style-type: none"> <li>• Manufacturing Requirements Planning or MRP II utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing, inventory control to product distribution.</li> </ul>
1990s	Enterprise Resource Planning (ERP)	<ul style="list-style-type: none"> <li>• Enterprise Resource Planning or ERP uses multi-module application software for improving the performance of the internal business processes.</li> <li>• ERP systems often integrates business activities across functional departments, from product planning, parts purchasing, inventory control, product distribution, fulfillment, to order tracking.</li> <li>• ERP software systems may include application modules for supporting marketing, finance, accounting and human resources.</li> </ul>

#### Attributes of an ERP software

ERP applications address the complete business process. ERP applications are modular generally covering all aspects of the business as each aspect is dependant upon the other. Thus you will generally find certain standard modules as part of ERP software which are manufacturing, supply chain, financials, CRM, human resources and warehouse management. It may also be stated that depending upon business size, phased approach may be opted to

implement the ERP. A phased approach becomes necessary because of business process realignment and implementation issues particulars relating to change in habits of the users.

During the past, the software laid greater stress on financial transactions and their cumulative result with information for other department being provided as a secondary objective. ERP is extended to the enterprise level, encompassing not only the organization but also the entities external to organization i.e. suppliers and customer.

### **Text in the clips (Packages)**

The perception was correct in the past. But as economy is growing, finance is not the only important field. Supply chain, production, marketing they all are very important parts of industry whether in form of goods or services. So for this purpose information should be available as soon as possible through out the company e.g. about the stock levels, processes used to produce finished goods till packing and dispatching it to customers and recovering. ERP is a system that helps in making information available live throughout the system at one time and it is available to all. So now a days it is no longer a finance driven. It is basically a company driven idea and the idea is to serve the customer well.

### **Gist of the clips**

ERP is across the enterprise in its literal sense. ERP is a package that builds in itself at facets of a business.

## **43.5 ERP & Customer relationship management**

Integration involves a broader view of various soft wares being used by the organization. Now CRM is also being used in connection with the ERP for efficient planning and effective control.

### **Text in the clips (Packages)**

Some of the world's good ERP system, they do have planning and interpretation methodology embedded in them. When we went under the procedure of implementing, we were told that there are two modes to do the same: long procedure and short procedure. The long procedure is spread over two years. The short procedure is spanned over nine month's time. The short procedure can also be termed as the quick methodology. In short procedure, the organization needs to have a certain time line, certain procedures and certain things are to be done. The logic of having this short implementation procedure is that the human natures if it is too long people lose interest, things change, people change, processes change, so we need to do it in a very quick implementation mode. For this we have to form what we call a project team. The project team is further headed by the steering committee in which members are taken from various functions. We don't need to have all people present at the same time but at a time we need to have four or five people to be present for every function which is being configured to align with the ERP system and connected by the ERP consultants.

### **Gist of the clips**

ERP should be seen as an independent project. Like with every other project, this must have an independent project team. The project team is made up of generally heads of departments of various functions. This team is led by a steering committee comprising those charged with policy making to ensure that any decisions are taken expeditiously.

**LESSON 44****ERP & E-commerce**

Organizations do accept that when we talk of E-commerce in real terms, not just having a website for online information but actually to be able to execute transactions, there has to be an integrated software up and running. Especially when Consumerism is the prime focus, being integrated and online will help in better implementation of CRM.

**Text in the clips**

This is known as the business to business B2B and business to consumer B2C. They have become buzz words but they are very real. What most ERP's are heading towards are internet portals. The front end becomes the internet portal and the other businesses and customers can come in through that.

**Gist of the clips**

Now consumers and business use the gateway of internet to walk into the business and make transactions. So Websites with online buying options have become the virtual selling locations for the business.

**44.1 ERP & CRM**

Customer has become of critical importance in the modern day business. Early on, organizations used to focus more on how much has been sold what has been produced. But now the focus is quite different. Focus has been placed on the requirements of the customer, providing quality service and quickness of response to customer queries. Analysis of the customer data from their personal habits to spending one's have become a crucial element of doing a successful business. ERP has this unique potential to improve the quality of customer handling.

**Text in the clips**

Our larger customers who drive most of our business, they conduct budgeting activity for most of their products, for which they need semi finished or raw materials from us. These requirements are incorporated in our system even before a purchase order is received from our customer. So we know well ahead of time what the requirements of our customer will be on a periodic basis. This gives us time to plan what kinds of raw materials and production capacities we would require in a given period keeping other orders in view. This makes us well equipped in our supply chain, the materials to be imported, the delivery times being built into the system for reordering.

**Text in the clips**

Thus inventory management becomes more efficient and production bottlenecks are pre-empted. But as coming back to the customer and starting from the sales forecast, when we move on the purchase order which is first converted by the system into the sales order. As soon as the process starts the production planning department can have a look at it and plan a production order based on that that information is available to the sales people as well. So whatever process that job has gone through can be accessed by the sales person, whether the stock is available or not.



**Text in the clips**

We all want to know what is receivable from all the customers. Initially we had a system of having receivables report and analysis of all the customers every ten days. Now with the ERP system the moment you make any entry in the ERP system, every thing instantaneously gets updated. Hence sales officer has relevant information available at any point of time. The all other information about the purchases, supply chain, inventory levels, production process, delivery times, status of dispatch, etc is available up to date as soon as the data is input. Hence our current lag time is approximately 3 hours which is much better than the earlier of four weeks.

**Gist of above clips**

Customer is of supreme importance. Every thing for a business and starts, revolves around and ends at the customer. The business processes, the production, the inventory, the after sales service all should be built and monitored in accordance with the requirements of the customer. In the modern day world the ERP system helps us to achieve this object the most optimizing way and eliminates time lags to a substantial level.

**44.2 Change management**

Change management means to plan, initiate, realize, control, and finally stabilize change processes on both, corporate and personal level. Implementation of ERP or any other integration software needs commitment and proper management. Managing change in implementation projects has become a serious concern for the management.

**Types of Change**

- **Organizational Development:** This is the more gradual and evolutionary approach to change. It bases on the assumption that it is possible to align corporate objectives with the individual employees' objectives. In practice, however, this will rarely be possible.
- **Reengineering:** This is known as corporate transformation or business transformation. It is the more radical form of change management, since it challenges all elements of processes or structures that have evolved over time.

**Gist of the clips**

Recruitment of specialized personnel is a very important element. Skills of people should complement in a way to remove deficiencies of each other and to become a fruitful combination

**Is a change inevitable?**

A further classification of change can be seen as internal to organization, and external to organization. Since implementation of ERP is an organization wide activity both in terms of processes and skill levels required, it can be seen as an Internal Change. Of course external development like market demands, up-gradation of technology and other similar matters also necessitates change.

Change has to be planned, monitored and managed before we can get successful and fruitful results. Where management is deciding to bring in change, it has to ask itself certain questions and consider issues emerging from the change.

**Factor to consider:**

Following factors should be considered in order for change to be successful:

- Have we got the right leadership and "buy-in" support for the proposed change?
- Is the proposed change aligned with the strategic plan?
- What current/future issues/concerns will performance measurement / management address?
- What are the implications and barriers to successful implementation?
- What are the inherent risks/costs of not embracing the change?
- Who should we target as the key drivers for the "new way we are going to do things round here?"
- What processes will we need to change/introduce?
- How will success be measured and what value will success have for the business and individual?
- How do we change people's behavior?
- Who will feel threatened by the change?

**44.3 Phases of Change Management**

Change management should not be seen as a one off event. Rather it is a process which is spread over a period of time and divided into various phases. Various management models define and segregate change management into various set of phases. However the phases which we will discuss below shall give a general understanding of what happens in a change management process. The terms and phases may vary according to management models and various studies conducted.

- Shock and Surprise – Confrontation with unexpected situation mostly
  1. by accident e.g. loss in a business unit or
  2. planned e.g. workshops for personal development
- Denial & Refusal – people express their conviction that change is not necessary
- Rational Understanding – People realize the need for change and find short term solutions
- Emotional Acceptance – if management succeeds in creating willingness for change, people change their beliefs and behaviour, otherwise change process stops or slows down.
- Exercising & Learning – People start to try new behaviours and processes, as a result will experience success and failures. Change managers should create easier tasks at start to create early wins
- Realization – the knowledge gained in previous phase has feed-back effect.
- Integration – LAST PHASE: total link-up is created between newly acquired patterns of thinking and acting. New behaviors become routine.

**Another view of phases**

Change management phases can be classified in an alternative way:

- Unfreezing -- Preparing a situation for change by disconfirming existing attitudes and behaviors.
- Changing -- Taking action to modify a situation by altering the targets of change.
- Refreezing -- Maintaining and eventually institutionalizing the change.

### **Why people resist change?**

There are various reasons why people feel afraid of the change. The change may act as a favorable agent for many at the organization. However it is merely the fear of the unknown that in most cases creates hurdle.

- Fear of the unknown—mostly the reaction is “God knows what’s going to happen!”.
- Lack of good information – involvement from the lower levels is not taken by the management and they are not fully aware of the future happenings.
- Fear for loss of security – Mostly changes lead to down sizing which is termed mostly by organizations as right sizing.
- No reason to change – no reason sounds convincing to people to accept a change.
- Fear for the loss of power – Mostly changes make organizational structures more horizontal, flexible resulting into delegation of authority and handing over powers to lower levels.
- Lack of resources
- Bad timing – Employees sometimes are approached with a proposal of change when they are already feeling.
- Habit – people with closed mind are not innovative to learn new things and this may prove to be a major hurdle in bringing in change.

### **What can be done about resistance to change?**

- Education and communication – Changes bring new things for learning. The employees should be informed of these and given an opportunity to learn to enhance awareness.
- Participation and involvement – in every step of bringing change, those affected should be involved and their concerns and views should be given value.
- Facilitation and support – As minds start getting adjusted, those affected should be facilitated and given time to properly assimilate the newly emerging aspects.
- Negotiation and agreement – in case where resistance is high, terms of agreement may be settled with dialogue.
- Manipulation and cooptation – Twisting and distorting facts for the sake of seeking acceptance is becoming a normal practice. If corporate management threatens to close down a particular manufacturing plant if that plant's employees fail to accept an across-the-board pay cut, and if the threat is actually untrue, management is using manipulation.
- Explicit and implicit coercion – As a last resort, the application of direct threats or force upon the resisters. Examples of coercion are threats of transfer, loss of promotions, negative performance evaluations, and a poor letter of recommendation.

**44.4 Change agents**

Successful changes and their management are backed by presence of a change agent. A person or a team who leads a change project or business-wide initiative by defining, researching, planning, building business support and carefully selecting volunteers to be part of a change team. Change Agents must have the conviction to state the facts based on data, even if the consequences are associated with unpleasantness. Change Agent consciously challenges the status quo, is comfortable with leading change initiatives with uncertain outcomes and systematically considers new and better ways of doing things. ERP is such a large scale project that sponsorship from the senior management is an immediate must. Unless the project itself and the consequential change is sponsored from the senior level, the chances of success are quite bleak.

**44.5 ERP– Ownership and sponsor ship:**

Implementation need the right mix of people – both from the business and from the IT side. Those who think that it's a pure computerization of organization which can be taken solely by the IT people are wrong. Nor is it a project to be handled solely by the business people. Hence a balanced mixture of people from IT and business background is required for a successful implementation.

**LESSON 45****Importance of ethics in IS**

Information is a source of power. Consequently, developments in information systems also involve social and political relationships-- and so make ethical considerations in how information is used all the more important. Electronic systems now reach into all levels of government, into the workplace, and into private lives to such an extent that even people without access to these systems are affected in significant ways by them. New ethical and legal decisions are necessary to balance the needs and rights of everyone.

**45.1 Meaning of Ethics**

Ethics are moral choices made by individuals in relation to the rest of the community, standards of acceptable behavior, and rules governing members of a profession. ETHICS are principles and rules concerning duty to society, profession and business. Ethics is about how we ought to live. The purpose of ethics in information systems is not philosophical or academic, it can mean the survival of a business or industry. The issues relating to electronic information systems include control of and access to information, privacy and misuse of data, International considerations. Issues of ethics and privacy have always been there even when computerized environments were in their natal phase. However, with the advancement in technology, the issues have grown sophisticated and so are the remedies.

**45.2 Ethical Challenges**

Information system security association of USA has listed down following ethical challenges

1. Misrepresentation of certifications, skills
2. Abuse of privileges
3. Inappropriate monitoring
4. Withholding information
5. Divulging information inappropriately
6. Overstating issues
7. Conflicts of interest
8. Management / employee / client issues

**Netiquette**

Netiquette, or on-line civility, is a matter of common sense and of remembering the context of behavior. The etiquette guidelines for posting messages to online services, and particularly Internet newsgroups. Netiquette covers not only rules to maintain civility in discussions (i.e., avoiding flames), but also special guidelines unique to the electronic nature of forum messages.

**Netiquette Guidelines**

- In general, do not waste other people's time, be disruptive, or threaten.
- Do not take up network storage space with large, unnecessary files; these should be downloaded.
- Do not look at other people's files or use other systems without permission.
- When joining a bulletin board or discussion group, check the FAQ (frequently asked questions) file before asking questions.

- Remember that on-line communications lack the nuances of tone, facial expression, and body language. Write clearly. Try to spell correctly and to use good grammar.
- Do not SHOUT needlessly. Capital letters are the on-line equivalent of shouting.
- Use asterisks to give emphasis, but do so \*sparingly\*.
- Sign messages, and include an e-mail address when writing to strangers, just in case a message's header is lost.
- People who become too obnoxious can be banned from a system or simply ignored.

Many companies and professional organizations develop their own codes of ethics. A code of ethics is a collection of principals intended as a guide for the members of a company or an organization. The diversity of IT applications has increased and the increased use of the technology have created a variety of ethical issues.

### 45.3 Privacy and Ethics

Whenever one has to talk of privacy, ethics is the second half of it. It won't be wrong to say that privacy may not have been an issue had it not been linked with the ethical view a society has. There are certain aspects which when put together formulate a set of ethical issues. These are

1. Privacy issues
2. Accuracy issues
3. Property issues
4. Accessibility issues

#### Privacy issues

Following aspects should be covered when privacy is dealt with.

- What kind of surveillance should be used by an employer on an employee?
- What things can keep to themselves and not be forced to reveal to others?
- What information about individuals should be kept in database and how secure is the information there – Issues of Data Protection
- What can be revealed to others about oneself if one is required to do so?

#### Accuracy Issues

Following are some of the accuracy issues.

- How can we ensure that information will be processed and presented properly?
- Who is responsible for checking the correctness of information collected?
- Is there any track of errors, omissions made in the database and who has made them at what time.
- Who is to be held accountable for the changes made in data base, whether authorized or unauthorized, intentional or unintentional.

#### Property Issues

Following are some of the property issues.

- There has to be defined owner of the information
- Issues of software piracy

- Use of corporate computers for private use
- Who should access which component of information database.

### Accessibility Issues

These mostly comprise of two aspects.

- Extent of access to be given to various employees in the organization.
- The definition of privileges of each person.

### Privacy

Before we start of with the concept of privacy in computerized environments let's take a look what privacy is in its literal terms. Privacy means the quality or condition of being secluded from the presence or view of others, the state of being free from unsanctioned intrusion: *a person's right to privacy*, the state of being concealed; secrecy. Privacy is quite a subjective/relative concept. The limits and boundaries for it are defined by everybody in his own context.

### Protecting Privacy

There are certain important considerations. The rights of privacy must be balanced against the needs of the society. Every society has to decide somewhere on the gray area between hiding all and knowing all extremes. Public's rights to know is superior to the individual's rights of privacy. Usually public and individual's rights stand in conflict with each other. Since government agencies have their concerns in priority e.g. criminal investigation, undesirable social activities. Various aspects can be seen as a threat to privacy.

#### 45.4 Threats to Privacy

As technology has grown sophisticated, various aspects can be seen as a threat to privacy.

- Electronic surveillance
- Data Profiling
- Online Privacy
- Workplace monitoring
- Location tracking
- Background checks
- Financial privacy
- Medical record and genetic profiling
- Digital right
- Intellectual property rights
- Taxation Issues

#### 45.5 Electronic Surveillance

Secret video surveillance is quite a common technology used at offices and public places and events. CCTV's commonly known as Closed Circuit Televisions can be seen at almost every place. Privacy and civil liberties advocates condemn the use of this technology for recognition of criminals. Since, in part such technologies tend to hit privacy of many who are productive part of the society. Civil libertarians advocate against this kind of monitoring. Employees have limited protection against employers. Many countries are getting serious on finding the right balance between personal privacy and electronic surveillance in terms of threats to national

security.

#### 45.6 Data Profiling

As we make our way through everyday life, data is collected from each of us, frequently without our consent and often without our realization. We pay our bills with credit cards and leave a data trail consisting of purchase amount, purchase type, date, and time. Data is collected when we pay by check. Our use of supermarket discount cards creates a comprehensive database of everything we buy. When our car, equipped with a radio transponder, passes through an electronic toll booth, our account is debited and a record is created of the location, date, time, and account identification. We leave a significant data trail when we surf the Internet and visit websites. When we subscribe to a magazine, sign up for a book or music club, join a professional association, fill out a warranty card, give money to charities, donate to a political candidate, tithe to our church or synagogue, invest in mutual funds, when we make a telephone call, when we interact with a government agency.

#### 45.7 Online Privacy and E-Commerce

News stories of Internet privacy threats are commonplace these days. The Internet was designed as an inherently *insecure* communications vehicle. Hackers easily penetrate the most secure facilities of the military and financial institutions. Internet companies have designed numerous ways to track web users as they travel and shop throughout cyberspace. "Cookie" is no longer a word associated solely with sweets. It now refers to cyber-snooping. Identity thieves are able to shop online anonymously using the credit-identities of others. Web-based information brokers sell sensitive personal data, including Social Security numbers, relatively cheaply.

#### 45.8 Workplace Monitoring

Privacy advocates often use these words to describe the workplace. Many forms of monitoring technologies are available in the marketplace and are becoming cheaper each year video surveillance, telephone monitoring, e-mail and voice mail monitoring, computer keystroke tracking, Internet Web site monitoring, location tracking using badges worn by employees and satellite tracking of the company fleet.

Privacy issues in Work place monitoring

What makes matters worse is that these systems can be deployed secretly and invisibly. Employers are not required by law to disclose to their employees that such monitoring is being conducted. A requirement of Employer Disclosure is not a normal practice in various countries. The only places where employees can expect to be free from surveillance are in bathrooms and locker rooms, but even this protection is not absolute.

#### Workplace Monitoring Justifications

Employers make several arguments to justify their use of monitoring systems.

1. The employer owns the systems used by the employees to do their work - primarily the phone and computer systems.
2. Employers are responsible for the work product of their employees. Therefore they have a right, even a duty to monitor.
3. Employers must be able to detect and prevent the sharing or selling of trade secrets and other matters of corporate intellectual property.
4. Employers have been successful in making these arguments when aggrieved workers have filed lawsuits for privacy violations. The few court cases have largely been decided in the



employers' favor.

### **Wireless Communication and Locations Tracking**

The products and services offered by the wireless industry are also hitting the privacy aspects. The signals emitted by a cell phone may be used to track location of a user from the nearest communications towers. Cell phones these days have the ability to pinpoint the user's location to the nearest 100 feet for emergency assistance. Marketers also use this cell positioning technology to market their products. For instance if we are passing by a food chain, we might receive a message telling us that just off the next exit is a restaurant that serves our favorite cuisine or a new discount package.

### **Back Ground Checks**

More and more organizations try to check back ground history of the employees in certain respects. For instance banks for issue of loans, leasing companies, insurance companies and employers. Usual aspects are credit profiling e.g. credit worthiness reports by Credit Information Bureau of SBP, Ethnic background, criminal background, addiction and medical records.

### **Issues of Privacy**

The cost of background checks has decreased dramatically in recent years. As a result, more employers are conducting them. Mostly the retrieved information in background checks is either incorrect or misleading. The reason is that there is no such thing as a perfect database.

### **Financial Privacy**

Banks, insurance companies, and brokerage firms are now able to affiliate with one another under one corporate roof. Credit card companies, banks, insurance companies, and brokerage firms may share their respective databases with one another but they cannot sell customer data to third parties without prior notice to customers commonly known as affiliate sharing. Certain outcomes of affiliate sharing are "junk" mail, e-mail, telemarketing solicitations and SPAM (simultaneously produced advertised message). Elderly individuals with cash-rich portfolios could be vulnerable to fraud artists' promises of lucrative returns on risky investments. In certain countries legislation on Financial Information Privacy has been successfully enacted that requires an "opt in" by customers before a financial institution can sell personal information to third parties.

### **Medical Record confidentiality**

Most individuals consider their medical information to be among the most sensitive of any information about them.

In the field of health care, another privacy issue on the healthcare front is genetic profiling. In many countries, the use of genetic data to discriminate in both employment and health insurance is of growing concern to consumers, healthcare professionals, and policymakers alike.

### **Digital Right Management**

The migration of print, music, and images to the Internet has spawned new technologies called "digital rights management" systems (DRM) that infringe upon intellectual freedom. Intellectual property scholars point out that copyright and privacy have traditionally been compatible

because copyright provisions control public distribution of content. The right to explore ideas in books, music, and movies without having to identify ourselves. The right to anonymity is a vital foundation stone of our democratic society.

Download of content from internet for misuse must be controlled. Private use of copyrighted material has been governed by various legislations. The most recent development in this regard is TRIPS.

#### 45.9 TRIPS

Trips is an AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS. The agreement has been instituted by World Trade Organization for all its members. The agreement sets minimal rules for national intellectual property law in order to prevent member nations from using intellectual property as a hidden trade barrier against other nations. Part II of the agreement specifically defines the scope and use of various intellectual property rights

1. Copyright and Related Rights
2. Trademarks
3. Geographical Indications
4. Industrial Designs
5. Patents
6. Layout-Designs (Topographies) of Integrated Circuits
7. Protection of Undisclosed Information
8. Control of Anti-Competitive Practices in Contractual Licences

Article 10.1 of TRIPS provides that computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971).

Since Pakistan is signatory to WTO it had to take necessary steps to ensure transfer of intellectual property rights from / to Pakistan. Accordingly the Electronic Data Protection Act 2005 was enacted by the parliament covering various aspects relating to various forms of data, privacy and consent issues of data subjects whose data is processed, security of electronic data, disclosure and dissemination issues and addressing complaints and offences.

#### Taxation Issues

Take a situation where a transaction is done online. The server processing the transaction for execution may be in USA. The supplier of the product may be in Canada. The shipment may be made from UK. The owner of the website may be in Australia. The person paying online may be physically in Pakistan. The Question is where should the transaction be taxed: at the source of origin or the place of execution. The E-commerce while giving convenience has also complicated the situation. Electronic transfers are made to foreign countries which may be known to the banks but are hidden from tax authorities. Covert banking channels are used. Undisclosed assets are accumulated.

#### 45.10 Privacy Codes and Policies

These were some of the issues developing on privacy. An organization may think of developing and implementing a privacy policy. One way to protect privacy is to develop privacy policies or codes which can help organizations avoid legal problems. Senior management should take acceptance of employees, customers and suppliers and address issues

accordingly.

**Aspects to be covered by Privacy Policy**

It should cover issues like an overview on what the policy aims to cover, scope of application of the policy, all employees of the organization, customers both online and offline, random visitors registering for the information extraction in case of web privacy, Giving customers and employees an idea what sort and extent of processing and handling may be performed on the data being collected from them every time they visit, Informing web visitors that as they visit the website, the web server will save cookies on their terminal and the benefit which the visitors will get i.e. the web-server will recognize the visitor when the website is visited next time and the fact that IP addresses are being saved by the web server and if combined with the ISP address, can help to locate computer originating message. This is not an exclusive detail of issues. Other issues may also be added according to the need of the organization.