Block 1
Role of MIS in Organization

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Organization and Information Systems, Changing Environment and Its Impact of Business

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परिमापक

अनुवाद की स्थिति में

मूल लेखक	अनुवाद
मूल सम्पादक	भाषा सम्पादक
मूल परिमापक	परिमापक

सहयोगी टीम

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प्रकाशक : उत्तर प्रदेश राजर्षि टण्डन मुक्त विश्वविद्यालय, प्रयागराज की ओर से डॉ0 अरुण कुमार गुप्ता, कुलसचिव द्वारा पुनः मुद्रित एवं प्रकाशित वर्ष-2020।

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Block - 1 : Introduction

Block one comprises four units. Unit one deals with Organisation and Information Systemll, changing environment and its impact on business. Unit two deals with ITES and its influence - data. Unit three deals with organization structure, managers and activities. Unit four deals with types of decisions and information.

UNIT-1 : ORGANIZATION AND INFORMATION SYSTEMS

Objectives

In this global era information will play a pivotal role in the 21st century. In every sphere either technology, marketing, social or related to community as a whole the information will be the cutting edge. Information Technology will serve as a potential tool.

Structure

1.0 Overview

1.1 Introduction

1.1.1 MIS Model:

1.1.2 Components of MIS

1.1.3 MIS Characteristics

1.2 Organization and information systems

1.3 Changing Environment and its Impact on business

1.4 Summary

1.5 Self Assessment Test

1.6 Furthers Readings

1.0 Overview

In this global era information will play a pivotal role in the 21st century. In every sphere either technology, marketing, social or related to community as a whole the information will be the cutting edge. Information Technology will serve as a potential tool.

1.1 Introduction

It is the information age- a time is when knowledge is power. Today everything is based on information and new technologies; it is widely recognized that information systems knowledge is essential for managers because most organizations need information systems to survive and even businesses are using information to gain and sustain a competitive advantage. In this information age,IT and MIS play a vital role. Now what is IT and MIS?

Information Technology (IT): It is combination of two words: Information and technology.

Information: information means data that have been shaped into a form that is meaningful and useful to human beings. Data, in contrast, are streams of raw facts representing events occurring in organizations

or the physical environment before they have been organized and arranged into aform that people can understand and use.

Raw Data → Process → Processed and Organised → Data Information

Example:

Roli Pawan Keya Neha Rahul	Name : Roli Roll no :13 BC 45 Class : B.C.A. Ist yr. Semester : 1st
Data	Information

Figure 1.1- Data and Information

Technology:

Technology means the "scientific study or knowledge for practical purpose that knowledgeof method or invention that allow humans to control or adapt to their environment. Any form of technology used by people to handle information is called technology.Because MIS deals with the coordination and use of the three very important organizational resources –Information, people and information technology so we can say:

A *Management Information System* is an integrated user-machine system, for providing information, to support the operations, management, analysis & decision-making functions in an organization.

- The System utilizes computer hardware & software, manual procedures, models for analysis, planning, control & decision making and a database.
- MIS provides information to the users in the form of reports and output from simulations by mathematical models.
- The report and model output can be provided in a tabular or graphic form.
- MIS provide a variety of information products to a manager which includes 3 reporting alternatives:
- Periodic Scheduled Reports: Weekly Sales, Analysis Reports, Monthly Financial Statements etc.
- ExceptionReports:Periodic Report but contains information only about specific events.
- Demand Reports and Responses:Information on demand.

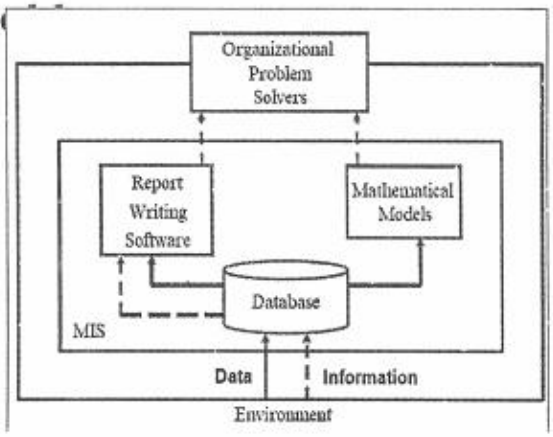

Figure 1.2- Model of MIS

Both data and information are entered from the environment.

- Database contains the data provided by the subsystem.
- The database contents are used by software that produces periodic and special reports as well as mathematical models that simulate various aspects of the firm's operations.
- The software outputs are used by persons who are responsible for solving the firm's problems.

1.1.2 Components of MIS

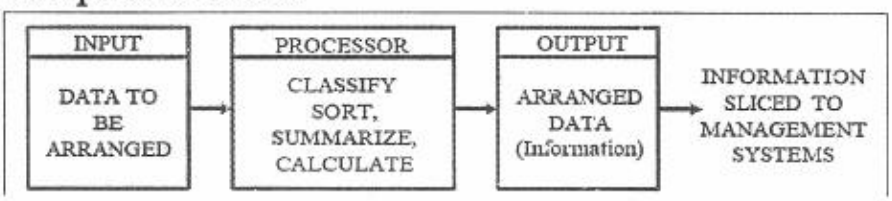

Figure1.3- Components of MIS

1.1.3 MIS Characteristics

- Management Oriented/directed
- Business Driven
- Integrated
- Common Data Flows
- Heavy Planning Element
- Subsystem Concept
- Flexibility & Ease of Use
- Database
- Distributed Systems
- Information as a Resource

1.2 Organization and information systems

The word organization means two things. The first meaning of the wordorganization is an institution or a functional group. Business organization, Hospital, School, University is some such institution keeping in view the concept of division of labour, authority, responsibility and decision making so that the institution as a stablesystem, works coherently towards the achievement of goals. The level at which a person is holding position. The authority is measured on the basis of Command on control of resources, the risk of business, and the decision making power tomanage the risk and reward. When the authority, is distributed in a vertical order in terms of levels, the organization is built on the principle of hierarchy of authority. Theeffectiveness of the authority is based on the span of control, i.e., the number of personbeing managed and controlled by a person. Depending on the organization, and business,the span may differ from four to seven. The span outside this range has proved to beunproductive and inefficient.

Organizations require many different kinds of skills and people. In addition to managers, knowledge workers (such as engineers, architects, or scientists) design products or services and create new knowledge and data workers (such as secretaries, bookkeepers, or clerks) process the organization's paperwork. Production or service workers (such as machinists, assemblers, or packers) actually produce theOrganization's products or services.

Each organization has a unique culture, or fundamental set of assumptions, values, and ways of doing things, that has been accepted by most of its members. Parts of an organization's culture can always be found embedded in its information systems.

Different levels and specialties in an organization create different interests and points of view. These views often conflict. Conflict is the basis for organizational politics. Information systems come out of this cauldron of differing perspectives, conflicts, compromises, and agreements that are a natural part of all organizations.

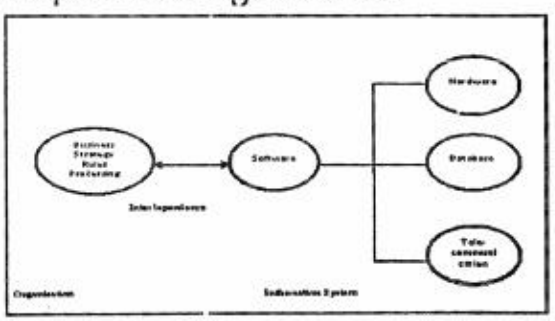

Figure 1.4: Interdependency between Organization and Information system

What is an Information System?

An information system can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making, coordination and control in an organization. In addition to support decision making, coordination, and control, information systems may also help managers and workers to analyse problems, visualize complex subjects, and create new products. Information systems contain information about significant people, places, and things within the organization or in the environment surrounding it.

Three activities in an information system produce the information that organizations need to make decisions, control operations, analyze problems, and create new products or services. These activities are input, processing, and output. Input captures or collects raw data from within the organization or from its external environment. Processing converts this raw input into a more meaningful form. Output transfers the processed information to the people who will use it or to the activities for which it will be used.

Information systems also require feedback, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage.

An information system contains information about an organization and its surrounding environment. Three basic activities—input, processing, and output—produce the Information organizations need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Environmental factors such as customers, suppliers, competitors, stockholders, and regulatory agencies interact with the organization and its information systems.

For example In Procter & Gamble's point-of-sale system, the raw input consists of the item identification number, item description, and amount of each item sold along with the retailer's name and identification number. A computer processes these data by comparing the amount of each item sold to the historical sales pattern for that item to determine if the item might soon be out of stock. The system then sends alerts over computers and wireless devices to appropriate store personnel to reorder the item, which become the system outputs.

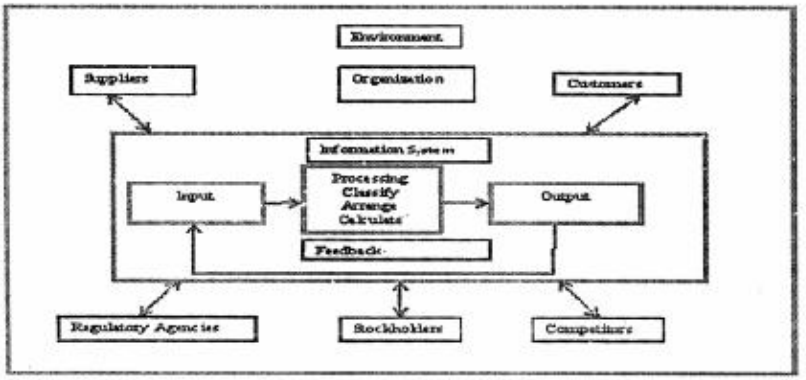

Figure 1.5: Functions of an informationsystem

The system thus provides meaningful information, such as lists of what retailer ordered? what items,? the totalnumber of each item ordered daily,? the total number of each item ordered by each retailer,? and items thatneed to be restocked?

Formal information systems can be either computer-based or manual. Manual systems use paper-and-penciltechnology. Although computer-based information systems use computer technology to process raw data intomeaningful information, there is a sharp distinction between a computer and a computer program on the onehand, and an information system on the other. Electronic computers and related software programs are thetechnical foundation, the tools and materials, of modern information systems. Computers provide theequipment for storing and processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing. Knowing how computers and computer programswork is important in designing solutions to organizational problems, but computers are only part of aninformation system.

1.3 Changing environmentand its impact on business

Even though the organization is structured properly, over the period of time it starts failing slowly due to the change in the environment, the people and the business. Like a living organization, an organization undergoes a process of birth and death. The process of organization outlives the purpose for which it is established moves much faster, if proper corrective action is not taken. The organization structure in its life cycle, starting from the introduction, growth, maturity and decline should change suitably in the respective phases. The behavioural change through the organizational change is achieved by creating a climate for change, deciding, designing and implementing the change, watching and institutionalizing the change.

Statically there are many number of ways to validate the impact of technology is having on the business world.

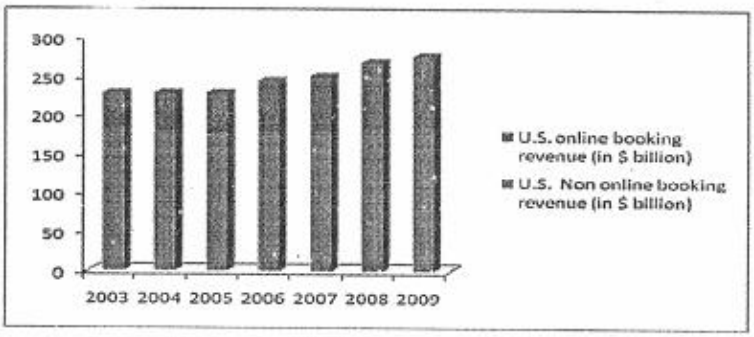

Figure 1.6: Online Vs Non-online travel booking revenue through 2009

Five powerful worldwide changes have altered the business environment.

- Internet growth and technology convergence.
- **Globalization**: The emergence and strengthening of the global economy.
- The transformation of industrial economies and societies into knowledge and information-based service economies.
- The transformation of the business enterprise.
- The emergence of the digital firm.

Internet growth and technology convergence

- Plays pivotal role in creating and changing an organization's task environment.
- Marketing over the internet.
- Improved access to service (e.g. Banking)
- Online, real time financial management systems.
  -Can determine profit and loss on a daily basis.
- New business Technologies with the favourable cost.
- E-business, E-commerce, E-government.
- Rapid changes in market & market structure.
- Increased obsolescence of traditional business models

Globalization

- Management and control in a global marketplace
- Competition in world markets
- Global work groups
- Global delivery systems
- Growing percentage of economy relies upon import and export

Transformation of Industrial Economies

- Knowledge- and information-based economies
- Productivity
- New products and services
- Knowledge: a central productive and strategic asset
- Time-based competition
- Shorter product life
- Turbulent environment-Complex and constantly changing
- Limited employee knowledge base
- Privately controlled markets
- Based on supply and demand
- Free market competition
- Profit incentives

Transformation of the business Enterprise

- Flattening
- Decentralization
- Flexibiility
- Location independence
- Technological advancement
- Low transaction and coordination costs
- Empowerment
- Collaborative work and teamwork

Emergence of the Digital Firm

- Used to transform material, information and other inputs in to finished goods and services.
- Role in strategy: creates strategic option not feasible with older technologies (approaching those of traditional large scale manufacturing facilities)
- Digitally enabled relationships with customers, suppliers, and employees
- Core business processes accomplished via digital networks
- Digital management of key corporate assets
- Rapid sensing and responding to environmental changes

These changes in the business environment and climate,pose a number of new challenges to business firms and their management.

The organization system is an open system and MIS should be so designed that it highlights the critical business, operational, technological

and environmental changes to the concerned level in the organization, so that the action can be taken to correct the situation. The principle of the feed forward control should be extensively used as a design feature to provide a prior warning to the decision maker. Since the organization system has a dynamic role to play to meet the changing needs of a business, the MIS becomes a common support system for playing the dynamic role.

When an organization is moving through the business phases of introduction, growth, maturity and decline, MIS should provide an information support, relevant to that phase of the business cycle. This means the designer of MIS should foresee such requirements and make the design flexible enough to support such requirements. There are some compelling reasons which force all the organizations to resort to strategic business planning.

The following reasons make planning an essential management process to keep the business in a good shape and condition:

1. Market forces
2. Technological change
3. Complex diversity of business
4. Competition
5. Environment (Threats, Challenges, and Opportunities)

1. Market forces

It is very difficult to predict the market forces such as the demand and supply, the trend of the market growth, the consumer behaviour and the choices, the emergence of new product and the new product concepts. The ability of the organization to predict these forces and plan the strategies is limited for the various reasons. The market forces affect the sales, the growth and the profitability. With the problems arising out of market forces, it is difficult to reorient the organization quickly to meet the eventualities adversely affecting the business unless the business is managed through a proper business plan.

2. Technological Change

There are a number of illustrative cases throughout the world on the technological breakthroughs and changes which have threatened the current business creating new business opportunities. The emergence of the microchip, plastic, laser technology, fiberoptics technology, unclear energy, wireless communication, audio-visual transmission, turbo engines, thermal conductivity and many more, are the examples which have made some products obsolete, threatening

the current business, but at the same time, have created new business opportunities. The technological changes have affected not only the business prospects but the managerial and operational styles of the organizations. In the absence to any corporate plan, such a technological change can bring the organization into some difficult problems and, in some cases, can pose a threat to its survival. The corporate plan is expected to ensure the recovery of the business investment before such a technological change takes over.

3. Complex Diversity of Business

The scope of business is wide, touching many fronts. The variety of products, the different market segments, the various methods of manufacturing the multiple locations, the dependence on the external factors, such as the transport, the communications and the manufacturing resources brings complexity in the management of business. Many factors are uncontrollable and unless there is a plan, prepared with due consideration to the diverse and complex nature of business, handling these factors is not possible. This might lead to the loss of business opportunity. As the business grows, it reaches a stage where the strategies such as the expansion vertical or horizontal, integration-forward or backward, diversification-in the same line or in the diverse line of business, are the issues which the management is required to handle.These issues are investment-oriented and have a far-reaching effect on the business growth, direction and profitability.

4. Competition

Facing competition in the business means fighting on a number of fronts. Competition could be direct or indirect. It may share the marker or create a new product which will shift the market affecting your business. Competitions could be solely in the management of business, when there is hardly any product distinction or it may come from certain sectors which are being promoted by the government. The companies compete on the merits such as the knowhow, quality, prompt delivery, after sales service, etc.Competition is a natural phenomenon in business, and it has to be dealt with in a propermanner to protect business interests. This means that the management has to continuouslyevolve new strategies like:price cutting, advertising promotions, enhanced customer service or warranties, improvements in product or service quality; to deal with the competition. Evolving strategies and theirimplementation, calls for forward thinking and planning, without which it is not possibleto handle competition. Competition forces the management to look for new products, new markets, and new technologies to keep the marimproved. Strategies also have to be implemented in a proper sequence as businesscompetition demands an intricate planning, testing and

implementation of the strategies.The competition should never be underestimated and has to be met squarely throughcorpo.ate planning.

5. Environment

The environment is beyond the control of the management. Depending upon theorganizations business and its purpose, different environments have bearing on thefortunes of business. It could be one of the social, businesses, economic, industrial, technological environments affecting the business. Many a times, it could be a mix ofdifferent environments. The environmental changes are difficult to predict and aregenerally slow. Therefore, many times the managements are caught unaware by theenvironmental changes. To illustrate the environment's impact on business, someexamples of recent origin are mentioned as follows.

Spread education programmers have created new opportunities for knowledgeprocessing and communication. The introduction of television has adversely affected thefilm industry and its immense popularity has considerably retracted other amusementactivities like going for a picnic or to a circus. Personal computers are fast replacing thetypewriters on account of changing office environment.

Values and attitudes make the penetration in the market difficult. The difference in thevalues and attitudes of the rural and urban consumers calls for separate products withdifferent advertising strategies for them. The attitude of the consumer towards fast foodor frozen food decides its spread and popularity. Similarly continucus increase in the costof transport affects the tourism and hotel industry but promotes the home entertainmentindustry. The policies of the Government also affect the business and the industry. TheInternational laws and agreement create new opportunities and threats to the business.Forecasting the probable environment changes like the change in populationmix consumer preferences and their behaviour government policies new opportunities andso on and forth is a major task.

Business planning therefore is absolutely essential for the survival of the business PeterDrucker defines long-range planning as the process of making the present managerial(Risk taking) decisions systematically and with the best possible knowledge of theirfuturity organizing systematically the efforts needed to carry out these decisions andmeasuring the results of these decisions against the expectations through organizedthrough systematic feedback. Planning is neither forecasting nor making future decisionstoday it is making current decisions in the light of future.

Planning does not eliminate the risk but provides an effective tool to face it.Comprehensive corporate planning is not an aggregate of the functional plans but it is asystematic approach aiming to manoeuvre the enterprise direction over a period of timethrough an uncertain environment to achieve the stated goals and the objective of theorganization.

1.4 Summary

Management Information System is an integrated user-machine system, for providing information, to support the operations, management, analysis & decision-making functions in an organization. There are many ways which puts an impact on business environment such as globalization, technology convergence, diversity of business etc.

1.5 Self Assessment Test

1. What is MIS? How it is so important in to-days life?
2. Define the role of MIS. Also define the MIS model?
3. What is the scope of information system and Management Information system?
4. What is Information system? Explain the purpose of an information system?
5. Define the role of Information System in a business?
6. How environmental changes effect the business?
7. Explain the characteristics of MIS?
8. Discuss about the components of MIS in detail?

1.6 Further Reading

1. Management Information System,PHI Publication,by S.Sadagopan
2. Management Information Systems: Managing the Digital Firm (English) 11th Edition,Pearson Publication, by Kenneth C. Laudon & Jane P. Laudon
3. Management Information System,Tata McGraw - Hill Education, by O'brien J

UNIT-2 THE ITES AND ITS INFLUENCE

Structure of Unit

2.0 Overview

2.1 Data and Information

2.1.1 Data classification

2.2 Information Technology

2.3 ITES

2.3.1 Attributes of Information

2.4 Summary

2.5 Self Assessment Test

2.6 Furthers Readings

2.0 Objectives

Data is statistical facts or figures and processed data or meaningful data is known as information. Data classification is the categorization of data for its most effective and efficient use. ITES, is a form of outsourced service which has emerged due to involvement of IT in various fields.

2.1 Data and Information

Data is raw unprocessed facts and figures that have no context or purposeful meaning and information is processed data that has meaning and is presented in a context. Or we can say:

Data become information when they are processed. To process data one needs to

(1) ***clean*** the data from errors and reduce sources of unreliability,

(2) ***analyze*** data to make it relevant to decision at hand, and;

(3) ***organize*** data in ways that help understanding.

Data goes through many distinct steps before it becomes information, including:

acquisition of data, classification of data, storage of data, retrieval of data, editing of data, verification and quality control of process that produced the data, aggregation of data, hypothesis generation, description of data, test of analysis assumptions, analysis, extrapolation of implications of findings, choice of format for presentation of data, distribution of reports, evaluation of effectiveness of reports.

A datum has to go through considerable amount of manipulations and then it becomes meaningful information.

For example, a computer operator may enter 36.41, which is data, because we do not know why or in what context it is being used. However, if this number then appears on a bill to show that you owe a company £36.41 for goods received then this data has changed into information, because it has acquired a context (its a bill) and meaning.

The figures will be held as binary data on some media such as a hard disk. It is the software which accesses this data and displays it in its context. It may also have some structure, if it is held in a program like a database for example, and a database will also give it structure. So, the software which turns the figures from data into information and gives them meaning.

The binary patterns on backing storage devices such as a disk, CD or DVD, or memory stick, are all classed as data. For example, the binary patterns that describe an icon on your desktop are data. They become information after the operating system software has processed them, because then they become meaningful to you as the icons representative of your hard disk or Internet explorer.

Metadata

Metadata can be thought of as data that describes data. It may have been introduced to you in the Database Unit where it is defined as a data dictionary. This is one example, but other formats of metadata exist. It may be the card-index system used by libraries before computerisation, where each card told you the author, title and location of the book. It can also be thought of as data about documents or files stored on the computer. The computer keeps a file on its hard disk where it records information about each and every file on the computer. This includes information such as when the file was created or modified; who created it; the size of the file; the file type it is. This master or directory file is an example of metadata.

2.1.1 Data classification

Data classification is the categorization of data for its most effective and efficient use. In a basic approach to storing computer data, data can be classified according to its critical value or how often it needs to be accessed, with the most critical or often-used data stored on the fastest media while other data can be stored on slower (and less expensive) media. This kind of classification tends to optimize the use of data storage for multiple purposes - technical, administrative, legal, and economic.

Data can be classified according to any criteria, not only relative importance or frequency of use. For example, data can be broken down according to its topical content, file type, operating platform, average file size in megabytes or gigabytes, when it was created, when it was last accessed or modified, which person or department last accessed or modified it, and which

personnel or departments use it the most. A well-planned data classification system makes essential data easy to find.

Knowledge

Humans have an endless thirst for knowledge, but how do we obtain knowledge? We can read books and magazines, study course materials, and of course we can gain knowledge from watching TV and listening to the radio. The knowledge about the weekend's sports matches can mean as much to one person as the latest advances in rocket science does to another.

We tend to gain knowledge from information and we use that information to make decisions.

Knowledge can be split into two categories: explicit and tacit. Explicit knowledge is rules or processes or decisions that can be recorded either on paper or in an information system. Tacit knowledge exists inside the minds of humans and is harder to record. It tends to be created from someone's experiences, so again it is based on a set of rules or experiences.

2.2 Information Technology

Information Technology (IT) is a broad subject concerned with the use of technology in managing and processing information, especially in large organizations. IT deals with the use of electronic computers and computer software to convert, store, protect process, transmit, and retrieve information. For that reason, computer professionals are often called IT specialists or Business Process Consultants, and the division of a company or university that deals with software technology is often called the IT department. Other names for the latter are information services or Management Information Service, Managed Service Providers (MSP).

In the United Kingdom education system, information technology was formally integrated into the school curriculum when the National Curriculum was devised. It was quickly realised that the work covered was useful in all subjects. With the arrival of the Internet and the broadband connections to all schools, the application of IT knowledge, skills and understanding in all subjects became a reality. This change in emphasis has resulted in a change of name from Information Technology to Information and Communication Technology (ICT). ICT in Education can be understood as the application of digital equipment to all aspects of teaching and learning. It is present in almost all schools and is of growing influence.

The growth of use of Information and Communications Technology and its tools in the field of Education has seen tremendous growth in the recent past. Technology has entered the classroom in a big way to become part of a teaching and learning process.

2.3 ITES

Information Technology Enabled Services, or ITES, is a form of outsourced service which has emerged due to involvement of IT in various fields such as banking and finance, telecom, insurance, etc. Some of the examples of ITES are medical transcription, back-office accounting, insurance claim, and credit card processing and many-more.

Firms usually from developed countries outsource such services to countries like India, China and Philippines in order to gain from large talent pool and low labour cost.

Going ahead we may see more companies outsourcing such services and hence high competition is expected within countries and companies providing IT-enabled services.

Value of Information is directly linked to how it helps decision makers achieve their organization's goals and can be measured

- in time required to make a decision
- Increased profits to the company

2.3.1 Attributes of Information

A literature review was undertaken to identify the attributes of information as an asset.

Many of the attributes which have appeared in the literature over the years are summarised by Repo (1986):

- Information is human. It exists only through human perception;
- Information is expandable. The free flow of information maximises its use;
- Information is compressible; means accurate
- Information is substitutable. It may save money by substituting the use of other resources; means current
- Information is easily transportable by using applicationsof new information technology;
- Information is diffusible. It tends to "leak" though we try to contain it;
- Information is shareable; giving it away does not mean losing it

Sufficient Attributes

So according to the nature, requirement and importance the information has main three attributes:

1. Usability

- Relevant
- Simple
- Flexible
- Economical

2. Delivery
   - Timeliness
   - Accessible
   - Secure
3. Quality
   - Accurate
   - Verifiable
   - Complete
   - Reliable

Some other attributes are origin, frequency, form of preparation, scope, time of horizon, timelessness.

All are defined in the following table:

Attribute	Definition
Accessible	Information should be easily accessible by authorized users so they can obtain it in the right format and at the right time to meet their needs.
Accurate	Information must be true, correct and must accurately describe the item or event means accurate information is error free. In some cases , anaccurate information is generated because inaccurate data is fed into the transformation process.[this is commonly called Garbage In Garbage Out :GIGO]
Complete	Complete information contains all the important facts it provides user with all the details needed to understand the solution means Complete information allows managers to consider all relevant factors when making decisions. For example An investment report that does not include all the important cost is not complete.
Economical	Information should also be relatively economical to produce. Decision makers must always balance the value of information with the cost of producing it.
Flexible	Flexible information can be used for a variety of purposes. For example, information on how much

	inventory is on hand for a particular part can be used by a sales representative in closing a sale, by a production manager to determine whether more inventory is needed, and by a financial executive to determine the total value the company has invested in inventory.
Form of preparation	Tables or graphics displays of the information are the most common written or printed forms or verbal presentation.
Frequency	Prepared/ presented to users and up to date.
Origin	May originate from sources within or outside organization.
Quality	The accuracy and reliability of available information affects the quality of decisions that managers make using the information.
Relevant	Pertains to the situation in hand i.e. Having information specific to a situation assists managers in making better decisions. Relevant information is important to the decision maker. Information showing that? prices might drop might not be relevant to a computer chip manufacturer.
Reliable	Reliable information can be depended on. In many cases, the reliability of the information depends on the reliability of the data collection methods. In other instances, reliability depends on the sources of the information. A rumour from an unknown source that gold prices might go down might not be reliable.
Scope	Coverage of area of the interest –Board or narrow
Secure	Information should be secure from access by unauthorized users.
Simple	Information should be simple, not overly complex. Sophisticated and detailed information might not be needed. In fact, too much information can cause information overload, whereby a decision maker has too much information and is unable to determine what is really important.
Time horizon	Past –present-future activities and events.
Timelessness	Available when it is needed and without excessive delay means the availability of real-time information that reflects current conditions allow managers to maximize the effectiveness of their decisions.
Timely	Timely information is delivered when it is needed. Knowing last week's weather conditions will not help when trying to decide what dress to wear today.

Verifiable	Information should be verifiable. This means that you can check it to make sure it is correct perhaps by checking many sources for the same information.

Table 2.1: List of attributes with proper meaning

2.4 Summary

Processed data is known as Information. IT Enabled services are used in every sphere of life including medical transcription, back-office accounting, insurance claim, and credit card processing and many-more. Information should have attributes such as usability, delivery and quality.

2.5 Self Assessment Test

1. What is Information system and Information technology?
2. What is the difference between Data and Information? Explains with example?
3. What is ITES? Where it is used? Explain the attributes of information?
4. Define the classification of data?
5. Describe barriers to information search within organizations?
6. Describe the role of organization structures in information processing?
7. What is the relation among data, information and knowledge?
8. Define the steps how data is processed to become information?

2.6 Further Reading

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2. Management Information System, Tata McGraw - Hill Education, by O'brien J

UNIT-3 ORGANIZATION

Structure

3.0 Objective
3.1 Introduction
3.2 Concept of Organization Structure
3.2.1 Significance of Organization Structure
3.2.2 Organization Structure
3.3 Types of Organization Structure
3.3.1 Functional Structure
3.3.2 Divisional Structure
3.3.3 Adaptive Structure
Dimensions of Organization Structure
Organisational Effectiveness
3.4 Managers
3.4.1 Activities of Manager
3.5 The Level of People
3.6 Information Need
3.7 Summary
3.8 Self Assessment test
3.9 Further Readings

3.0 Objectives

The Organization and significance of any organization plays a vital role in fulfilling the goals and accomplishment of tasks. Managers are the key members in fulfilling these tasks.

3.1 Introduction

In an organization, a number of activities are performed. These activities are required to be coordinated. Organization structure is designed for division of tasks, grouping of activities and coordinating and controlling the tasks of the organisation. The detailed study of all components and dimensions of organisational structure is required for creation of efficient and stable structure. Well-designed organisation structure facilitates the smooth functioning of the organisation.

3.2 Concept of Organisation Structure

Organisation structure may be defined as the established pattern of relationships among the components of the organisation. Organisation structure in this sense refers to the network of relationships among individuals and positions in an organisation. organisation structure as the formal system of task and reporting relationships that controls, coordinates and motivates employees so that they cooperate and work together to achieve an organisation's goals. The whole structure takes the shape of a pyramid. The structural organisation implies the following things.

The formal relationships with well-defined duties and responsibilities. The hierarchical relationships between superior and subordinates within the organisation The tasks or activities assigned to different persons and the departments; Coordination of the various tasks and activities; A set of policies, procedures, standards and methods of evaluation of performance which are formulated to guide the people and their activities. The arrangement which is deliberately planned is the formal structure of organisation. But the actual operations and behaviour of people are not always governed by the formal structure Clear-cut Authority Relationships, Pattern of Communication, Location of Decision Centres, Proper Balancing , Making use of Technological Improvements, Stimulating Creativity ,Encouraging Growth, Making use of Technological Improvements

3.2.1 Significance of Organisation Structure

The organisation structure contributes to the efficient functioning of organisation in the following ways.

Clear-cut Authority Relationships, Pattern of Communication, Location of Decision Centres, Proper Balancing, Making use of Technological Improvements, Stimulating Creativity ,Encouraging Growth, Making use of Technological Improvements

3.2.2 Components of Organisation Structure

Division of Labour

Delegation of Authority

Departmentation: Its Benefits are: Administrative control, Fixation of responsibility, Freedom or autonomy, Development of managers

Span of Control: Nature of the Work Ability of the Manager; Efficiency of the Organisation Staff Assistants, Time Available for Supervision,

3.3 Types of Organisation Structure

Different types of Organisation structure can be created on the basis of arrangement of activities. Accordingly, three broad types of structural forms are:

- Functional Structure
- Divisional Structure, and
- Adaptive Structure

3.3.1 Functional Organization Structure

The organisation is divided into a number of functional areas. This organisation has grouping of activities in accordance with the functions of an organisation such as production, marketing, finance, human resource and so on.The specialist in charge of a functional department has the authority over all other employees for his function.

Advantages

- Is logical and reflection of functions
- Follows principle of occupation specialisation
- Simplifies training
- Better control as the manager in charge of each functional department is usually a specialist.

Disadvantages

- Overspecialisation and narrow viewpoints of key personnel can limit the organisation growth.
- Reduced coordination between functions.
- Conflicts between different functions could be detrimental for the organisation as a whole.
- Difficult for general managers to coordinate different departments.

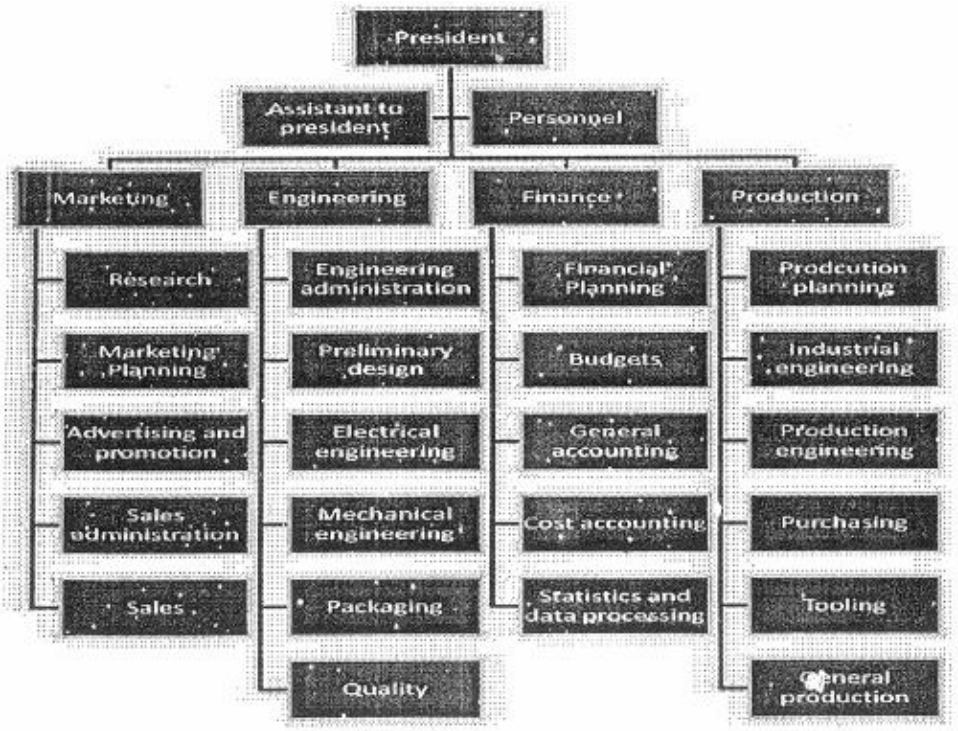


Figure 3.1 : Functional Structure

3.3.2 Divisional Structure

The divisional organisation structure is more suited to every large enterprise particularly those which deal in multiple products to serve more than one distinctive markets. The organisation is then divided into smaller business units which are entrusted with the business related to different products or different market territories. In other words, independent divisions (product divisions or market division), are created under the overall control of the head office. Each divisional manager is given autonomy to run all functions relating to the product or market segment or regional market. Thus, each division may have a number of supporting functions to undertake. A divisional structure may consist of two or more product divisions or market or territorial divisions as depicted in the figure 3.2 and 3.3.

3.3.3 Adaptive Structure

Organisation structure is often designed to cope with the unique nature of undertaking and the situation. This type of structure is known as adaptive structure. There are two types in structures.

i) Project Organisation, and

ii) Matrix Organisation

i) Project Organisation: The project structure consists of a number of horizontal organisational units to complete projects of a long duration. A team of specialists from different areas is created for each project.

Usually this team is managed by the project manager. The project staff is separate from and independent of the functional departments.

Advantages

- Special attention can be provided to meet the complex demand of the project.
- It allows maximum use of specialist knowledge thus chances of failure are very less.
- Project staff works as a team towards common goal which results in high motivation level for its members.

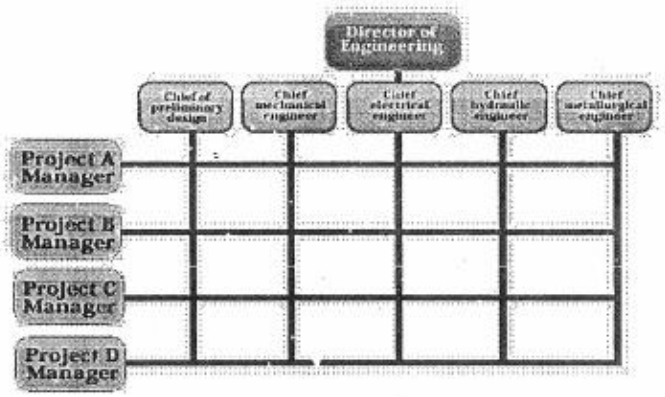
Disadvantages

As the project staff consists of personnel from diverse fields, it might be quite challenging for the project manager to coordinate among them.

ii) **Matrix Organisation:**

Matrix organisation combines two structures – functional departmentation and project structure.

- Functional department is a permanent feature of the matrix structure and retains authority for overall operation of the functional units.
- Project teams are created whenever specific projects require a high degree of technical skill and other resources for a temporary period.
- Project team form the horizontal chain and functional departments create a vertical chain of command.
- Members of a particular team are drawn from the functional departments and are placed under the direction of a project manager who has the overall responsibility of a particular project.



Matrix Organisation Structure

Figure 3.2: Matrix Organisation

Advantage

- Is oriented towards end results.
- Professional identification is maintained
- Pinpoints product-profit responsibility

Disadvantages

- Conflict in organisation authority exists.
- Possibility of disunity of command exists
- Requires manager effective in human relations

Matrix organisations are used in industries with highly complex product systems for example, aerospace industry where project teams are created for specific space or weapon systems.

Some others organizational structures are:

Line Organisation

It is perhaps the oldest and the simplest organisational structure. In this kind of structure every manager exercise a direct authority over his subordinate who in turn directly reports to their superiors.

- There is a hierarchical arrangement of authority.
- Each department is self-contained and works independently of other departments.
- Lines of authority are vertical i.e. from top to bottom.
- There are no staff specialists.

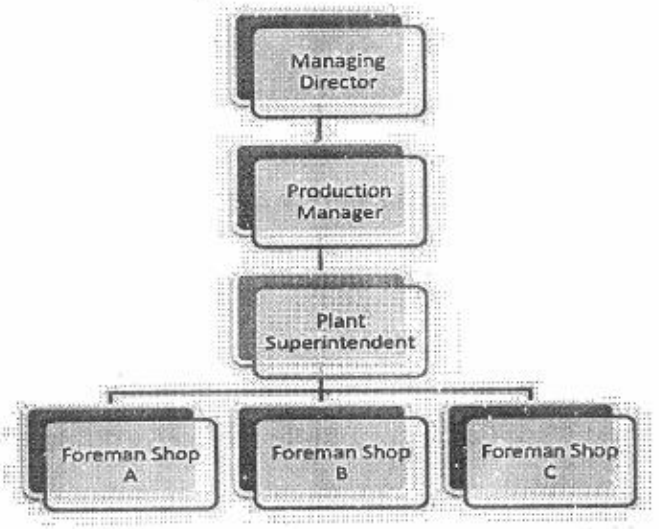


Fig.: 3.3 : Line Organization

Advantages

- Simple to establish and operate
- Promotes prompt decision making.

- Easy to control as the managers have direct control over their subordinates.
- Communication is fast and easy as there is only vertical flow of communication.

Disadvantages

- Lack of specialisation
- Managers might get overloaded with too many things to do.
- Failure of one manager to take proper decisions might affect the whole organisation.

However, line structures are suitable for

- small businesses where there are few subordinates
- Organisations, where there is largely of routine nature and methods of operations are simple.

Line and Staff Organisation

It is a combination of line and functional structures. In this organisation a structure, the authority flows in a vertical line and get the help of staff specialist who are in advisory. When the line executives need advice, information about any specific area, these staff specialists are consulted. For example Chief accountant has command authority over accountants and clerks in the accounts departments but he has only advisory relationship with other departments like production or sales.

Advantages

- Line managers are provided by expert advice by these specialists.
- Staff managers provide specialist advice which can improve quality of decisions in various departments.

Disadvantages

- Line managers and staff managers might have conflicts on particular issues.
- Line and staff managers might not be clear as to what the actual area of operations is and what is expected of them. Co-ordination may be a problem.
- Staff personnel are not accountable for the results and thus may not take tasks seriously.
- However, Line and staff organisation is very suitable for large organisation.

Dimensions of Organisation Structure

Robins has identified three dimensions of organisation structure, i.e.

1. Formalization,

2. Centralisation and
3. Complexity.

1. Formalization: It refers to the extent to which the activities, rules, procedures, instructions, etc. are specified and written. This primarily means that the degree to which the activities of the organisation are standardised. High division of labour i.e., specialisation, high level of delegation of authority, high degree of departmentation and wide span of control lead to high degree of formalization.

The major benefits of Formalization are as follow:

- Standardised activities reduce the variability in the organisation.
- It promotes coordination. All activities are defined and specified which facilitate the process of coordination.
- There is least scope of discretion. The decision is taken on the basis of standard rules and procedures; hence the scope of personal discretion is reduced.
- Operating costs are reduced.
- The standard activities reduce the conflict and ambiguity.

Formalization is criticised on the following ground:

- It prevents creativity and flexibility in the organisation.
- It may be difficult for the organisation to change the rules.
- The formulation and implementation of new rules may face great resistance by the employees.

Despite these limitations formalization has been widely used in the organisation. The formalized structure helps in smooth functioning of the organisation. Well defined jobs and relationships enhance the efficiency of the organisation.

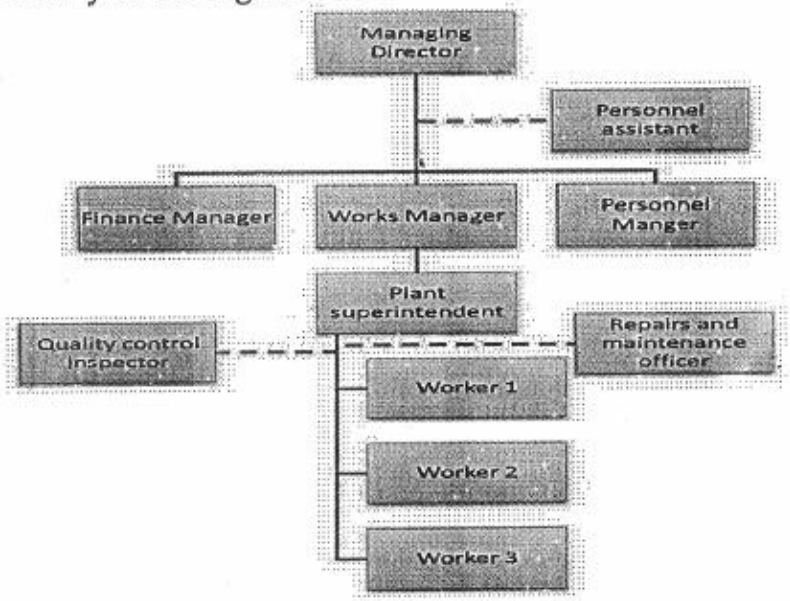


Figure 3.4 : Line and Staff Organisation

2. **Centralisation:** There are some organisations, where top management makes all the decisions and middle and lower level managers merely implement the decisions taken by the top management. At the other extreme, there are some organisations in which decisions are made at all levels of management. The first case fits into the centralised structure whereas the second one is highly decentralised.

Control and decision-making reside at the top levels of management. However, absolute centralisation is ? because it would mean that subordinates have no duties, power or authority. Centralisation may be essential in small organisation to survive in a highly competitive world. But as the organisation becomes more complex in terms of increasing size, interdependence of work-flow, complexity of tasks and spatial physical barriers within and among groups, a function requisite for efficiency is to move decision-making centres to the operating level. Thus, the larger the size of an organisation, the more urgent is the need for decentralisation. This does not mean that decentralisation is good and centralisation is bad.

On the other hand, decentralisation is the systematic effort to delegate to the lowest levels all authority except that which can be exercised at central points. It is the pushing down of authority and power of Decision-making to the lower levels of organisation. The centres of decision-making are dispersed throughout the organisation. The essence of decentralisation is the transference of authority from a higher level to a lower level. It is a fundamental principles of democratic management where each individual is respected for his inherent worth and constitution.

3. **Complexity:** It refers to the differences among the jobs and units. It reflects the degree of differentiation existing within the organisation. A variety of jobs and units create more complex organisation structure. The management of complex structure may be difficult. Based on the complexity of activities, there may be horizontal differentiation, vertical differentiation and spatial differentiation. Let us learn them briefly.

Horizontal differentiation refers to the number of different units at the same level. This means if the number of activities which require more specialised skills, the organisation will tend to be more complex.

Specialisation and departmentation are good examples of such differentiation. Another differentiation i.e. vertical differentiation refers to the number of levels in the organisation. It reflects the depth of the hierarchy in the organisation. This means that increase in hierarchical level enhances complexity in the organisation.

In such organisation, coordination and communication become difficult. The process of interaction is influenced by span of control which determines the number of persons effectively supervised by a manager.

In the wide span, the managers have more persons to be supervised and in the narrow span they have fewer people to be supervised. The supervision depends on number of other factors as well.

The third types of differentiation i.e., spatial differentiation refers to the degree to which location of units and the personnel are dispersed. Now a day's activities of the organisation are located in different areas. The multiple location increases the complexity of the organisation. Coordination and interaction also become difficult in such organisation.

An increase in above types of differentiation may lead to increase in complexity in the organisation. Thus, the complexity of the organisation determines the amount of coordination, communication and control.

Organisational Effectiveness

How can we measure effectiveness? In order to measure the effectiveness let us analyse following components of organisational Effectiveness.

The different components of organisational effectiveness can be found from the answer to the following questions.

- Are the employees satisfied with the organisation?
- Are the customers satisfied with the organisation?
- Is the organisation profitable?
- Is the organisation growing in terms of profit, revenue, number of products, expansion into new Locations, line of products etc?
- Is the organisation productive i.e., creating goods and services of high value at minimum cost?

And is the organisation innovative or stale?

Several factors influence the organisational effectiveness. Let discuss them in detail.

1) Managerial Policies and Practices

Managerial policies and practices integrate the entire organisation, maintain balance among the interest groups in the organisation, and accommodate them with the external environment. The major managerial policies and practices are as follow:

Strategy: A strategy is a plan for interacting with the competitive environment to achieve organisational goals.

Leadership: It is the process of influencing members towards the achievement of organisational goals. It is said that managers are people who do things right and leaders are people who do the right thing.

Decision-making: Decision-making is choosing among alternatives.

Rewards: It is primarily meant to sustain employee morale and improve or maintain productivity.

Communication: It is the linkages among members of the organisation whereby they exchange information.

2) Environmental Characteristics

Organisational effectiveness is influenced to a great degree by the external environmental characteristics. It is dependent on how is the external environment predictable, complex and hostile to the organisation and its activity.

The major characteristics are as follow:

Predictability: Predictability refers to how certain or uncertain an organisation may be towards supply of various resources; human, raw material etc.

Complexity: Environment complexity refers to the heterogeneity and range of activities which are relevant to an organisation's operations.

Hostility: A hostile environment is one in which the underpinning of the organisation is threatened. E.g. Union Carbide after the Bhopal gas leakage about the hostility of environment.

3) Employee characteristics

The characteristics of the human resource could make or break an organisation. It is employee characteristics, which is reflected in the success or failure of an organisation. *The major characteristics are as follow:*

Goals: Goals define where the organisation wants to go. Goals provide a directional nature to people's behaviour and guide their thoughts and actions.

Skills: Skill is the ability to engage in a set of behaviour that are functionally related to one another and that lead to a desired performance in a given area.

Motives: A motive is an inner state of a person that energizes activates, or moves and directs towards the achievement of a pre-defined goal.

Attitudes: Attitudes influence job behaviour and hence organisational effectiveness.

Values: The value that a person holds influences his or her motivation and subsequently behaviour.

4) Organisational Characteristics

Organisational characteristics refer to the general conditions that exist within an organisation. Various organisational characteristics influence organisational effectiveness. *The major characteristics are as follow:*

Structure: An organisational structure defines how are job tasks formally divided, grouped and coordinated. For organisational effectiveness, six elements need to be addressed while designing organisational structure. These are: work specialisation, departmentation, chain of command, span of control, centralisation and decentralisation, and formalization.

Technology: The term technology refers to how an organisation transfers its inputs into outputs. Every organisation has at least one technology for converting financial, human and physical resources into products or services. The choice of technology and its use influences organisational effectiveness.

Size: In a narrow sense organisational size refers to the number of people in an organisation. But, if we take a broader view, size refers to the physical capacity of the organisation, the personnel available to the organisation, the organisational inputs or outputs and the discretionary resources available to an organisation. It is the size which influences the structure which in turn influences organisational effectiveness.

Benefits of organisational effectiveness:

- Structures and behaviours are aligned with business needs.
- Disruption to business is minimised which reduces operational risk.
- Employee morale is sustained which maintains productivity.
- The right employees and talent are retained.
- Employees objectives and rewards are aligned to business goals.

3.4 Managers

Managers are people who steer an organization towards meeting its' objectives. Management has been described as: 'the process of planning, organizing, leading and controlling the efforts of organization members and of using all organizational resource to achieve stated

organisational goals.' A manager's job is to maintain control over the way an organization does things, and at the same time to lead, inspire and direct the people under them.

In a company the shareholders will elect a board of directors to represent their interests. A Managing Director will be appointed who has overall responsibility for running the company.

The managing director with help from other directors will appoint senior managers to run the company.The type of managers appointed will depend on the structure of the company. Possible structures will include:

- **Regional Managers** when an organization operates on a regional basis
- **Functional Managers** when an organization is split up into various functions e.g. human resources, finance, sales etc.
- **Departmental Managers** when an organization is split up into departments e.g. a school, or a retailing outlet
- **General Managers** for example, an office or factory may have a general manager who functional managers' report to.

Each manager in an organization is given an area of responsibility. Typically they will have targets and objectives to meet which fit into the organizations overall targets and objectives. Managers are typically responsible for:

- establishing, prioritizing, and making sure that objectives are met
- establishing a framework for communications, and patterns of work within their area of responsibility e.g. department
- communicating targets, goals and results to people that work for them
- motivating employees
- setting out the administrative arrangements for their area of responsibility
- Creating, monitoring, and making sure that budgets are achieved.

A key managerial responsibility is for the management of resources. The sorts of resources that a manager will be responsible for will include:

- **People** - directing the activities and looking after people
- **Financial** - using financial resources in the best possible way for the organisation in line with profit and sales targets.
- **Materials** - making sure that materials are used in the most productive way with the minimum waste

- **Machinery and equipment**- using the most appropriate machinery and equipment, and making sure that it is maintained, replaced and updated where necessary
- **Time** - ensuring efficient use of time
- **Buildings** - making sure that premises are safe and are being used in the best possible way
- **Information** - making sure that the organisation uses the most effective information processing technologies.

Shareholders are the owners of a company. They hold shares entitling them to a share in the profits and the right to be represented by directors at board meetings. Directors are the elected representatives of shareholders. Executive directors are responsible for ongoing decision making in the business. Non-executive directors provide regular advice to the company but are not directly involved in the day-to-day supervision of the company.

3.4.1 Activities of Managers

Henry Fayol, a French industrialist; also identified the five functions in which all managers must engage:

- **Planning** - forecasting the future and designing an operating plan
- **Organization** - structure of tasks and authority
- **Commanding** - directing the activity of subordinates
- **Coordinating** - binding together individual efforts and directing them to a common goal
- **Controlling** - ensuring that what gets done is consistent with the plan

The two principal tasks facing the manager in creating a useful organization are: **Differentiation**, that is dividing the tasks, and **Integration**, that is coordinating the differentiated elements. Here Mintzberg's five *coordinating* principles are useful to keep in mind:

- **Mutual Adjustment** — Achieve coordination of work by informal communication. Control rests in the hands of the doers. This method is used in the simplest and smallest organizations and, paradoxically, in the most complicated as well, as it is the only method that works under extremely difficult circumstances.
- **Direct Supervision** - Coordination is achieved by having one individual take responsibility for the work of others. In libraries, this is often referred to as first-line supervision. A librarian may

supervision the work of pages, student assistants, volunteers, and/or clerical workers each performing different tasks.

- **Standardization of Work Processes** -Coordination is achieved by specifying the process by which work is to be performed. Mintzberg uses the example of the assembly instructions provided with a child's toy. Recipes in cookbooks are another example. Sometime part of the work process is standardized — e.g., the cataloguing effort in a university library must conform to the MARC record.
- **Standardization of Outputs** - Coordination is achieved when the final results of the work are specified — either the dimensions of a product or the delivery specifications of a service. The worker has freedom to achieve the results in a variety of ways as long as the end result conforms to the results standard.
- **Standardization of Skills** - Coordination is achieved via standardized training. Particular skills and knowledge are learned through an educational program often before the individual is employed but sometimes through extensive training programs afterward. Mintzberg uses an example of an anaesthesiologist and a surgeon who meets in the operating room and hardly need to communicate at all instead relying on their expectations of the prior training received to coordinate their work.

3.5 Organisational Level: Level of people

There are four levels in any organization and the person associated to the organization also categorised according to the level.

- Operational-level systems -support ***operational managers*** by monitoring the day-to-day's elementary activities and transactions of the organization. e.g. TPS.
- Knowledge-level systems- support ***knowledge and data workers*** in designing products, distributing information, and coping with paperwork in an organization. e.g. KWS, OAS
- Management-level systems- support the monitoring, controlling, decision-making, and administrative activities of ***middle managers***. e.g. MIS, DSS
- Strategic-level systems- support long-range planning activities of ***senior management***. e.g. ESS

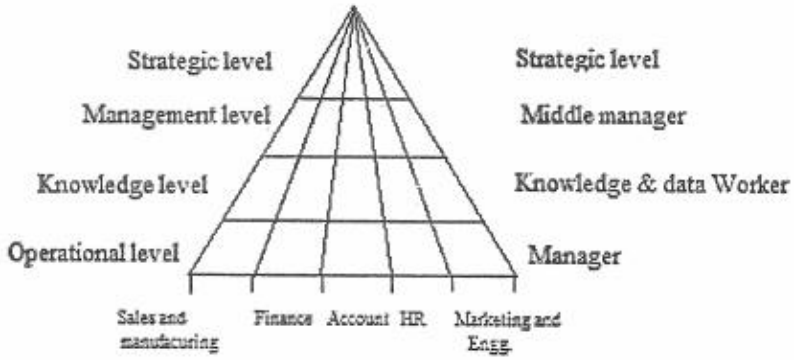


Figure: 3.5 Organisational levels

3.6 Information Need

There is lots of reason but some important points define. The New Role of Information Systems in Organization:

- Separating work from location
- The Widening Scope of Information Systems
- The Network Revolution and the Internet
- Reorganizing work flows
- Increasing flexibility of organizations
- The changing management process
- Redefining organizational boundaries
- Electronic Commerce and Electronic Business
- Learning to use new opportunities with Technology
- The strategic business challenge
- The globalization challenge:
- The information systems investment challenge
- The responsibility and control challenge

3.7 Summary

In an organisation, a number of activities are performed. Organisation structure is designed for division of tasks, grouping of activities and coordinating and controlling the tasks of the organisation. Well-designed organisation structure facilitates the smooth functioning of the organisation. The tasks are performed and executed by Managers for fulfilling the organizational needs.

3.8 Self Assessment Test

1) What is Organisational Structure? Discuss the significance of Organisational Structure.

2) What are the components of organisation structure? Discuss them and explain how they help in smooth functioning of the organisation.

3) Explain various types of organisation structure. How do they facilitate the smooth functioning of the organisation?

4) Describe various dimensions of organisation structure. Do you think that the study of formalization, centralisation and complexity help in enhancing the efficiency of the organisation. Discuss.

5) What is Organisational Effectiveness? Explain different components and determinants of Organisational effectiveness.

6) Define the role of a manger in the organisation?

7) Explain different responsibilities of a manger in any organisation?

3.9 Further Reading

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UNIT-4 TYPES OF DECISIONS AND INFORMATION

Unit Structure

4.0 Objective

4.1 Decision

- 4.1.1 Types of decisions
- 4.1.2 Decision Making Process

4.2 Information system

4.3 Categorization of information

- 4.3.1 Forms of Information
- 4.3.2 Sources of Information
- 4.3.3 Nature of Information
- 4.3.4 Levels of Information
- 4.3.5 Time of Information
- 4.3.6 Frequency of Information
- 4.3.7 Type of Information
- 4.3.8 Use of Information

4.4 Characteristics of Information

4.5 Summary

4.6 Self Assessment test

4.7 Further Readings

4.0 Objectives

Management information systems provide prescribed reports and responses to managers on a periodic, exception, demand, or push reporting basis to meet their need for information to support decision making.

4.1 Decision

The word "**decision**" is derived from the Latin word "decido". Which means "A decision, therefore is

- A Settlement
- A fixed intuition to bringing to a conclusive result
- A judgment
- A resolution

A decision is the choice out of several options made by the decision maker to achieve some objective in a given situation.

Business Decision: Business decisions are those which are made in the process of conducting business to achieve its objective in a given situation.

Characteristic of Business Decision Making

a. Sequential in nature.

b. Exceedingly complex due to risk and trade off.

c. Influenced by personal values.

d. Made in institutional setting and business environment.

4.1.1 Types of Decisions

1. Organizational or Personal Decisions: In an organization, when an individual takes decisions as an executive for the organization, these are known as Organizational decisions. The authority for taking such decisions can be delegated from a superior to a subordinate. Such decisions affect Organizational functioning directly.

An executive can take decisions about himself which are personal decisions. These decisions normally affect personal life of the decision-maker, though at many times they may affect organization also, such as, leaving of the organisation by an individual. Decision making power cannot be delegated to anyone else in the case of personal decisions.

2. Routine or Strategic Decisions: Routine decisions are taken in the context of day-today operation of the organization. Mostly, they are of repetitive nature and related with the general functioning. They do not require much analysis and evaluation and can be made quickly.

Strategic decisions are those which are taken during the current time period, but whose primary effect is felt during some future period. Strategic decisions affect Organizational structures, objectives, facilities, and finances. These decisions are mostly non-repetitive in nature. Since they have fundamental effects on the organization, they are taken after careful analysis an evaluation of various alternatives.

3. Policy or Operative Decisions: Policy decisions are taken by top management in the organization which determines the basic policies. The policy decisions are very important and have long term impact. Tense decisions provide help in establishing the business such as deciding location of plant, volume of production, sale and purchase decisions, policy decisions regarding the employees etc. Operative decisions are related with the day-to-day operation of the business. These are taken generally by middle and lower managers who are more closely related with the supervision of actual operations.These decisions may be written or otherwise.

4. Individual or Group decisions: This classification is based on the basis of persons involved in the decision-making process. Individual decisions are taken by a single individual. These are taken is the context of routine or programmed decisions where the analysis of various variables in simple and for which broad policies are already provided. Sometimes, important decisions are taken by single individuals also. Group decisions are taken by a group constituted for this specific purpose or by a standing committee. These decisions are generally very important for the organization. Group decisions have certain positive value such as greater participation of individuals and quality in decisions, and certain negative values such as delay in decision-

making process and difficulty in fixing the responsibility of decisions.

Organizational decisions differ in a number of ways. The following basis is used to classify the decisions:

1. **Purpose of Decision-making:** On the basis of the purpose of decision-making activities, the organizational decisions are divided into 3 categories:

Strategic Planning Decisions: Strategic planning decisions are those decisions in which the decision-maker develops objectives and allocates resources to achieve these objectives. Such decisions are taken by strategic planning level (top level) managers.

Management Control Decisions: Management control decisions are taken by management control level (middle level) managers and deal with the use of resources in the organization.

Operational Control Decisions: Operational control decisions deal with the day-to-day problems that affect the operation of the organization. These decisions are taken by the managers at operational level (bottom level) of the organization.

2. **Levels of Programmability:** Simon on the basis of level of the programmability of a decision, proposed two types of decisions:

- Programmed, also known as structured decisions
- Non-programmed, also known as unstructured decisions.

*Programmed/Structured Decisions:*Such classification of decisions is made on the basis of the use of operational research. Programmed or structured are those decisions, which are well defined and some specified procedure or some decision rule might be applied to reach a decision. Such decisions are routine and repetitive and require little time for developing alternatives in the design phase and are take in within the broad policy structure. These generally have short-run impact, and are taken by lower managers, such as, granting leave to an employee, purchase of materials in normal routine etc.Programmed or structured decisions have traditionally been made through habit, by operating procedures or with other accepted tools.

*Non-programmed /Unstructured Decision:*Decisions, which are not well defined and have not pre-specified procedures decision rule are known as unstructured or non-programmed decisions. Non-programmed decisions are of non-repetitive nature. The necessity of such decisions arises because of some specific circumstances. Thus, these are very important for the organization; such as, opening of a new branch at a new place, introducing a new product in the market, etc.

3. **Knowledge of Outcomes:** Another approach of classifying decisions is the level of knowledge of outcomes. An outcome defines what will happen, if a decision is made or course of action taken. When there is more than one alternative, the knowledge of outcome becomes important.

On the basis of the level of knowledge of outcomes, decision-making can be classified into three categories.

Decision under certainty: Decision-making under certainty takes place when the outcome of each alternative is fully known. There is only one outcome for each alternative.

Decision under risk: Decision-making under risk occurs when there is a possibility of multiple outcomes of each alternative and a probability of occurrence can be attached to each outcome.

Decision under uncertainty: Decision-making under uncertainty takes place when there are a number of outcomes for each alternative & the probabilities of their occurrences are not known.

4.1.2 Decision Making Process:

To solve a decision problem it is necessary that the decision-maker chooses the best of the available alternatives. In the process; managers have to function in the following manner.

1. *The Problems.* The first step is to determine what the real and correct problem is and to find out a satisfactory an what input data is required for this. A problem exists whenever one faces a question whose answer involves doubt and uncertainty.

2. *Search for Alternatives.* A problem can be solved in several ways, however, all the ways are not equally satisfying. If there is only one way of solving a problem, no question of decision arises. The managers, in order to get most satisfactory result of a decision, must try to find out the various alternatives available. The practice of developing alternatives is the best guarantee for ensuring adequate attention on the part of managers.

3. *Evaluation of Alternatives.*After the various alternatives are identified, the next step is to evaluate them and select one that will best contribute to the goal. In the various alternatives, there lie various tangible factors. The tangible factors can be assessed in terms of quantity such as rupees, ma-hours, units of output, etc. There are intangible factors which cannot be assessed in terms of quality. However, both these tangible and intangible factors must be weighed in deciding upon a course of action.

4. *Comparison of Alternatives.* The evaluation of various alternatives presents a clear picture as to how each one of them contributes to Organizational objectives. A comparative study of all such alternatives is made to find out which is the most satisfactory.

5. *Selection of Alternatives.*Comparative study gives the information about the way various alternatives are contributing in the solution of problem. The bet among these should be selected. However, while selecting, factors like risk, economy of efforts, timing and limiting factors should be considered adequately.

4.2 Information System

Information Systems is an:-

Integrated components processing, storing and disseminating information in an organisation, and also interdisciplinary study of systems that provide information to users in organisations. Information Systems are

becoming the foundation of business models and processes. They allow for the distribution of knowledge; Information is Clusters of facts meaningful and useful to human beings in processes such as making decisions. Data is Streams of raw facts representing events such as business transactions and it is meaningless without structure

Why is IS Important?

- For an organisation to survive and prosper
- More locations (networking, Internet)
- New products and services
- Improve jobs and work flows:
- Efficiency
- Cost
- Ethical and social issues

Examples of IT

- Hardware (PC, UNIX server)
- Software (e-mail, Internet, Windows, Word)
- Consumer devices (mobiles, train times)

Examples of IS

- File systems, databases, e-mail servers / clients
- e-commerce
- SAP, student records

Approaches of IS

- Technical
- Behavioural
- Sociotechnical

A Framework for IS (with respect to support provided):

Executive Support Systems (ESS): *Information system at the strategic level of an organization that address unstructured decision making through advanced graphics and communications.*

TYPE: Strategic level

- INPUTS: aggregate data; internal and external
- PROCESSING: interactive
- OUTPUTS: projections
- USERS: senior managers
- DECISION-MAKING: highly unstructured

EXAMPLE: 5 year operating plan

Management Information Systems (MIS): *Information system at the management level of an organization that serves the functions of planning, controlling, and decision making by providing routine summary and exception reports.*

- TYPE: Management-level
- INPUTS: high volume data
- PROCESSING: simple models

- OUTPUTS: summary reports
- USERS: middle managers
- DECISION-MAKING: structured to semi-structured

EXAMPLE: annual budgeting

Decision Support Systems (DSS): *Information system at the management level of an organization that combines data and sophisticated analytical models or data analysis tools to support semi-structured and unstructured decision making.*

- TYPE: Management-level
- INPUTS: low volume data
- PROCESSING: simulations, analysis
- OUTPUTS: decision analysis
- USERS: professionals, staff managers
- DECISION-MAKING: semi-structured
- EXAMPLE: sales region analysis

Knowledge Work Systems (KWS): *Information system that aids knowledge workers in the creation and integration of new knowledge in the organization.*

- TYPE: Knowledge-level
- INPUTS: design specifications
- PROCESSING: modelling
- OUTPUTS: designs, graphics
- USERS: technical staff; professionals
- EXAMPLE: Engineering workstations

Office Automation Systems (OAS): *Computer system, such as word processing, electronic mail system, and scheduling system, that is designed to increase the productivity of data workers in the office.*

- TYPE: Knowledge-level
- INPUTS: documents, schedules
- PROCESSING: document management, scheduling, communication
- OUTPUTS: documents; schedules
- USERS: clerical workers

EXAMPLE: document imaging system

Transaction Processing Systems (TPS): *Computerized system that performs and records the daily routine transactions necessary to conduct the business; these systems serve the operational level of the organization*

- TYPE: Operational-level
- INPUTS: transactions, events
- PROCESSING: updating
- OUTPUTS: detailed reports
- USERS: operations personnel, supervisors
- DECISION-MAKING: highly structured

EXAMPLE: payroll, accounts payable

4.3 Categorisation of information

Information can be categorised under many headings that help us to determine its overall usefulness. The main categories are Forms, Source, Nature, Level, Time, Frequency, Type, and Use and their sub-categories in some detail.

4.3.1 Forms of Information

*Written:*The vast majority of information created within an organisation is in the written form. This can include hand-written or word processed information and information in e-mails as well as reports produced from different classes of software, both general-purpose packages and? software solutions. Examples of written information are reports, memos and tables, receipts, invoices, statements, and summary accounting information. The list is almost endless and different businesses will produce their own type of written information.

Oral: Another common form of information is oral, which is information presented as sound. The commonest form of aural information is of course speech and examples of this would be formal meetings (where minutes are taken), informal meetings, talking on the phone and voice-mail messages. Nowadays many organizations will have employees giving a presentation or talk to a group where there may be use made of music and sound effects as well as speech.

Visual: This form of information includes when pictures, charts and graphs are used to communicate information. Again, many presentations will make use of data projectors and presentation software that will include text, graphics and animations. Full video can also be projected via a data projector, and presentations can use video filmed with a digital video camera and then edited on a computer and distributed via CD or DVD now that DVD writers are quite common.

4.3.2 Sources of Information

Primary information: A primary source of information is one that provides data from an original source document. This may be as simple as an invoice sent to a business or a cheque received. It may be more complex, such as a set of sales figures for a range of goods for a tinned food manufacturer for one week, or it may be a set of sales figures over several weeks and several locations. There are many examples of primary sources in many walks of life, but generally a primary source is defined as being where a piece of information appears for the first time.

Secondary information: A secondary source of information is one that provides information from a source other than the original. Secondary sources are processed primary sources, second-hand versions. Examples of secondary sources could be an accounts book detailing invoices received, a bank statemen: that shows details of cheques paid in and out. Where statistical information is gathered, such as in surveys or polls, the survey

data or polling data is the primary source and the conclusions reached from the survey or the results of the poll are secondary sources.

Internal information: All organisations generate a substantial amount of information relating to their operation. This internal information is vital to the successful management of the organisation. The information may be available from a number of sources within the organisation, for example:

- Marketing and sales information on performance, revenues, markets shares, distribution channels, etc.
- Production and operational information on assets, quality, standards, etc.
- Financial information on profits, costs, margins, and cash flows, investments, etc.
- Internal documentation such as order forms, invoices, credit notes, procedural manuals.

External information: An external source of information is concerned with what is happening beyond the boundaries of the organisation. This covers any documentation relating to a subject area produced as a summary or detailed report by an agency external to an organisation. Such information may be obtainable from government agencies or private information providers. Examples might include:

- census figures
- telephone directories
- judgments on court cases
- computer users' yearbook
- legislation
- national opinion polls
- trade journals
- Ordnance Survey maps
- professional publications
- financial services agencies such
- industry standards as Dunn and Bradstreet
- the Internet

4.3.3 Nature of Information

Formal information: This involves presenting information in a structured and consistent manner. It is usually defined, within an organisation, as the main way of communicating between and within parts of the organisation. It is also usually the main way of communicating externally from an organisation. The main methods of formal communication are still the formal letter, properly structured reports, writing of training materials, etc. Formal information is communicated in cogent, coherent, well-structured language.

Informal information: This describes less well-structured information that is transmitted within an organisation or between individuals who usually

know each other. It tends to be categorised as 'unofficial' information, and is communicated by casual conversations, e-mails, or t xt messages between colleagues. The language used is less well-structured than formal communication and tends to include colloquialisms and shorthand; and spelling is less important.

Quantitative information: This is information that is represented using words. Any event or object that is represented using words to describe its attributes is an example of qualitative information.

4.3.4 Levels of Information

Within an organisation planning, control and decision-making is carried out at various levels within the structure of the organisation.

The three levels at which information can be used are strategic, tactical and operational and there is a direct correlation between the levels of importance of individuals or groups within an organisation and the level of information that is being communicated.

Strategic information: Strategic information is used at the very top level of management within an organisation. These are chief executives or directors who have to make decisions for the long term. Strategic information is broad based and will use a mixture of information gathered from both internal and external sources. In general a timescale may be from one to five years or even longer depending on the project. Some oil related projects are planned from the outset to last for 25 or more years. A supermarket building a new superstore will look at a timescale of 20 years or so, whilst even a small business may have a five-year strategy. Strategic plans will have little or no detail in them and more detailed strategic plans will be made slightly lower down the managerial ladder. A good strategic plan will be easier to flesh out lower down than a poor or vague strategic plan. Similarly, well-constructed and more detailed plans will be easier to implement than poorly constructed plans.

Tactical information: The next level down is the tactical level, and tactical planning and decision-making takes place within the guidelines set by the strategic plan.Tactical information will be mostly internal with a few external sources being used. Internal information is likely to be function related: for example, how much 'down time' a production line must allocate for planned maintenance. Tactical information is used by middle management (employees) when managing or planning projects. The timescale is usually at least between 6 months and 5 years (depending on the scale of the strategic project). Circumstances vary but a small project may have a tactical timescale of between one and six months. Tactical plans have a medium level of detail and will be very specific; they deal with such matters as who is doing what and within what specific budgets and timescales. These plans have medium scope and will address details at the operational level. They will generally have specific objectives and be geared towards implementation by operational level employees.

Operational information: The lowest level is operational and operational planning takes place based on the tactical plans. The lowest

level of management or workers in an organisation implements operational plans. These may be section leaders or foremen in a large organisation or workers such as shop assistants, waiting staff, and kitchen staff, etc., in smaller businesses where there is no supervisory layer. The timescale is usually very short, anything from immediately, daily or at most a week or month. Results of operational work will usually be passed upwards to let the tactical planners evaluate their plans.

4.3.5 Time

Historic information: This is information gathered and stored over a period of time. It allows decision makers to draw comparisons between previous and present activities. Historic information can be used to identify trends over a period of time.

Present: This is information created from activities during the current work window (day, week or month). In real-time systems this information would be created instantly from the data gathered (for example, the temperature in a nuclear power plant turbine), giving accurate and up-to-date information.

Future: This is information that is created using present and historic information to try to predict the future activities, trends and events relating to the operation of an organisation. An example would be sales figures for a company: if the sales figures are up 10% from those recorded this time last year it might be anticipated that next month's sales figures will also be up by 10%.

4.3.6 Frequency of Information

Continuous: This is information created from data gathered several times a second. It is the type of information created by a real-time system. For example, sensors may be set up to collect temperature and humidity readings in a large commercial greenhouse. It will be important for that information to be collected constantly because any variation in either the temperature or the humidity could point to the failure of some machinery and an alarm could be sounded to alert the staff. A very important system exists on modern aircraft where the navigation and flight-control systems are continuously monitoring and making adjustments; another is on a computerised production line where constant monitoring allows the system to correct faults. Obviously many other types of real time systems exist but a feature of them all will be that they check data continuously.

Periodic: This is information created at regular timely intervals (hourly, daily, monthly, annually). Different examples of information generated by an organisation are needed at specific periods of time.

- *Annually* – On an annual basis a company must submit its report and accounts to the shareholders.
- *Monthly* – Banks and credit-card companies produce monthly statements for the majority of their customers.
- *Daily* – A supermarket will make daily summaries of its sales and use the product information to update its stock levels and to reorder stock automatically.

- *Hourly* – A busy call centre will often update totals for each operator on an hourly basis and give the top employee for the hour some reward.

4.3.7. Types of Information

Detailed: Detailed information might be an inventory list showing stock levels, actual costs to the penny of goods, detailed operating instructions, and so on. This information is most often used at the operational level within an organisation.

Sampled: This information usually refers only to selected records from a database: for example, only selected customers from a company's full customer list. In a supermarket this may be product and sales summaries given to departmental managers (bakery, fruit and vegetables, etc.). Sampled information is often used at a tactical level within an organisation. Depending on the size of the organisation it may also be relevant at a strategic level.

Aggregated: This is information that consists of totals created when detailed information is collated. An example of aggregated information is the details of all purchases made by customers? each month and displayed in a chart showing total sales for each month over a year.

In order to show all three types of information, here is an example that some of you should be familiar with. In a league of teams who play each other twice in a season, the detailed information would be the score line for each game played by all the teams in the league. Sampled information would be the details for a team in the league relating to their performance. Aggregated information would be the goals for, goals against and goal difference for a team in a league.

4.3.8 Use of Information

Planning: Planningis the process of deciding, in advance, what has to be done and how it is to be done. Planning should be based on good information. Planning is not an end in itself; its primary purpose is to provide the necessary structure for decision-making and resulting actions, throughout the organisation. The process of planning provides an opportunity to construct a sequence of actions that, when executed, will achieve the required aims and objectives. Basically, planning means decisions by management about:

- what is to be done in the future
- how to do it
- when to do it
- who is to do it.

An objective is something that needs to be achieved and a plan contains the activities or actions required to achieve the objective.

Control: Control can be defined as the monitoring and evaluation of current progress against the steps of a pre-defined plan or standard. If these tasks are not proceeding in line with expectations then action is taken to bring the project back in line with what had been planned.

Control is carried out at strategic, tactical and operational levels. The type of control changes according to the level of management as does the

amount of time spent on control.

At an operational level the majority of the time of the manager or supervisor will be spent on control activities where the work of staff is compared to very specific financial or quantifiable terms (e.g. how many boxes have been packed?)

At higher **levels**, planning and control are more closely linked, with management **being** concerned with the monitoring of progress against the plan, assessing the ibility of the plan itself and predicting future conditions.

Organisations and individuals must plan in order to operate effectively. Likewise they must also operate controls to ensure that progress is being made against the plan. These controls are needed because unexpected events can cause actual results to change from the expected planned results. Control activities attempt to keep the organisation in line with the original plan or to enable the organisation to change to meet the new conditions. Unexpected events range from short delays in the completion of an element of a plan – which may be relatively minor – to major disturbances such as a large new competitor entering the marketplace.

Control measures actual progress against what is expected and provides information upon which remedial action can be taken, if required, either to change performance in order to conform to the original plan or to modify the plan.

Decision-making: Decision-making is the process of selecting an action or actions from those possible based on the information available. Decision making involves determining and examining the available actions and then selecting the most appropriate actions in order to achieve the required results. Decision-making is an essential part of management and is carried out at all levels of management for all tasks. All decisions are arrived at in the same way. The manager must choose, by some means, the result or results that s/he wishes to achieve and do **some** form of appraisal of the situation.

Decision-making is made up of four phases:

- finding occasions for decision making
- find possible courses of action (i.e. what choices are available)
- choosing among these courses of action
- evaluating past choices.

4.4 Characteristics of Information

Good information is that which is used and which creates value. Experience and research shows that good information has numerous qualities. Good information is relevant for its purpose, sufficiently accurate for its purpose, complete enough for the problem, reliable and targeted to the right person. It is also communicated in time for its purpose, contains the right level of detail and is communicated by an appropriate channel, i.e. one that is understandable to the user.

Further details of these characteristics related to organisational information for decision-making follows:

Availability/accessibility:Information should be easy to obtain or access. A good example of availability is a telephone directory, as every home has one for its local area. It is probably the first place you look for a local number. But nobody keeps the whole country's telephone books so for numbers further a field you probably phone a directory enquiry number. For business premises, say for a hotel in London, you would probably use the Internet. Businesses used to keep customer details on a card-index system at the customer's branch. If the customer visited a different branch a telephone call would be needed to check details. Now, with centralised computer systems, businesses like banks and building societies can access any customer's data from any branch.

Accuracy: Information needs to be accurate enough for the use to which it is going to be put. To obtain information that is 100% accurate is usually unrealistic as it is likely to be too expensive to produce on time. The degree of accuracy depends upon the circumstances. At operational levels information may need to be accurate to the nearest penny – on a supermarket till receipt, for example. At tactical level department heads may see weekly summaries correct to the nearest £100, whereas at strategic level directors may look at comparing stores' performances over several months to the nearest £100,000 per month. Accuracy is important. As an example, if government statistics based on the last census wrongly show an increase in births within an area, plans may be made to build schools and construction companies may invest in new housing developments. In these cases any investment may not be recouped.

Reliability or objectivity: Reliability deals with the truth of information or the objectivity with which it is presented. You can only really use information confidently if you are sure of its reliability and objectivity.When researching for an essay in any subject, we might make straight for the library to find a suitable book. We are reasonably confident that the information found in a book, especially one that the library has purchased, is reliable and (in the case of factual information) objective. The book has been written and the author's name is usually printed for all to see. The publisher should have employed an editor and an expert in the field to edit the book and question any factual doubts they may have. In short, much time and energy goes into publishing a book and for that reason we can be reasonably confident that the information is reliable and objective. Compare that to finding information on the Internet where anybody can write unedited and unverified material and 'publish' it on the web. Unless you know who the author is, or a reputable university or government agency backs up the research, then you cannot be sure that the information is reliable. Some Internet websites are like vanity publishing, where anyone can write a book and pay certain (vanity) publishers to publish it.

Relevance/appropriateness: Information should be relevant to the purpose for which it is required. It must be suitable. What is relevant for one manager may not be relevant for another. The user will become frustrated if information contains data irrelevant to the task in hand. For example, a

market research company may give information on users' perceptions of the quality of a product. This is not relevant for the manager who wants to know opinions on relative prices of the product and its rivals. The information gained would not be relevant to the purpose.

Completeness: Information should contain all the details required by the user. Otherwise, it may not be useful as the basis for making a decision. For example, if an organisation is supplied with information regarding the costs of supplying a fleet of cars for the sales force, and servicing and maintenance costs are not included, then a costing based on the information supplied will be considerably underestimated. Ideally all the information needed for a particular decision should be available. However, this rarely happens; good information is often incomplete. To meet all the needs of the situation, you often have to collect it from a variety of sources.

Level of detail/conciseness: Information should be in a form that is short enough to allow for its examination and use. There should be no extraneous information. For example, it is very common practice to summarise financial data and present this information, both in the form of figures and by using a chart or graph. We would say that the graph is more concise than the tables or figures as there is little or no extraneous information in the graph or chart. Clearly there is a trade-off between level of detail and conciseness.

Presentation: The presentation of information is important to the user. Information can be more easily assimilated if it is aesthetically pleasing. For example, a marketing report that includes graphs of statistics will be more concise as well as more aesthetically pleasing to the users within the organisation. Many organisations use presentation software and show summary information via a data projector. These presentations have usually been well thought out to be visually attractive and to convey the correct amount of detail.

Timing: Information must be on time for the purpose for which it is required. Information received too late will be irrelevant. For example, if you receive a brochure from a theatre and notice there was a concert by your favourite band yesterday, then the information is too late to be of use.

Value of information: The relative importance of information for decision-making can increase or decrease its value to an organisation. For example, an organisation requires information on a competitor's performance that is critical to their own decision on whether to invest in new machinery for their factory. The value of this information would be high. Always keep in mind that information should be available on time, within cost constraints and be legally obtained.

Cost of information:Information should be available within set cost levels that may vary dependent on situation. If costs are too high to obtain information an organisation may decide to seek slightly less comprehensive information elsewhere. For example, an organisation wants to commission a market survey on a new product. The survey could cost more than the forecast initial profit from the product. In that situation, the organisation would probably

decide that a less costly source of information should be used, even if it may give inferior information.

The difference between value and cost

Many students in the past few years have confused the definitions of value and cost. Information gained or used by an organisation may have a great deal of value even if it may not have cost a lot. An example would be bookshops, who have used technology for many years now, with microfiche giving way to computers in the mid to late 1990s. Microfiche was quite expensive and what the bookshops received was essentially a list of books in print. By searching their microfiche by publisher they could tell you if a particular book was in print. Eventually this information became available on CD-ROM. Obviously this information has value to the bookshops in that they can tell you whether or not you can get the book. The cost of subscribing to microfiche was fairly high; subscribing to the CD-ROM version only slightly less so.

Much more valuable is a stock system which can tell you instantly whether or not the book is in stock, linked to an on-line system which can tell you if the book exists, where it is available from, the cost and delivery time. This information has far more value than the other two systems, but probably actually costs quite a bit less. It is always up-to-date and stock levels are accurate. We are so used to this system that we cannot envisage what frustrations and inconvenience the older systems gave. The new system is certainly value for money.

4.5 Summary

Information systems can support a variety of management decision-making levels and decisions. These include strategic, tactical and operational decision making. Major changes are taking place in traditional MIS, DSS and EIS tools.

4.6 Self Assessment Test

1. Explain why information has no specification but it has a character and value.
2. Can value of information be improved? Can information have a value which is person independent?
3. Explain the difference between data processing and information processing.
4. What do you mean by level of programmability in information system?
5. Write the characteristics of information.
6. Explain the source of information to do the project in any organisation.

7. The character and value of information is linked to the people in the organization and tothe management process in the organization. Explain.
8. Explain how quality of information improves the knowledge and decision makingcapability of the people.
9. Is it worth to invest for obtaining perfect information? Is it possible to specify the perfect information?
10. Take up a project in a known organization and identify the information in followingclasses:
    - Organizational,
    - Strategic,
    - Knowledge,
    - Planning, and
    - Control.

4.7 Further Reading

1. Information Sources, Services and Systems,PHI, Gurdev Singh
2. Information Technology: An Introduction for Today's Digital World, CRC Press, Richard Fox.
3. Principles of Information Systems: A Managerial Approach, Delmar Cengage Learning, R.M. Stair and G. Reynolds.
4. Business Information Systems: Technology, Development and Management for the E-Business, Prentice Hall, P. Bocij, A. Greasley and S. Hickie.

Block 2

SYSTEM ANALYSIS AND DESIGN

Unit 5 5
Need for System Analysis- Stages in system analysis, Structured SAD and tools like DFD, Context Diagram, and Decision Table and structured Diagram.

Unit 6 19
System Development Models: Water Flow, Prototype, spiral, RAD-Roles and Responsibilities of System analyst, Database Administrator and Database Designer.

Unit 7 40
System Development Life Cycle : sequential Process of software development, Computer Aided Software Engineering (CASE)

Unit 8 55
Tools and the modular approach to software development, Information System audit.

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परिमापक

अनुवाद की स्थिति में

मूल लेखक	अनुवाद
मूल सम्पादक	भाषा सम्पादक
मूल परिमापक	परिमापक

सहयोगी टीम

संयोजक Dr. Gaurav Sankalp, SoMS, UPRTOU, Allahabad

Khand-2 : Block Introduction

Block two deals with four units. Unit five need for system analysis. Unit six system development and its models. Unit seven life cycle of system development and Unit eight deals with tools and the modular approach to software development and information system autit.

UNIT-5 NEED FOR SYSTEM ANALYSIS

Structure

5.0 Objective

5.1 Introduction

5.2 Stages in Structured SAD Model

- 5.2.1 Feasibility Study
- 5.2.2 Analysis v
- 5.2.3 Design
- 5.2.4 Implementation
- 5.2.5 System Maintenance and Evaluation

5.3 Structured Analysis Tools

- 5.3.1 Data flow Diagram (DFD)
- 5.3.2 Data Dictionary
- 5.3.3 Structured English
- 5.3.4 Decision Trees
- 5.3.5 Decision Tables
- 5.3.6 Context diagram
- 5.3.7 Structure Chart
- 5.3.8 Structured Design
- 5.3.9 Pros and Cons of Each Tool

5.4 Summary

5.5 Self Assessment Test

5.6 Furthers Reading

5.0 Objectives

Structured Analysis & Design plays a central role in the development of System.Each system plays a role which contributes to the accomplishment of the MIS objective.The tools of the system and the method of development enforce a discipline on the designer to follow the steps strictly as stipulated.

5. 1 Introduction

The success of MIS lies in meeting the information needs of the various personnel in organization across all levels of the management. The possibility of a mistake is almost ruled out. The system analysis

with its structural analysis and design approach ensures appropriate coverage of the sub systems. The data entities and attributes are considered completely keeping in view the needs of the systems in question and their interface with other systems.

5.2 Stages in Structured System Analysis and Design Method

The system may call for an open system design. In such case while making the system analysis and design, the aspect of open system design is considered, and necessary modifications are introduced in the design of the information system.

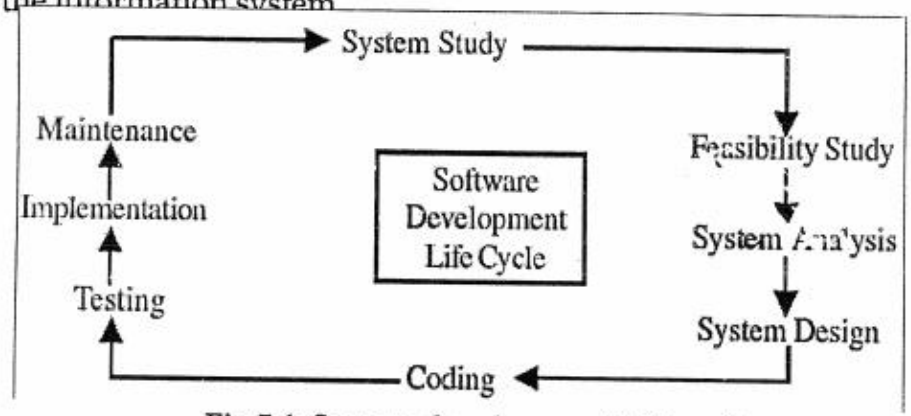

Fig 5.1: System development Life cycle

The system analysis and design, as atool of the MIS development, helps in streamlining the procedures of the company to current needs of the business and information objectives. The system analysis and design exercise considers testing the feasibility of the system as an important step. The system analysis is not restricted to the data-process-output. It also covers the technologies which enable the process feasible. The role of system analyst is more towards data generation, storage and its management in terms of quality, status, access and usage.

The development methodology may be the conventional design of data, databases and files approach or object oriented analysis and design approach, the MIS design is same. The difference is in the development cycle time, quality of information, efficiency of design and the ease of maintenance of the system.

It is a set of techniques and graphical tools that allow the analyst to develop a new kind of system that is understandable to the user.

A systems analysis team is often brought in to improve on an existing system. Frequently this involves moving from a paper-based filing system to one which is computerised. The following revision notes describe some of the key stages in a systems analysis study.

5.2.1 Feasibility Study

This involves writing a report to convince management of the merits

of adopting the proposed new system. Some aspects of the study include:

- Terms of reference: objectives , boundaries , constraints
- Description of the existing system (including any problems and the projected costs)
- Criteria (essential requirements and desirable features of the proposed system)
- Solution (including development plan and cost/benefit analysis)

If the feasibility study is accepted then the systems analyst moves to the next stage which is a full analysis of the system.

5.2.2 Analysis

The analysis involves some or all of the following stages:

- Fact finding – this is usually done in four ways
- Understanding the current system
- Produce data flow diagrams
- Identify the user requirements
- Interpret the user requirements
- Agree the objectives with the user
- Collect data from the current system

Fact Finding

Observing the existing system first hand

This involves watching the personnel using the existing system to find out exactly how it works. There are a number of advantages and disadvantages of using this method to gather information about the existing system:

Advantage

- the analyst obtains reliable data
- it is possible to see exactly what is being done
- this is an inexpensive method compared to other techniques

Disadvantage

- people are generally uncomfortable being watched and may work in a different way
- what they are watching may not be representative of a typical day's work
- if workers perform tasks that violate standard procedures, they may not do this when being watched!!

Questionnaires

This involves sending out questionnaires to the work force and/or to customers to find out their views of the existing system and to

find out how some of the key tasks are carried out. As with observation, there are a number of advantages and disadvantages in using this technique:

Advantage

- questions can be answered quickly
- an inexpensive way of gathering data from a large number of people
- allows individuals to remain anonymous
- it is quick to analyse data

Disadvantage

- number of people returning questionnaires is often quite low
- questions asked tend to be rather inflexible
- no immediate way to clarify a vague/incomplete answer to a question
- it is difficult to prepare a good questionnaire

Interviewing

This involves a one to one question and answer session between the analyst and employee/customer. A good method if the analyst wants to probe deeply into one specific aspect of the existing system. As with the previous method, there are a number of advantages and disadvantages:

Advantage

- opportunity to motivate the interviewee to give open and free answers to the analyst's questions
- allows the analyst to probe for more feedback from the interviewee(easier to extend a topic than it is when using questionnaires)
- can ask modified questions or questions specific to the interviewee based on previous responses

Disadvantage

- can be a very time consuming exercise
- can be expensive to carry out
- unable to remain anonymous

Looking at existing paperwork

This allows the analyst to see how paper files are kept, look at operating instructions and training manuals check accounts, etc. This will give the analyst some idea of the scale of the problem, memory size requirements, type of input/output devices needed, and so on. They will often gain information not obtained by any of the other methods described above. However, it can be a very time consuming exercise.

5.2.3 Design

Once the analysis has taken place and the systems analyst has

some idea of the scale of the problem and what needs to be done, the next stage is to design the key parts of the recommended system.

The following is a list of tasks that are usually done (this is by no means an exhaustive list):

- design the data capture forms/input forms
- design the screen layouts
- design output forms and reports
- produce systems flowcharts and/or pseudo code
- select/design any validation rules that need to be used
- select the most appropriate data verification method(s)
- file structures/tables need to be designed/agreed
- select/design the hardware requirements for the new system
- select/design the software requirements
- produce any algorithms or program flowcharts
- design a testing strategy/plan

5.2.4 Implementation

Once the "final" system has been designed it is then necessary to put together the hardware and software and introduce the new system.

There are many stages in this complicated process:

- produce the documentation; there are two basic types here to consider:

User documentation :this usually consists of:

- how to load/run the software
- how to save files
- how to do a search
- how to sort data
- how to do print outs
- how to add, delete or amend records
- the purpose of the system/program/software package
- screen layouts (input)
- print layouts (output)
- hardware requirements
- software requirements
- sample runs (with results and actual test data used)
- error handling/meaning of errors
- troubleshooting guide/help lines/FAQs
- how to log in/log out

*Technical documentation:*this usually consists of:

- program listing/coding
- programming language(s) used
- flowchart/algorithm
- purpose of the system/program/software
- input formats
- hardware requirements
- software requirements
- minimum memory requirements
- known "bugs" in the system
- list of variables used (and their meaning/description)
- file structures
- sample runs (with results and actual test data used)
- output formats
- validation rules

- install the hardware and, if necessary, the new software
- Fully test the new system once installed: it is necessary to develop a proper testing strategy to ensure all possible scenarios are covered and that all error trapping techniques are fully tested.i.e. *normal data , abnormal/erroneous data ,extreme/boundary data*
- Changeover to the new system:changeover is usually done in one of four ways; the following notes summarise these methods and gives advantages and disadvantages of all the techniques: *direct changeover, parallel, pilot, phased*

The following table summarises the risks involved in all four methods:

Method	Relative costs	Input needed by the user	Input needed by Systems team	Impact of failure of method
Parallel	High	High	Low	Low
Pilot	Medium	Low	Medium	Low
Phased	Medium	Medium	Medium	Medium
Direct	Low	Medium	Low (if successful) otherwise VERY High)	High

Table 1.1: changeover to the new system

5.2.5 System Maintenance and Evaluation

Once a system is up and running it is necessary to do some evaluation and carry out maintenance if necessary. This is summarised below:

- compare final solution with the original requirement

- identify any limitations in the system
- identify any necessary improvements that need to be made
- evaluate the user's responses to using the new system
- compare test results from new system with results from the old system
- compare performance of new system with performance of old system
- update hardware as new items come on the market or the company changes in any way which requires new devices to be added/updated
- update software if necessary if company structure changes or legislation is introduced which affects how the company operates

5.3 Structured Analysis Tools

In structured analysis and design tools plays a vital role like:

- Use graphics whenever possible to help communicate better with the user.
- Differentiate between logical and physical system
- Build a logical system model to familiarize the user with system characteristics and interrelationships before implementation

There are several tools that help in the structured analysis of the system.

5.3.1 Data flow Diagram (DFD)

A Data Flow Diagram (DFD) is a graphical representation of the "flow" of data through an information system. It differs from the system flowchart as it shows the flow of data through processes instead of computer hardware. Data flow diagrams were invented by Larry Constantine, developer of structured design. It consists of a series of bubbles joined by lines. Bubbles represent transformations and the lines represent the data flows in the system. So this is also called a *bubble* chart.

Data flow diagrams (DFDs) are one of the three essential perspectives of Structured Systems Analysis and Design Method (SSADM). The sponsor of a project and the end users will need to be briefed and consulted throughout all stages of a system's evolution. With a dataflow diagram, users are able to visualize how the system will operate, what the system will accomplish, and how the system will be implemented. The old system's dataflow diagrams can be drawn up and compared with the new system's dataflow diagrams to draw comparisons to implement a more efficient system. Dataflow diagrams can be used to provide the end user with a physical idea of where the data they input ultimately has an effect upon the structure of the whole system from

order to dispatch to relook. How any system is developed can be determined through a dataflow diagram.

It is common practice to draw a System Context Diagram first which shows the interaction between the system and outside entities. The DFD is designed to show how a system is divided into smaller portions and to highlight the flow of data between those parts. This context-level Data flow diagram is then "exploded" to show more detail of the system being modelled. It is the starting point in the system design that decomposes requirements to the lowest level of detail. It identifies major transformations that eventually become programs in system design.

Adatabase designer to begin the process by drawing a context-level DFD, which shows the interaction between the system and outside entities. This context-level DFD is then "exploded" to show more detail of the system that is being modelled.

DFD Symbols

- **Square** defines a source or destination of data.
- **Arrow** identifies data flow, means the data in motion. It is a pipeline through which information flows.
- **Circle or a bubble** represents a process that transforms incoming data flow into outgoing data
- **Open rectangle** is a data store, or data at rest, or a temporary repository of data

Constructing a DFD

- Processes should be named and numbered for easy reference
- The direction of flow is from top to bottom and from left to right
- Data flow from the source to destination, although they may flow back to a source
- When a process is exploded into lower level details, they are numbered
- The names of data stores, sources, and destinations are written in capital letters. Process and data flow names have the first letter of each word capitalized

Advantages

- Represents data flows
- May be used at high or low level of analysis. For instance, if the DRE is low during analysis and design, it means you should spend time improving the way you conduct formal technical reviews.
- Provides good system documentation.
- Process bubbles can be hierarchically decomposed into sub-DFDs; the inputs and outputs must match at all levels of decomposition, so the design has validation.

Disadvantages

- Weak in its display of input and output details.

5.3.2 Data Dictionary

A data dictionary or *database dictionary* is a file that defines the basic organization of a database. A database dictionary contains a list of all files in the database, the number of records in each file, and the names and types of each data field. Most database management systems keep the data dictionary hidden from users to prevent them from accidentally destroying its contents. Data dictionaries do not contain any actual data from the database, only book-keeping information for managing it. Without a data dictionary, however, a database management system cannot access data from the database.

Database users and application developers can benefit from an authoritative data dictionary document that catalogs the organization, contents, and conventions of one or more databases. This typically includes the names and descriptions of various tables and fields in each database, plus additional details, like the type and length of each data element. There is no universal standard as to the level of detail in such a document, but it is primarily a distillation of metadata about database structure, not the data itself. A data dictionary document also may include further information describing how data elements are encoded. One of the advantages of well-designed data dictionary documentation is that it helps to establish consistency throughout a complex database, or across a large collection of federated databases.

- A structured place to keep details of the contents of data flows, processes, and data store.
- It is a structured repository of data about data.
- It is a set of definitions of all DFD elements

Advantages of Data Dictionary

- Documentation- it is a valuable reference in any organization.
  For example: date consists of day, month and year
- It improves analyst/user communication by establishing consistent definitions of various elements, terms and procedures
- It is important step in building a database
- May be used at high or low level of analysis.

Disadvantages

- Does not provide details.

The three types of items to be defined in data dictionary are:

Data Elements:- this is the smallest unit of data. Further decomposition is not possible.

The ISO-11179 Standards give rules for creating Data Element names.

Data Structure: - This is a group of Data Elements which together form as a unit in a data structure. For example: phone is a data structure

consisting of four data elements: area-code-exchange-number-extension.

Data flows and Data stores: - data flows are data structures in motion. Data Stores are data structures in store. (***Data structures in a data store*** - a data store is a location where data structures are temporarily located.)

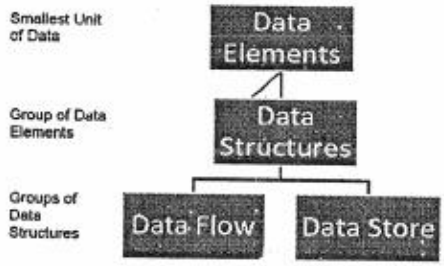

Fig 1.2: Data dictionary

5.3.3 Structured English

It uses logical constructs to carry out instructions for actions. Decision are made through the use of IF, THEN, ELSE and SO statements. It is highly correlated to the decision tree. It would not be a misnomer to call it the pseudo code of the program.

Example: IF order is from Bookstore and

IF order is for 6 copies or more per book title

THEN: Discount is 25%

ELSE (order is for fewer than 6 copies per book title)

SO: no discount is allowed

ELSE (order is from libraries or individuals)

5.3.4 Decision Trees

These clearly sketch out the logical structure based on some criteria. Based on the fulfilment of certain criteria, one can traverse from the top level node to the lowest level node. However, this representation of "traversing" can be easily depicted with the use of STRUCTURED ENGLISH.

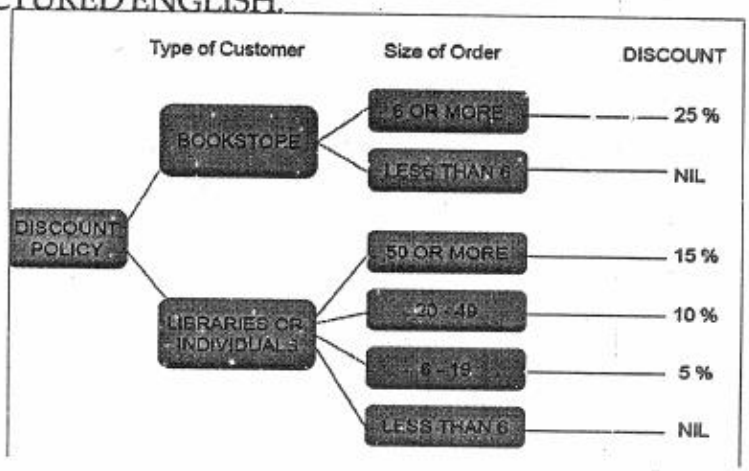

Fig1.3: Decision tree

5.3.5 Decision Tables

A decision table is a table of contingencies for defining a problem and the actions that need to be taken for it. It is a single representation of the relationships between conditions and actions; these pairs of condition sets and actions sets are known as rules. A condition is usually given a value of 'Y' for 'Yes, it is true", 'N' for 'No' and a dash for 'Do not care' in each rule. A decision tree fails to tell us what conditions to test. Where a decision table wins over a decision tree it that it can clearly call out the conditions that need to be tested. Whereas a decision tree fails to tell us what conditions to test, a decision table can clearly call out the conditions to test. Another advantage is that a decision table can be used to generate code in a procedural application language which is optimized for performance based on the expected likelihood of a rule being valid in the data.

Condition Stub		Condition Entry					
		1	2	3	4	5	6
	Customer is Bookstore	Y	Y	N	N	N	N
IF	Order size 6 copies or more ?	Y	N	N	N	N	N
(Condition)	Customer Librarian or Individual			Y	Y	Y	Y
	Order-size 50 copies or more ?			Y	N	N	N
	Order-size 20-49 copies ?				Y	N	N
	Order-size 6-19 copies ?					Y	N
Then	Allow 25% Discount	X					
(action)	Allow 15% Discount			X			
	Allow 10% Discount				X		
	Allow 5% Discount					X	
	No Discount allowed		X				X
	Action Stub	Action Entry					

Fig. 1.4 : Decision Table

5.3.6 Context Diagram

Fig 1.5 : Context Diagram

Example:

Context diagrams are diagrams that represent the user outside a system that could ineract with that system. This diagram is the highest level view of a system, similar to Block Diagram, showing a, possibly software-based, system as a whole and its inputs and outputs from/to external factors.software-based, system as a whole and its inputs and outputs from/to external factors.

These types of diagram are"pictures the system at the Centre, with no details of its interior structure, surrounded by all its interacting systems, environment and activities. The objective of a system context diagram is to focus attention on external factors and events that should be considered in developing a complete set of system requirements and constraints". System context diagram are related to Data Flow Diagram, and show the interactions between a system and other actors with which the system is designed to face. System context diagrams can be helpful in understanding the context in which the system will be part of software engineering.

5.3.7 Structure Chart

A Structure Chart (SC) is a chart, that shows the breakdown of the configuration system to the lowest manageable levels. This chart is used in structured programming to arrange the program modules in a tree structure. Each module is represented by a box which contains the name of the modules. The tree structure visualizes the relationships between the modules.

In structured analysis structure charts are used to specify the high-level design, or architecture, of a computer program. As a design tool, they said the programmer in dividing and conquering a large software problem, that is, recursively breaking a problem down into parts that are small enough to be understood by a human brain. The process is called top-down design, or functional decomposition. Programmers use a structure chart to build a program in a manner similar to how an architect uses a blueprint to build a house. In the design stage, the chart is drawn and used as a way for the client and the various software designers to communicate. During the actual building of the program (implementation), the chart is continually referred to as the master-plan.

5.3.8 Structured Design

Structured Design (SD) is concerned with the development of modules and the synthesis of these modules in a so called "module hierarchy". In order to design optimal module structure and interfaces two principles are crucial:

- *Cohesion* which is "concerned with the grouping of functionally related processes into a particular module",and
- *Coupling* relates to "the flow of information, or parameters, passed between modules. Optimal coupling reduces the interfaces of modules, and the resulting complexity of the software".

Page-Jones (1980) has proposed his own approach, which consists of three main objects: structure charts, module specifications and a data dictionary. The structure chart aims to show "the module hierarchy or calling sequence relationship of modules. There is a module specification for each module shown on the structure chart. The module specifications can be composed of pseudo-code or a program design language. The data dictionary is like that of structured analysis. At this stage in the software development lifecycle, after analysis and design have been performed, it is possible to automatically generate data type declarations", and procedure or subroutine templates.

5.3.9 Pros and Cons of Each Tool

Which tool is the best depends' on a number of factors: the nature and complexity of the problem, the number of actions resulting from the deci-sions, and the ease of use. In reviewing the benefits and limitations of each tool, we come to the following conclusions:

1. The primary strength of the DFD is its ability to represent data flows. It may he used at high 01" low levels of analysis and provides good system documentation. However, the tool only weakly shows input and output detail. The user often finds it confusing initially.
2. The data dictionary helps the analyst simplify the structure for meeting the data requirements of the system. It may be used at high or low levels of analysis, but it does not provide functional details, and it is not acceptable to many nontechnical users.Structured English is best used when the problem requires sequences of actions with decisions.
3. Decision trees are used to verify logic and in problems that involve a few complex decisions resulting in' a limited number of actions.
4. Decision trees and decision tables are best suited for dealing with complex branching routines such as calculating discounts or sales commissions or inventory control procedures.

Given the pros and cons of structured tools, the analyst should be trained in the use of various tools for analysis and design. He/she should use decision tables and structured English to get to the heart of complex problems. A decision table is perhaps the most useful tool for communicating problem details to the user.

The major contribution of structured analysis to the system develop-ment life cycle is producing a definable and measurable

document-the structured specification. Other benefits include increased user involvement, improved communication between user and designer, reduction of total personnel time, and fewer "kinks" during detailed design and implementa-tion. The only drawback is increased analyst and user time in the process. Overall the benefits outweigh the drawbacks, which make structured analy-sis tools viable alternatives in system development.

5.4 Summary

The system analysis with its structural analysis and design approach ensures appropriate coverage of the sub systems.The success of MIS lies in meeting the information needs of the various personnel in organization across all levels of the management and meeting out all requirements of the organization and decision making.

5.5 Self Assessment Test

1. What are the different phases of traditional system life cycle?
2. In which phase DFD, Flow-chart and ER-diagram are used?
3. What are the various steps in the development phase?
4. Which phase of system development life cycle take maximum time: Defining the problem, identifying its causes, specifying the solution, and identifying the information requirements, maintenance and how.
5. How software tools are different with each other's?
6. Which of the design lays out the components of the system and their relationship to each other, as they would appear to users?

5.6 Further Readings

1. Fundamentals of Information Technology, 2/e, Vikas Publication, Alexis Leon & Mathews Leon.
2. Guide toSoftware Development: Designing and Managing the Life Cycle , Springer,Arthur M. Langer
3. The Ultimate Guide to the SDLC,Font Life Publications, Victor M. and Font Jr.
4. Introduction to systems analysis & design 4th ed. New Delhi : Prentice Hall of India, Awad, Elias M
5. Modern systems analysis and design 2nd ed. Delhi : Pearson Education Asia, Kain, Richard Y.

UNIT-6 SYSTEM DEVELOPMENT MODELS

Unit Structure

6.0 Objective

6.1 Introduction

6.2 Water fall Life Cycle Model

- 6.2.1 Phases
- 6.2.2 Application
- 6.2.3 Advantage
- 6.2.4 Disadvantage

6.3 Modified Water Fall Model

- 6.3.1 Advantage
- 6.3.2 Disadvantage

6.4 Prototype Life Cycle Model

- 6.4.1 Phase
- 6.4.2 Version
- 6.4.3 Types of Prototyping
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- 6.4.5 Disadvantage

6.5 Spiral Life Cycle Model

- 6.5.1 Phase
- 6.5.2 Applications
- 6.5.3 Disadvantage
- 6.5.4 Disadvantage

6.6 RAD

- 6.6.1 Development Methodology
- 6.6.2 Phases
- 6.6.3 Advantage
- 6.6.4 Disadvantage

6.7 Roles and responsibilities of System analyst

6.8 Roles and responsibilities of Database Administrator

6.9 Roles and responsibilities of Database Designer.

6.10 Summary

6.11 Self Assessment Test

6.12 Further Reading

6.0 Objectives

The term software development life cycle model is a way of describing the planning,designing, coding, and testing of a software system, as well as the method in which thesesteps are implemented.

6.1 Introduction

There is various software development approaches defined and designed which are used/employed during development process of software, these approaches are also referred as "Software Development Process Models". Each process model follows a particular life cycle in order to ensure success in process of software development. A variety of life cycle models exist, but they all include the same constituent parts. All life cycle models take a project through several primary phases: a requirements-gathering phase, a design phase, a construction or implementation phase, and a testing phase.

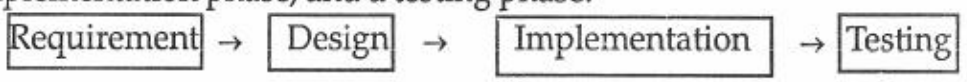

Fig2.1: General software development life cycle model

Each phase produces feedback that affects the next phase. For instance, the requirementsgathered during the requirements phase influence the design, which is translated intoworking software code during the implementation phase. The software code is verifiedagainst the requirements during the testing phase.

6.2 Water fall Life Cycle Model

The Waterfall life cycle model, also known as the classic or linear-sequential life cyclemodel, is one of the simplest to understand and use. The Waterfall model is characterized by a series of steps that must be completed in a linear, sequential order. Each phase iscompleted and verified before development progresses to the next phase.

6.2.1 Phases

The **phases** in Waterfall model are:

- **Feasibility study:** This is project initiation stage. This define whether the project is feasible in term of making, finance, application etc. or not.

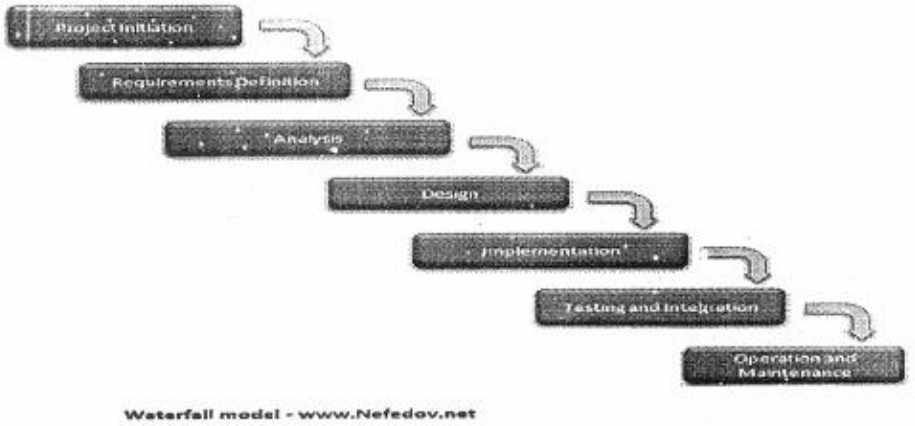

Fig 2.2: Waterfall life cycle model

- **Requirement Gathering and analysis:** All possible requirements of the system to bedeveloped are captured in this phase and documented in a requirement specification doc.
- **System Design:** The requirement specifications from first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture.
- **Implementation:** With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing. Integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
- **Deployment of system:** Once the functional and non-functional testing is done, the product is deployed in the customer environment or released into the market.
- **Maintenance:** There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

All these phases are cascaded to each other in which progress is seen as flowing steadily downwards (like a waterfall) through the phases. The next phase is started only after the defined set of goals are achieved for previous phase and it is signed off, so the name "Waterfall Model". In this model phases do not overlap.

6.2.2 Application

Every software developed is different and requires a suitable SDLC approach to be followed based on the internal and external factors. Some situations where the use of Waterfall model is most appropriate

are:

- Requirements are very well documented, clear and fixed.
- Product definition is stable.
- Technology is understood and is not dynamic.
- There are no ambiguous requirements.
- Ample resources with required expertise are available to support the product.
- The project is short.

6.2.3 Advantage

- Simple and easy to understand and use
- Easy to manage due to the rigidity of the model .each phase has specific deliverables and a review process.
- Phases are processed and completed one at a time.
- Works well for smaller projects where requirements are very well understood.
- Clearly defined stages.
- Well understood milestones.
- Easy to arrange tasks.
- Process and results are well documented.

6.2.4 Disadvantage

- No working software is produced until late during the life cycle.
- High amounts of risk and uncertainty.
- Not a good model for complex and object-oriented projects.
- Poor model for long and on-going projects.
- Not suitable for the projects where requirements are at a moderate to high risk of changing, so risk and uncertainty is high with this process model.
- It is difficult to measure progress within stages.
- Cannot accommodate changing requirements.
- No working software is produced until late in the life cycle.
- Adjusting scope during the life cycle can end a project.
- Integration is done as a "big-bang. At the very end, this doesn't allow identifying any technological or business bottleneck or challenges early.

6.3 Modified Water Fall Model

One important drawback of water fall model is there is no back tracking concept .Means if at any time user want to change their requirement or enhance the requirement, or developer again think about object and found any new clue or mistake or forget some point then there

is no concept to go backward from any stage, so if mistake was found in previous stage then there is no option to correct it in later stage. so Later on the drawbacks of Water fall model had removed by modified waterfall model in which back tracking is possible and path is exist from each stage to stage.

6.3.1 Advantage

- More flexible than pure water fall model.
- Implementation of easy areas does not need to wait for hard ones.

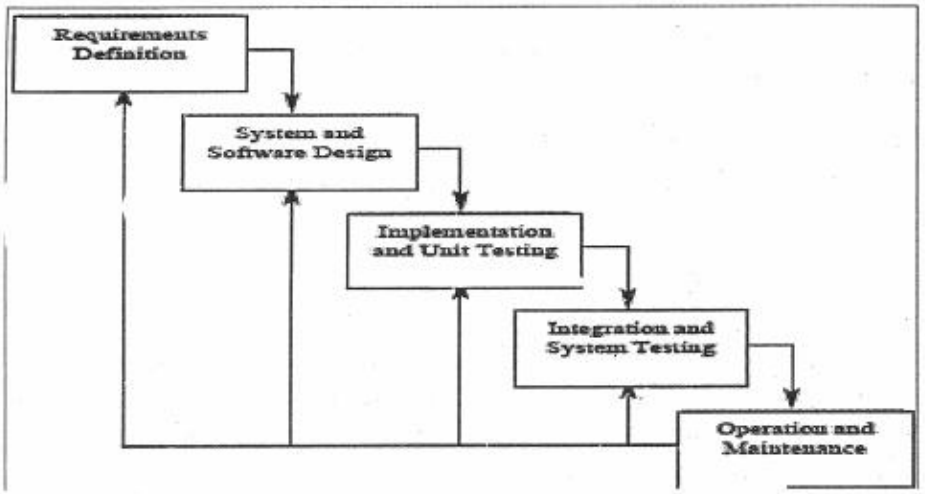

Fig 2.3: Modified Waterfall life cycle model

6.3.2 Disadvantage

- Unforeseen interdependencies can create problems
- Activities performed in parallel are subject to miscommunication and mistaken assumptions
- Milestones are more ambiguous than the pure waterfall.

6.4 Prototype Life Cycle Model

A prototype is a working model that is functionally equivalent to a component of the product.

In many instances the client only has a general view of what is expected from the software product. In such a scenario where there is an absence of detailed information regarding the input to the system, the processing needs and the output requirements, the prototyping model may be employed.

This model reflects an attempt to increase the flexibility of the development process by allowing the client to interact and experiment with a working representation of the product. The developmental process only continues once the client is satisfied with the functioning of the prototype. At that stage the developer determines the specifications of the client's real needs.

Software prototyping

Software prototyping, a possible activity during software development, is the creation of prototypes, i.e., incomplete versions of the software program being developed. A prototype typically implements only a small subset of the features of the eventual program, and the implementation may be completely different from that of the eventual product.

The purpose of a prototype is to allow users of the software to evaluate proposals for the design of the eventual product by actually trying them out, rather than having to interpret and evaluate the design based on descriptions.

Prototyping has several benefits: The software designer and implementer can obtain feedback from the users early in the project. The client and the contractor can compare if the software made matches the software specification, according to which the software program is built. It also allows the software engineer some insight into the accuracy of initial project estimates and whether the deadlines and milestones proposed can be successfully met.

6.4.1 Phase

The phase of prototype model involves are:

- Identify basic requirements: Determine basic requirements including the input and output information desired. Details, such as security, can typically be ignored.
- Develop Initial Prototype: The initial prototype is developed that includes only user interfaces.
- Review: The customers, including end-users, examine the prototype and provide feedback on additions or changes.
- Revise an Enhancing the Prototype: Using the feedback both the specifications and the prototype can be improved. Negotiation about what is within the scope of the contract/product may be necessary. If changes are introduced then a repeat of steps 3 and 4 may be needed.

6.4.2 Versions

There are two main versions of prototyping model:

Version I: Prototyping is used as a requirements technique.

Version II: Prototype is used as the specifications or a major part thereof.

Version One: This approach uses the prototype as a means of quickly determining the needs of the client; it is discarded once the specifications have been agreed on. The emphasis of the prototype is on representing those aspects of the software that will be visible to the client/user (e.g. input approaches and output formats). Thus it does not matter if the prototype hardly works.

Note that if the first version of the prototype does not meet the client's needs, Then it must be rapidly converted into a second version.

Version Second: In this approach, the prototype is actually used as the specifications for the design phase. This advantage of this approach is speed and accuracy, as not time is spent on drawing up written specifications. The inherent difficulties associated with that phase (i.e. incompleteness, contradictions and ambiguities) are then avoided.

6.4.3 Types of Prototyping

Software prototyping has many variants. However, all the methods are in some way based on two major types of prototyping:

- Throwaway or rapid prototyping
- Evolutionary Prototyping or breadboard prototyping

6.4.4 Advantages

There are many advantages to using prototyping in software development, some tangible some abstract.

- Encourages active user participation
- Helps resolve discrepancies among users
- Gives users a feel for the final system
- Helps determine technical feasibility
- Helps sell the idea of a proposed system
- Reduced time and costs
- Improved and increased user involvement

6.4.5 Disadvantage

Using, or perhaps misusing, prototyping can also have disadvantages.

- Insufficient analysis
- User confusion of prototype and finished system
- Developer attachment to prototype
- Excessive development time of the prototype
- Expense of implementing prototyping
- Leads people to believe the final system will follow
- Gives no indication of performance under operational conditions
- Leads the project team to forgo proper testing and documentation

6.5 Spiral Life Cycle Model

The *spiral model or Meta model* is a software development process combining elements of both design and prototyping-in-stages, in an effort to combine advantages of top-down and bottom-up concepts. Also known as the spiral lifecycle model (or spiral development), it is a systems development method (SDM) used in information technology (IT). This model of development combines the features of the

prototyping and the waterfall model. The spiral model is intended for large, expensive and complicated projects. This should not be confused with the Helical model of modern systems architecture that uses a dynamic programming approach in order to optimise the system's architecture before design decisions are made by coders that would cause problems.

The spiral model combines the idea of iterative development (prototyping) with the systematic, controlled aspects of the waterfall model. It allows for incremental releases of the product, or incremental refinement through each time around the spiral. The spiral model also explicitly includes risk management within software development. Identifying major risks, both technical and managerial, and determining how to lessen the risk helps keep the software development process under control. The idea is to have a continuous stream of products produced and available for user review.

The Spiral life cycle model is similar to the Incremental model but incorporates risk analysis. It is divided into four phases: planning, risk analysis, engineering, and evaluation. A project passes through each of these phases in sequence, repeatedly, in a series of iterations called **spirals**. At the beginning of the development process, critical requirements are identified for the first spiral. Subsequent spirals add functionality to this baseline spiral.

6.5.1 Phase

The Spiral model is represented by a spiral passing through four quadrants, which represent the four phases of development.

- Requirements' gathering is performed in the *planning phase*.
- During the *risk analysis phase*, a formal process is undertaken to identify alternative action and their relative risks. A prototype is also developed during this phase.
- Software is coded and tested during the *engineering phase*.
- During the *evaluation phase*, the customer has an opportunity to evaluate the output before the project proceeds to the next spiral.
- The angular component represents the progress in the current spiral, and the radius represents the project cost.

The spiral lifecycle model allows for elements of the product to be added in when they become available or known. This assures that there is no conflict with previous requirements and design. This method is consistent with approaches that have multiple software builds and releases and allows for making an orderly transition to a maintenance activity. Another positive aspect is that the spiral model forces early user involvement in the system development effort. For projects with heavy user interfacing, such as user application programs or instrument interface applications, such involvement is helpful.

Starting at the centre, each turn around the spiral goes through several task regions:

- Determine the objectives, alternatives, and constraints on the new iteration.
- Evaluate alternatives and identify and resolve risk issues.
- Develop and verify the product for this iteration.
- Plan the next iteration.

Note that the requirements activity takes place in multiple sections and in multiple iterations, just as planning and risk analysis occur in multiple places.

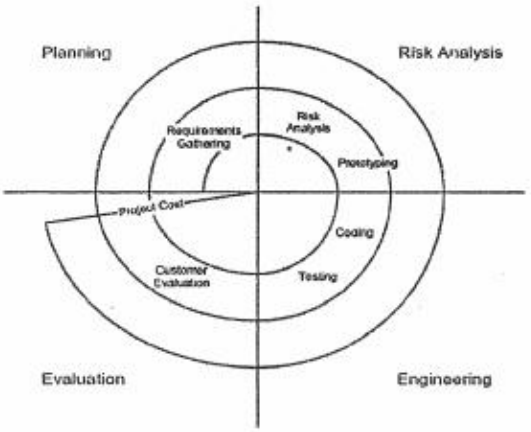

Fig 2.4: Spiral life cycle model

Final design, implementation, integration, and test occur in iteration 4. The spiral can be repeated multiple times for multiple builds. Using this method of development, some functionality can be delivered to the user faster than the waterfall method. The spiral method also helps manage risk and uncertainty by allowing multiple decision points and by explicitly admitting that all of anything cannot be known before the subsequent activity starts.

The steps in the spiral model can be generalized as follows:

1. The new system requirements are defined in as much detail as possible. This usually involves interviewing a number of users representing all the external or internal users and other aspects of the existing system.
2. A preliminary design is created for the new system.
3. A first prototype of the new system is constructed from the preliminary design. This is usually a scaled-down system, and represents an approximation of the characteristics of the final product.
4. A second prototype is evolved by a fourfold procedure:
   (1)Evaluating the first prototype in terms of its strengths, weaknesses, and risks;

(2) Defining the requirements of the second prototype;

(3) Planning and designing the second prototype;

(4) constructing and testing the second prototype.

5. At the customer's option, the entire project can be aborted if the risk is deemed too great. Risk factors might involve development cost overruns, operating-cost miscalculation, or any other factor that could, in the customer's judgment, result in a less-than-satisfactory final product.

6. The existing prototype is evaluated in the same manner as was the previous prototype, and, if necessary, another prototype is developed from it according to the fourfold procedure outlined above.

7. The preceding steps are iterated until the customer is satisfied that the refined prototype represents the final product desired.

8. The final system is constructed, based on the refined prototype.

9. 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.

6.5.2 Applications

For a typical shrink-wrap application, the spiral model might mean that you have a rough-cut of user elements (without the polished / pretty graphics) as an operable Application, add features in phases, and, at some point, add the final graphics. The spiral model is used most often in large expensive and complicated projects. For smaller projects, the concept of agile software development is becoming a viable alternative.

6.5.3 Advantage

- Estimates (i.e. budget, schedule, etc.) become more realistic as work progresses, because important issues are discovered earlier.
- At its core the Spiral model is built on earlier software development models, and it borrows from both the Waterfall and Incremental models.
- Working software code is developed early; thus, the customer is given many opportunities to evaluate the software and plenty of time to ease into adoption of the software
- It is more able to cope with the (nearly inevitable) changes that software development generally entails.
- Software engineers (who can get restless with protracted design processes) can get their hands in and start working on a project earlier

6.5.4 Disadvantage

- Highly customized limiting re-usability
- Applied differently for each application
- The Spiral model can cost considerably more to implement than other life cycle models.

- Risk of not meeting budget or schedule
- The risk analysis phase requires highly specific expertise, and the project's successdepends on the output of this phase.
- The Spiral model is inappropriate for use in small and medium-scale projects that are not mission-critical.

6.6 Rapid Application Development (RAD)

Rapid application development (RAD) (also called *rapid prototyping*) - emphasizes extensive user involvement in the rapid and evolutionary construction of working prototypes of a system to accelerate the systems development process. Prototypes are models of the software components. The development team continually designs, develops, and tests the component prototypes until they are finished RAD (rapid application development) is a concept that products can be developed faster and of higher quality through:

- Gathering requirements using workshops or focus groups
- Prototyping and early, reiterative user testing of designs
- The re-use of software components
- A rigidly paced schedule that defers design improvements to the next product version
- Less formality in reviews and other team communication

Some companies offer products that provide some or all of the tools for RAD software development. (The concept can be applied to hardware development as well.) These products include requirements gathering tools, prototyping tools, computer-aided software engineering tools, language development environments such as those for the Java platform, groupware for communication among development members, and testing tools. RAD usually embraces object oriented programming methodology, which inherently fosters software re-use. The most popular object-oriented programming languages, C++ and Java, are offered in visual programming packages often described as providing rapid application development.

6.6.1 Development Methodology

The traditional software development cycle follows a rigid sequence of steps with a formal sign-off at the completion of each. A complete, detailed requirements analysis is done that attempts to capture the system requirements in a Requirements Specification. Users are forced to "sign-off" on the specification before development proceeds to the next step. This is followed by a complete system design and then development and testing.

These are many of the reasons why software development projects either fail or don't meet the user's expectations when delivered.RAD is a methodology for compressing the analysis, design,

build, and test phases into a series of short, iterative development cycles.

This has a number of distinct advantages over the traditional sequential development model.RAD projects are typically staffed with small integrated teams comprised of developers, end users, and IT technical resources. A small team, combined with short, iterative development cycles optimizes speed, unity of vision and purpose, effective informal communication and simple project management.

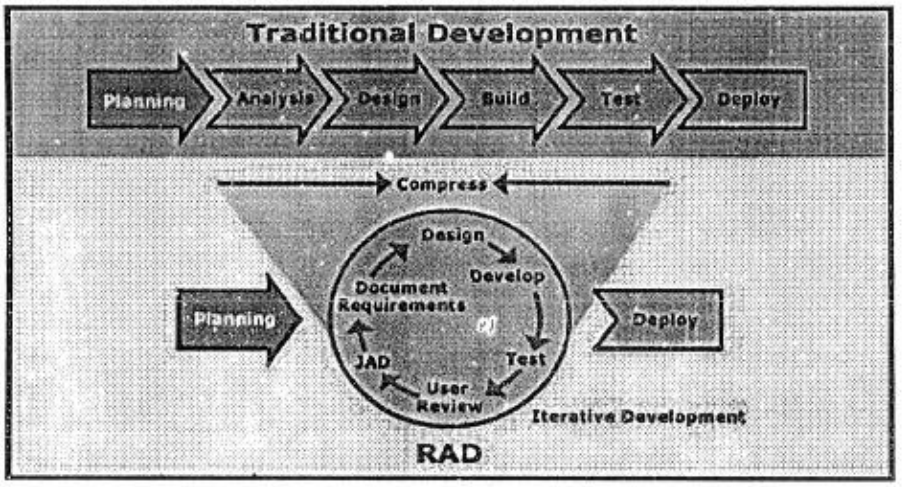

Fig 2.5: RAD Model

6.6.2 Phases

Figure 6.5 : The Rapid application Development(RAD) Methodology.

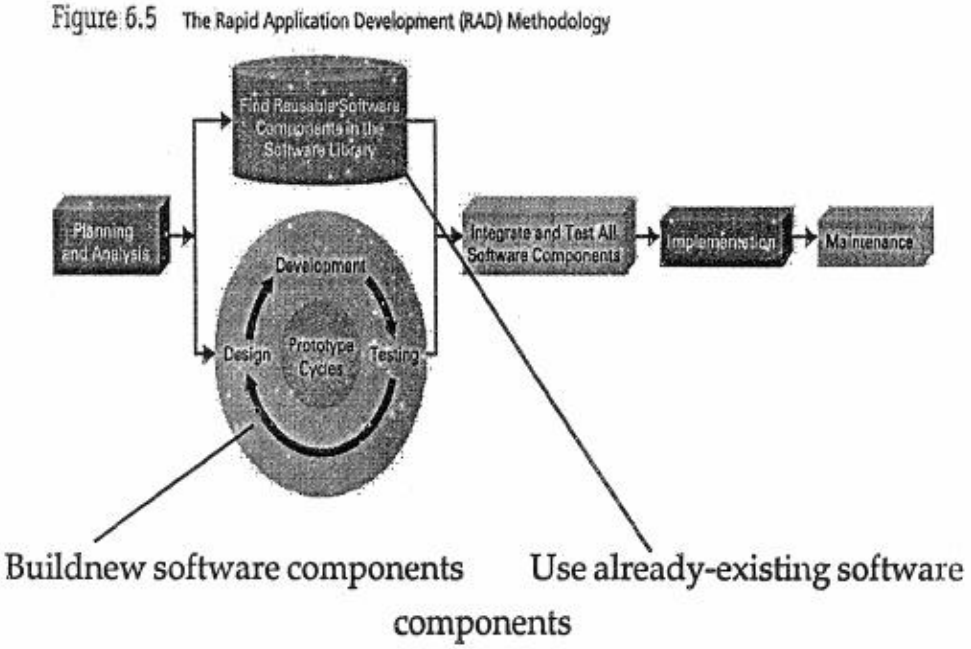

Fig 2.6: RAD Life Cycle Model

RAD model has the following phases:

- **Business Modeling:** The information flow among business functions is defined by answering questions like what information drives the

business process, what information is generated, who generates it, where does the information go, who process it and so on.

- **Data Modeling:** The information collected from business modeling
  is refined into a set of data objects (entities) that are needed to support the business. The attributes (character of each entity) are identified and the relation between these data objects (entities) is defined.
- **Process Modeling:** The data object defined in the data modeling phase are transformed to achieve the information flow necessary to implement a business function. Processing descriptions are created for adding, modifying, deleting or retrieving a data object.
- **Application Generation:** Automated tools are used to facilitate construction of the software; even they use the 4th GL techniques.
- **Testing and Turn over:** Many of the programming components have already been tested since RAD emphasis reuse. This reduces overall testing time. But new components must be tested and all interfaces must be fully exercised.

6.6.3 Advantage

RAD reduces the development time and reusability of components help to speed up development. All functions are modularized so it is easy to work with.

6.6.4 Disadvantage

For large projects RAD require highly skilled engineers in the team. Both end customer and developer should be committed to complete the system in a much abbreviated time frame. If commitment is lacking RAD will fail. RAD is based on Object Oriented approach and if it is difficult to modularize the project the RAD may not work well.

6.7 Role and responsibilities of Database Administrator

Database administrators (DBAs) are primarily responsible for specific databases in the subsystem. The DBA creates the hierarchy of data objects, beginning with the database, then table spaces, tables, and any indexes or views that are required. This person also sets up the referential integrity definitions and any necessary constraints.

The DBA essentially implements the physical database design. Many tools are available to help DBAs perform their tasks. The DBA can be responsible for granting authorizations to the database objects, although sometimes there is a special security administration group that does this.

The centralization of data and control of access to this data is inherent to a database management system. One of the advantages of this centralization is the availability of consistent data to more than one application. Responsibility for an accurate implementation of control lies with the DBA.

In a typical installation, the DBA is responsible for:

- Providing the standards for, and the administration of, databases and their use
- Guiding, reviewing, and approving the design of new databases
- Determining the rules of access to the data and monitoring its security
- Ensuring database integrity and availability, and monitoring the necessary activities for reorganization backup and recovery
- Approving the operation of new programs with existing production databases, based on results of testing with test data.

In general, the DBA is responsible for the maintenance of current information about the data in the database. Initially, this responsibility might be carried out using a manual approach. But it can be expected to grow to a scope and complexity sufficient to justify, or necessitate, the use of a data dictionary program.

The DBA is not responsible for the actual content of databases. This is the responsibility of the user. Rather, the DBA enforces procedures for accurate, complete, and timely update of the databases.

The success of a database environment depends on central control of database design, implementation, and use. This central control and coordination is the role of the database administrator (DBA).

The DBA is a single person; however, large organizations may divide DBA responsibilities among a team of personnel, each with specific skills and areas of responsibility such as database design, tuning, or problem resolution.

The DBA in the IS Organization

The ability of the database administrator (DBA) to work effectively depends on the skill and knowledge the DBA brings to the task, and the role the DBA has on the overall Information Systems (IS) operation sucusses the relationship of the DBA to the IS organization, and makes suggestions for taking advantage of that relationship.

Position of the DBA in the Organization

The DBA should be placed high enough in the organization to exercise the necessary degree of control over the use of the database and to communicate at the appropriate level within user departments.

However, the DBA should not be remote from the day-to-day processes of monitoring database use, advising on and selecting applications, and maintaining the required level of database integrity.

The appropriate position and reporting structure of the DBA depends solely on the nature and size of the organization. In most organizations, the DBA is best placed as a functional manager with an status equivalent to the systems, programming, and operations managers. The DBA should have direct responsibility for all aspects of the continued operation of the database. It is also useful to give the DBA at least partial control over the programming and IS operation standards, since the DBA must have the ability to ensure that DBMS-compatible standards are understood and observed.

Necessary Attributes for a DBA

The DBA is an essential resource to the organization: a politician, technician, diplomat, and policeman. The DBA needs to be a fair-minded person who is able to see both sides of database problems (that is, the IS department's side and the user's side) without prejudice in favour of either side. The DBA is expected to resolve problems for the benefit of the organization as a whole.

The DBA also needs

- administrative skill to set up and enforce the standards and procedures for using the database;
- technical ability to understand the factors governing hardware performance, with considerable knowledge both of the operating system software and the DBMS being used;
- a thorough knowledge of existing and future applications; and
- Skills to produce an efficient database design that meets the application requirements.

In many medium-to-large installations, DBA functions are performed by a team rather than an individual. In this case, different members of the team specialize in different skills and aspects of managing database resources.

In a small installation, it may be difficult to justify a team, yet impossible to find an individual with all the necessary attributes. A DBA must rely on assistance from other specialists such as the systems programmer, senior operator, or senior analyst.

Management Support

To be effective, the DBA must be recognized and supported by both IS and user group management. With an in-depth understanding of the database operation and the service it provides to the organization, the DBA needs to be recognized as a centre of competence for all matters involving the design or use of the database.

What Mistakes Are Possible?

When establishing the DBA function, the following mistakes should be avoided:

- Placing the DBA too low in the organization (insufficient authority). To function effectively, the DBA should be given enough authority to match the DBA's responsibilities. Far from being a threat to the established scheme of IS management, the DBA should be seen as a necessary adjunct when working in a DBMS environment. The DBA needs the cooperation, support, and respect of fellow managers, but will not have it if he or she is denied sufficient authority to perform the necessary tasks.
- Placing the DBA too high in the organization (too much authority). The position of the DBA should ensure the smooth operation of the DBMS environment, not bring it to a standstill under mounds of paper, unnecessarily restrictive procedures, or overbearing management. It is accepted that the dividing line between too little and too much authority is narrow, but the line must be recognized and drawn for each organization.
- Failing to define all DBA functions and responsibilities. The DBA should be authorized to perform the necessary functions, as they apply to the DBMS site. These functions need to be defined by participating managers from both the IS and user areas after careful consideration of the organization's requirements. Once the functions are defined, the DBA is responsible for establishing the procedures needed to ensure that they are performed.
- Failing to select a DBA with sufficient administrative experience. The DBA function is not an appropriate place to teach administration to a junior manager. The DBA function requires considerable management expertise, particularly in the area of human relations.

Establishing Database Control and Administration

When establishing the system for controlling and administering the database environment, the general responsibilities of the DBA include

- establishing database procedures and standards;
- assisting in database design;
- educating users;
- selecting applications suitable for the database system;
- maintaining database documentation; and
- Administering the database.

DBA Function Summary

The following is a summary of the functions for which the DBA is generally responsible:

Designing : Standard data definitions, Physical database Security, privacy and recovery procedures Support software (if not acquired with the DBMS package)

Selecting : Database management system, Performance measurement tools Tuning aids

Predicting : Effect of changing volumes/new applications

Deciding : Search strategies, Access methods ,Database design, Record relationships ,Rules of use of database

Training : Analysts and programmers: in database techniques Operators: in database operating procedures

Enforcing : Standards for design, documentation, etc., Quality control Access rules

Organizing/Administering: Data dictionary creation/maintenance, File conversionsIntegrity, security and recovery benchmarks, Acceptance tests Communication of changes to the users

Measuring: : Hardware performance, Software performance Database usage statistics

Tuning: : System performance

6.8 Role and Responsibility of Database Designer

The database designer role defines the tables, indexes, views, constraints, triggers, stored procedures, table spaces or storage parameters, and other database-specific constructs needed to store, retrieve, and delete persistent objects. The database designer must have a solid working knowledge of the following:

System Architecture, including Database and System performance tuning, as well as hardware and network workload balancing an understanding of the implementation language and environment

The data model is a subset of the implementation model which describes the logical and physical representation of persistent data in the system. It also includes any behaviour defined in the database, such as stored procedures, triggers, constraints, and so forth.The data model is used to describe the logical and possibly physical structure of the persistent information managed by the system. The data model is specifically needed where the persistent data structure cannot be automatically and mechanically derived from the structure of persistent classes in the design model. It is used to define the mapping between persistent design classes and persistent data structures, and to define the persistent data structures themselves. It is most frequently needed when the design model is an object model and the persistent storage mechanism is based upon a relational database, although it is generally needed whenever

the persistent storage mechanism is based upon some non-object-oriented technology.

The Data Model is created in the Elaboration phase, based upon architecturally significant persistent classes. The Data Model is refined and expanded during the Construction phase.

A **database designer** is responsible for the integrity of the data model, ensuring that the data model as a whole is correct, consistent, and understandable.

6.9 Role and responsibilities of Systems Analyst

Responsibilities (activities)

1. Assists current or potential application users in identifying and describing problems orOpportunities that might be addressed either:
   a) by implementing a new (automated or manual) system, or
   b) by changing an existing application system.
2. Investigates such problems and opportunities to determine the feasibility of a system solution and to identify the general kinds of system solution that appear appropriate.
3. Analyses users' business requirements in detail and, where appropriate, prepares functionalspecifications1 for a proposed new (or changed) system.
4. Assists and guides prospective users of a proposed new or changed system in:
   a) quantifying the benefits of having the system (or the penalties for not having it).
   b) assessing the impact of the system on their organization and on the operation of theirbusiness.
5. Obtains rough estimates of the cost of operating and maintaining a proposed new or changed system, assuming use of appropriate technology, tools, and methods.
6. Assists the *project manager* 3 in identifying the skills and resources needed to implement anew system or to modify an existing system, and in preparing rough estimates of:
   a) the cost of developing or changing the system,
   b) the duration of a project to do so.
7. Assists the sponsoring users in:
   a) Analysing the costs, benefits, risks, and return-on-investment of the proposed new system,
   b) Understanding the exact nature of the proposed system,
   c) Deciding whether to proceed with the implementation.
8. Designs and develops users' manuals 4 and corresponding training programs for a system being developed.

9. Prepares, in consultation with users, implementers, and operations representatives, theacceptance (or parallel) test plan for any new or changed system.

10. Assists the users in preparing for the installation and start-up of any new system beingimplemented.

Accountability *(or results)*

The Systems Analyst will be performing his or her role satisfactorily, with respect to assigned projects, when:

1. Post-implementation project reviews show that the estimated benefit/cost ratios are being met or exceeded by 80% of the systems 5 that are eventually installed.

2. At least 95% of the systems5 that turn out not to be justified are abandoned before significant effort is spent on implementation.

3. Users of new or changed systems are fully aware before installation of:
   a) Exactly what the new system will do,
   b) Their own responsibilities toward successful implementation,
   c) Any difficulties or negative effects of the system

4. Proposed functional specifications1 are based upon:
   a) a thorough and largely correct understanding of the users' business needs
   b) all applicable company standards
   c) Appropriate, up-to-date technology.

5. Non-trivial *bugs* in systems that have been tested according to agreed-upon test plans occur no more than once in 10000 transactions.

6. User management complains that a new system is hard to use or hard to learn in fewer thanone project in ten.

Authority

In order to accomplish his or her functions, the Systems Analyst may, without additional authorization:

1. Communicate informally and in writing with the sponsoring users and affected people in the user's organization.

2. Delegate tasks to subordinate members of the project team.

3. Request services from other parts of the company, subject to the limitations of the projectbudget.

4. Decline to undertake activities in support of implementing systems that appear to be infeasible or clearly unjustified (except where management specifically directs that the work be done on a "best effort" basis).

5. Decline to support implementing systems for which the user does not fully understand thefunctional specification, the benefits, and the estimated costs (except where managementspecifically directs that the work be done on a "best effort" basis).
6. Examine relevant materials relating
   (a) To previous or current systems to be replaced and
   (b) To other systems that may have an interface to the proposed system.
7. Obtain and store actual ("live") data for testing, subject to security and confidentiality regulations.
8. Decline to concur in the production installation of a system for which either no adequate test plan exists or the test plan has not been followed.

6.10 Summary

There are various software development approaches defined These are also referred as "Software Development Process Models". Each process model follows a particular life cycle in order to ensure success in process of software development. A variety of life cycle models exist, but they all include the same constituent parts.

6.11 Self Assessment Test

1. What problems does the system analyst face in ascertaining the information requirement at the various levels of management? How are these problems tackled?
2. When should the analyst resort to prototype experimentation for judging the requirement? How is modelling used in this approach?
3. What is Waterfall model and list its advantages, disadvantages
4. How does the risk factor affect the spiral model of software development?
5. Why is maintenance of software important? Discuss some of the problems that are faced during maintenance of software.
6. Differentiate all SDLC models and which one is best and how?
7. In which circumstances different models gives best result. Define for all?
8. Define the role of DBA in the development of software.

6.12 Further Readings

1. Systems Analysis and Design ,Irwin Professional Publishing, by Whitten
2. Software Engineering: A Practitioners Approach 6th Ed,Mcgraw Hill Education , Roger S. Pressman
3. Software Engineering, Second edition, Technical Publications,A. A. Puntambekar

UNIT-7 SYSTEM DEVELOPMENT LIFE CYCLE

Unit Structure

7.0 Objective
7.1 Introduction
7.2 Sequential Process of system development:
- 7.2.1 What prompts a new system?
- 7.2.2 Phase 1: System Planning (Preliminary Investigation)
- 7.2.3 Phase 2: System Requirements analysis
- 7.2.4 Phase 3: System Design
- 7.2.5 Phase 4: System Implementation
- 7.2.6 Phase 5: System Operation and Support (Maintenance)
- 7.2.7 General Considerations In Building An Information System

7.3 CASE tool
- 7.3.1 Reasons for using a CASE tool.
- 7.3.2 CASE environment?
- 7.3.3 Differentiate in between a CASE environment and a programming environment.
- 7.3.4 Benefits of a CASE environment.
- 7.3.5 Requirement of a prototyping CASE tool.
- 7.3.6 Features of a good prototyping CASE tool
- 7.3.7 Structured analysis and design with CASE tools
- 7.3.8 Code generation with CASE tools
- 7.3.9 Test case generation CASE tool.
- 7.3.10 Application of CASE

7.4 Summary
7.5 Self Assessment Test
7.6 Further Reading

7.0 Objectives

The goals of an information system must be thoroughly understood, and formal procedures and methods applied to ensure that the project is delivered on time and to the required specification.

7.1 Introduction

Large systems development projects may involve dozens of people working over several months or even years, so they cannot be allowed

to proceed in a haphazard fashion.

The systems life cycle methodology approaches the development of information systems in a very methodical and sequential manner. Each stage is composed of certain well-defined activities and responsibilities, and is completed before the next stage begins. This approach was popular in the 1960s and 70s, when systems were largely transaction-processing systems and had a much heavier reliance on programming than most modern information systems, which are database-oriented.

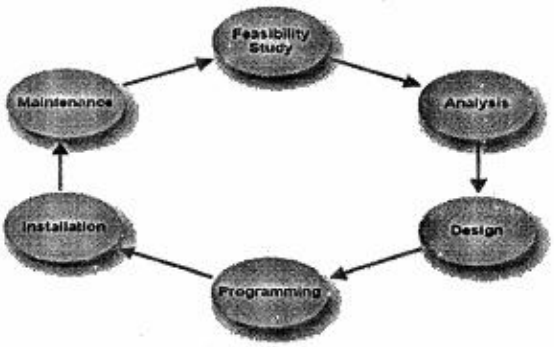

Fig 7.1 : System development life cycle

The structured analysis uses a series of phases to plan, analyze, design, implement and support an information system.

- Information requirements change as a company grows and reacts to internal and external forces.
- This is especially true in today's dynamic business environment, where constant change is the norm.
- To be successful a company needs information systems that can handle a continuous stream of new demands.
- The system development life cycle (SDLC) is a series of steps that companies use to build an information system.
- Although it is the most common development strategy, alternative approaches do exist, such as prototyping.
- SDLC consists of 5 phases: -
  1. *System Planning*
  2. *System Analysis*
  3. *System Design*
  4. *System Implementation*
  5. *System Operation, Support and Security*

7.2 Sequential Process of system development

The systems life cycle approach to development is also known as the 'waterfall model', and a variation on the basic diagram is shown in Figure 3.2.

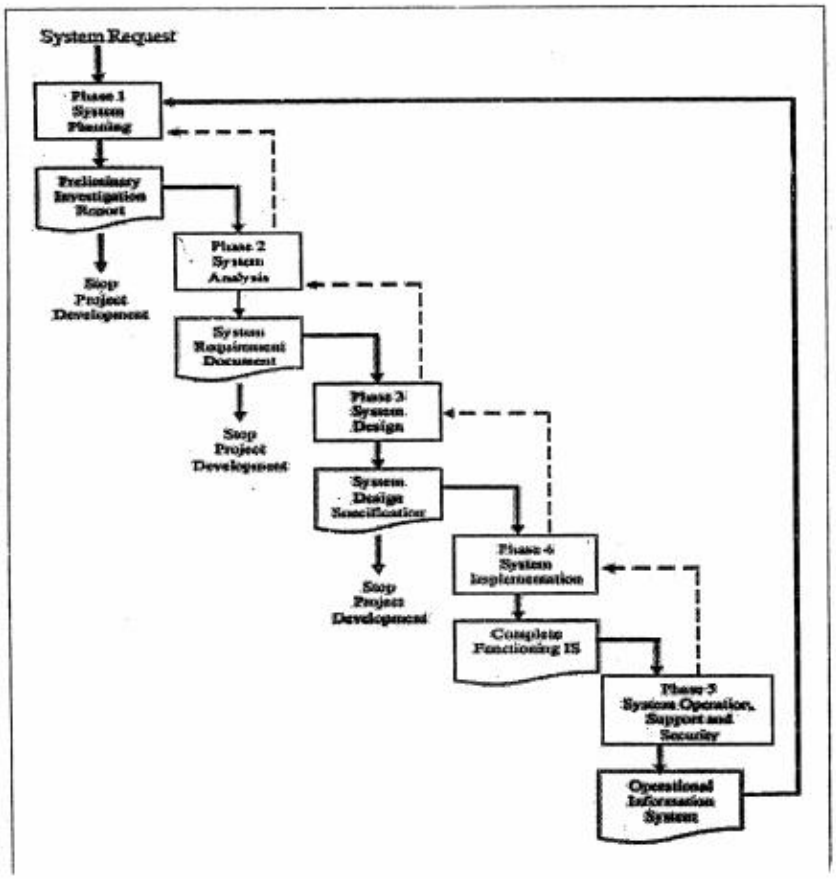

Fig 7.2 : Sequential Process of system development

Note that the arrows go up and down the 'waterfall', reflecting the fact that developers often have to rework earlier stages in the light of experience gained as development progresses.A project milestone terminates each stage of a li e-cycle-oriented approach. At this stage, the 'deliverable' resulting from hat stage – such as the documentation for the analysis or the design, or the program code or finished database application, is *signed off* by all concerned parties and approval is given to proceed. The 'concerned parties' usually include the end-users, the management and the developers, as well as other experts such as database administration personnel. This sequence continues until the evaluation stage has been completed and the finished system is delivered to the end-users.

In this model, the end-user has very little say in the development process, which is carried out by technical specialists such as systems analysts and programmers. He or she is presented with the finished system at the end of the development cycle and if it is not quite what was wanted, it is generally too late to make changes. Therefore, it is extremely important that the system requirements are very clearly specified and understood by all parties before being signed off.Such levels of certainty are difficult to achieve and this is one of the major drawbacks of the 'waterfall model'.

7.2.1 What prompts a new system?

The development of a new information system is a major undertaking and not one to be undertaken lightly. Wal-Mart, an American discount store, spent $700m on its new computerised distribution system in the 1980s. Tesco, Sainsbury's and Marks and Spencer have spent massive sums of money on their computer systems in the past decade. Businesses must adapt to remain competitive. Some of the reasons for introducing a new system may be:

1. *The current system may no longer be suitable for its purpose.* Changes in work processes, expansion of the business, changes in business requirements or the environment in which the organisation operates may all lead to a reassessment of information system requirements.

2. *Technological developments may have made the current system redundant or out-dated.* Advances in hardware, software and telecommunications bring new opportunities which an organisation cannot ignore if it is to keep ahead of its rivals.

3. *The current system may be too inflexible or expensive to maintain,* or may reduce the organisation's ability to respond quickly enough to customer's demands.

7.2.2 Phase 1: System Planning (Preliminary Investigation)

SDLC starts with a written request, called a system request, that identifies the needs of an IS or describes the desired changes or improvement by the management concern (the end user).

- The request can be very significant or relatively minor.
- A major request might involve the creation or an entire information system to meet a new business need (manually to computerize) or the replacement of an existing information system that can no longer handle current requirements (computerize to computerize).
- A minor request might ask for adding a new report or changing an
- existing calculation formula.
- The purpose of the planning phase is to identify clearly the nature
- and scope of the business opportunity or problem.
- This requires a preliminary investigation, which is a critical step, because the outcome will affect the entire development process.
- The recommendation should be whether the proposal is to be pursued further.
- If management decides to proceed, the next step after the preliminary investigation is the system analysis phase, else the project will be terminated here.

Feasibility study

This is the first stage of the systems life cycle. The **scope** and **objectives** of the proposed system must be written down. The aim of the feasibility study is to understand the problem and to determine whether it is worth proceeding. There are five main factors to be considered:

Technical feasibility
Economic feasibility
Legal feasibility
Operational feasibility
Schedule feasibility

Fig 3.3: TELOS – a mnemonic for the five feasibility factors

- **Technical feasibility** means investigating whether the technology exists to implement the proposed system, or whether this is a practical proposition.
- **Economic feasibility** has to do with establishing the cost-effectiveness of the proposed system – if the benefits do not outweigh the costs, then it is not worth going ahead.
- **Legal feasibility** determines whether there is any conflict between the proposed system and legal requirements – for example, will the system contravene the Data Protection Act?
- **Operational feasibility** is concerned with whether the current work practices and procedures are adequate to support the new system. It is also concerned with social factors – how the organisational change will affect the working lives of those affected by the system.
- **Schedule feasibility** looks at how long the system will take to develop, or whether it can be done in a desired time-frame.

The completion of this stage is marked by the production of a feasibility report produced by the systems analyst. If the report concludes that the project should go ahead, and this is agreed by senior managers, detailed requirements analysis will proceed.

7.2.3 Phase 2: System Requirements analysis

The second phase of systems analysis is a more detailed investigation into the current system and the requirements of the new system.

- The purpose of the system analysis phase is to learn exactly how the current system operates, to determine and document what the system should do and to recommend alternatives solutions.
- Through the process of fact-finding or requirement determination (requirement modelling), you define all the functions performed by

the current system and determine what improvements are needed in the proposed information system.

- After gathering the facts, S/A will analyse them carefully. This process is called requirements analysis.
- Later, SA develops a specific plan or alternative plans to solve the problems exist in the current system.
- The end product for this phase is the system requirements documents, which describe all management and users requirements, alternative plan and the recommendation.
- Management decision might be to develop a system in-house, purchase a commercial package or modify an existing system.

Gathering details about the current system will involve:

- Interviewing staff at different levels of the organisation from the end-users to senior management.
- Examining current business and systems documents and output. These may include current order documents, computer systems procedures and reports used by operations and senior management.
- Sending out questionnaires and analysing responses. The questions have to be carefully constructed to elicit unambiguous answers.
- Observation of current procedures, by spending time in various departments. A time and motion study can be carried out to see where procedures could be made more efficient, or to detect where bottlenecks occur.

The systems analyst's report will examine how data and information flow around the organisation, and may use **data flow diagrams** to document the flow. It will also establish precisely and in considerable detail exactly what the proposed system will do (as opposed to how it will do it). It will include an in depth analysis of the costs and benefits, and outline the process of system implementation, including the organisational change required. It must establish who the end-users are, what information they should get and in what form and how it will be obtained.

Alternative options for the implementation of the project will be suggested. These could include suggestions for:

- Whether development should be done in-house or using consultants;
- What hardware configurations could be considered;
- What the software options are.

Case study: Computer-dating the customer

When it started a century ago, marketing treated all customers the same. By the 1960s, marketers were able to break that anonymous

mass into segments. Now customer databases allow them to treat customers as individuals. They may know consumers' names and addresses, what they buy, what they have stopped buying and even how they respond to a rise in the price of dog food. For big multinational retailers, this is the equivalent of going back to the days of the individual store owner who knew and greeted each customer personally. The benefits are potentially huge: instead of spending millions on advertising beamed at people who may be indifferent or even hostile to it, retailers can use databases to help them hang on to their existing customers and persuade them to buy more. But it is not trouble-free: databases are expensive to collect and analyse, and some customers may see such individual marketing as an invasion of their privacy. Talbot's, a 385-store women's clothing chain based in Massachusetts, has compiled a database of 7m names that includes information about customers' sizes. This has enabled them to forecast more accurately which sizes will sell in particular stores. It also asks all customers for their post codes when they pay, to help it plan new store openings. The effort seems to be paying off. For the past five years the company has been opening around 50 new stores a year. (According to *The Economist 4 March 1995)*

4.2.4 Phase 3: System Design

- Purpose of system design is to develop a design (blueprint) that satisfied all requirements specified.
- This phase will identify all necessary outputs, inputs, files, application programs and even the manual procedures.
- In addition, this phase might include designing of internal and external controls, such as computer-based and manual features to guarantee that the system will be reliable, accurate, maintainable and secure.
- The design is documented in the system design specification and presented to management and users for their review and approval.
- Management and user involvement is critical to avoid any misunderstanding about what the new system will does, how it will do it and what it will cost.
- The design specifies the following aspects of a system:
    - The hardware platform – which type of computer, network capabilities, input, storage and output devices;
    - The software – programming language, package or database;
    - The outputs – report layouts and screen designs;
    - The inputs – documents, screen layouts and validation procedures;
    - The user interface – how users will interact with the computer system;
    - The modular design of each program in the application;

- The test plan and test data;
- Conversion plan – how the new system is to be implemented;
- Documentation including systems and operations documentation. Later, a user manual will be produced.

7.2.5 Phase 4: System Implementation

- During systems implementation, the IS is being constructed and put in place.
- Application programs are written, tested and documented; operational documentation and procedures are completed; and approval is obtained from users and management.
- The objective of the implementation phase is to deliver a completely functioning and documented information system that has been reviewed and approved.
- Final preparations include the users and performing the actual transition (conversion) from the old system to the new one and training users.
- At the conclusion of this phase, the system is ready for use.
- Once the new system is operational, conduct an assessment, called post-implementation system evaluation to assess the overall quality of the information system.
- E.g. post-implementation systems evaluation uses to determine whether the system operates properly and if costs and benefits are within expectations.

This phase includes both the coding and testing of the system, the acquisition of hardware and software and the installation of the new system or conversion of the old system to the new one.

The installation phase can include:

- Installing the new hardware, which may involve extensive recalling and changes in office layouts;
- Training the users on the new system;
- Conversion of master files to the new system, or creation of new master files.

Methods of conversion

There are several different methods of conversion:

- *Direct changeover.* The user stops using the old system one day and starts using the new system the next — usually over a weekend or during a slack period. The advantage of this system is that it is fast and efficient, with minimum duplication of work involved. The disadvantage is that normal operations could be seriously disrupted if the new system has errors in it or does not work quite as expected.

- *Parallel conversion.* The old system continues alongside the new system for a few weeks or months. The advantage is that results from the new system can be checked against known results, and if any difficulties occur, operations can continue under the old system while the errors or omissions are sorted out. The disadvantage of parallel conversion is the duplication of effort required to keep both systems running, which may put a strain on personnel.
- *Phased conversion.* This is used with larger systems that can be broken down into individual modules that can be implemented separately at different times. It could also be used where for example only a few customer accounts are processed using the new system, while the rest remain for a time on the old system. Phased conversion could be direct or parallel.
- *Pilot conversion.* This means that the new system will be used first by only a portion of the organisation, for example at one branch or factory.

7.2.6 Phase 5: System Operation and Support (Maintenance)

Post-implementation review

An important part of the implementation is a review of how the new system is performing, once it has been up and running for a period of time. Minor programming errors may have to be corrected, clerical procedures amended, or modifications made to the design of reports or screen layouts. Often it is only when people start to use a new system that they realise its shortcomings! In some cases they may realise that it would be possible to get even more useful information from the system than they realised, and more programs may be requested. The process of *system maintenance,* in fact, has already begun, and the life cycle is complete.

- After the implementation stage, the information system is ready to be used.
- During systems operation, maintenance and enhancements sometimes are requested to resolve problems identified by users.
- Information systems need to be replaced after several years of operation.
- Maintenance changes are made to correct errors or to conform to government or users requirements.
- Enhancements are modifications that increase capability, such as providing new information in an existing report or adding a new report are save of these examples.

  All software systems require maintenance, and in fact the vast majority of programmers are employed to maintain existing programs rather than to write new ones. There are differing reasons for this, and different types of maintenance.

- **Perfective maintenance.** This implies that while the system runs satisfactorily, there is still room for improvement. For example, extra management information may be needed so that new report programs have to be written. Database queries may be very slow, and a change in a program may be able to improve response time.
- **Adaptive maintenance.** All systems will need to adapt to changing needs within a company. As a business expands, for example, there may be a requirement to convert a standalone system to a multiuser system. New and better hardware may become available, and changes to the software may be necessary to take advantage of this. New government legislation may mean that different methods of calculating tax, for example, are required. Competition from other firms may mean that systems have to be upgraded in order to maintain a competitive edge.
- **Corrective maintenance.** Problems frequently surface after a system has been in use for a short time, however thoroughly it was tested. Some part of the system may not function as expected, or a report might be wrong in some way; totals missing at the bottom, incorrect sequence of data, wrong headings, etc. Frequently errors will be hard to trace, if for example a file appears to have been wrongly updated.

7.2.7 General Considerations in Building An Information System

Complete the phases in sequence

- Follow the SDLC phases in order by completing one phase before you start the next phase.
- When phases are bypassed or rushed, you can expect problems with the developed information system.
- By understanding all the requirements, it will create a better design, and a good design helps avoid problems in later phases, such as during construction.
- It is cost effective to complete one phase before moving to the next phase, so to reduce the chances of rework.
- Completing the phase in sequence, however, does not mean that you must restrict all your thoughts to just the current phase.
- As you work on a particular phase, you also should consider the impact of your decisions on later phases.
- If you plan carefully, tasks from later phases sometimes can begin before the completion of the prior phase.
- The ability to overlap phases is especially important when you are working on a system that must be developed rapidly.
- Powerful project management tools and techniques are available to help you to manage multiple tasks in system development process.

Focus on end products

- Each end product or deliverable represents milestones or checkpoint in the system development and these marks the completion of a specific phase.
- Management uses these checkpoints to assess the status of the project and decide what should happen next.
- Possible choices are to proceed to the next phase, redo portions of the work that have just completed, return to an earlier phase, or terminate the project entirely.
- One major factor that influence or help in management's decision is the quality of the end product.
- Thus, the document should strive for strong content and high quality

Estimate required resources

- Management needs to know the cost of developing and operating the proposed information system.
- At the start of each phase, you must provide a more specific cost estimates for that phase, for all succeeding phases, and for the operation of the information.
- Sound business decisions require accurate cost projections, so your figures must be reliable.
- This will also help you to best delegate the task among the development team members.

7.3 CASE tool and its scope

- A CASE (Computer Aided Software Engineering) tool is a generic term used to denote any form of automated support for software engineering. In a more restrictive sense, a CASE tool means any tool used to automate some activity associated with software development. Many CASE tools are available. Some of these CASE tools assist in phase related tasks such as specification, structured analysis, design, coding, testing, etc.; and others to non-phase activities such as project management and configuration management Integrated CASE include both
- **Repository**
  - Database containing all development objectives
    - Data elements and definitions
    - Requirements
    - Code modules
  - Enables a team to work on the CASE project
    - Data model
  - Dictionary and schema

7.3.1 Reasons for using CASE tools

The primary reasons for using a CASE tool are:

- To increase productivity
- To help produce better quality software at lower cost

7.3.2 CASE environment

Although individual CASE tools are useful, the true power of a tool set can be realized only when these set of tools are integrated into a common framework or environment. CASE tools are characterized by the stage or stages of software development life cycle on which they focus. Since different tools covering different stages share common information, it is required that they integrate through some central repository to have a consistent view of information associated with the software development artifacts. This central repository is usually a data dictionary containing the definition of all composite and elementary data items. Through the central repository all the CASE tools in a CASE environment share common information among themselves. Thus a CASE environment facilities the automation of the step-by-step methodologies for software development. A schematic representation of a CASE environment is shown in fig. 3.3.

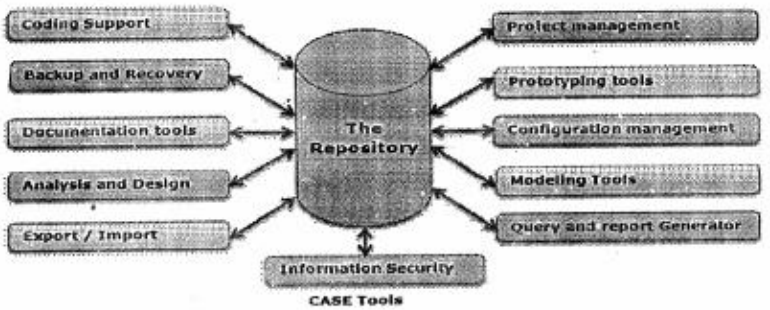

Fig. 3.3 : CASE Environment

7.3.3 CASE environment vs. programming environment

A CASE environment facilitates the automation of the step-by-step methodologies for software development. In contrast to a CASE environment, a programming environment is an integrated collection of tools to support only the coding phase of software development.

7.3.4 Benefits of CASE environment

Several benefits accrue from the use of a CASE environment or even isolated CASE tools. Some of those benefits are:

- A key benefit arising out of the use of a CASE environment is cost saving through all development phases. Different studies carry out to measure the impact of CASE put the effort reduction between 30% to 40%.
- Use of CASE tools leads to considerable improvements to quality. This is mainly due to the facts that one can effortlessly iterate through the different phases of software development and the chances of human error are considerably reduced.

- CASE tools help produce high quality and consistent documents. Since the important data relating to a software product are maintained in a central repository, redundancy in the stored data is reduced and therefore chances of inconsistent documentation is reduced to a great extent.
- CASE tools take out most of the drudgery in a software engineer's work. For example, they need not check meticulously the balancing of the DFDs but can do it effortlessly through the press of a button.
- CASE tools have led to revolutionary cost saving in software maintenance efforts. This arises not only due to the tremendous value of a CASE environment in traceability and consistency checks, but also due to the systematic information capture during the various phases of software development as a result of adhering to a CASE environment.
- Introduction of a CASE environment has an impact on the style of working of a company, and makes it oriented towards the structured and orderly approach.

7.3.5 Featuresof a prototyping CASE tool

Prototyping is useful to understand the requirements of complex software products, to demonstrate a concept, to market new ideas, and so on.

The important features of a prototyping CASE tool are as follows:

- Define user interaction
- Define the system control flow
- Store and retrieve data required by the system
- Incorporate some processing logic

7.3.6 Features of a good prototyping CASE tool

There are several stand-alone prototyping tools. But a tool that integrates with the data dictionary can make use of the entries in the data dictionary, help in populating the data dictionary and ensure the consistency between the design data and the prototype.

A good prototyping tool should support the following features:

- Since one of the main uses of a prototyping CASE tool is graphical user interface (GUI) development, prototyping CASE tool should support the user to create a GUI using a graphics editor. The user should be allowed to define all data entry forms, menus and controls.
- It should integrate with the data dictionary of a CASE environment.
- If possible, it should be able to integrate with external user defined modules written in C or some popular high level programming languages.
- The user should be able to define the sequence of states through which a created prototype can run. The user should also be allowed to control the running of the prototype.

- The run time system of prototype should support mock runs of the actual system and management of the input and output data.

7.3.7 Structured analysis and design with CASE tools

Several diagramming techniques are used for structured analysis and structured design. The following supports might be available from CASE tools.

- A CASE tool should support one or more of the structured analysis and design techniques.
- It should support effortlessly drawing analysis and design diagrams.
- It should support drawing for fairly complex diagrams, preferably through a hierarchy of levels.
- The CASE tool should, provide easy navigation through the different levels and through the design and analysis.
- The tool must support completeness and consistency checking across the design and analysis and through all levels of analysis hierarchy. Whenever it is possible, the system should disallow any inconsistent operation, but it may be very difficult to implement such a feature. Whenever there arises heavy computational load while consistency checking, it should be possible to temporarily disable consistency checking.

7.3.8 Code generation and CASE tools

As far as code generation is concerned, the general expectation of a CASE tool is quite low. A reasonable requirement is traceability from source file to design data. More pragmatic supports expected from a CASE

tool during code generation phase are the following:

The CASE tool should support generation of module skeletons or templates in one or more popular languages. It should be possible to include copyright message, brief description of the module, author name and the date of creation in some selectable format.

- The tool should generate records, structures, class definition automatically from the contents of the data dictionary in one or more popular languages.
- It should generate database tables for relational database management systems.
- The tool should generate code for user interface from prototype definition for X window and MS window based applications.

7.3.9 Test case generation CASE tool

The CASE tool for test case generation should have the following features:

- It should support both design and requirement testing.
- It should generate test set reports in ASCII format which can be directly imported into the test plan document.

7.3.10 Application of CASE

- A *CASE repository* is a system developers' database. It is a place where developers can store system models, detailed descriptions and specifications, and other products of system development. Synonyms include dictionary and encyclopedia.
- *Forward engineering* requires the systems analyst to draw system models, either from scratch or from templates. The resulting models are subsequently transformed into program code.
- *Reverse engineering* allows a CASE tool to read existing program code and transform that code into a representative system model that can be edited and refined by the systems analyst.

7.4 Summary

Large systems development projects may involve dozens of people working over several months or even years, so they cannot be allowed to proceed in a haphazard fashion. The systems life cycle methodology approaches the development of information systems in a very methodical and sequential manner.

7.5 Self Assessment Test

1. Define a system. Explain the components of a system.
2. How do you explain system development life cycle?
3. Discuss the importance of system analysis and design in the development of a system.
4. What is CASE and CASE tools? Why we use CASE tool.
5. What is SDLC? Describe the stages of SDLC.
6. What are the tools using for system development?
7. What is CASE environment? Differentiate CASE environment and a programming environment.
8. Explain the Benefits of CASE.

7.6 Further Readings

1. Computer Aided Software Engineering ,Springer , Hausi A. Muller (Editor), Ronald J. Norman (Editor), Jacob Slonim
2. Software Engineering: A Practitioners Approach 6th Ed, Mcgraw Hill Education , Roger S. Pressman
3. Fundamentals Of Software Engineering, 3/E , Phi ,Rajib Mall

UNIT-8 TOOLS AND THE MODULAR APPROACH

Unit Structure

8.0 Objective
8.1 Tools for software development.
8.2 Modular approach to software development
  8.2.1 Bottom-up Approach
  8.2.2 Top-Down Approach
  8.2.3 Modular Approach
8.3 Audit
  8.3.1 Specific goals of the audit
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8.0 Objectives

A tool is software support that helps create models or other components required in the project. The different approaches and tools are used for software development. The audits are done to take the accountability of the objectives.

8.1 Tools for software development

Some tools related to system analysis and design like DFD, Context Diagram, Structure Chart, Data Dictionary, Decision table ,Decision Tree etc. , are defined in first unit and CASE is in IIIrd unit and other are defined in this section Like: editors, C-S help, debugging tools, Individual tools developed to support single activities (e.g. compilation, debugging)

- Integrated environments i.e., tools that work together like environment supporting one programming language
- Open environments i.e., tools have public interfaces which allow them to communicate and cooperate with other tools which respect those interfaces

Representative tools—

Editors: Textual or graphical, Can follow a formal syntax, or can be used

for informal text or free-form pictures, Monolingual (e.g., Java editor) or multilingual

Linkers: Combine object-code fragments into a larger program and can be monolingual or poly lingual,In a broader sense, tools for linking specification modules, able to perform checking and binding across various specification modules

Interpreters: Traditionally at the programming language level, Also at the requirements specification level, requirements animation can be numeric or symbolic

Code generators: In a general sense, transform a high level description into a lower-level description, a *specification* into an *implementation* example 4th Generation Languages

Debuggers: May be viewed as special kinds of interpreters where execution states inspect able, execution mode definable, animation to support program understanding

Software testing Tools

(1) Test documentation tools -support bookkeeping of test cases-forms for test case definition, storage, retrieval

(2) Tools for test data derivation-e.g., synthesizing data from path condition

(3) Tools for test evaluation:e.g., various coverage metrics

Tools for testing other software qualities

Static analyzers: Data and flow control analyzers

- can point out possible flaws or suspicious-looking statements e.g., detecting uninitialized variables

GUI tools: Graphical User Interfaces are now standard

– Common abstractions include -windows and the desktop metaphor

User-Interface Management Systems

Provide a set of basic abstractions (windows, menus, scroll bars, etc.) that may be used to customize a variety of interfaces

Provide a library of run-time routines to be linked to the developed application in order to support input and output

– UIMS fall both under the category of development tools and under the category of end-product components

Configuration Management:

- Repository
  - shared database of artifacts
- Version management
  - versions stored, change history maintained
- Work-space control
  - check-out into private work-space
  - check-in into shared work-space
- Product modeling and building

- facilities to (re)build products

Tracking tools: Used during entire process to maintain information about the process and track that information

- The most important of these are *defect-tracking tools*
  - used to store information about reported defects in the software product and track that information

Reverse and reengineering: Program understanding systems

- synthesize suitable abstractions from code and e.g., control and data flow graphs or use graphs
- extract cross-references and other kinds of documentation material on the product
- Reverse engineering tools also support the process of making the code and other artifacts consistent with each other

Process support: Maintain "to do" lists, reminding next activities in the process, Automate sequences of recurring actions, Full process support via PSEEs (Process-centered Software Engineering Environments)-driven by a process-modeling language

Management: Tools for Gantt and PERT charts like graphical interface

- support to analysis
  - Cost estimation tools
- based on models, such as COCOMO

Tool integration: Data integration approach

- store all process artifacts in a repository
- common data representation for artifacts that different tools can use to communicate with each other
  - Control integration approach

  Different tools can communicate with each other through control message

8.2 Modular approach to software development

Smaller and less complex tasks are easier to understand than larger ones and are less demanding of resources. Modular approaches involve dividing investments into smaller parts in order to reduce investment risk, deliver capabilities more rapidly, and permit easier adoption of newer and emerging technologies.

Modular refers to a software engineering approach geared toward developing software applications in terms of modules or components. A modular information system is built around different modules that encompass a cohesively whole solution and/or system.'

Software engineering includes many development techniques like, Top-down, Bottom-up,and also including modular programming, which breaks solutions into smaller and manageable modules that are separately designed and developed. These modules are often integrated with other relevant application, which promotes reusability benefits.

8.2.1 Bottom-up Approach

- Identifying the processes that need computerization as they arise
- Analyzing them as systems
- Either coding or purchasing packaged software to meet the immediate problem

Disadvantages of a Bottom-Up Approach:

- There is a duplication of effort in purchasing software, and entering data
- Worthless data are entered into the system
- Overall organizational objectives are not considered and hence cannot be met

8.2.2 Top-Down Approach

Top-down design is the process of designing a solution to a problem by systematically breaking a problem into smaller, more manageable parts. First, start with a clear statement of the problem or concept – a single big idea.

- Next, break it down into several parts.
- If any of those parts can be further broker. down, then the process continues...
- The final design might look something like this *organizational chart*, showing the overall structure of separate units that form a single complex entity.
- Top-down design allows the systems analyst to ascertain overall organizational objectives and how they are best met in an overall system
- The system is divided into subsystems and their requirements
- An organizational chart is like an upside down tree, with nodes representing each process.
- The *leafnodes* are those at the end of each branch of the tree.
- The leaf nodes represent modules that need to be developed and then recombined to create the overall solution to the original problem.
- Top-down design leads to *modulardevelopment*.

Advantages of the Top-Down Approach

- Avoiding the chaos of attempting to design a system all at once
- Enables separate systems analysis teams to work in parallel on different but necessary subsystems
- Prevents losing sight of what the system is supposed to do

Disadvantages of the Top-Down Approach:

- There is a danger that the system will be divided into the wrong subsystems
- Once subsystem divisions are made, their interfaces may be neglected or ignored
- The subsystems must be eventually reintegrated

8.2.3 Modular Approach

The modular approach, which segregated project development into separate teams assigned to different modules, facilitated software development life cycle (SDLC) focus, management and operations. The modular programming approach gradually evolved into development libraries bundled with programming language compilers. Modular programming is popular with middle and senior management because it facilitates manageability and accountability during each development phase, as separate teams are usually designated for separate application functionality modules.

By following a modular approach, agencies can recognize the following benefits:

- Delivery of usable capabilities that provide value to customers more rapidly as agency missions and priorities mature and evolve;
- Increased flexibility to adopt emerging technologies incrementally, reducing the risk of technological obsolescence;
- Decreased overall investment risk as agencies plan for smaller projects and increments versus "grand design" (each project has a greater overall likelihood of achieving cost, schedule, and performance goals than a larger, all-inclusive development effort);
- Creation of new opportunities for small businesses to compete for the work;
- Greater visibility into contractor performance. Tying award of contracts for subsequent Task Orders to the acceptable delivery of prior projects provides agencies better visibility into contractor performance and allows a greater opportunity to implement corrective actions without sacrificing an entire investment;
- An investment can be terminated with fewer sunk costs, capping the risk exposure to the agency when priorities change, a technology decision doesn't work or the contractor's performance doesn't deliver results.

Modular Development:Breaking the programming into logical, manageable portions or modules Works well with top-down design .Each individual module should be functionally cohesive, accomplishing only one function

Advantages of Modular Development

Modular development is the process of developing software modules individually then combining the modules to form a solution to an overall problem. Modular development of computer software makes a large project more manageable , is faster for large projects , leads to a higher quality product , makes it easier to find and correct errors, increases the reusability of solutions ,is faster for large projects.

- Different people can work on different modules, and then put their work together.This means that different modules can be developed at the same time, which speeds up the overall project and leads to a

higher quality product.

- Programmers with knowledge and skills in a specific area, such as graphics, accounting, or data communications, can be assigned to the parts of the project that require those skills.
- Most computer systems are filled with layers of short programming modules that are constantly reused in different situations.
- Modules developed as part of one project, can be reused later as parts of other projects, modified if necessary to fit new situations.
- Over time, libraries of software modules for different tasks can be created, Libraries of objects can be created using object-oriented programming languages

8.3 Audit

8.3.1 Specific goals of the audit

- Confidentiality
- Integrity
- Reliability
- Availability
- Compliance with legal / regulatory requirements

8.3.2 Classification of Audits

- Financial audits
- Operational audits
- Integrated audits
- IS audits
- Specialized audits
- Forensic audits

8.3.3 Information System audit

The IT audit focuses on determining risks that are relevant to information assets, and in assessing and evaluating controls in order to reduce or mitigate these risks.

Any audit that encompasses review and evaluation (wholly or partly) of automated information processing systems, related non-automated Processes and the interfaces between them.

IS auditing is the process of collecting and evaluating evidence to determine whether information systems and related resources, adequately safeguard assets, maintain data and system integrity, provide relevant and reliable information, achieve organizational goals effectively, consume resources efficiently, and have in effect internal controls that provide reasonable assurance that operational and control objectives will be met.

An information technology audit, or information systems audit, is an examination of the controls within an Information technology (IT) infrastructure.

- It is a process of collecting and evaluating evidence of an organization's information systems, practices, and operations.
- The evaluation of obtained evidence determines if the information systems are safeguarding assets, maintaining data integrity, and operating effectively to achieve the organization's goals or objectives.

8.3.4 Purpose of Information System audit

The IT audit's agenda may be summarized by the following questions:

- *Integrity* - Will the information provided by the system always be accurate, reliable, and timely?
- *Confidentiality* - Will the information in the system be disclosed only to authorized users?
- *Availability* - Will the organization's computer systems be available for the business at all times when required?

8.3.5 Objectives of IS Auditing Standards

The Objective of the audit includes the internal control system(s) for the use and protection of information and the information system, as under:

- Data
- Application systems
- Technology
- Facilities
- People

- Inform management and other interested parties of the profession's expectations concerning the work of audit practitioners
- Inform information system auditors of the minimum level of acceptable performance required to meet professional responsibilities

8.3.6 Need of IS Auditing

- Increasing level of computerization of manual functions
- Rapid technological development
- Lack of user knowledge resulting in insecure practices
- Role of networks
- Viruses, Worms, Hackers and other security threats
- Changing Regulatory environment
- Assessment of the risks associated with the use of the information systems and approach to managing those risks.
- Information system strategy plans to implement the strategy and monitoring of progress against those plans.
- Information system budgets and monitoring of variances.
- High level policies for information system use and the protection and monitoring of compliance with these policies.
- Major contract approval and monitoring of performance of the supplier.
- Monitoring of performance against service level agreements.

- Acquisition of major systems and decisions on implementation.
- Impact of external influences on information system such as internal, merger of suppliers or liquidation etc.
- Control of self-assessment reports, internal and external audit reports, quality assurance reports or other reports on Information System.
- Business Continuity Planning, Testing thereof and Test results.
- Compliance with legal and regulatory requirements.
- Appointment, performance monitoring and succession planning for senior information system staff including internal information system audit management and business process owners.

8.3.7 Types of IT Audits

Internal, External, risk based audit.

Internal Auditing

"Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes."

Functions include amongst other things, examining, evaluating and monitoring the adequacy and effectiveness of the accounting and internal systems

Internal Audit Vs. External Audit

- The role of internal auditing is determined by management and its function's objective varies accordingto management's requirements and as such it is part of the entity.
- External audit, on the other hand, is carried out independently to express an opinion on the fairness ofthe financial statements, with the primary concerned objective of determining whether the financial statements are free from material misstatements. It is, therefore, not a part of entity.
- Nevertheless some of the means of achieving their respective objectives are often similar and thus certain aspects of internal auditing may be useful in determiningthe nature, timing and extent of external audit procedures.

Risk Based Auditing

- Focus on risk of occurrences that could prevent the University from achieving its goals
- There are many types of risk – fraud, improper reporting, ineffective or inefficient use of resources, credibility loss, etc.
- Focus on areas with high risk and high probability that controls are not in place or are weak
- Risk based audit plan developed with input from across the University
- Risk factors:
  - Impact
  - Probability
  - Controls

Preventive Measures

- Make sure your controls are working
- Review and reconcile
- Check the work of your subordinates
- Don't give in to the temptation to skip controls because you are busy!

8.3.8 ISACA Standards and Guidelines for IS Auditing

- **Audit charter**

o The responsibility, authority and accountability of the information systems audit functions are to be appropriately documented in an audit charter or engagement letter.

- **Independence**

1. **Professional Independence**: In all matters related to auditing, the IS auditor is to be independent of the auditee in attitude and appearance.
2. **Organizational Relationship**: The IS audit function is to be sufficiently independent of the area being audited to permit objective completion of the audit.

- **Professional Ethics and Standards**Due professional care and observance of applicable professional auditing standards are to be exercised in all aspects of the information systems auditor's work.
- **Competence**

1. **Skills and Knowledge:** The information systems auditor is to be technically competent, having the skills and knowledge necessary to perform the auditor's work.
2. **Continuing Professional Education:** The information systems auditor is to maintain technical competence through appropriate continuing professional education.

- **Planning**

The information systems auditor is to plan the information systems audit work to address the audit objectives on audit standards and requirements and to comply with applicable professional auditing standards.

- **Performance of audit work**

1. **Supervision:** Information systems audit staff are to be appropriately supervised to provide assurance that audit objectives are accomplished and applicable professional auditing standards are met.
2. **Evidence:** During the course of the audit, the information systems auditor is to obtain sufficient, reliable, relevant and useful evidence to achieve the audit objectives effectively. The audit findings and conclusions are to be supported by appropriate analysis and interpretation of this evidence.

- **Reporting**

The information systems auditor is to provide a report in an appropriate form to intended recipients upon completion of audit work. The

audit report is to state the scope, objectives, period of coverage and the nature and extent of the audit work performed. The report is to identify the organization, the intended recipients and any restrictions on circulation. The report is to state the findings, conclusions, recommendations and any reservations or qualifications that the auditor has with respect to the audit

- **Follow-up activities**

The information systems auditor is to request and evaluate appropriate information on previous relevant findings, conclusions and recommendations to determine whether appropriate actions have been implemented in a timely manner.

8.3.9 IS Audit Cycle

- Planning
- Understand the Process(s)
- Walkthrough the Process/Controls.
  - Design of control
- Test the Controls
  - Operating Effectiveness
- Conclude and Report

1. IS Audit Planning

- Adequate planning is a necessary first step in performing effective IT audits
- Need to understand the general business environment as well as the associated business and control risks
- Assess operational and control risks and identify control objectives during audit planning

To perform an audit planning, the IS auditor should

(i) Gain an understanding of the business' mission, objectives, processes, information and processing requirements such as availability, integrity and security and information architecture requirements. In general terms, processes and technology.

(ii) Perform risk analysis.

1. Conduct an internal control review.
2. Set the audit scope and audit objective(s).
3. Develop the audit approach or audit strategy.
4. Assignresourcestoaudit and addressengagementlogistics.

In planning the engagement, IS Auditors should consider:

- The objectives of the activity being reviewed and the means by which the activity controls its performance.
- The significant risks to the activity, its objectives, resources, and operations and the means by which the potential impact of risk is kept to an acceptable level.
- The adequacy and effectiveness of the activity's risk management and control systems compared to a relevant control framework or model.

- The opportunities from making significant improvements to the activity's risk management and control systems.

2. **IS Audit Process: General audit procedures includes**
   - Understanding of the audit area/subject
   - Risk assessment and general audit plan
   - Detailed audit planning
   - Preliminary review of audit area/subject
   - Evaluating audit area/subject
   - Compliance testing
   - Substantive testing
   - Reporting(communicating results)
   - Follow-up

3. **Audit Methodology:** The audit methodology is a set of documented audit procedures designed to achieve planned audit objectives. The audit strategy is the audit methodology, which is a set of documented audit procedures designed to achieve planned audit objectives. It's components are:
   - a statement of scope,
   - statement of audit objectives and
   - statement of work programs

4. **Audit risk and materiality:**

Risk-based approach
- Emphasis on knowledge of the business and technology
- Focuses on assessing the effectiveness of a "combination" of controls
- Linkage between risk assessment and testing focusing on control objectives.
- Focuses on the business from a management perspective

Risk Assessment Techniques
- Enables management to effectively allocate limited audit resources
- Ensures that relevant information has been obtained
- Establishes a basis for effectively managing the audit department
- Provides a summary of how the individual audit subject is related to the overall organization and to business plans

More and more organizations are moving to a risk-based audit approach that is usually adapted to develop and improve the continuous audit process. This approach is used to assess risk and to assist with an IS auditor's decision to do either compliance testing or substantive testing.

(i) A risk-based audit approach, IS auditors are not just relying on risk; they also are relying on internal and operational controls as well as knowledge of the company or the business. This type of risk assessment decision can

help relate the cost-benefit analysis of the control to the known risk, allowing practical choices.

(ii) Business risks are the concerns about the probable effects of an uncertain event on achieving established objectives. The nature of these risks may be financial, regulatory or operational. By understanding the nature of the business, IS auditors can identify and categorize the types of risks that will better determine the risk model or approach in conducting the audit.

5. **Control objectives and the related key controls that address the objective.**

- An auditor should be able to identify key controls and then decide to test these controls through substantive or compliance verification methods. The IS auditor is to identify application controls after developing an understanding and documenting the application or function, and based upon that, should identify key control points. This will allow the auditor to determine if controls are working as expected and results of compliance tests will allow the auditor to design more extensive compliance or substantive testing.

Relationship between substantive and compliance tests and the two categories of substantive tests.

- Substantive tests substantiate the integrity of actual processing. It provides evidence of the validity and integrity of the balances in the financial statements and the transactions that support these balances.
- Compliance tests determine if controls are being applied in a manner that complies with management policies and procedures.

Correlation between the level of internal controls and the amount of substantive testing required.

If the results of testing controls reveal the presence of adequate internal controls, then the IS auditor is justified in minimizing the substantive procedures. Conversely, if the testing controls reveals weaknesses in control that may raise doubts about the completeness, accuracy or validity of the accounts, substantive testing can alleviate those doubts.

6. **Collection of Evidence:** It is a requirement that the auditor's conclusions must be based on sufficient, competent evidence.

- Independence of the provider of the evidence
- Qualification of the individual providing the information or evidence
- Objectivity of the evidence
- Timing of evidence

Techniques for gathering evidence:

- Review IS organization structures
- Review IS policies, procedures and standards
- Review IS documentation
- Interview appropriate personnel
- Observe processes and employee performance.

7. **Judging materiality of findings**

- The concept of materiality is a key issue when deciding which findings to bring forward in an audit report. Key to determining the materiality of audit findings is the assessment of what would be significant to different levels of management.
- Assessment requires judgment of the potential effect of the finding if corrective action is not taken. Assess what is significant to different levels of management. Discuss examples of what might be important to different levels of management and why.

8. **Communicating audit results:** Results or concerns should be communicated to senior management and to the audit committee of the board of directors. IS auditors should feel free to communicate issues or concerns to such management.

- *Audit report structure and contents.* There is no specific format for an IS audit report; therefore, the organization's audit policies and procedures will generally dictate the format.
- *Exit interview.* Used to discuss the findings of the audit and recommendations with management. Ensure that the facts presented in the report are correct, recommendations are realistic and cost effective, and if not, seek alternatives through negotiation with the audit area; and establish implementation dates for agreed recommendations.

Presentation techniques to communicate the results of the audit work could include the following:

- **Executive summary**: an easy to read and concise report that presents findings to management in an understandable manner.
- **Visual presentation**: could include overhead transparencies, slides or computer graphics.
- **Oral presentation**

9. **Timing of follow-up:** *An Audit is ongoing process*: The IS auditor is not effective if audits are performed and reports issued but not followed up on to determine if management has taken appropriate corrective actions. IS auditors should have a follow-up program to determine if agreed corrective actions have been implemented.

The timing of follow-up will depend upon the criticality of the findings and would be subject to the IS auditor's judgment. The results of the follow-up should be communicated to appropriate levels of management.

10. **Audit Documentation**

IS audit documentation is the record of the audit work performed and the audit evidence supporting the findings and conclusions.

The IS auditor should understand techniques for documenting an information system as well as documenting the understanding of the information systems environment. The IS auditor should be able to prepare adequate work papers, narratives, complete interview questionnaires and create understandable systems flowcharts.

What is included in the audit report?

- What was found
- Why it happened
- What is required
- What effect it has
- Recommendation for improvemer
- Response – who, when and how
- Follow-up
- Review corrective action
- Report to Audit Committee

8.4 Summary

The variousapproaches are used for developing any software like: top-down, bottom up and modular approach and various tools are used during system analysis and design and different type of audits are used for maintaining control and security .

8.5 Self Assessment Test

1. What is the difference between top- down and bottom–up approach?
2. What is IT audit? Why it is important? What is its purpose?
3. How is IT audit carried out?
4. What audit report contains after audit?
5. Explain the steps of IS audit cycle.
6. What are the advantages of modular development?
7. Define the types of IT audit.
8. Which type of tools is used in software development? Explain each of them.

8.6 Further Readings

1. Advanced Auditing and Professional Ethics,Best Word publication pvt. Ltd, Surabhi Bansal
2. First Lessons in Information Systems Control And Audit,Snow White Publications Pvt. Ltd, R. Chandrasekhar
3. Software Engineering: A Practitioners Approach 6th Ed, Mcgraw Hill Education , Roger S. Pressman
4. Fundamentals Of Software Engineering, 3/E , Phi ,Rajib Mall

Block 3
ENTERPRISE SYSTEMS

Unit 9 5
Enterprise Resource Planning

Unit 10 15
Supply Chain Management

Unit 11 34
Knowledge Management and e-governance

Unit 12 50
Nature of IT decision

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परिमापक

अनुवाद की स्थिति में

मूल लेखक	अनुवाद
मूल सम्पादक	भाषा सम्पादक
मूल परिमापक	परिमापक

सहयोगी टीम

संयोजक Dr. Gaurav Sankalp, SoMS, UPRTOU, Allahabad

Block Introduction

Block three comprises of four units. Unit nine deals withEnterprise Resource Planning, Unit Ten deals with supply chain management, unit eleven deals knowledge management and e-governance. Unit twelve deals with nature of IT decision.

UNIT-9 Enterprise Resources Planning

Unit Structure

9.0 Objective
9.1 Introduction
9.2 Major Features of ERP System
9.3 Characteristics
9.4 Components
9.5 Scope of ERP system
9.6 Benefits
9.7 Advantages and Disadvantages of ERP Systems:
9.8 Selection Criteria
9.9 Issues and Challenges in ERP Implementation
9.10 Levels of ERP
9.11 Summary
9.12 Self Assessment Test
9.13 Further Readings

9.0 Objectives

Enterprise Resource Planning (ERP) systems integrate internal and external management of information across an entire organization—embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc. ERP systems automate this activity with an integrated software application.

9.1 Introduction

ERP facilitates information flow between all business functions inside the organization, and manages connections to outside stakeholders.

Enterprise system software is a multi-billion dollar industry that produces components that support a variety of business functions. IT investments have become the largest category of capital expenditure in United States-based businesses over the past decade. Enterprise systems are complex software packages that offer the potential of integrating data and processes across functions in an enterprise. Although the initial ERP systems focused on large enterprises, there has been a shift towards smaller enterprises also using ERP systems.

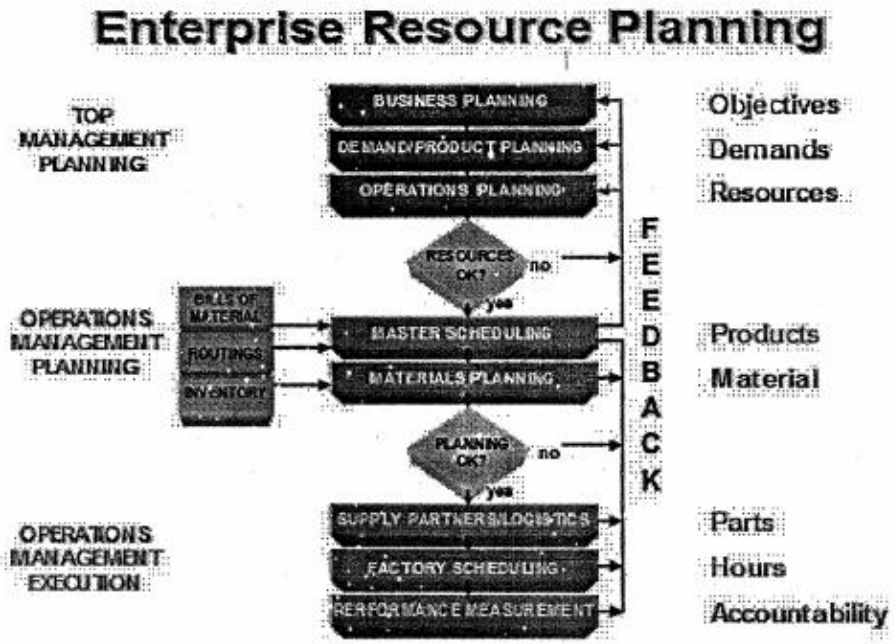

Figure 9.1: Enterprise Resources Planning

The main exar. ple is ERP systems.Organizations consider the ERP system their back bo..e and a vital organizational tool because it integrates varied organizational systems, and enables flawless transactions and production. However, an ERP system is radically different from traditional systems development. ERP systems can run on a variety of computer hardware and network configurations, typically employing a database as a repository for information.

9.2 Major Features of ERP System

- ERP provides multi-platform, multi-mode manufacturing, multi-currency, multilingual facilities.
- It supports strategic and business planning activities, operational planning and execution activities, creation of materials and resources .All these functions are effectively integrated for flow and update of information immediately upon entry of any information.
- Has end to end supply chain management to optimize the overall demand and supply data.
- ERP facilitates company –wide integrated information system covering all functional areas like manufacturing, selling and distribution, payables, receivables ,inventory accounts , human resources , purchase etc.
- ERP performs core activities and increases customers service , thereby augmenting the corporate image.
- ERP bridges the information gap across organization.
- ERP provides complete integration of systems not only across department but also across companies under the same

management.

- ERP is the solution for the better project management.
- ERP allows automatic introduction of the latest technologies like Electronic Fund Transfer(EFT), Electronic Data Interchange.
- ERP eliminates most business problems like materials shortage, productivity enhancements, customer service, cash management, inventory problems, quality problems, prompt delivery etc.
- ERP provides intelligent business tools like decision support system, Executive Information System, Data mining and easy working systems to enable better decisions.

9.3 Characteristics

ERP (Enterprise Resource Planning) systems typically include the following characteristics:

1. Flexibility
2. Open system architecture
3. Comprehensive
4. On-line connectivity to other business entities
5. Collection of the best business practice
6. An integrated system that operates in real time (or next to real-time), without relying on periodic updates
7. A common database, which supports all applications
8. A consistent look and feel throughout each module
9. Installation of the system without elaborate application/data integration by the Information Technology (IT) department provided the implementation is not done in small steps.

9.4 Components

- Transactional database
- Management portal/dashboard
- Businessintelligence system
- Customizable reporting
- Simple resource planning - Who Is Doing what and When?
- Analyzing the product
- External access via technology such as web services
- Search
- Document management
- Messaging/chat/wiki
- Workflow management

9.5 Scope of ERP system

Figure 1.2: Future trends of ERP

An ERP system covers the following common functional areas. In many ERP systems these are called and grouped together as *ERP modules*:

Financial accounting

General ledger, fixed asset, payables, receivables, cash management, financial consolidation

Management accounting

Budgeting, costing, cost management, activity based costing

Human resources

Recruiting, training, payroll, benefits, 401K, diversity management, retirement, separation

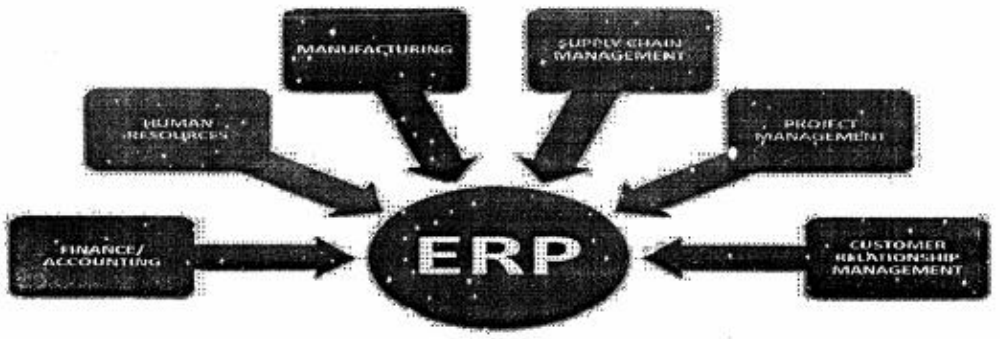

Figure 1.3: Functions of EPR system

Manufacturing

Engineering, bill of materials, work orders, scheduling, capacity, workflow management, quality control, manufacturing process, manufacturing projects, manufacturing flow, product life cycle management

Supply chain management

Supply chain planning, supplier scheduling, order to cash, purchasing, inventory, product configuration, claim processing

Project management

Project planning, resource planning, project costing, work break down structure, billing, time and expense, performance units, activity

management

Customer relationship management

Sales and marketing, commissions, service, customer contact, call centre support - CRM systems are not always considered part of ERP systems but rather Business Support systems (BSS). Specifically in telecom scenario

Data services

Various "self–service" interfaces for customers, suppliers and/ or employees

9.6 Benefits

- Having integrated systems helpsthat many businesses had previously started to use.
- Integrate financial information and customer order information
- Everyone working with the same information and removes misinformation
- Standardize and speed up manufacturing processes, as well as reduce inventory
- One of the greatest benefits of an ERP system is Provides organizations with information that was previously difficult (if not impossible) to obtain, allowing the organization to perform more efficiently and effectively.
- ERP can greatly improve the quality and efficiency of a business. By keeping a company's internal business process running smoothly, ERP can lead to better outputs that benefit the company such as customer service, and manufacturing.
- ERP provides support to upper level management to provide them with critical decision making information. This decision support allows the upper level management to make managerial choices that enhance the business down the road.
- ERP also creates a more agile company that better adapts to change. ERP makes a company more flexible and less rigidly structured so organization components operate more cohesively, enhancing the business—internally and externally.

9.7 Advantages andDisadvantages of ERP Systems

Enterprise Resource Planning is an important enterprise application that integrates all the individual departments/ functions in a single software application.

ERP Systems make it easier to track the work-flow across various departments and reduce the operational costs involved in manually tracking, and perhaps duplicating data using individual & disparate systems.

1. Complete **visibility** into all the important processes across various departments of an organization (especially for senior management personnel).
2. Automatic and coherent **work-flow** from one department / function to another to ensure smooth transition/ completion of processes.
3. A unified and single **reporting** system to analyze the statistics/ numbers/ status etc in real-time, across all the functions / departments.
4. Since **same software** is used across all departments – this can avoid individual departments having to buy and maintain their own software systems.
5. Certain ERP vendors can extend their ERP systems to provide **Business Intelligence** functionalities as well.
6. Advanced **e-commerce integration** is possible with ERP systems that can handle web-based order tracking/ processing.
7. There are **various modules** in an ERP system like Finance/ Accounts, Human Resource Management, Manufacturing, Marketing / Sales, Supply Chain / Warehouse Management, CRM, Project Management, etc.
8. Since ERP is a **modular software** system, it's possible to implement either a few modules (or) many modules based on the requirements of an organization. If more modules implemented, the integration between various departments might be better.
9. Single Database is implemented on the back-end to store all the information required by the ERP system and that enables centralized storage / back-up of all enterprise data.
10. ERP systems are more **secure** as centralized security policies can be applied to them and all the transactions happening via the ERP systems can be tracked.
11. ERP systems provide visibility and hence enable better/ faster **collaboration** across all the departments.
12. It is possible to integrate other systems (like bar-code reader, for example) to the ERP system through an **API** (Application Programming Interface).
13. ERP systems make it **easier** for order tracking, inventory tracking, revenue tracking, sales forecasting and related activities.
14. ERP systems are a boon for managing **globally dispersed** enterprise companies.

Disadvantages:

1. The **cost** of ERP Software, planning, customization, configuration, testing, implementation, etc is too high.
2. ERP deployments take **1-3 years** to get completed and fully functional.
3. Too little **customization** may not integrate the ERP system with the business process & too much customization may slow down the project and make it difficult to upgrade.

4. The **cost savings/ payback** may not be realized immediately after the ERP implementation & it is quite difficult to measure the same.
5. The **participation** of users is very important for successful implementation of ERP projects – So, exhaustive user training and simple user interface might be criticalfrom daily operations. But ERP systems are generally difficult to use (and learn).
6. There may be additional **indirect costs** like new IT infrastructure, upgrading the WAN links, etc.
7. **Migration** of existing data to the new ERP systems is always difficult to achieve as with integrating ERP systems with other stand alone software systems.
8. ERP implementations are difficult to achieve in **decentralized organizations** with disparate business processes and systems.
9. Once an ERP systems is implemented it becomes a **single vendor lock-in** for further upgrades, customizations etc.
10. Harmonization of ERP systems can be a mammoth task (especially for big companies) and requires a lot of time, planning, and money.
11. Overcoming resistance to sharing sensitive information between departments can divert management attention.
12. Re-engineering business processes to fit the ERP system may damage competitiveness or divert focus from other critical activities.
13. Due to ERP's architecture (OLTP, On-Line Transaction Processing) ERP systems are not well suited for production planning and supply chain management (SCM).

Recognized ERP limitations have sparked new trends in ERP application development. Development is taking place in four significant areas: more flexible ERP, Web-enable ERP, inter-enterprise ERP, and e-business suites

9.8 Selection Criteria

There are certain general guidelines, which are to be followed before starting the implementation of an ERP package:

- Understanding the corporate needs and culture of the organization and then adopt the implementation technique to match these factors.
- Doing a business process redesign exercise prior to starting the implementation.
- Establishing a good communication network across the organization.
- Providing a strong and effective leadership so that people down the line are well motivated.
- Finding an efficient and capable project manager.

- Creating a balanced team of implementation consultants who can work together as a team.
- Selecting a good implementation methodology with minimum customization.
- Training end-users.
- Adapting the new system and making the required changes in the working environment to make effective use of the system in future.

9.9 Challenges in ERP Implementation

Challenges in implementing ERP solutions are quite normal. Though it is not completely a technical job, a lot of planning and proper communication is very much essential to implement ERP across the organization. Some common challenges have noticed incompany's experience, when ERP is implemented.

1. Consultants, vendor and users have to work together to achieve the overall objectives of the organization. The consultants have to clearly understand the user needs and the prevailing business realities and design the business solutions keeping in the mind all these factors.
2. Proper customization of the package to the organization has to be in tune with the user's needs and business objectives.
3. Role and responsibility of the employees have to be clearly identified, understood and configured in the system.
4. Acceptance by employees for the new processes and procedures is critical for the success of the package.
5. Package to be implemented in totalityto achieve the maximum benefits
6. Selection of right kind of consultants
7. **Interconnections/ Integration problems:** It is very important, that **implementation is done in stages.** Trying to implementeverything at once will lead to a lot of confusion and chaos in interconnection and integrate the modules in proper shape.
8. ***Technological complexity***Installation of hardware and software required for the package.
9. Product quality and vendor unreliability
10. Organisational change
11. **Appropriate training is very essential** during and after the implementation. The staff should be comfortable in using the application or else, it will backfire, with redundant work and functional inefficiencies.
12. **Lack of proper analysis of requirements** will lead to non-availability of certain essential functionalities. This might affect the operations in the long run and reduce the productivity and profitability.
13. **Lack of proper ERP management i.e.** Lack of Support from Senior Management will lead to unnecessary frustrations in work place.

Also, it will cause delay in operations and ineffective decisions. So, it is essential to ensure that the Senior Management supports the transformation.

14. **Compatibility Issues with ERP Modules** lead to issues in integration of modules. Companies associate different vendors to implement different ERP modules, based on their competency. It is very essential that there is a way to handle compatibility issues.

15. **Cost of technology i.e.** Cost Overheads will result, if requirements are not properly discussed and decided during the planning phase. So, before execution, a detailed plan with a complete breakdown of requirements should be worked out. Because cost is too high and is increase if any change is required after some time.

16. **Investment in Infrastructure** is very essential. ERP applications modules will require good processing speed and adequate storage. Not allocating suitable budget for infrastructure will result in reduced application speed and other software issues. Hardware and Software Security is also equally important.

These are certain generic challenges while implementing ERP solutions. Depending on the sector in which the company operates in, the extent of complications may vary. So, it is very essential to bring onboard, an expert team of consultants. This will ensure the implementation process is smooth without any glitches.

9.10 Levels of ERP

Best practices are incorporated into most ERP systems which reduces risk by 71% when compared to other software implementation. Different levels of Best-ERP Practices can be understood by the following diagram:-

Figure1.4.: Three Levels of ERP

9.11 Summary

ERP provides multi-platform, multi-mode manufacturing, multi-

currency, multilingual facilities. It is Flexible, Open system architecture, Comprehensive, Collection of the best business practice, an integrated system. It consists of Transactional database, Management portal/ dashboard, Businessintelligence system, Customizable reporting, Simple resource planning, Document management, Workflow management. An ERP system covers, *Firancial accounting, Management accounting, Human resources, Manufacturing, Supply chain management, Project management, Customer relationship management, Data services.* ERP Systems make it easier to track the work-flow across various departments and reduce the operational costs involved in manually tracking, and perhaps duplicating data using individual & disparate systems. The cost of ERP implementation is too high, time consuming, difficult to achieve in decentralized organizations. It also includes some selection criteria. Besides that it includes some challenges during implementation. .

9.12 Self Assessment Test

1. What is ERP (Enterprise Resources Planning)?
2. What are the characteristics of ERP?
3. What are the functional areas of ERP?
4. What are the components of ERP?
5. Why should implement an ERP system?
6. What are the benefits of an ERP System?
7. What are the features of ERP?

9.13 Further Readings

1. Erp: A Managerial Perspective, Tata McGraw - Hill, Sadagopan
2. Enterprise resource planning ,Tata McGraw - Hill publishing company ltd. ,by alexis leon
3. Enterprise Systems for Management, 2/E,Pearson Publication,by Luvai Motiwalla & Jeffrey Thompson
4. ERP : The Future of Business Automation, Atlantic, Zubair H. Shaikh

UNIT-10 Supply Chain Management

Unit Structure

10.0 Objective
10.1 Introduction
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10.0 Objectives

Supply chain management (SCM) is the management of an interconnected or interlinked between network, channel and node businesses involved in the provision of product and service packages required by the end customers in a supply chain. Supply chain management spans the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.

10.1 Introduction

Supply chain management (SCM) is also defined as the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally."

Why is supply chain management so important?

- To gain efficiencies from procurement, distribution and logistics.
- To make outsourcing more efficient.
- To reduce transportation costs of inventories.
- To meet competitive pressures from shorter development times, more new products, and demand for more customization.
- To meet the challenge of globalization and longer supply chains.
- To meet the new challenges from e-commerce.
- To manage the complexities of supply chains.
- To manage the inventories needed across the supply chain.

Supply chain is the system by which organizations source, make and deliver their products or services according to market demand.

- Supply chain management operations and decisions are ultimately triggered by demand signals at the ultimate consumer level.
- Supply chain as defined by experienced practitioners extends from suppliers' suppliers to customers' customers.

Supply chain management is facilitated by :

- Processes
- Structure
- Technology

The Production Planning and Inventory Control Process encompasses the manufacturing and storage sub-processes, and their interface(s). More specifically, production planning describes the design and management of the entire manufacturing process (including raw material scheduling and acquisition, manufacturing process design and scheduling, and material handling design and control). Inventory control describes the design and management of the storage policies and procedures for raw materials, work-in-process inventories, and usually, final products.

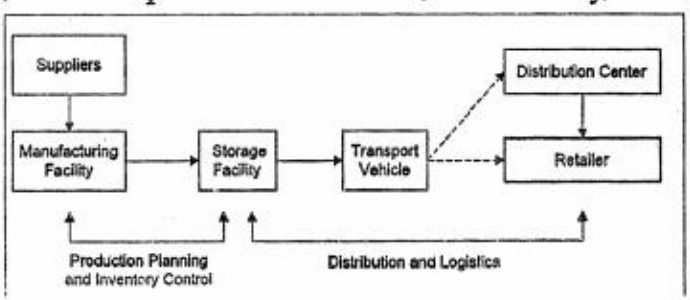

Figure 2.1: The Supply Chain Process

The Distribution and Logistics Process determines how products are retrieved andtransported from the warehouse to retailers. These products may be transported toretailers directly, or may first be moved to distribution facilities, which, in turn, transport products to retailers. This process includes the management of inventory retrieval, transportation, and final product delivery.

These processes interact with one another to produce an integrated supply chain. The design and management of these processes determine the extent to which the supply chain works as a unit to meet required performance objectives.

Objectives of Supply Chain Management:

The traditional objective of supply chain management is to minimize total supply chain cost to meet fixed and given demand. This total cost may be comprised of a number of terms including

- raw material and other acquisition costs
- in-bound transportation costs
- facility investment costs
- direct and indirect manufacturing costs
- direct and indirect distribution center costs
- inventory holding costs
- inter-facility transportation costs
- out-bound transportation costs

Supply Chain Management becomes a tool to help accomplish corporate strategic objectives:

- reducing working capital,
- taking assets off the balance sheet,
- accelerating cash-to-cash cycles,
- Increasing inventory turns, and so on.

Another definition is," Supply chain strategies require a total systems view of the links in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence, costs must be lowered throughout the chain by driving out unnecessary expenses, movements, and handling. The main focus is turned to efficiency and added value, or the end-user's perception of value. Efficiency must be increased, and bottlenecks removed. The measurement of performance focuses on total system efficiency and the equitable monetary reward distribution to those within the supply chain. The supply chain system must be responsive to customer requirements."

10.1.1 Major Features of SCM

Supply chain includes:

- Material flows
- Information flows

- Financial flows

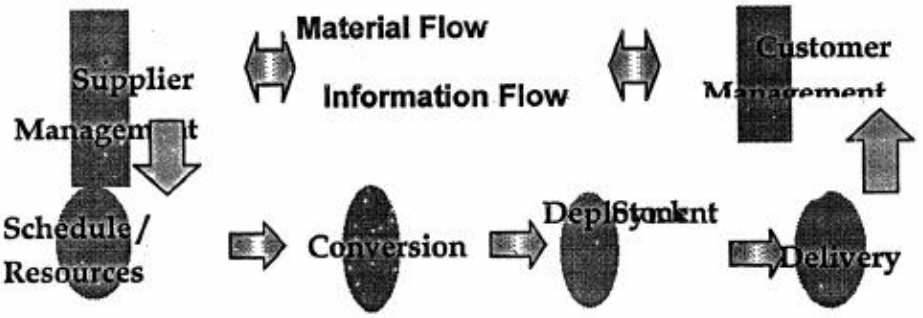

Figure2.2: Flow of information and Materials

- *Material flow.* It is in the direction from supplier to customer through the chain. It involves procurement of the materials, transformation of these materials into finished products and distribution of these finished products to the customers.
- *Financial flow.* It involves payment options, credit card information, credit terms, payment schedule etc. It is in the direction from customer to supplier as payment for products or services originates from customer and end at supplier.
- *Information flow.* In today's e- supply chain management flow of information is considered to be as significant as the flow of material and finance. It involves product information, demand forecasts, order status report, delivery report, customers' communication, etc. Information is always two-way, particularly in e-business.

10.1.2 Difficulties in SCM:

Different organizations in the supply chain may have different, conflicting objectives.

- *Manufacturers:*long run production, high quality, high productivity, low production cost.
- *Distributors:* low inventory, reduced transportation costs, quick replenishment capability.
- *Customers:* shorter order leads time, high in-stock inventory, large variety of products, low prices.
- Supply chains are *dynamic* - they evolve and change over time.

10.1.3 Two Faces of Supply Chain Management

SCM has two major faces to it.

The first can be called loosely as the back-end and comprises the physical building blocks such as the supply facilities, production facilities, warehouses, and distributors, retailers, and logistics facilities. The back-end essentially involves production, assembly, and physical movement. Major decisions here include:

- **Procurement** (supplier selection, optimal procurement policies, etc.)

- **Manufacturing** (plant location, product line selection, capacity planning, production scheduling, etc.)
- **Distribution** (warehouse location, customer allocation, demand forecasting, inventory management, etc.)
- **Logistics** (selection of logistics mode, selection of ports, direct delivery, vehicle scheduling, etc.)
- **Global Decisions** (product and process selection, planning under uncertainty, real-time monitoring and control, integrated scheduling)

The second face (which can be called the front-end) is where IT and ITEC play a key role. This face involves processing and use of information to facilitate and optimize the back-end operations. Key technologies here include: EDI (for exchange for information across different players in the supply chain); Electronic payment protocols; Internet auctions (for selecting suppliers, distributors, demand forecasting, etc.); Electronic Business Process Optimization; E-logistics; Continuous tracking of customer orders through the Internet; Internet-based shared services manufacturing; etc.

There are two type of chain : Supply Chain and Demand Chain

- The supply chain encompasses all of those activities associated with moving goods from the raw-materials stage through to the end user."
- Demand chain is defined as the system by which organizations manage sales and distribution of products and services to end users.
- Conceptually incorrect to look at demand chain separately
- Look at the pipe as a whole.and pipe is more a network and Not necessarily linear

10.1.4 Supply Chain Elements:

Strategic:

- Dealing with Supply Chain Design
- Resource Acquisition
- Long-Term Planning (1 Year ++)
- Determining the number, location and capacity of facilities
- Make or buy decisions
- Forming strategic alliances

Tactical

- Reduction/ Distribution Planning
- Resource Allocation
- Medium Term Planning (Quarterly,Monthly)
- Determining inventory levels
- Quality-related decisions

Operational

- Shipment Scheduling
- Resource Scheduling
- Short Term Planning (Weekly,Daily)
- Production planning and control decisions
- Some make or buy decisions

10.1.5 Stages of SCM

A supply chain is the collection of steps that a company takes to transform raw components into final products and deliver them to customers. Supply chain management (SCM) is the process that is used by a company to ensure that its supply chain is efficient and cost effective. This typically is comprised of five stages: planning, development, manufacturing, logistics and returns.

During the planning stage, a strategy must be developed to address how a given product will meet the needs of the customers. A significant portion of this strategy often focuses on planning a profitable supply chain. The development stage involves building a strong relationship with suppliers of the raw materials that are needed in making the product the company delivers. This phase involves not only identifying reliable suppliers but also creating methods for shipping, delivery and payment. In the next stage, the product is manufactured, tested, packaged and scheduled for delivery. Then, at the logistics phase, customer orders are received, and delivery of the goods is planned. The final stage of supply chain management is when customers can return defective products. The company also must address customer questions during this stage.SCM is a systems approach to managing the entire flow of information, materials, and services from raw materials suppliers through factories and warehouses to the end customer.

The Five Key Issues of Logistics Effectiveness are core to Supply Chain Management—

- Movement of Product
- Movement of Information
- Time / Service
- Cost
- Integration, both internal and external, both organizations and systems

10.1.6 Effects of Supply Chain Management

The initial benefits of supply chain management accrue to the customer, the initiator of his supply chain. He earns the reduction in inventories by driving out excesses inventories which he must purchase, store and be responsible for. The impact of supply chain management to the supplier may be more difficult to classify, initially, as benefits.

They may vary, but may include—

- Fewer orders initially while the customer draws down excess inventories.
- Small and more frequent orders.
- Vendor carries inventory, not the customer.
- Higher warehousing costs for picking smaller and more orders.
- Higher freight costs for shipping smaller order and more orders.
- Penalties for not meeting the customer's requirements.
- Possible loss of business for not meeting the customer's requirements.
- Additional capital expenditure to satisfy the need for information and technology to provide the base for SCM responsiveness. Supply chain management success dictates new ways of doing business for suppliers. There is no "standard" practice; no "standard" way of doing business. Instead, there is a practice for each customer.

10.1.7 Function of SCM:

Supply Chain Management department functions:

- Inventory management
- Transportation service procurement
- Materials handling
- Inbound transportation
- Transportation operations management
- Warehousing management

10.1.8 Services of Supply Chain Management:

- Operational Analysis and Design Materials Handling
- Distribution Strategy
- Operational Improvements, Distribution Management
- Computer Systems
- Warehouse Design Project Management
- Operational Commissioning
- Computer Simulation
- Technical seminars

10.1.9 Key dimensions of SCM:

The five key dimensions of supply chain management through the implementation procedure that are required to achieve superior performance.

These areas must be addressed iteratively and, generally, in a hierarchical fashion:

1. **Strategy**—specifically, the alignment of supply chain strategies with the overall business direction. Key decision points for managers here include:

- What is required to align the supply chain with the business strategy?
- What level of customer service must we provide to each customer segment to compete effectively?
- Which channels of distribution best meet our goals and our customers' needs?

2. **Infrastructure**, which affects cost-service performance and establishes the boundaries within which the supply chain must operate. Pertinent questions include:

- How must the physical network of plants and distribution be structured?
- Can we rationalise our current network?
- Can we use contract manufacturing or third-party logistics capabilities?
- What transportation services can best link together the network of facilities?
- Which activities should we outsource?

3. **Process**—the drive to achieve functional excellence and integration across all majorprocesses. Managers must ask themselves the following:

- What are the core supply chain processes driving the business?
- How can we adapt best-in-class approaches to our core processes (e.g.,
- manufacturing, integrated demand planning, procurement, cycle-time
- compression, dynamic deployment)?
- How can we build linkages with our suppliers and customers?

4. **Organisation**—providing the critical success factors of cohesion, harmony, andintegration across organisation entities. Questions to consider include:

- What level of cross-functional integration is required to manage core processes
- effectively?
- How can we leverage cross-company skills and abilities?
- What performance-measurement and reporting structure can help us achieve our objectives?

5. **Technology**, which empowers the supply chain to operate on a new level of performance and is creating clear competitive advantages for those companies able toharness it. Companies should address the following points:

- Do our IT platform and core applications software support world-class SCM?

- Where will advanced decision-support capabilities have the greatest impact on
- business performance?
- What data are required to manage the core business processes outlined above?
- How can we capitalise on advanced communications (e.g., intranets and the Internet) in managing the supply chain?
- How can we leverage enhanced visibility of customer demand and other key operating parameters?

10.1.10 Supply Chain Decisions

The decisions for supply chain management categories into two broad categary—strategic and operational. As the term implies, strategic decisions are made typically over a longer time horizon. On the other hand, operational decisions are short term, and focus on activities over a day-to-day basis. The effort in these types of decisions is to effectively and efficiently manage the product flow in the "strategically" planned supply chain.

There are four major decision areas in supply chain management:

1) location, 2) production, 3) inventory, and

4) transportation (distribution), and;There are both strategic and operational elements in each of these decision areas.

- **Location Decisions**

The geographic placement of production facilities, stocking points, and sourcing points is the natural first step in creating a supply chain. The location of facilities involves a commitment of resources to a long-term plan. Once the size, number, and location of these are determined, so are the possible paths by which the product flows through to the final customer. These decisions are of great significance to a firm since they represent the basic strategy for accessing customer markets, and will have a considerable impact on revenue, cost, and level of service. These decisions should be determined by an optimization routine that considers production costs, taxes, duties and duty drawback, tariffs, local content, distribution costs, production limitations, etc. Although location decisions are primarily strategic, they also have implications on an operational level.

- **Production Decisions**

The strategic decisions include what products to produce, and which plants to produce them in, allocation of suppliers to plants, plants to DC's, and DC's to customer markets. As before, these decisions have a big impact on the revenues, costs and customer service levels of the firm. These decisions assume the existence of the facilities, but determine the exact path(s) through which a product flows to and from these facilities. Another critical issue is the capacity of the

manufacturing facilities—and this largely depends the degree of vertical integration within the firm. Operational decisions focus on detailed production scheduling. These decisions include the construction of the master production schedules, scheduling production on machines, and equipment maintenance. Other considerations include workload balancing, and quality control measures at a production facility.

- **Inventory Decisions**

These refer to means by which inventories are managed. Inventories exist at every stage of the supply chain as either raw material, semi-finished or finished goods. They can also be in-process between locations. Their primary purpose to buffer against any uncertainty that might exist in the supply chain. Since holding of inventories can cost anywhere between 20 to 40 percent of their value, their efficient management is critical in supply chain operations. It is strategic in the sense that top management sets goals. However, most researchers have approached the management of inventory from an operational perspective. These include deployment strategies (push versus pull), control policies—the determination of the optimal levels of order quantities and reorder points, and setting safety stock levels, at each stocking location. These levels are critical, since they are primary determinants of customer service levels.

- **Transportation Decisions**

The mode choice aspect of these decisions is the more strategic ones. These are closely linked to the inventory decisions, since the best choice of mode is often found by trading-off the cost of using the particular mode of transport with the indirect cost of inventory associated with that mode. While air shipments may be fast, reliable, and warrant lesser safety stocks, they are expensive. Meanwhile shipping by sea or rail may be much cheaper, but they necessitate holding relatively large amounts of inventory to buffer against the inherent uncertainty associated with them. Therefore customer service levels, and geographic location play vital roles in such decisions. Since transportation is more than 30 percent of the logistics costs, operating efficiently makes good economic sense. Shipment sizes (consolidated bulk shipments versus Lot-for-Lot), routing and scheduling of equipment are key in effective management of the firm's transport strategy.

10.2 Modules in SCM

The specific modules included; will be selected during a short assessment conducted after the proposal is accepted.

- Overview of Supply Chain Management
- Supply Chain Organization Structure and Strategy
- Operations and Supply Chain Strategy
- SCM Processes (Purchasing, Logistics, Forecasting, Etc.)

- Sales and Operations Planning
- Managing Production across the Supply Chain (MPS, MRP, APS)
- Supply Chain Information Systems
- The Supply Chain Operation Reference (SCOR) model.
- Customer Driven Quality Management
- Capacity Management
- Supply Chain Design and Improvement Approaches (Lean Production, JIT, BPR, Six Sigma Tools, etc.)

Specialty Modules:

The specific modules included will be selected during a short assessment conducted after the proposal is accepted.

Logistics Modules:

- Transportation Network Design and Optimization
- Pack Design for Logistics
- Logistics Planning
- Warehouse Management
- Inventory Management and Optimization
- Distribution Planning and Optimization
- Global Issues in Logistics (INCO terms, freight, etc.)

Purchasing Modules:

- The Roles and Responsibilities of Purchasing
- Supplier Quality
- Supplier Selection and Qualification
- Total Cost of Ownership
- Price/Cost Management
- Negotiations for Strategic Sourcing
- Relationship Management

On-Line Learning Modules:

Web based, self-paced learning modules will be utilized in this program as pre- or post- class work for the students. The modules will be timed and synchronized with the workshops or modules as the program is configured after the assessment. All modules are presented in English or Chinese. The student can switch between either language on a slide by slide basis.

- SCM Overview
- Analyzing Supply Chain Information Flow
- Supply Chain planning
- Production Planning
- Production Optimization

- The Role of Purchasing
- Warehousing
- Warehouse Operations I
- Warehouse Operations II
- Transportation Overview
- Transportation Optimization
- Transportation Planning
- Pack Management I
- Inventory Basics
- Inventory Optimization

10.3 Customer Relationship Management

It is a strategy used to learn more about customers' needs and behaviors in order to develop stronger relationships with them.

CRM is an acronym that stands for Customer Relationship Management. It describes as:

- Strategy that a company uses to handle customer interactions.
- It is a business strategy with outcomes
- that optimize profitability, revenue and customer satisfaction
- by organizing around customer segments,
- fostering customer-satisfying behaviors and
- Implementing customer-centric processes."

10.3.1 CRM Perspectives:

- CRM at the Functional level
  - Set of processes to execute marketing functions like sales force automation or mktg. campaign management
- CRM at the Customer-facing level
  - Set of activities that provide a single-view of the customer across all contact channels
  - Customer intelligence obtained is available across all customer-facing functions
- CRM at the Organizational level - Strategic CRM
  - Knowledge about customers and their preferences have implications for the entire organization

Organizations can find their most valuable customers through "RFM" - Recency, Frequency, and Monetary value.

- How recently a customer purchased items (Recency)
- How frequently a customer purchased items (Frequency)
- How much a customer spends on each purchase (Monetary Value)

One example of a common CRM strategy is the rewards card program offered by many supermarkets. The store gives its customers a

free card that gives them access to special deals and discounts when they swipe the card during checkout. But that card also tracks everything the customer buys and allows the store to create an extremely detailed customer profile based on his or her purchasing habits. Armed with that information, the store can then offer its customers targeted coupons and other programs that will motivate its customers to buy more products from that store.

Many CRM software and/or service packages exist to help companies manage the customer relationship process. In fact, salespeople tend to think of these computer programs as the be-all and end-all of CRM. But CRM has existed for much longer than the computer in fact, it has been around in one form or another for as long as people have been buying and selling. Computers have greatlyenhanced the customer relationship management process because the key to a good CRM is uncovering and storing information about customers. The more a company knows about its customers, the better it can manage those relationships as in the above example of supermarket rewards cards.

CRM software can help by storing all this information in an easy-access format. With a typical CRM program, new leads are entered into the program's database and salespeople add notes throughout the sales cycle. It's then easy for a company to compile reports from this data that help it to design a CRM strategy that's tailored to its customers. The CRM software can also automatically send out emails to individual customers as designated by the salesperson. For example, a salesperson might program his CRM to send out a thank-you message whenever a customer reaches his or her one-year anniversary of purchase, or to send an e-card on the customer's birthday.

Once a company has collected information about a customer, the next step is training its salespeople and other employees in using that information to keep the customer relationshipstrong. Because salespeople are often the 'face' of the company, theirs is an important role in any CRM program. Frequently a customer who runs into a technical problem will phone her salesperson instead of calling up the customer service team. She already knows her salesperson and probably has good feelings about him, or she wouldn't have bought the product from him. It's safer and easier to reach out to someone she knows than to try to explain her problems to a stranger. So even after the sale is complete, salespeople often continue to speak with customers on a regular basis.

These customer interactions can be a burden for a salesperson, but they can also bring a blessing in the form of future sales. When a salesperson helps his customer overcome a difficult problem, it's much more likely that she'll get in touch with him for future purchases. And there's also a good chance that she'll send her friends and family to him as well. And this is exactly what a customer relationship

management system is trying to accomplish. It's critical that the sales team understands and implements its company's CRM strategy.

For this reason, the sales manager should make a point of keeping on top of the company's CRM strategy and should pass along any changes to the sales team immediately. She should also counsel her team on how to build and maintain a good customer relationship. Most salespeople are happy to do so once the fruits of this labor start rolling in in the form of additional sales.

10.3.2 The Evolution of CRM

Three steps in the Evolution of CRM include reporting, analyzing, and predicting

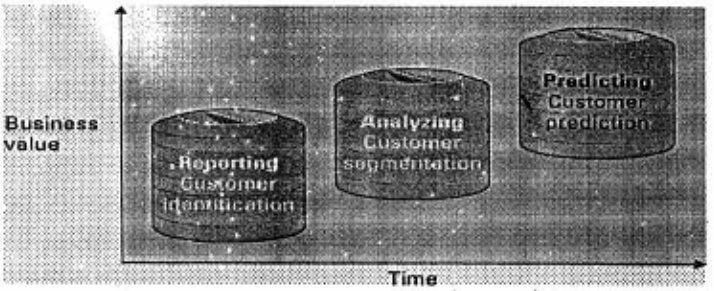

Figure Figure 2.3: Evolution of CRM

- *CRM reporting technology* – help organizations identify their customers across other applications
- *CRM analysis technologies* – help organization segment their customers into categories such as best and worst customers
- *CRM predicting technologies* – help organizations make predictions regarding customer behavior such as which customers are at risk of leaving

10.3.3 Benefits of CRM

CRM enables an organization to:

- Provide better customer service
- Make call centers more efficient
- Cross sell products more effectively
- Help sales staff close deals faster
- Simplify marketing and sales processes
- Discover new customers
- Increase customer revenues
- Customer retention
- Share of customer or share of wallet
- Cross-selling
- Up-selling

10.3.4 Success factors

CRM success factors include:

- Clearly communicate the CRM strategy
- Define information needs and flows

- Build an integrated view of the customer
- Implement in iterations
- Scalability for organizational growth

10.3.5 Future CRM trends

CRM future trends include:

- CRM applications will change from employee-only tools to tools used by suppliers, partners, and even customers
- CRM will continue to be a major strategic focus for companies
- CRM applications will continue to adapt wireless capabilities supporting mobile sales and mobile customers
- CRM suites will incorporate PRM and SRM modules

10.4 Phases of CRM

Three phases of CRM

- Acquiring New Relationships
- You acquire new customers by promoting your company's product and service leadership.
- Enhancing Existing Relationships
- You enhance the relationship by encouraging excellence in cross-selling and up-selling, thereby deepening and broadening the relationship.
- Retaining Customer Relationships
- Retention focuses on service adaptability – delivering not what the market wants but what customers want.

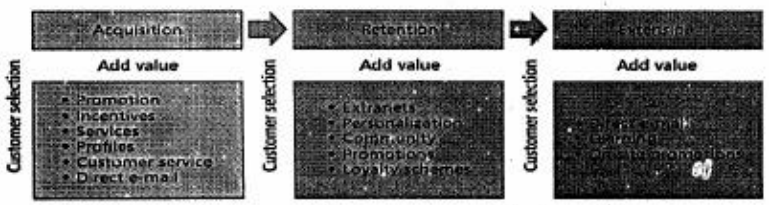

Figure 2.4: Three phases of customer relationship management

Acquisition

Acquiring customers is, means for business survival and growth; thus, the initial stage of customer relationship management is acquiring the customers to manage. This may be achieved through one or more effective marketing techniques, including advertisements, sales and events held in-store. Collect personal information and organize it into a database to keep customers abreast of future marketing efforts, therefore growing these initial customers into a loyal client base that returns to the store or website for more than one purchase. Use secure measures to keep from allowing sensitive customer information to be released.

Retention

Retaining the customers is the common "phase two" of customer relationship management, and involves the effort necessary to keep customers returning to the store for their purchases of either the same product or something similar. Companies often use this stage of CRM to create brand or company loyalty among customers. Sales associates may use marketing tactics such as VIP memberships, coupon strategies and other enticing methods of attracting the consumers to purchase additional products. This phase increases the trust that the customer grows for the business, if applicable.

Expansion

In the expansion phase of CRM, the firm attempts to widen each customer's purchasing trends by introducing him to additional product lines and persuading him to purchase other items. The customer expands his trust, preferred products, company loyalty and overall satisfaction with the company. These expanded purchases are often referred to as supplemental purchases. The goal of the company is to keep each customer purchasing the original item, the new item and all similar items.

10.4.1 Advantages and Disadvantages of CRM

Advantages:

- While company is quickly growing, customers are more satisfied as well.
- Service provided in a better way, and a quicker way.
- Sales force automated.
- Integrated customer information.
- Certain processes eliminated.
- Operation cost cut, and time efficient.
- Brand names more quickly established.
- A central database so that everyone in your company can keep track of customer contacts.
- Sales and marketing teams can benefit from having all this inside knowledge about customers.
- Let's you set up rules for distributing work throughout your company.
- Let's you pick and choose the functionality that you want.

Disadvantages:

- Organizational wise change of priority to customers.
- Significant investment of time and money.
- Threatens management's control/power struggle.
- Heightens people's resistance to change.
- Inappropriate integration leads to disaster.

10.4.2 Steps to improve CRM

1. Build a database

2. Analyze, define types, profitability
3. Customer selection
4. Activities to delight selected customers discourage others
5. Analyze again to see how we're doing

10.4.3 Cyclical Nature of CRM

The CRM model is cyclical in nature; once a customer purchases a new item and expands her trust and product loyalty with the firm, it is as if the customer was re-acquired with a new purchasing trend and product line. The company attempts to grow her interest and retain her, as in the second phase, followed by another expansion of the buying trends. The cycle keeps increasing until the customer no longer wishes to obtain other specific products from the company.

Figure2.5: CRM strategy

CRM is all about getting to know your customers and using this knowledge to form profitable relationships with them. CRM has been around in various forms as long as there have been vendors and customers. Modern CRM originated in large marketing companies from systems that served two separate areas – sales force automation and call centre management. The sales force needed information about customers so it could sell the company's products. Call centers needed information about customers so they could handle enquiries and resolve problems

Although usually separate departments with independent functions and management both areas required access to the same customer information. The original CRM systems simply captured, stored and allowed them to access to this information. Customer-driven CRM looks for answers to some very important questions:

- What will our customers buy?
- When will our customers buy?
- What will make our customers buy?
- How much will our customers pay?
- What creates value for them, and if we create value will this bond them to us?

Once it has the answers to these questions the business actually re-invents itself to provide everything that will acquire customers and

retain them. If over time the answers to the questions change, the business will change as well. In effect, the customer determines the structure and systems of the business.

To enable this to happen CRM software will continue to evolve, particularly by more integration of a business' communications channels, and by strengthening links to all sources of information within the organization.

There will be a much greater emphasis on long-term partnerships between CRM developers and their clients. CRM systems will be designed to grow as the business grows rather than requiring replacement of CRM systems at regular intervals. In the longer term it's likely that a business will restructure itself around its CRM system as the system evolves, reducing the time needed to create effective and more profitable responses to the growing amount and quality of customer information available for analysis.

10.5 Summary

Supply Chain Management is so important to gain efficiencies from procurement, distribution and logistics; to make outsourcing more efficient; to reduce transportation costs of inventories etc. It is facilitated by: Processes, Structure, Technology. Its traditional objective is to minimize total supply chain cost to meet fixed and given demand. Supply chain includes: Material flows, Information flows and financial flows. Different organizations in the supply chain may have different, conflicting objectives. There are two type of chain : Supply Chain and Demand Chain. It contains some elements which are Strategic, Tactical and Operational. There are five Key Issues of Logistics Effectiveness to Supply Chain Management: Movement of Product, movement of Information, Time / Service, Cost, Integration, both internal and external, both organizations and systems. There are five key dimensions through the implementation procedure that are required to achieve superior performance: strategy, infrastructure, process, organization and technology. The major decision areas are location, production, inventory, and transportation. There are three phases of CRM: acquiring New Relationships, Enhancing Existing Relationships and Retaining Customer Relationships.

10.6 Self Assessment Test

1. What are key SCM system characteristics?
2. Explain the general ways of how a CRM can be enhanced?
3. How CRM can be improved?
4. Explain the CRM One Order concept, and logical structure of a business transaction?
5. What tools are available to import/export data from a CRM system?

6. Define the benefits and success factors of CRM.
7. Explain the advantages and of CRM to implement in an organization.
8. Explain the function of SCM.
9. Define the stages used in SCM
10. What are the SCM goals, requirement and scope?

10. 7 Further Reading

1. Logistics and Supply Chain Management by Martin Christopher
2. Supply Chain Management: Strategy, Planning, and Operation, PHI,by Sunil Chopra and Peter Meindl
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UNIT-11 Knowledge Management and e- governance

Unit Structure

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11.2 Why is Knowledge Management Difficult?
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11.0 Objective

Knowledge management is emerging as a key concern of organizations. Enterprises are realising how important it is to "know what they know" and be able to make maximum use of the knowledge. This knowledge resides in many different places such as: databases, knowledge bases and are distributed right across the enterprise.

11.1 Introduction

Most traditional company policies and controls focus on the tangible assets of the company and leave unmanaged their important knowledge assets.

All too often one part of an enterprise repeats work of another part simply because it is impossible to keep track of, and make use of, knowledge in other parts. Enterprises need to know:

- What their knowledge assets are;
- How to manage and make use of these assets to get maximum return.

Success in an increasingly competitive marketplace depends critically on the quality of knowledge which organisations apply to their key business processes. For example the supply chain depends on knowledge of diverse areas including raw materials, planning, manufacturing and distribution. Likewise product development requires knowledge of consumer requirements, new science, new technology, marketing etc.

The challenge of deploying the knowledge assets of an organisation to create competitive advantage becomes more crucial as:

- The marketplace is increasingly competitive and the rate of innovation is rising, so that knowledge must evolve and be assimilated at an ever faster rate.
- Corporations are organising their businesses to be focused on creating customer value. Staff functions are being reduced as are management structures. There is a need to replace the informal knowledge management of the staff function with formal methods in customer aligned business processes.
- Competitive pressures are reducing the size of the workforce which holds this knowledge.
- Knowledge takes time to experience and acquire. Employees have less and less time for this.
- There are trends for employees to retire earlier and for increasing mobility, leading to loss of knowledge.
- There is a need to manage increasing complexity as small operating companies are trans-national sourcing operations.

A change in strategic direction may result in the loss of knowledge in a specific area. A subsequent reversal in policy may then lead to a renewed requirement for this knowledge, but the employees with that knowledge may no longer be there.

11.1.1 Definition

Knowledge assets are the knowledge regarding markets, products, technologies and organisations, that a business owns or needs to own and which enable its business processes to generate profits, add value, etc.

Knowledge management is not only about managing these knowledge assets but managing the processes that act upon the assets. These processes include: developing knowledge; preserving knowledge; using knowledge, and sharing knowledge.Therefore, **Knowledge management** involves the identification and analysis of available and required knowledge assets and knowledge asset related processes, and

the subsequent planning and control of actions to develop both the assets and the processes so as to fulfil organisational objectives.

Knowledge management (KM) comprises a range of strategies and practices used in an organisation to identify, create, represent, distribute, and enable adoption of insights and experiences. Such insights and experiences comprise knowledge, either embodied in individuals or embedded in organisations as processes or practices. More recently, other fields have started contributing to KM research; these include information and media, computer science, public health, and public policy. Many large companies and non-profit organisations have resources dedicated to internal KM efforts, often as a part of their business strategy, information technology, or human resource management departments. Several consulting companies also exist that provide strategy and advice regarding KM to these organisations.

'Knowledge management efforts typically focus on organisational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organisation. KM efforts overlap with organisational learning, and may be distinguished from that by a greater focus on the management of knowledge as a strategic asset and a focus on encouraging the sharing of knowledge. It is seen as an enabler of organisational learning and a more concrete mechanism than the previous abstract research.

11.2 Why is Knowledge Management Difficult?

There are many problems associated with identifying these knowledge assets and being able to use them and manage them in an efficient and cost-effective manner. Enterprises need:

- to have an enterprise-wide vocabulary to ensure that the knowledge is correctly understood;
- to be able to identify, model and explicitly represent their knowledge;
- to share and re-use their knowledge among differing applications for various types of users; this implies being able to share existing knowledge sources and also future ones;
- to create a culture that encourages knowledge sharing.

Knowledge engineering methods and tools have come a long way towards addressing the use of a company's knowledge assets. They provide disciplined approaches to designing and building knowledge-based applications. There are tools to support the capture, modelling, validation, verification and maintenance of the knowledge in these applications. However these tools do not extend to supporting the processes for managing knowledge at all levels within the organisation.

At the strategic level the organisation needs to be able to analyse and plan its business in terms of the knowledge it currently has and the

knowledge it needs for future business processes. At the tactical level the organisation is concerned with identifying and formalising existing knowledge, acquiring new knowledge for future use, archiving it in organisational memories and creating systems that enable effective and efficient application of the knowledge within the organisation. At the operational level knowledge is used in everyday practice by professional personnel who need access to the right knowledge, at the right time, in the right location.

11.3 A Knowledge Management Framework

The knowledge management framework we use was originally based on work by vanderSpek and de Hoog. It covers-

Techniques to Manage Knowledge

We believe that the knowledge modelling techniques that exist to support the use of the knowledge, along with traditional business management techniques, provide a starting point to manage the knowledge assets within a company.

Therefore the techniques we employ for managing knowledge within the organisation are drawn from these two distinct areas:

- the techniques that have been used previously from business management, for example, SWOT (Strengths Weaknesses Opportunities Threats) analysis, balanced scorecards (Kaplan, Robert S.; Norton, David P. (1996)), modelling languages such as: IDEF (Process Flow and Object State Description Capture Method, Mayer, R., Cullinane, T., de Witte, P., Knappernberger, W., Perakath, B., & Wells, S. (1992)) and RADs (Role Activity Diagrams, Ould, M. (1993));
- the knowledge techniques that have been used previously for the disciplined development of knowledge-based applications (Benus, B. (1993) and Schreiber, A. T., Akkermans, J. M., Anjewierden, A. A., De Hoog, R., Van De Velde, W., &Wielinga, B. J. (1998)).

Our recommended approach is a multi-perspective modelling approach. Several models need to be developed, each of which represents a different perspective on the organisation which can be characterised as "How, What, Who, Where, When and Why"

- How the organisation carries out its business - modelling the business processes
- What the processes manipulate - modelling the resources
- Who carries out the processes - modelling capabilities, roles and authority
- Where a process is carried out - modelling of the communication between agents
- When a process is carried out - this specifies the control over processes

Knowledge Management Roadmaps

Knowledge Asset Road Maps highlight the critical knowledge assets required by an organisation to meet market needs five to ten years in the future. They are mechanisms enabling organisations to visualise their critical knowledge assets, the relationships between these and the skills, competencies and technologies required to meet future market demands. They allow:

- individual knowledge management actions to be defined and justified in terms of their contribution to the overall aims.
- effective communication of the work and progress on the programme to the participants and observers.
- management aids for those involved in carrying out the programme and measuring its progress.
- more effective communication between users, researchers, technicians, managers and directors involved in the various aspects of the programme.
- sensible decisions to be taken on the opportunities for further exploiting the results of the programme.
- the identification of knowledge gaps that need to be filled.

The Road Map is a living document regularly updated and serves as a framework for the monitoring of the knowledge management programme. The document reflects the current state of the interrelationships between work in progress and proposed for the future and the overall milestones and aims of the programme. Our work on knowledge management road map is more fully described .

IT Support for Knowledge Management

AIAI, at the University of Edinburgh is concerned with how specific aspects of AI, namely modelling, ontologies and planning techniques can support knowledge management. These techniques allow an integrated support framework to be developed for knowledge management based on adaptive workflow techniques.

11.4 Elements of KM

KM involves processes of coding, classifying, storing, organizing, retrieving, analyzing and harvesting.

1. **Coding** – We have to identify the elements of our experience that are relevant for our learning and put them into a language that we can communicate with ourselves and others.
2. **Classifying, Organizing and Storing** –These are three very integrated processes. In our memory we can store practically infinite information, yet we frequently cannot recall them. The failure to recall is most probably not due to the loss of memory but the lost of the link to such memory. The failure of retrieval is most

likely the loss of the information about how things are stored. The analogy in IT is that when we delete a file from our hard disk, the file is not actually deleted; it is the entry in the file directory that is deleted. The data of the file still sits somewhere in the disk. Thus, the whole issue is who we would classify our knowledge, organize, and store them. Taxonomy is the term frequently used for classification. For example, social work knowledge can be classified as casework, group work, and community work; or micro and macro practices, etc.

3. **Retrieving** – The efficiency of retrieval depends very heavily on how knowledge is classified, organized and stored. In IT terms, it also depends on the power of the search engine available and the search strategy adopted by individuals.

4. **Analyzing** – This experience can be of use only if we can analyze and evaluate them. This is even more important in an organization where there is a variation in expertise. Amateur or inexperienced staff may not be able to differentiate the level of usefulness of experience and knowledge. They will rely heavily on the analysis of the experts to screen and utilize the useful information.

5. **Harvesting** – The volume of knowledge can be beyond grasp and optimal utilization. Periodical review and summarization of existing experience is necessary to make optimal use of the large volume of experience.

11.5 Multidisciplinary Nature of KM

Knowledge management draws upon a vast number of diverse fields such as:

- Organizational science.
- Cognitive science.
- Linguistics and computational linguistics.
- Information technologies such as knowledge-based systems, document andinformation management, electronic performance support systems, and database technologies.
- Information and library science.
- Technical writing and journalism.
- Anthropology and sociology.
- Education and training.
- Storytelling and communication studies.
- Collaborative technologies such as Computer Supported Collaborative Work
- and groupware, as well as intranets, extranets, portals, and other web technologies.

11.6 Key to the success of KM

1. The development of knowledge structure and taxonomy within an organization provides the platform for coding, classification, organizing and storing of information.
2. The culture of sharing is the key to success of KM. Experience sits in individuals. It requires efforts for individuals to put down their experience into codified information, such as reports, so that their experience can be accessed by others. However, having experience is one thing, but to communicate such experience it demands substantial effort to translate and present them to the others. Thus, the culture of sharing of experience is crucial to the success of the development of KM in an organization.

11.7 Types of knowledge

Knowledge in organization is often classified into two types: explicit and tacit. Explicit knowledge is knowledge that can be captured and written down in document or databases. Examples of explicit knowledge include instruction manuals, written procedures, best practices, lessons learned and research findings. Explicit knowledge can be categorized as either structured or unstructured.

Documents, databases, and spreadsheets are examples of structured knowledge, because the data or information in them is organized in a particular way for future retrieval. In contrast, e-mails, images, training courses, and audio and video selections are examples of unstructured knowledge because the information they contain is not referenced for retrieval.

Tacit knowledge is the knowledge that people carry in their heads. It is much less concrete than explicit knowledge. It is more of an "unspoken understanding" about something, knowledge that is more difficult to write down in a document or a database.

An example might be, knowing how to ride a bicycle – you know how to do it, you can do it again and again, but could you write down instructions for someone to learn to ride a bicycle? Tacit knowledge can be difficult to access, as it is often not known to others. In fact, most people are not aware of the knowledge they themselves possess or of its value to others. Tacitknowledge is considered morevaluable because it provides context for people, places, ideas and experiences. It generally requires extensive personal contact and trust to share effectively.

Old Knowledge and New Knowledge:

Most knowledge management strategies generally have one (or sometimes both) of two thrusts. The first is to make better use of the knowledge that already exists within the organization, and the second is to create new knowledge.

Making better use of the knowledge that already exists within an organization ("old" knowledge) often begins with "knowing what you know". Very often leading managers comment: "if only we knew what we knew".

Too frequently, people in one part of the organization reinvent the wheel or fail to solve a problem because the knowledge they need is elsewhere in the organization but not known or accessible to them. Hence the first knowledge management initiative of many companies is that of finding out what they know, and taking steps to Transfer StrategiesKnowledge can be transferred via:

- documents
- internet/intranet
- groupware
- databases
- knowledge bases
- face to face communication

The best ways to absorb tacit knowledge is to be present in the domain where tacit knowledge is practiced. This can be done through job rotation, job training, and on-site learning. This involves on-site decision making, absorbing the mechanics, and the heuristics as they occur, and finally coming up with a new knowledge base that emulates the domain in a unique way. However, the main limitation of such strategy is time.

11.7.1 Types of Knowledge Transfer

- Collective Sequential Transfer
- Explicit Inter team Knowledge Transfer
- Tacit Knowledge Transfer

11.8 Principles and Processes of Knowledge Management

Right knowledge, Right place, Right time:

Some people mistakenly assume that knowledge management is about capturing all the best practices and knowledge that people possess and storing it in a computer system in the hope that one day it will be useful. In fact this is a good example of what knowledge management is not about! Consider this: how often has information or knowledge been pushed at you when you don't need it -- paper, emails, training, another irrelevant meeting? Then later, when you do need it, you vaguely rememberseeing something relevant but can't find it. Some surveys suggest that professional workers spend ten per cent of their time looking for information. they know is somewhere. And if what you want is in people's heads, and they're not always around, how can you access it when you need it? What if you don't even know whose head it's in, or if they'd be willing to share it with you? In a nutshell, good knowledge

management is all about getting the right knowledge, in the right place, at the right time.

The right knowledge is the knowledge that you need in order to be able to do your job to the best of your ability, whether that means diagnosing a patient, making a decision, booking a referral, answering a patient's question, administering a treatment, training a new colleague, interpreting a piece of research, using a computer system, managing a project, dealing with suppliers etc. Information and knowledge can usually be found in a whole variety of places research papers, reports and manuals, databases etc. Often it will be in people's heads yours and other people's. The right place, however, is the point of action or decision the meeting, the patient helpline, the hospital bedside, behind the reception desk and so on. The right time is when you (the person or the team doing the work) need it.

Ways with knowledge: collecting and connecting

Knowledge management programmes tend to have both a "collecting" and a "connecting" dimension.The collecting dimension involves linking people with information. It relates to the capturing and disseminating of explicit knowledge through information and communication technologies aimed at codifying, storing and retrieving content, which in principle is continuously updated through computer networks. Through such collections of content, what is learned is made readily accessible to future users. However it has its limitations. Even where comprehensive collections of materials exist, effective use may still need knowledgeable and skilled interpretation and subsequent alignment with the local context to get effective results, just as reading a newspaper article on brain surgery does not qualify or enable a reader to conduct brain surgery. An organisation that focuses completely on collecting and makes little or no effort at connecting tends to end up with a repository of static documents.The connecting dimension involves linking people with people – specifically people who need to know with those who do know, and so enhancing tacit knowledge flow through better human interaction, so that knowledge is diffused around the organisation and not just held in the heads of a few. Connecting is necessary because knowledge is embodied in people, and in the relationships within and between organisations. Information becomes knowledge as it is interpreted in the light of the individual's understandings of the particular context. Examples of connecting initiatives include skills directories and expert directories – searchableonline staff directories that give much more detail about who does what and who knows what, collaborative working, communities of practice – networks of people with a common interest, and various "socialisation" activities . This connecting dimension tends to be the main emphasis programmes. However an organisation that focuses entirely on connecting, with little or no attempt at collecting, can be very inefficient. Such organisations may waste time in "reinventing wheels". Most knowledge management programmes aim at an integrated approach to

managing knowledge, by combining the benefits of both approaches and achieving a balance between connecting individuals who need to know with those who do know, and collecting what is learned as a result of these connections and making that easily accessible to others. For example, if collected documents are linked to their authors and contain other interactive possibilities, they can become dynamic and hence much more useful.

Ways with knowledge: people, processes and technology

One popular and widely-used approach is to think of knowledge management in terms of three components, namely people, processes and technology:

People: Getting an organisation's culture "right" for knowledge management is typically the most important and yet often the most difficult challenge. Knowledge management is first and foremost a people issue. Does the culture of your organisation support ongoing learning and knowledge sharing? Are people motivated and rewarded for creating, sharing and using knowledge? Is there a culture of openness and mutual respect and support? Or is your organisation very hierarchical where "knowledge is power" and so people are reluctant to share? Are people under constant pressure to act, with no time for knowledge-seeking or reflection? Do they feel inspired to innovate and learn from mistakes, or is there a strong "blame and shame" culture?

Processes: In order to improve knowledge sharing, organisations often need to make changes to the way their internal processes are structured, and sometimes even the organisational structure itself. For example, if an organisation is structured in such a way that different parts of it are competing for resources, then this will most likely be a barrier to knowledge sharing. Looking at the many aspects of "how things are done around here" in your organisation, which processes constitute either barriers to, or enablers of, knowledge management? How can these processes be adapted, or what new processes can be introduced, to support people in creating, sharing and using knowledge?

Technology: A common misconception is that knowledge management is mainly about technology getting an intranet, linking people by e-mail, compiling information databases etc. Technology is often a crucial enabler of knowledge management.it can help connect people with information, and people with each other, but it is not the solution. And it is vital that any technology used "fits" the organisation's people and processes otherwise it will simply not be used.

These three components are often compared to the legs of a three legged stool if one is missing, then the stool will collapse. However, one leg is viewed as being more important than the others people. An organisation's primary focus should be on developing a knowledge-friendly culture and knowledgefriendlybehaviours among its people,

which should be supported by the appropriate processes, and which may be enabled through technology.

11.9 Why is km important today?

The major business drivers behind today's increased interest in and application of KM lie in four key areas:

Globalization of business. Organizations today are more global—multisite, multilingual, and multicultural in nature.

Leaner organizations. We are doing more and we are doing it faster, but we also need to work smarter as knowledge workers, adopting an increased pace and workload.

Corporate amnesia. We are more mobile as a workforce, which creates problems of knowledge continuity for the organization and places continuous learning demands on the knowledge worker. We no longer expect to spend our entire work life with the same organization.

Technological advances. We are more connected. Advances in information technology not only have made connectivity ubiquitous but have radically changed expectations. We are expected to be "on" at all times, and the turnaround time in responding is now measured in minutes, not weeks.

11.9.1 KM for Individuals, Communities, and Organizations

Knowledge management provides benefits to individual employees, to communities of practice, and to the organization itself. This three-tiered view of KM helps emphasize why KM is important today

For the **individual**, KM:

* Helps people do their jobs and save time through better decision making and problem solving.
* Builds a sense of community bonds within the organization.
* Helps people to keep up to date.
* Provides challenges and opportunities to contribute.

For the **community** of practice, KM:

* Develops professional skills.
* Promotes peer-to-peer mentoring.
* Facilitates more effective networking and collaboration.
* Develops a professional code of ethics that members can follow.
* Develops a common language.

For the **organization**, KM:

* Helps drive strategy.
* Solves problems quickly.
* Diffuses best practices.
* Improves knowledge embedded in products and services.
* Cross-fertilizes ideas and increases opportunities for innovation.

* Enables organizations to stay ahead of the competition better.
* Builds organizational memory.

11.10 What is E-Governance?

It is the use of a range of modern Information and Communication Technologies such as Internet, Local Area Networks, mobiles etc. by Government to improve the effectiveness, efficiency, service delivery and to promote democracy.

E-Governance is the application of Information and Communication Technology (ICT) for delivering Government Services, exchange of information, communication transactions, integration various stand-alone systems and services between Government and Citizens (G2C), Government and Business (G2B) as well as back office processes and interactions within the entire Government frame work.

11.11 Types of E- governance

- G2C (Government to Citizens)
- G2B (Government to Businesses)
- G2E (Government to Employees)
- G2G (Government to Governments)
- C2G (Citizens to Governments)

Through the e-Governance, the Government services will be made available to the citizens in a convenient, efficient and transparent manner. The Government being the service provider, it is important to motivate the employees for delivering the services through ICT. To achieve this, the Government employees are being trained on technology and started realising the advantage of ICT. The aim is to make them thorough with e-Governance applications and responsive to the technology driven administration.

Evolution of e-Governance is a highly complex process requiring provisioning of hardware, software, networking, process-re-engineering and change management. In a truly e-Governed system, there should be minimal human intervention and decision on cases. It should be 'system driven' rather than 'individual driven', thereby curtailing the scope for subjective interpretation in the process of disposal of cases, particularly routine cases.

Governance: An Information perspective

- Representative democracy relies on supposition that best way to make a decision is wider participation for all its citizens having access to relevant information.
- Government is by nature an information intensive organization.
- Information is power and information management is political.

Governance in IT framework

- Expansion of Internet and electronic commerce, is redefining relationships among various stake holders in the process of Governance.
- A new model of governance would be based upon the transactions in virtual space, digital economy and dealing with knowledge oriented societies.
- Electronic Governance is an emerging trend to re-invent the way the Government works.

E-Governance Focus on:

- Greater attention to improve service delivery mechanism
- Enhancing the efficiency of production
- Emphasis upon the wider access of information

11.12 E-Governance vs. E-Government

"Government's foremost job is to focus society on achieving the public interest."

"Governance is a way of describing the links between government and its broader environment - political, social and administrative."

GOVERNMENT	GOVERNANCE
Superstructure	Functionality
Decisions	Processes
Rules	Goals
Rules	Performance
Implementation	Coordination
Outputs	Outcomes
e-Government	**e-Governance**
electronic service delivery	electronic consultation
electronic workflow	electronic controllership
electronic voting	electronic engagement
electronic productivity	networked societal guidance

Table: 3.1 Difference between e-governance and e- government

11.13 Why e-Governance?

E-Government can transform citizen service, provide access to information to empower citizens, enable their participation in government and enhance citizen economic and social opportunities, so that they can make better lives, for themselves and for the next generation.

11.14 Challenges in e-governance

- Trust

- Resistance to change
- Digital Divide
- Cost
- Privacy and Security

11.15 Information Access and Service Delivery models of e-governance

- Broadcasting Model
- Critical Flow Model
- Comparative Analysis Model
- Interactive Service Model

11.16 Issues in the e-governance implementation

Technology Issues

- Three basic elements
- infrastructure layer
- application layer
- integration technology
- Application layer is made up of software and services that either extend the site's performance or make it easier to manage.
- The integration layer is to use the Internet to tie together practically all the traditional disciplines associated with various services provided by the web site.

Infrastructure layer

Carrier

- Basic element by which site is connected to the internet.
- ISPs provide internet connection and bandwidth required for the sites.

Hosting centre

- specially designed rooms for equipment. E-governance also. looking for such specially designed rooms which are cost effective and efficient.

Three more layers of infrastructure are needed for the better performance of the web sites load balancing, security layer, and caching.

Basic Application Layer

- Content management system makes it easy to create and organize web content
- Personalization system stores the visitor/ citizen profile while they visit the site.
- Transaction engine allows the visitor to configure his/her request and facilitates to pay by credit card or other means.

- Site analysis system stores information such as how many visitors came in every month.
- Campaign management system goes beyond the site analysis and helps to launch certain marketing efforts.
- Customer support system gives a helping hand to a visitor who has trouble using a site.

Integration technology

- Application integration enables the user to talk with the "legacy" system.
- Sales integration collects all sales data in various government centers in real time and provides remarkable opportunities to forecast and track the visitors.
- Once the transactions are completed over the web, the transaction details are to be plugged into accounting system. This is facilitated by financials system

Application software

- The three-step method is proposed
- Where are we
- Where we want to go
- How do we get there

Management of Change related Issues

- Important to investigate how the business of government and the nature of governance itself change in the digital networking conomy.

11.17 E-Governance Projects in india

- E-Seva(electronic Seva)in Andhra Pradesh
- E-Sampark in Chandigarh
- E-Mitra in Rajasthan
- E-Mamta (Mother & Child Tracking System) in Gujrat
- ePension (Pension Disbursement System) in Himachal Pradesh
- Suwidha (Single User Window Disposal Help Line for Application) in Panjab
- Gyandoot in Madhya Pradesh
- KHAJANE (Online Treasury System) in Karnataka
- LokMitra in Himachal Pradesh

11.18 Summary

The knowledge management is a techniques to Manage Knowledge, Knowledge Management Roadmaps, IT Support for Knowledge Management. KM involves processes of coding, classifying, storing, organizing, retrieving, analyzing and harvesting. KM is Multidisciplinary in Nature. Knowledge in organisation is often classified into two types: explicit and tacit. There are several principles of it e.g. Right knowledge,

Right place, Right time. The major business drivers behind today's increased interest in and application of KM lie in four key areas: *Globalization of business, Leaner organizations, corporate amnesia and Technological advances. It* provides benefits to individual employees, to communities of practice, and to the organization itself. This three-tiered view of KM helps emphasize why KM is important today. E-Governance is the application of Information and Communication Technology (ICT) for delivering Government Services, exchange of information, communication transactions, integration various stand-alone systems and services between Government and Citizens (G2C), Government and Business (G2B) as well as back office processes and interactions within the entire Government frame work. There are several issues in the e-governance implementation. Some popular E-Governance projects in india are E-Seva (electronic Seva) in Andhra Pradesh, E-Sampark in Chandigarh, E-Mitra in Rajasthan etc.

11.19 Self Assessment Test

1. What is knowledge management? Define its key elements.
2. Differentiate e-governance with e- government the types of e-governance
3. What is E-Governance? And why e-governance is used?
4. What are the types of knowledge and explain the importance of knowledge management in to-days life.
5. What are the main Issues in the e-governance implementation?
6. Give the name of four real projects in India.

11.20 Further Readings

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2. E - Governance: Concepts and Case Studies, PHI ,by C.S.R
3. Corporate Governance: Principles, Polices and Practices, 2/e, Pearson Publication, by A.C. Fernandox
4. Knowledge Management : Enabling Business Growth, TMH, Ganesh Natarajan , Sandhya Shekhar

UNIT-12 Nature of IT decision

Unit Structure

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12.2 Strategic Decision
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13.7 Self Assessment Test
13.8 Further Reading

12.0 Objective

Making effective decisions, as well as recognizing when a bad decision has been made and quickly responding to mistakes, is a key ingredient in organizational effectiveness.Some experts believe that decision making is the most basic and fundamental of all managerial activities. Decision making is most closely linked with the Planning function. However, it is also part of Organizing, Leading and Controlling.

12.1 Introduction

The choice of IT makes a qualitative diff in the decision making process Wrong choice of IT would kill a good MIS design IT choice is governed by the requirement of the mission critical application of the org The IT affects the people, the processes & productivity of the org The choice of IT is a strategic decision making for long term impact on the effectiveness of the MIS.

Determining the impact of information technology ("IT") on non-profits' organizational structure and outcomes has become a crucial task for non-profit's and grant makers. With the speed of communications and the pace of business constantly on the increase, non-profit's and grant makers need to know how technology is affecting them and their grantees—what they need, what they could be doing better, whether their

IT systems are helping or hindering them in achieving their missions. But certain knowledge of the impact of technology on an organization or a program is like a pot of gold at the end of the rainbow: its value is obvious, and it looks easy to find, but the path toward it is hazy and ephemeral.

12.2 Strategic Decision

One of the essential parts of creating and running a small business is creating a mission or vision for the business and a set of goals the company aims to achieve. Strategic decision making, or strategic planning, describes the process of creating a company's mission and objectives and deciding upon the courses of action a company should pursue to achieve those goals.

12.2.1 Strategic Decision Making

Strategic deals with the long-run future of the entire organization and have three characteristic

1. *Rare*- Strategic decisions are unusual and typically have no precedent to follow.
2. *Consequential*-Strategic decisions commit substantial and demand a great deal of Commitment.
3. *Directive*- Strategic decisions set precedents for lesser decisions and future actions throughout the organization.

Four decision making conditions

Certainty

- decision makers know which objectives they want to achieve
- alternatives are clearly defined
- knowledge of outcomes is complete
- all information needed is fully available

Risk

- *decision makers know which objectives they want to achieve*
- *alternatives are clear*
- *likelihood of outcomes is subject to chance*
- good information is available

Uncertainty

- decision makers know which objectives they want to achieve
- alternatives are incomplete
- likelihood of outcomes is not understood
- information is incomplete

Ambiguity

- objectives to be achieved are not clear
- alternatives are difficult to define
- information about outcomes is unavailable

12.2.2 Strategic Planning Basics

Strategic decision making is an on-going process that involves

creating strategies to achieve goals and altering strategies based on observed outcomes. For example, the managers of a pizza restaurant might have the objective of increasing sales and decide to implement a strategy of offering lower prices on certain products during off hours to attract more customers. After a month of pursuing the new strategy, managers can look at sales data for the month and evaluate whether the strategy resulted in increasing sales and then choose to keep the new price scheme or alter their strategy.

SWOT Analysis

A SWOT analysis is a common strategic planning tool that managers can use to examine internal and external factors that may influence the ability to achieve goals. A SWOT analysis involves creating a list of a business's strengths and weaknesses and the external threats and opportunities it faces. Identifying strengths, weaknesses, opportunities and threats can help managers create strategies to exploit strengths or minimize weaknesses to take advantage of opportunity and avoid threats.

Cost-Benefit Analysis

A cost-benefit analysis is a strategic decision making tool that can help managers choose between two or more different courses of action. In a cost-benefit analysis, managers estimate the amount of revenue they expect a certain project to generate and the expected costs of pursuing the project. By estimating the costs and benefits associated with several different projects, managers can determine which project is expected to produce the greatest benefit.

Outside Advice

While entrepreneurs and small business owners may be experts in their chosen industry, they are often not experts in actually managing businesses. Business owners often seek outside help to aide in the strategic decision making process. The Small Business Administration says that mentors can be a vital source of advice for small business owners. Some businesses hire professional consultants to help them make strategic decisions.

Observable Behaviour In Making Sound Decisions:

The following actions have been observed in effective decision-making.

1. Gather information before making a decision.
2. Cross check information sources for agreement.
3. Identify alternatives/contingencies so that possible solutions may be explored.
4. Discuss consequences of decisions in an effort to enhance the decision-making process.
5. Provide the rationale for decisions

Following steps are strategic decision-making process is proposed

1. Evaluate current performance results
2. Review corporate governance

3. Scan the external environment
4. Analyze strategic factors (SWOT)
5. Generate, evaluate and select the best alternative strategy
6. Implement selected strategies
7. Evaluate implemented strategies

Managers in charge of strategic decision-making are capable of providing only satisfactory solutions to problems. Most human decision makers "whether individual or organizational, are concerned with the discovery and selection of satisfactory alternatives; only in exceptional cases are concerned with the discovery and selection of optimal alternatives" As a result, it appears that strategy must deal with that appears to satisfy a basic set of criteria

Decision-making under uncertainty is the central idea in strategy and it consists of lots of strategic decisions.

The development of effective and successful strategies requires the development of three organizational skills:

- anticipating the shape of the uncertain future. This is no easy task since uncertainty involves not only uncertainty about the probabilities of the alternatives available, but also uncertainty about the probability distribution itself;
- generating new alternatives for strategic decisions (i.e. through the role of imagination and intuition in decision making);
- implementing new decisions to make adaptation more effective. Adaptation refers not only the level of the organization adapting to its environment, but also at the individual level ("What a person wants and wants and likes")

Strategic planning is an organizational management activity that is used to set priorities, focus energy and resources, strengthen operations, ensure that employees and other stakeholders are working toward common goals, establish agreement around intended outcomes/ results, and assess and adjust the organization's direction in response to a changing environment. It is a disciplined effort that produces fundamental decisions and actions that shape and guide what an organization is, who it serves, what it does, and why it does it, with a focus on the future. Effective strategic planning articulates not only where an organization is going and the actions needed to make progress, but also how it will know if it is successful.

Strategic management is the comprehensive collection of ongoing activities and processes that organizations use to systematically coordinate and align resources and actions with mission, vision and strategy throughout an organization. Strategic management activities transform the static plan into a system that provides strategic performance feedback to decision making and enables the plan to evolve and grow as requirements and other circumstances change.

12.2.3 Steps in Strategic Planning & Management

There are many different frameworks and methodologies for strategic planning and management. While there is no absolute rules

regarding the right framework, most follow a similar pattern and have common attributes.

1. analysis or assessment, where an understanding of the current internal and external environments is developed,
2. strategy formulation, where high level strategy is developed and a basic organization level strategic plan is documented
3. strategy execution, where the high level plan is translated into more operational planning and action items, and
4. Evaluation or sustainment / management phase, where ongoing refinement and evaluation of performance, culture, communications, data reporting, and other strategic management issues occurs.

12.3 Configuration Design

Configuration design is a kind of design where a fixed set of predefined components that can be interfaced (connected) in predefined ways is given, and an assembly of components selected from this fixed set is sought that satisfies a set of requirements and obeys a set of constraints. It includes the design of Data type, Data Volume, RDBMS & 4GL Process Speed, Data Sharing, Query processing, Interface & gateways, security & Integrity, Comm. Protocol ,Storage capacity, I/O operations

The associated *design configuration problem* consists of the following three constituent tasks:

1. **Selection** of components,
2. **Allocation** of components, and
3. **Interfacing** of components (design of ways the components interface/connect with each other).

Types of knowledge involved in configuration design include:

- Problem-specific knowledge:
- Input knowledge:
- Requirements
- Constraints
- Technology
- Case knowledge
- Persistent knowledge (knowledge that remains valid over multiple problem solving sessions):
- Case knowledge
- Domain-specific, method-independent knowledge
- Method-specific domain knowledge
- Search-control knowledge

There are two major parts of the configuration design: Physical Design and Parametric Design.

- What is the Physical Design process? It is the design step to convert the Conceptual Design into realizable physical elements: circuits, software, mechanical structures, etc.

- What is a Parametric Design process? It is the design step to specify the physically variable parameters: dimensions, voltage levels, current levels, operating frequencies,

12.4 Evaluation

Evaluation is the process of analyzing, reflecting upon, and summarizing assessment information, and making judgments and/or decisions based on the information collected. Evaluation:

- tests usability and functionality of system
- occurs in laboratory, field and/or incollaboration with users
- evaluates both design and implementation
- should be considered at all stages inthe design life cycle

12.4.1 Goals of Evaluation

- assess extent of system functionality
- assess effect of interface on user
- identify specific problems

12.4.2 Principles of Evaluation

Evaluation should be

1. Based on clearly stated objectives
2. Comprehensive
3. Cooperative
4. Used Judiciously
5. Continuous and integral part of the teaching – learning process

12.4.3 Key features for Evaluating Information Technology

1. Begin evaluation efforts with a "theory of change". A clear understanding of staffexpectations of the difference new information technology will make in their work and theirproduction is a fundamental component of evaluation. This theory of how things will be better becomes the baseline against which results are measured.

2. Clarity of purpose is critical to success. What is technology expected to do, why, and forwhom are questions that need to be asked and answered often by a group of key constituents including staff, end users, board, and funders.

3. Define the scope of your efforts. There also needs to be a clear understanding of the limitations of internal capacity building—staff may be able to receive more calls from clients, or more efficiently refer clients to other resources, but this does not automatically mean that clients will be better served or better off.

4. A basic grounding in information technology is a prerequisite. We have found that in order to successfully engage in this conversation it is essential that key players have at least aworking knowledge of the promises and limitations of information technology.

5. Trusted, impartial technical assistance can make all the difference. The presence of a trusted technical assistance (TA) advisor,

such as a circuit rider, is enormously helpful as part of this conversation for smaller nonprofits without the in-house expertise to make educated purchasing decisions. It's important that an advisor not be perceived as having something to sell—nonprofits need access to TA experts whose advice isn't motivated by self-interest.

6. Technology is useless without training. Perhaps the most important key to the success of technology efforts is that nonprofit organizations must have adequate and ongoing training to use the new tools at their disposal.

12.4.5 Types of evaluation

As we developed diff choices of IT & its configuration, then the decision making enters into the evaluation phase for selection. The selection criteria for Evaluation would have diff dimensions to be satisfied simultaneously.

These dimensions are as follows;

1. Technical Evaluation
2. Operational Feasibility
3. Financial Consideration

Technical Evaluation; TE deals with the testing parameters, such as data transfer needs, the response level connectivity of the diff H/W platforms, degree of performance TE confirms the IT approach to the info processing needs of the org It helps to break down the H/W on a time scale It is necessary to select the latest technology in all areas of info processing TE planned by scheduling the activities such as bench marking & brain storming session for selection of vendors specifications

Operational Feasibility; OF evaluation considers the people – related issues & whether the systems & the procedures of the org are complementary & conducive The environment must support proper implementation of a IT The short coming on people side lack of subject knowledge, ability to absorb the technology & use it efficiently & effectively The modern IT needs sophisticated back-up of the data at a requisite point & time.

Financial Consideration ; All the options can be evaluated in terms of the investment All business investments are evaluate in terms of ROI The IT investments are difficult to judge on the

12.5 IT Implementation Plan

Implementation of the technology is a complex task & needs detailed & Careful planning for successful implementation. It is necessary to prepare a plan of implementation; The IT Implementation Plan provides an overview of the processes the system is intended to support. If the system is a database, provide a description of the type of data maintained, sources and uses of that data. Include any identification numbers, titles, abbreviations, version numbers and release numbers to describe the system.

The IT Implementation Plan is now available in electronic form which is really a Web interface to a database of TIP data. Using this the

Project Coordinators can if they wish provide the information on behalf of all the project partners, or they can simply start and ask the individual partners to complete the information about their own results and exploitation plans.

The Implementation Plan describes the assumptions made regarding the development and execution of this document as well as the applicable constraints. Some items to consider when identifying the assumptions and constraints are:

- o Schedule
- o Budget
- o Resource availability and skill sets
- o Software and other technology to be reused or purchased
- o Constraints associated with product interfaces

System Organization

The Implementation Plan provides a description of the system structure and the major system components essential to its implementation. It should describe both hardware and software, as appropriate. Charts, diagrams, and graphics may be included as necessary to provide a clear picture of the system.

12.5.1 Major Task

The IT Implementation Plan provides descriptions of the major system implementation tasks. The tasks described in this section are not site-specific, but generic or overall project tasks that are required to install hardware, software, and databases, prepare data and validate the system

If several implementation approaches are being reviewed, then identify the advantages, disadvantages, risks, issues, estimated time frames, and estimated resource requirements for each option considered. These options could include:

- Incremental implementation or phased approach
- Parallel execution
- One-time conversion and switchover
- Any combinations of the above.

Include the following information for the description of each major task, if appropriate:

- What the task will accomplish
- Resources required to accomplish the task
- Key person(s) responsible for the task
- Criteria for successful completion of the task (e.g., "user acceptance")

Examples of major tasks are the following:

- Provide overall planning and coordination for the implementation
- Provide appropriate training for personnel
- Ensure that all manuals applicable to the implementation effort are available when needed

- Provide all needed technical assistance
- Schedule any special computer processing required for the implementation
- Perform site surveys before implementation
- Ensure that all prerequisites have been fulfilled before the implementation date
- Provide personnel for the implementation team
- Acquire special hardware or software
- Perform data conversion before loading data into the system
- Prepare site facilities for implementation

Consider addressing the changes that may be necessary once the system has been implemented. These changes may include, but are not limited to, personnel and technology equipment alignment, and contractor support.

12.5.2 Implementation Schedule

The Implementation Plan provides a schedule of activities to be accomplished.

Security and Privacy

The Implementation Plan includes an overview of the system security and requirements that must be followed during implementation. If the system contains personal data, describe how Privacy Act concerns will be addressed.The Implementation Plan provides an overview and discussion of the security features that must be addressed when it is implemented. It should include the determination of system sensitivity and the actions necessary to ensure that the system meets all the criteria appropriate to its Certification level.

Implementation Support

The Implementation Plan describes the support hardware, software, facilities, and materials required for the implementation, as well as the documentation, necessary personnel and training requirements, outstanding issues and implementation impacts to the current environment.

Documentation

The subsection of the Project Implementation Plan lists any additional documentation needed to support the deliverable system.

Personnel

Like: Staffing Requirements(**number of personnel, length of time needed, types of skills, skill levels, expertise**),Training of Implementation Staff

Outstanding Issues

This subsection of the Project Implementation Plan states any known issues or problems relevant to implementation planning. This section answers the question, "Are there any specific issues, restrictions or limitations that must be considered as a part of the deployment?"

Implementation Impact

This subsection of the Project Implementation Plan describes how the system's implementation is expected to impact the network infrastructure, support staff, user community, etc. Include any references to Service Level Agreements which describe the performance requirements, availability, security requirements, expected response times, system backups, expected transaction rates, initial storage requirements with expected growth rate, as well as help desk support requirements.

Performance Monitoring

This subsection of the Project Implementation Plan describes the performance monitoring tool, techniques and how it will be used to help determine if the implementation is successful.

Configuration Management Interface

This subsection of the Project Implementation Plan describes Configuration Management, such as when versions will be distributed. Reference the Configuration Management Plan.

Implementation Requirements by Site

Site Name or Identification

This section of the Implementation Plan identifies the site by name, location and ownership.

Site Requirements(hardware, software, database, data and facilities requirement)

Site Implementation Details:

This part of Implementation Plan addresses the specifics of the implementation for this site. Include a description of the implementation team, schedule, procedures, and database and data updates.The following are examples of information to be included:

- o Control inputs
- o Operating instructions
- o Database data sources and inputs
- o Output reports
- o Restart and recovery procedures

Risks and Contingencies

This subsection of the Implementation Plan identifies the risks and specific actions to be taken in the event the implementation fails or needs to be altered at any point and includes the factors to be used for making the decision.

Implementation Verification and Validation

The Implementation Plan describes the process for ensuring that the implementation was not poorly executed. It describes how any noted discrepancies will be rectified.

Acceptance Criteria

This subsection of the Project Implementation Plan establishes the exit or acceptance criteria for transitioning the system into

production. Identify the criteria that will be used to determine the acceptability of the deliverables as well as any required technical processes, methods, tools, and/ or performance benchmarks required for product acceptance.

12.6 Summary

One of the essential parts of creating and running a small business is creating a mission or vision for the business and a set of goals the company aims to achieve. Strategic decision making, or strategic planning, describes the process of creating a company's mission and objectives and deciding upon the courses of action a company should pursue to achieve those goals. Strategic deals with the long-run future of the entire organization and have three characteristic: rare, consequential and directive.

Strategic planning includes swot analysis, cost-benefit analysis and outside advice. Evaluation is the process of analyzing, reflecting upon, and summarizing assessment information, and making judgments and/ or decisions based on the information collected. Implementation of the technology is a complex task & needs detailed & Careful planning for successful implementation. The IT Implementation Plan provides descriptions of the major system implementation tasks.

12.7 Self Assessment Test

1. What is strategic decision? Does it always help in the success of organisation / business?
2. What is strategic management? Write some characteristics of strategic decision.
3. What are the prerequisite of strategic planning?
4. Is implementation plan helps in any project andHow?
5. What is evaluation, its goal and principles? Define the major task of evaluation.
6. Define the term Configuration plan.

12.8 Further Readings

1. Strategic Management, Alex Miller, Irwin McGraw Hill
2. Strategic Management-The Indian Context, R. Srinivasan, PHI
3. Strategic Management : Concepts & Cases, 13/E, PHI Learning Pvt. Ltd, David F R
4. Business Policy And Strategic Management: Concepts And Applications (English) 2nd Edition ,PHI, Gupta Vipin, Gollakota

Block 4

SECURITY AND ETHICAL CHALLENGES

Unit 13 5
Ethical Responsibilities of Business Professionals - Business Technology

Unit 14 17
Computer Crime - Hacking, Cyber theft, unauthorized use at work, Cyber terrorism

Unit 15 29
Software and intellectual property : Privacy - Issues and the Internet Privacy : challenges

Unit 16 44
Ergonomics, Health and Social Issues, Working Condition.

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परिमापक

अनुवाद की स्थिति में

मूल लेखक	अनुवाद
मूल सम्पादक	भाषा सम्पादक
मूल परिमापक	परिमापक

सहयोगी टीम

संयोजक Dr. Gaurav Sankalp, SoMS, UPRTOU, Allahabad

Block Introduction

Block four comprises of four units. Unit thirteen deals wih Ethical responsibilities of business professionals- business technology. Unit fourteen deals with computer crime, hacking, Cyber theft, unauthorized use at work and cyber terrorism. Unit fifteen deals with software and Intellectual property , privacy and various issues of privacy. Unit sixteen deals with Ergonomics, Health and Social issues and working condition.

UNIT-13 Ethical Responsibilities of Business Professionals

Unit Structure

13.0 Objective
13.1 Introduction
13.2 Business Ethics and Social Responsibility
13.3 Ethical Responsibilities of Business Professional
13.3.1 Responsibilities of Business
13.3.2 Responsibility to Share Holders
13.3.3 Responsibility to Employees
13.3.4 Responsibility to Consumers
13.3.5 Responsibility to Community
13.4 Few Environmental Concerns
13.5 Ethical Issues
13.6 Recognizing Ethical Issues in Business
13.7 How to Implement Business Ethics
13.8 Issues involved in Internet Ethics
13.8.1 Ethical issues in disseminating information on the Internet
13.9 Summary
13.10 Self Assessment Test
13.11 Further Readings

13.0 Objectives

Ethics in business are nothing but the do's and don'ts by the business users in the business. In other words it could be referred as set of principles a business man ought to follow.

13.1 Introduction

"There should be business ethics" means that the business should be conducted according to certain self-recognized moral standards. Few unethical elements in the present day business are cheating, stealing, lying, bribing, corrupting etc.

A business man should be aware of the ethics in the business and should follow them in order to maintain ecological balance in the society.

13.2 Business Ethics and Social Responsibility

Business Ethics is the principles and standards that determine acceptable conduct in business organizations. The acceptability of behaviour in business is determined by customers, competitors, government regulators, interest groups, and the public, as well as each individual's personal moral principles and values.

The study and examination of moral and social responsibility in relation to business practice and decision making in business is known as "Business Ethics". The term "business" is commonly referred to the commercial activities achieved at making profit. But gradually there is a substantial change in the way in which people viewed the business.

In the past primary objective of a business was profit maximization but the present perspectives on business objective is not maximization. It is profit maximization in long run besides fulfilling the ethics in the business. A business is regarded as social institution forming integral part of social systems.The business is viewed as subsystem to the social system.

This is because any type of social system is influenced by

1. The way the business functions
2. The organization of the business
3. Innovations
4. Transmission and diffusion of information.
5. New ideas etc.

They have either direct or indirect effect on the society.

Many consumers and social advocates believe that businesses should not only make a profit but also consider the social implications of their activities. Earlier we define social responsibility as a business's obligation to maximize its positive impact and minimize its negative impact on society. Although many people use the terms *social responsibility* and *ethics* interchangeably, they do not mean the same thing. Business ethics relates to an *individual's* or a *work group's* decisions that society evaluates as right or wrong, whereas social responsibility is a broader concept that concerns the impact of the *entire business's* activities on society. From an ethical perspective, for example, we may be concerned about a health care organization or practitioner overcharging the provincial government for medical services. From a social responsibility perspective, we might be concerned about the impact that this overcharging will have on the ability of the health care system to provide adequate services for all citizens.

The most basic ethical and social responsibility concerns have been codified as laws and regulations that encourage businesses to conform to society's standards, values, and attitudes. At a minimum, managers are expected to obey these laws and regulations.

Most legal issues arise as choices that society deems unethical, irresponsible, or otherwise unacceptable. However, all actions deemed unethical by society are not necessarily illegal, and both legal and ethical concerns change over time. Business law refers to the laws and regulations that govern the conduct of business. Many problems and conflicts in business can be avoided if owners, managers, and employees know more about business law and the legal system. Business ethics, social responsibility, and laws together act as a compliance system requiring that businesses and employees act responsibly in society.

There are good business reasons for a strong commitment to ethical values:

1. Ethical companies have been shown to be more profitable.
2. Making ethical choices results in lower stress for corporate managers and other employees.
3. Our reputation, good or bad, endures.
4. Ethical behaviour enhances leadership.
5. The alternative to voluntary ethical behaviour is demanding and costly regulation.

It is important to understand that business ethics goes beyond legal issues. Ethical conduct builds trust among individuals and in business relationships, which validates and promotes confidence in business relationships. Establishing trust and confidence is much more difficult in organizations that have established reputations for acting unethically.

13.3 Ethical Responsibilities of Business Professionals

13.3.1 Responsibilities of Business

A firm expresses its responsibility to the society by reacting in either or both of the following two ways.

1. The manner in which it carries out its own business activities
2. The welfare activities it takes upon itself as an additional function

13.3.2 Responsibility to Share Holders

1. To make the shareholders feel secured by protecting their investments
2. To be transparent
3. To allow them to participate in decision making
4. To ensure them good dividends

13.3.3 Responsibility to Employees

1. To offer employees fair wages
2. To establish better working conditions
3. To provide them fair work standards and norms.
4. To provide labour welfare activities

5. To educate the employees by adopting proper training methods.
6. To recognize and appreciate the work of the employees and reward them or to promote them.
7. To install grievance handling cell.
8. To enable them to involve in decision making.

13.3.4 Responsibility to Consumers

To improve the efficiency of the business by

a) Increasing productivity.
b) Improving quality.
c) Suroothening distribution system.

1. To offer the products at reasonable prices.
2. To provide pre-purchase and post purchase service to the consumers.
3. To facilitate research and development to meet the customer requirements.
4. To maximize imperfections in distribution systems
5. To provide sufficient and unnecessary information about the product.

13.3.5 Responsibility to Community

1. To be pollution free and maintain ecological balance.
2. To invest more in research and development so as to improve the standard of living of the society.
3. To develop alternative recourses thereby preventing current resources being used from exhaustion.
4. To improve the efficiency of business operations.
5. To include in social welfare activities
6. To contribute to national effort to build up a better society If a firm fulfils all the above mentioned responsibilities then it is said to be following the business ethics. But in practice such an ideal business doesn't exist.

13.4 Few Environmental Concerns

One important factor a business man must not neglect is his responsibility to environment. The abundant natural resources are getting exhausted after 19th century due to rapid industrialization.

Animal Rights

One area of environmental concern in society today is animal rights. Probably the most controversial business practice in this area is the testing of cosmetics and drugs on animals that may be injured or killed as a result. Animal-rights activists, such as People for the Ethical Treatment of Animals, say such research is morally wrong because it

harms living creatures. Consumers who share this sentiment may boycott companies that test products on animals and take their business instead to companies, which do not use animal testing.

The uses of fur for luxury coats and skin for decoration purpose have been controversial for many years.

Land

The worst affected are as their cattle starve and they travel even in creasingdistance for grazing due to industrialization and urbanization

Pollution

Water pollution results from dumping toxic chemicals and raw sewage into rivers and oceans, oil spills, and the burial of industrial waste in the ground where it may filter into underground water supplies. Fertilizers and insecticides used in farming and grounds maintenance also run off into water supplies with each rainfall. Water pollution problems are especially notable in heavily industrialized areas.

Though people are keen in this issue by constructing dams and reservoirs the biproducts and industry waste couldn't find a better discharge channel than this. Hence sure measure must be taken in this context to keep the water free from pollution.

Air pollution is usually the result of smoke and other pollutants emitted by manufacturing facilities, as well as carbon monoxide and hydrocarbons emitted by motor vehicles. In addition to the health risks posed by air pollution, when some chemical compounds emitted by manufacturing facilities react with air and rain, acid rain results.

Acid rain has contributed to the deaths of many valuable forests and lakesin North America as well as in Europe. Air pollution may also contribute to theso-called greenhouse effect, in which carbon dioxide collects in the earth's atmosphere, trapping the sun's heat and preventing the earth's surface from cooling. Chlorofluorocarbons also harm the earth's ozone layer, which filters out the sun's harmful ultraviolet light; this too may be a cause of the greenhouse effect

Deforestation:

The results of deforestation for industrialization and urbanization are vulnerable. It is resulting in destruction of wild life, increase in price of wood, air production etc.

Habitat:

The people who are living in forests and remote areas love their shelter and livelihood in the vent of industrialization.

Health:

The business users must be conscious about the health of the society and behave responsibility for their health.

13.5 Ethical Issues

Ethical issues can be categorized in the context of their relation with conflicts of interest, fairness and honesty, communications, and business associations.

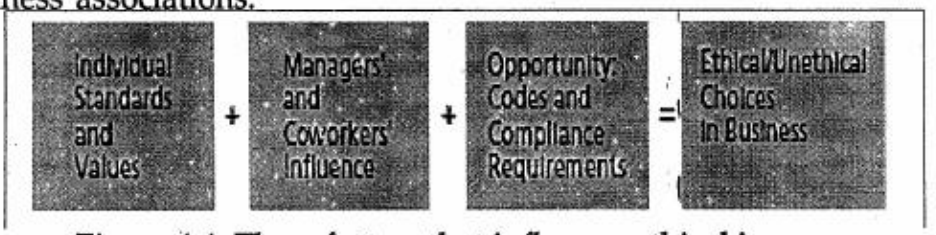

Figure 1.1: Three factors that influence ethical issues

Conflict of Interest: A conflict of interest exists when a person must choose whether to advance his or her own personal interests or those of others.

Example: A manager in a corporation is supposed to ensure that the company is profitable so that its stockholder-owners receive a return on their investment.

Fairness and Honesty: Fairness and honesty are at the heart of business ethics and relate to the general values of decision makers. At a minimum, business persons are expected to follow all applicable laws and regulations. But beyond obeying the law, they are expected not to harm customers, employees, clients, or competitors knowingly through deception, misrepresentation, coercion, or discrimination.

Example: A recent survey showed that nearly one-fourth of workers have been asked to engage in an unethical act at work, and 41 percent carried out the act. One aspect of fairness relates to competition. Although numerous laws have beenpassed to foster competition and make monopolistic practices illegal, companies sometimesgain control over markets by using questionable practices that harm competition.

Another aspect of fairness and honesty relates to disclosure of potential harm caused by product use. When Procter & Gamble introduced Olestra, the low cholesterol fat substitute, products in which it was used had labels warning consumers of potential problems with abdominal cramping.

As mentioned earlier, it is considered improper to give or accept **bribes** payments, gifts, or special favours intended to influence the outcome of a decision. A bribe is a conflict of interest because it benefits an individual at the expense of an organization or society.

Example: Wal-Mart Stores, Inc., may have the toughest policy against conflict of interest in the retail industry. Sam Walton, the late founder of Wal-Mart, prohibited company buyers from accepting so much as a cup of coffee from suppliers. The Wal-Mart policy is black and white and leaves no room for interpretation, and it is probably a factor in helping Wal-

Mart reduce costs. Other retailers typically allow buyers to accept meals, small gifts, and outings such as golf, fishing, or hunting trips.

Communications: Communications is another area in which ethical concerns may arise. False and misleading advertising, as well as deceptive personal-selling tactics, anger consumers and can lead to the failure of a business. Truthfulness about product safety and quality are also important to consumers. In the pharmaceutical industry, for example, dietary supplements, such as herbs, are sold with limited regulation and testing, and many supplements are sold by small, independent marketers.

Some manufacturers fail to provide enough information for consumers about differences between products. In the contact lens solution market, a number of manufacturers are marketing identical products with different prices. Bausch & Lomb, for example, priced its one-ounce bottle of Sensitive Eyes Drops at about $5.65. But a 12-ounce bottle of its Sensitive Eyes Saline Solution, which had the same ingredients and formulation but a different label, was priced at $2.79. "It's not only a sneaky way to make money, but it's lousy marketing, the type of thing that backfires . . .when it's made public."

Another important aspect of communications that may raises on cigarette packages

Business Relationships: The behaviour of businesspersons toward customers, suppliers, and others in their workplace may also generate ethical concerns. Ethical behaviour within a business involves keeping company secrets, meeting obligations and responsibilities, and avoiding undue pressure that may force others to act unethically.

Managers, in particular, because of the authority of their position, have the opportunity to influence employees' actions. For example, a manager can influence employees to use pirated computer software to save costs. The use of illegal software puts the employee and the company at legal risk, but employees may feel pressured to do so by their superior's authority.

It is the responsibility of managers to create a work environment that helps the company achieve its objectives and fulfil its responsibilities. However, the methods that managers use to enforce these responsibilities should not compromise employee rights. Organizational pressures may encourage a person to engage in activities that he or she might otherwise view as unethical, such as invading others' privacy or stealing a competitor's secrets. Or the firm may provide only vague or lax supervision on ethical issues, providing the opportunity for misconduct. Managers who offer no ethical direction to employees create many opportunities for manipulation, dishonesty, and conflicts of interest.

Plagiarism: taking someone else's work and presenting it as your own without mentioning or acknowledging the source is another ethical issue. In business, an ethical issue arises when an employee copies reports or takes the work or ideas of otners and presents them as his or her own. A manager attempting to take credit for a subordinate's ideas is engaging in another type of plagiarism.

So finally we can say the important ethical principles that a business should follows are:

1. Do not deceive or cheat the customers by selling substandard or defective products by under measurement or any other means.

   Example:Textile merchants in general clear the defective stock under the guise of discounts.

2. Do not destroy or distort competition.
3. Treasure sincerity and accuracy in advertising, labelling and packaging.

   Example: Ads of automobiles in general provide false details in every aspect.

4. Do not furnish the image of competitors by unfair practices.

   Example: Publishing false information about competitors, bribing the retailers etc.

5. Make accurate business records so that transparency to the shareholders can be achieved.
6. Pay taxes and discharge other obligation promptly.
7. Do not form castle agreements, even informal, to control production, prices etc to the common detriment.

   Example: Cellular network providers will be in informal castle agreements to control the traffic.

8. Refrain from secret kick-backs or pay logs to customers, suppliers, administrators, politicians etc.
9. Ensure payment of fair wages and fair treatment to the internal customers as well as external customers and share-holders.
10. Do not report to hoarding, black marketing or profiteering.

    Example: Management of theatres sell the tickets for higher prices during the initial days of release of a film starred by a crazy hero and heroine.

Cases Observed

In some cases the managers come across the situation where they have to neglect sure ethics in order to fulfil source. In those cases the managers must be keen about the level of distortion caused to the society by neglecting such ethics.

Example: Kidney transplantation in India has become most popular because of easy availability at low cost. The doctors run into confusion

when they come across the situation where a patient's life can be saved by disturbing the health of others.

Example: Deforestation for industrialization around Jamshedpur contributes a lot to the Indian economy by providing opportunities to many unemployed. But this disturbs the ecological balance in the society.

Example: Construction of Subarnarekha dam may result in growth in the economy yet mr. Tete four XLR Trapped the chairperson of Dalmundi iron ores and saved the dwellers

13.6 Recognizing Ethical Issues in Business

An **ethical issue** is an identifiable problem, situation, or opportunity that requires a person to choose from among several actions

that may be evaluated as right or wrong, ethical or unethical. In business, such a choice often involves weighing monetary profit against what a person considers appropriate conduct. The best way to judge the ethics of a decision is to look at a situation from a customer's or competitor's viewpoint:

Should liquid-diet manufacturers make unsubstantiated claims about their products?

Should an engineer agree to divulge her former employer's trade secrets to ensure that she gets a better job with a competitor?

Should a salesperson omit facts about a product's poor safety record in his presentation to a customer?

Such questions require the decision maker to evaluate the ethics of his or her choice.

Not all shortcomings in business ethics are global in scope.

For example, if you are a salesperson, when does offering a gift such as season basketball tickets to a customer become a bribe rather than just as ales practice? Clearly, there are no easy answers to such a question. But the size of the transaction, the history of personal relatior.ships within the particular company, aswell as many other factors may determine whether an action will be judged as right or wrong by others. When Wal-Mart began selling

sandals that strongly resembled the popular Tevabrand, Sports Sandal, took notice. Sales of Teva sandals fell from US$69 million to US$42 million, and company executives believed this was because Wal-Mart was selling copies (or "knock-offs") for 25 percent less. This ethical issue of right or wrong was resolved in court. Teva won the lawsuit, and Wal-Mart agreed to stop selling the shoes.

Ethics are also related to the culture in which a business operates.

In Canada or the United States, for example, it would be inappropriate for a businessperson to bring an elaborately wrapped gift to a prospective client on their first meeting—the gift could be viewed as a bribe. In Japan, however, it is considered impolite *not* to bringa gift.

Experience with the culture in which a business operates is critical to under standingwhat is ethical or unethical.

13.7 How to Implement Business Ethics

- Trade associations can be formed by the business users which should bloster the efforts of running any business with ethics.
- Trade association can promote business ethics in business user by
- Educating the members of the association and by consistent persuasion.
- Formulation a code of conduct for their members which should contain code of ethics.
- Praising and rewarding those firms and business users who keep up the ethics in business & by publishing.
- Another fact which the business user must realize is the management and ownership must be separated because the owners always tend for profit maximization where as the managers case for ethics as they work for fixed salaries.
- A managers must be a professional who possesses systematic knowledge and skill to perform certain responsible functions with authority and who is bound by certain ethics in the use of his knowledge and skill.
- A professional has to have autonomy.
- He/she has enormous responsibilities and shall not use his/her knowledge skill and authority unscrupulously shall not knowingly do distribute to his/her customers.

13.8 Issues involved in Internet Ethics

Internet is a relatively new research tool which provides a unique research environment

- It is difficult to make out which is private and which is public space
- It is easy to screen and collect data without obtaining consent from the author
- The participants and the researcher can easily fake identities

Using Web for Data Collection

Consent Issue:

- When is it necessary to take consent for using information available on the Internet?

- Data are collected from research participants through any form of communication, interaction, or intervention.
- Research participant is unaware of any observation or reporting is taking place

- How to obtain consent?

- By sending e-mails, by pasting notices on list-serve, discussion forum etc., by declaring on the website

- From whom to obtain consent?

- Depending upon the case may be, the consent should be btained from authors of posting on the Internet, Adiministrators of list serves/discussion forum etc., Webmaster

Anonymity Issue:

- This applies mainly to the case when research is conducted using discussion forum, user groups, list forums etc.
- In case of several sensitive issues, participants are very particular for anonymity
- The anonymity can be maintained by removing the identity elements such as message header, name of the list etc.
- Care should be taken to remove references of place, people and events in demographic data

Accuracy of Information:

- Most of the information available on the Internet is not peer reviewed
- Information published by authentic agencies only should be used
- As there is no face to face contact between the researchers and participants, possibility of miscreants providing incorrect information to mislead the study cannot be ruled out

13.8.1 Ethical issues in disseminating information on the Internet:

- Information about the owner of the site and purpose of the site should be clearly indicated
- Information should be truthful and unbiased
- Information should be accurate, easy to understand and up to date
- Consent from participants must be obtained before publishing any personal data
- Provide meaningful opportunity for users to give feedback to the site
- Copyright notice should be pasted on the site

13.9 Summary

Business Ethics is the principles and standards that determine acceptable conduct in business organizations. The acceptability of behaviour in business is determined by customers, competitors,

government regulators, interest groups, and the public, as well as each individual's personal moral principles and values. There are Ethical Responsibilities of Business Professionals which includes Responsibilities to Business, Share Holders, Employees, Consumers and Community. One important factor a business man must not neglect is his responsibility to environment which includes Animal Rights, Land, Pollution, Deforestation, Habitat and Health. Ethical issues can be categorized in the context of their relation with conflicts of interest, fairness and honesty, communications, and business associations. An ethical issue is an identifiable problem, situation, or opportunity that requires a person to choose from among several actions that may be evaluated as right or wrong, ethical or unethical.

13.10 Self Assessment Test

1. What are the ethical decisions that impact any organization?
2. How to contrast the difference between ethical &unethical values within an organization
3. What can companies do to promote a positive ethical & responsible workforce?
4. What ethical responsibilities does an organization have to a different stakeholder?
5. What are the ethical responsibility in accounting
6. What are the ethical decisions that impact any organization?
7. What are ethical responsibilities in an organization?

13.11 Further Reading

1. Business Ethics: An Indian Perspective, 2/e,Pearson Publication, by A.C. Fernando
2. Corporate Governance, Ethics and social responsibility.- Balachandran V, & Chandrashekharan V, 2/e, PHI, 2011.
3. Business Ethics and Corporate Governance - Ghosh B. N, Tata McGraw-Hill, 2012.
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UNIT-14 Computer Crime

Unit Structure

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14.2 Types of Computer Crime
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  14.2.2 Computer Fraud
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14.0 Objective

Throughout the past several decades there have been numerous advances in electronic resources. Technologies such as cellular phones, pagers, home computers, the Internet, websites, and palm pilots have added another dimension to crime. That dimension involves increased methods at criminals' disposal to commit certain crimes along with increased locations in which crimes can occur.

14.1 Introduction

To-days Computer crimes will likely become more frequent with the advent of further technologies. One approach can be found in the Convention on Cybercrime, which distinguishes between four different types of offences.

1. Offences against the confidentiality, integrity and availability of computer data and systems;
2. computer-related offences;
3. content-related offences; and
4. Copyright-related offences.

Generally computer crime can potentially cover an array of offenses. Computer crime is defined as any offense that uses or somehow involves a computer. The Department of Justice has defined computer crime as "Any violation of the criminal law that involves the knowledge

of computer technology for its perpetration, investigation, or prosecution."

Some defined computer crime as offenses committed in an "electronic environment" for economic gain or to cause damage or harm to others.

The Business Software Alliance, a public education and awareness organization, may be too restrictive classify computer crime as illegal activities that make use of electronic systems as a means to affect the security of computer systems and computer data.

Today, criminals can commit property crimes from the comfort of their own homes against people who live on the other side of the world through the use of computers.

14.2 Types of Computer Crime

There exists a constantly expanding list of the forms computer crime and computer fraud can take. Many traditional crimes, such as fraud, theft, organized crime rings, prostitution, stalking, and child pornography have been incorporated into the digital world. Offenders may find new opportunities to perpetrate their crimes using this new digital medium. The National White Collar Crime Centre notes, "...computers can be 'used as tools to commit traditional offenses.' This means that the functions specific to computers, such as software programs and Internet capabilities, can be manipulated to conduct criminal activity."Computer crimes can also be grouped into categories in which computers themselves are either the target or victim of an offense, or simply incidental to the act itself. Aside from traditional crimes that have been adapted to utilize electronic resources, there are also a number of offenses that exist specifically due to the accessibility of computer resources.

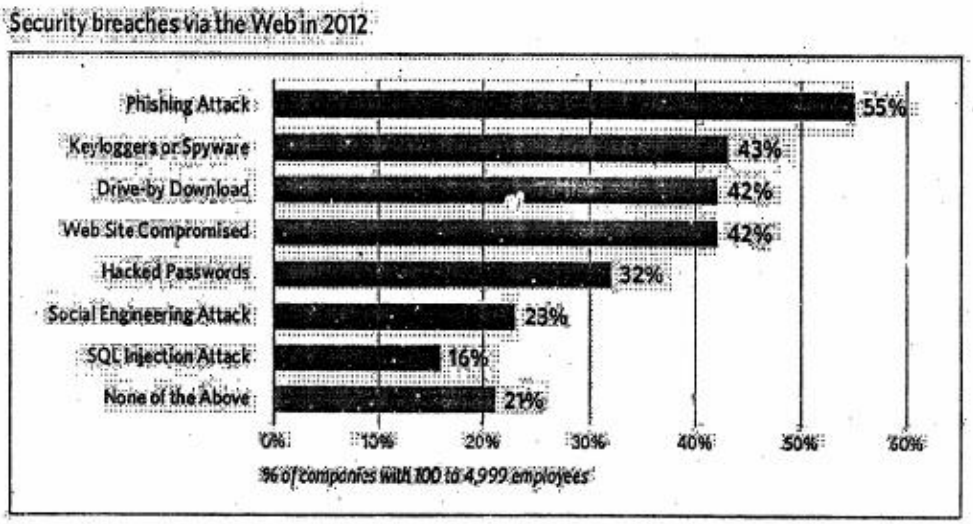

Figure 14.1: Types of cyber-attacks experienced by several benchmarked companies

Some of the traditional crimes now taking place on computers includes fraud, theft, harassment, and child pornography. Computer fraud consists of crimes such as online auction fraud, identity theft, financial and telecommunications fraud, credit card fraud, and various other schemes.

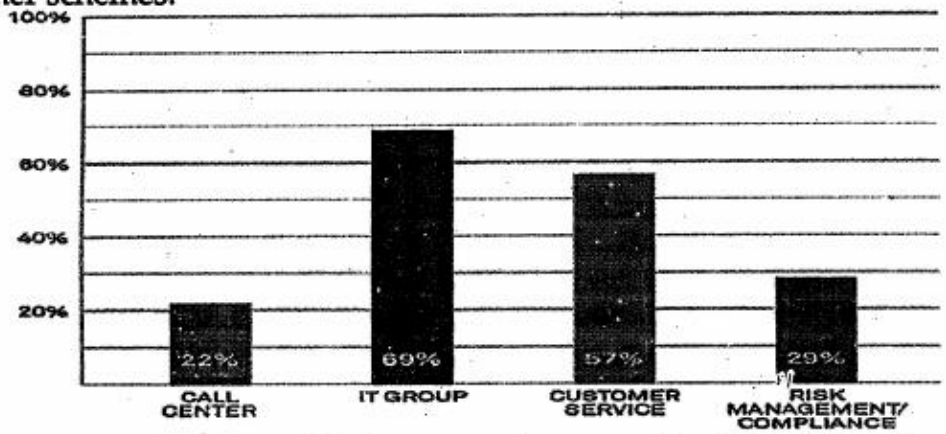

Figure 14.2: Areas of Greatest cost increases in a DDoS Attack

Theft crimes, as related to computer crime, include categories such as monetary, service and data theft, and piracy. Harassment offenses include online harassment and cyber stalking. Child pornography crimes include both the transmission of media that exploits children, as well as solicitation to commit sexual crimes against minors.

14.2.1 Hacking:

The actual word is "Cracking" and not "Hacking". 'Hackers' are very intelligent people who use their skill in a constructive and positive manner. They help the government to protect national documents of strategic importance, help organizations to protect documents and company secrets, and even sometimes help justice to meet its end by extracting out electronic evidence.

Hacking has been defined as "Deliberately gaining unauthorized access to an information system."

- A cracker is generally someone who breaks into someone else's computer system, often on a network, bypasses passwords or licenses in computer programs or in other ways intentionally breaches computer security. A cracker can be doing this for profit, maliciously, for some altruistic purpose or cause, or because the challenge is there. Some breaking-and-entering has been done ostensibly to point out weaknesses in a site's security system.
- But with time, both the word are used interchangeably.

What Hackers Do?

- Criminals Can Operate Anonymously Over the Computer Networks.
- Hackers Invade Privacy

- Hackers Destroy "Property" in the Form of Computer Files or Records
- Hackers Injure Other Computer Users by DestroyingInformation Systems

Types of Hackers

- **Code Hackers** - They know computers inside out. Theycan make the computer do nearly anything they want it to.
- **Crackers** - They break into computer systems. Circumventing Operating Systems and their security is their favorite past time. It involves breaking the security on software applications.
- **Cyber Punks** - They are the masters of cryptography.
- **Phreakers** - They combine their in-depth knowledge of the Internet and the mass telecommunications system.
- **Virus Builders** - Virus incidents have resulted in significant and data loss at some stage or the other. The loss could be on account of: -
  - Viruses - A virus is a programme that may or may not attach itself to a file and replicate itself. It can attack any area: from corrupting the data of the file that it invades, using the computer's processing resources in attempt to crash the machine and more.
  - Worms - Worms may also invade a computer and steal its resources to replicate themselves. They use the network to spread themselves. "Love bug" is a recent.
  - Trojan horse - Trojan horse is dicey. It appears to do one thing but does something else. The system may accept it as one thing. Upon execution, it may release a virus, worm or logic bomb.

14.2.2 Computer Fraud

Computer fraud is one of the most rapidly increasing forms of computer crime. Computer fraud is also commonly referred to as Internet fraud. Essentially, computer/ Internet fraud is "any type of fraud scheme that uses one or more components of the Internet-such as chat rooms, e-mail, message boards, or Web sites to present fraudulent transactions, or to transmit the proceeds of fraud to financial institutions or to others connected with the scheme" There are multiple forms of Internet fraud.

Computer fraud can be described as a subset of computer crime. Computer fraud uses electronic resources to present fraudulent or misrepresented information as a means of deception. The Bureau of Justice Statistics outlines fraud as "The intentional misrepresentation of information or identity to deceive others" and adds the qualifier of "use of electronic means" to delineate computer fraud.

In general, computer fraud should contain the same basic definition of traditional fraud, while employing new qualifiers that adapt its use for electronic resources. The Internet Crime Complaint Centre has identified several other forms of Internet fraud crimes. The additional forms include:

- *Advance Fee Fraud Schemes*-in, which the victim is required to pay significant fees in advance of receiving a substantial amount of money or merchandise. The fees are usually passed off as taxes, or processing fees, or charges for notarized documents. The victim pays these fees and receives nothing in return. Perhaps the most common example of this type of fraud occurs when a victim is expecting a large payoff for helping to move millions of dollars out of a foreign country. The victim may also believe he has won a large award in a nonexistent foreign lottery.
- *Business/Employment Schemes*-typically incorporate identity theft, freight forwarding, and counterfeit check schemes. The fraudster posts a help-wanted ad on popular Internet job search sites. Respondents are required to fill out an application wherein they divulge sensitive personal information, such as their date of birth and Social Security number. The fraudster uses that information to purchase merchandise on credit. The merchandise is sent to another respondent who has been hired as a freight forwarder by the fraudster. The merchandise is then reshipped out of the country. The fraudster, who has represented himself as a foreign company, then pays the freight forwarder with a counterfeit check containing a significant overage amount. The overage is wired back to the fraudster, usually in a foreign country, before the fraud is discovered.
- *Counterfeit Check Schemes*- a counterfeit or fraudulent cashier's check or corporate check is utilized to pay for merchandise. Often these checks are made out for a substantially larger amount than the purchase price. The victims are instructed to deposit the check and return the overage amount, usually by wire transfer, to a foreign country. Because banks may release funds from a cashier's check before the check actually clears, the victim believes the check has cleared and wires the money as instructed. One popular variation of this scam involves the purchase of automobiles listed for sale in various Internet classified advertisements. The sellers are contacted about purchasing the autos and shipping them to a foreign country. The buyer, or person acting on behalf of a buyer then sends the seller a cashier's check for an amount several thousand dollars over the price of the vehicle. The seller is directed to deposit the check and wire the excess back to the buyer so they can pay the shipping charges. Once the money is sent, the buyer typically comes up with an

excuse for canceling the purchase, and attempts to have the rest of the money returned. Although the seller does not lose the vehicle, he is typically held responsible by his bank for depositing a counterfeit check.

Credit/Debit Card Fraud-is the unauthorized use of a credit/debit card to fraudulently obtain money or property. Credit/debit card numbers can be stolen from unsecured web sites, or can be obtained in an identity theft scheme.

Freight forwarding/Reshipping-the receiving and subsequent reshipping of an on-line ordered merchandise to locations usually abroad. Individuals are often solicited to participate in this activity in chat rooms, or through Internet job postings. Unbeknownst to the reshipped, the merchandise has been paid for with fraudulent credit cards.

- *Identity theft*- occurs when someone appropriates another's personal information without his or her knowledge to commit theft or fraud. Identity theft is a vehicle for perpetrating other types of fraud schemes. Typically, the victim is led to believe they are divulging sensitive personal information to a legitimate business, sometimes as a response to an e-mail solicitation to update billing or membership information, or as an application to a fraudulent Internet job posting.
- *Investment Fraud*- an offering that uses fraudulent claims to solicit investments or loans, or that provides for the purchase, use, or trade of forged or counterfeit securities.
- *Non-delivery of Goods/Services*-merchandise or services that were purchased or contracted by individuals on-line are never delivered.
- *Phony Escrow Services*-in an effort to persuade a wary Internet auction participant, the fraudster will propose the use of a third-party escrow service to facilitate the exchange of money and merchandise. The victim is unaware the fraudster has spoofed a legitimate escrow service. The victim sends payment or merchandise to the phony escrow and receives nothing in return.
- *Ponzi/Pyramid Schemes*-investors are enticed to invest in this fraudulent scheme by the promises of abnormally high profits. However, no investments are actually made by the so called "investment firm". Early investors are paid returns with the investment capital received from subsequent investors. The system eventually collapses and investors do not receive their promised dividends and lose their initial investment.
- *Spoofing/Phishing*- a technique whereby a fraudster pretends to be someone else's email or web site. This is typically done by copying the web content of a legitimate web site to the fraudster's newly created fraudulent web site. Phishing refers to the scheme

whereby the perpetrators use the spoofed web sites in an attempt to dope the victim into divulging sensitive information, such as passwords, credit card and bank account numbers. The victim, usually via email is provided with a hyperlink that directs hi/her to a fraudster's web site. This fraudulent web site's name closely resembles the true name of the legitimate business. The victim arrives at the fraudulent web site and is convinced by the sites content that they are in fact at the company's legitimate web site and are tricked into divulging sensitive personal information. Spoofing and phishing are done to further perpetrate other schemes, including identify theft and auction fraud. The Anti-Phishing Working Group defines Phishing as "a form of online identity theft that uses spoofed emails designed to attract recipients to fraudulent websites which attempt to trick them into exposing personal financial data such as credit card numbers, account usernames and passwords, social security numbers, etc."

14.2.3 Cyber Theft

Computer crimes involving theft are very diverse. The gaining of access and removal of property through the use of electronic resources generally defines theft computer crimes. This property may include money, service, programs, data, or computer output, and computer time.

In addition, altering computer input or output without authorization, destroying or misusing proprietary information, and the unauthorized use of computer resources (theft of computer time) can be considered theft-related computer crimes.

Internet piracy is a more prominent form of theft in a digital medium. Like Piracy, it is the act of duplicating copyrighted material without authorization. For the past few years, private and law enforcement organizations have been putting a concentrated effort on stopping this offense.

14.2.4 Unauthorized use at work

Unauthorized access of a computer, computer system, or computer network is a prerequisite to many forms of computer crimes and computer fraud. This form of crime amounts to electronic intrusion, or gaining access to resources via a computer resource without permission. Unauthorized access may occur both on individuals' personal computers, as well as in the workplace. One major form of unauthorized access is known as hacking. Hacking is "...the act of gaining unauthorized access to a computer system or network and in some cases making unauthorized use of this access." As stated previously, unauthorized access may be a gateway to commit other offenses.

Another form of computer crime that is prohibited by most states is unauthorized use (1) A person may not intentionally, wilfully, and

without authorization access, attempt to access, or cause access to a computer, computer network, computer software, computer control language, computer system, computer services, computer data base, or any part of these services to (i) cause the malfunction or interrupt the operation of a computer, computer network, computer software, computer control language, computer system, computer services, computer data base, or any part of these systems or services; or (ii) alter, damage, or destroy data or a computer program stored, maintained, or produced by a computer, computer network, computer system, computer services, computer data base, or any part of these systems or services. (2) A person may not intentionally, wilifully, and without authorization: (i) identify or attempt to identify any valid access codes; or (ii) distribute or publicize any valid access codes to any unauthorized person.

Some others are:

Denial of Service

A denial of service attack is a targeted effort to disrupt a legitimate user of a service from having access to the service. This may be accomplished through a number of methods. Offenders can limit or prevent access to services by overloading the available resources, changing the configuration of the service's data, or physically destroying the available connections to the information

Computer invasion *of Privacy*

Computer assault of privacy is another form of computer crime proscribed in state legislatures.

A person is guilty of the crime of computer invasion of privacy when he uses a computer or computer network and intentionally examines without authority any employment, salary, credit, or any other financial or personal information relating to any other person. "Examination" under this section requires the offender to review the information relating to any other person after the time at which the offender knows or should know that he is without authority to view the information displayed.

Harmful Content Crimes

Included in this category are child pornography and exploitation crimes, harassment, stalking, and malicious programs and use of computer resources.

Spam

Another form of computer crime is spam mail. Spam mail is the distribution of bulk e-mail that offers recipients deals on products or services. The purpose of spam mail is to make customers think they are going to receive the real product or service at a reduced price. However, before the deal can occur, the sender of the spam asks for money, the recipients' credit card number or other personal information. The customer will send that information and never receive the product nor hear from the spammer.

14.2.5 *Cyber terrorism*

Cyber terrorism is the adaptation of terrorism to computer resources, whose purpose is to cause fear in its victims by attacking electronic resources.

The word "*cyber terrorism*" refers to two elements: **cyberspace** and **terrorism.**

Cyber terrorism is generally understood to mean unlawful attacks and threats of attack against computers, networks, and the information stored therein when done to intimidate a government or its people in furtherance of political or social objectives. Further, to qualify as cyber terrorism, an attack should result in violence against persons or property, or at least cause enough harm to generate fear.

Cyber terrorism is the use of Internet based terror attacks, done deliberately in order to create disturbances in usual working of the internet. Since, many computers are connected through internet, the chances of high disruption in computer related services in personal as well commercial devices. Attacks through cyber terrorism can be in form of various illegal activities whose number is on a constant increase, a few are most lethal and common. These include attacks from viruses, attacks from Trojans, attacks from BOTS, attacks on databases, black hat hacking etc.

Some of the examples of cyber-attacks or ways of cyber terrorism are: hacking into computer systems, introducing viruses to vulnerable networks, web site defacing, *Denial-of-service* attacks, or terroristic threats made via electronic communication.

Why is this situation alarming?

A computer performs three major operations.

1. Stores the data
2. Processes the data
3. Communicates with other computers of various types

Though extremely quick in all the tasks listed above, computers are much a man's machine and do need a good user for proper execution of processes. This means that they can be used to create programs that can create wonders to the technology as well as can shut the whole digital down to its very core. This has been with a help of a few examples given below:

There are two incidents which brought this issue of "**cyber terrorism**" into lime light.

1. It was during end 90's and early millennium, the fear of "Millennium Bug" has increased. The cyber-attacks also increased during the same time. Although the millennium bug was by no means a terrorist attack or plot against the world or the United States, it sparked fears of possibly large scale cyber-attacks.

2. It was after 9/11 attack on the cyber towers in United States of America, the fear of cyber-attacks accelerated. After these attacks, US took some strict measures to curb terrorism and started *"war on terror"*, which led to further media coverage of the potential threats of cyber terrorism in the years following. Mainstream media coverage often discusses the possibility of a large attack making use of computer networks to sabotage critical infrastructures with the aim of putting human lives in jeopardy or causing disruption on a national scale either directly or by disruption of the national economy.

Some of the Major attacks:

1999- NATO Computers were attacked.

2007- Estonian government ministry networks as well as two major Estonian bank networks.

2008- The website of Ukrainian president Viktor Yushchenko was attacked by hackers.

There are many other un-reported attacks on several state run bodies, companies, profit giving organizations, financial institutions, budget & funds allocations, etc. while some of the attacked are accused to be politically motivated, while some attacks are privately done by hackers, and sometimes as revenge or vengeance.

The current state of cyberspace is such that information is seriously at risk. The impact of this risk to the physical health of mankind is, at present, indirect. Computers do not, at present, control sufficient physical processes, without human intervention, to pose a significant risk of terrorism in the classic sense.

14.3 Why Cyber-attack sare Successful?

- The Insider Threat
- Persistence of Computer System Vulnerabilities
- Errors in New Software Products
- Inadequate Resources.

14.4 Warning Signs

- You have a good credit history but are turned down because of a default on your record.
- There are entries on your credit file you do not recognize.
- You are being chased for outstanding debt.
- Mail you normally expect from financial institutions does not arrive.
- You have lost or had important documents stolen.

- You apply for benefits and are told you are already claiming, when you are not.

14.5 Computer Security Tips

- Make sure you have a good anti-virus software which regularly runs scanning programs for spy ware, a personal firewall and a spam filter.
- Never keep passwords stored on your computer, or disclose them to anybody.
- If you are accessing banking details from a computer that is used by other people, ensure you do not click on "save" password, as another user could gain access.
- Check your bank statements and receipts carefully to ensure there are no fraudulent transactions.

14.6 Summary

There exists a constantly expanding list of the forms computer crime and computer fraud can take. Many traditional crimes, such as fraud, theft, organized crime rings, prostitution, stalking, and child pornography have been incorporated into the digital world. Hacking has been defined as "Deliberately gaining unauthorized access to an information system." A cracker is generally someone who breaks into someone else's computer system, often on a network, bypasses passwords or licenses in computer programs or in other ways intentionally breaches computer security.

Computer crimes involving theft are very diverse. Unauthorized access of a computer, computer system, or computer network is a prerequisite to many forms of computer crimes and computer fraud. Cyber terrorism is the adaptation of terrorism to computer resources, whose purpose is to cause fear in its victims by attacking electronic resources. Some of the Major attacks are 1999- NATO Computers, 2007- Estonian government ministry networks etc. we generally got some signs as warning. We must follow the computer security tips to avoid such problems.

14.7 Self Assessment Test

1. What are the top five Computer crime?
2. What are the different ways to Prevent Computer Crimes?
3. Write down any two types of computer crimes that occur over cyber space and how?
4. What is the difference between cyber theft and cyber fraud?
5. "Cyber-crimes performed by violating privacy rules." Explain it.

6. What is the effect of cyber-crimes in the global world?
7. Give any two example of cyber terrorism.
8. What is the role of hackers in computer crime?

14.8 Further Reading

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UNIT-15 Software and Intellectual Property

Unit Structure

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15.0 Objective

The concept of intellectual property (IP) will be understood better if we understand what is meant by the term property. To a lay mind, property means some material object belonging to a particular person.

15.1 Introduction

The concept of ownership is critical to the concept of property. Ownership means the right to possess, use and dispose of the property and at the desire of the owner, to exclude the others. If a society does not recognise ownership, it will not have a concept of property. In the legal sense, property refers to the bundle of rights that the law confers on a person by virtue of the ownership and possession of an object.

Two factors significantly influence the value of an object as property. The first factor is *insufficiency,* which refers to its availability in relation to the need. The *insufficiency* is a thing in relation to the demand for it, the higher is its value. The second important factor influencing the value of an object is *the knowledge of its use or uses*. The higher the value of an object, the more keenly it is protected as a *property*.

There are bundle of rights for property. These rights deal with various aspects of the relationship between man and his property, such as: ownership and possession; use and enjoyment of the fruits of the

application of property; exclusion of others from use and application of the property; and transfer of rights in the property.

The IPRs are based on three underlying premises:

1. Creative activity culminating in IP can be increased by measures aimed to encourage it; and also, this activity will not be generated in economically adequate quantity for public use without economic incentives.
2. Adequate economic benefits as just reward for the creation of IP can be ensured only through the grant of monopoly rights, even if for a limited period.
3. The provisions of the global IP regime ensure just economic returns to the generators of wealth through IP, and safeguard the interest of other entrepreneurs and the society in general.

Computer technology plays an increasingly important role in our society today. It penetrates more and more areas of our life, not only in business environments but also in daily surroundings. A computer cannot operate without instructions. These instructions, so-called computer programs or software, may be incorporated in the computer or apparatus, but are often created, reproduced and distributed on media such as CD-ROMs or transmitted on-line.

The growth of the Internet has put pressure on traditional intellectual property protections such as copyright and patent. Some forms of information, when made accessible on the Internet, are easily copied. Because the costs of copying are low and because copying is often anonymous, publishers have often responded with more aggressive enforcement of existing intellectual property rights and with calls for extensions of those rights to cover additional content, new media and new forms of access. This effort can actually be seen as part of a twenty-year trend toward tighter intellectual property enforcement and extensions of intellectual property rights.

One problem in determining where software fits in the intellectual-property system is that computer software and hardware technologies are changing rapidly, both qualitatively and quantitatively.

Another problem is compounding the problem of rapid technological change. The legal and technical communities do not have consistent definitions for terms like "algorithm" or "interface" that make up computer and computational parlance. For example, one common technical definition of the term algorithm is: "a set of rules which specify a sequence ofactions to be taken to solve a problem."

15.1.1 Checklist for dealing with IPR in software use and development

The layers of rights which are likely to protect software will each impose restrictions upon the user. It is therefore important that these and their characteristics are recognised to ensure that:

- Use of the software is legal

- Obligations to third parties are honoured
- Rights are protected
- Risks to an institution, its partners and funding bodies are minimised
- Ability to exploit rights in developed software is maintained
- Sustainability strategies can be realistically pursued.

To assist in this task, the check list below provides some useful points of reference:

- Carry out a regular software licensing compliance audit: familiarise yourself with the broad range of rights which are likely to protect the software that you wish to use and/or develop, as well as the legal ramifications and restrictions associated with each
- Maintain software and licence registers; there are several software products available for maintaining such a register.
- Incorporate software development and use within your IP Policy and IT Terms of Use.
- Assign staff to take responsibility for rights clearance and management.
- Allocate appropriate budgets and other resources to rights and licence management.
- Carry out prior art searches necessary for software development.
- Check terms of open source and proprietary licence agreements to ensure that your required use is permitted. This is especially important when creating new software using pre-existing components.
- Contact OSS Watch for further information about Open Source Licences if you are considering permitting of use of developed software under an Open Source licence.
- Negotiate with rights holders for any activities that are beyond the scope of the rights permitted and/or licence agreements which are necessary as part of your project.
- Ensure the incorporation of contractual terms relating to ownership and use of IP generated by contractors and freelancers within agreements.
- Carry out risk assessments relating to the use of patentable software. Other risks that will need to be considered include use of third party designs, trademarks and copyright materials. Bear in mind that making software available on the web may amount to distribution into many jurisdictions, for the purposes of patent litigation.
- Incorporate any identified risks within a risk registry and develop robust policies for minimising these risks.

- Consider the costs and benefits for registering further IP protection (such as patents and trademarks) for software and related goods and services developed in-house.
- Check the terms of any agreements and other contractual obligations such as consortium agreements relating to IPR and the stipulations relating to subsequent access to any software that you might be developing.

15.1.2 Types of Intellectual Property

IP has been generally divided into two main categories viz., (a) Industrial Property, (b) Copyright.

a) *Industrial property* consists of rights relating to inventions, trademarks, industrial designs and appellation of origin.

b) *Copyright* protects rights related to creation of human mind in the fields of literature, music, art and audio-visual works. The owner of copyright has rights not only in the original work, but also in creative work that is derived from the original work, e.g. its translation or adaptation or the enactment or production of a film based on the original work. Such rights relating to a copyright are called *related rights*. There are *neighbouring rights* on copyright, which protect performances of performing artists, phonograms and broadcasts. Related rights and neighbouring rights are terms used interchangeably.

Software is legally protected by (i) a range of Intellectual Property Rights (IPR), and in many cases by (ii) contractual agreements. Provisions in contracts under which the software is acquired, sometimes referred to as licences, are likely to specify authorised uses and conditions for such use.A computer program is automatically protected by copyright as a literary work. It may also be the subject of a granted patent, which in turn may or may not be valid.

Copyright: It is a traditional method. It Protects the precise *expression* of an idea (or algorithm) rather than the idea/algorithm itself. Often combined with trade secrecy (implemented via license of machine code only), limiting use for further development.

Copyright is an exclusive right, which means that unless (i) permission has been granted by the rights holder, or (ii) copyright in the work has expired, or (iii) an exception applies, it is an infringement to commit any of these restricted acts. Due to the special nature of software, a number of specified exceptions and permitted uses are provided.

Copyright places a number of restrictions upon use, which include:

- Permanent and temporary copying, either of the program as whole or a substantial part, either of the source or object code, including writing code in any language which is substantially based on it
- Communicating to the public (e.g., making it available on a website to other than authorised users) of all or a substantial part

- Making an adaptation, arrangement or other altered version, including a translation into another computer language; this includes repurposing of any elements, e.g. combination or incorporation with other software or other copyright works, e.g., to create a multi-media work or database
- Distribution or rental
- De-compilation of a program, unless it is for the purpose of creating an interoperable program
- Possessing or disseminating an infringing copy.

Items associated with the software are also likely to be protected by IPR, notably:

- a manual will be a copyright literary work
- icons and other pictorial elements are likely to be copyright artistic works
- a logo may be a copyright artistic work and/or a protected design and/or a registered or unregistered trade mark
- the name is likely to be protected against passing-off and other restricted uses as a trade-mark.

These rights apply regardless of the form of supply of the software, e.g. on a CD/DVD or by downloading, although the methods by which contracts are formed will differ (e.g. shrink-wrap, click-use). The validity of contractual provisions may depend on both general contract law (including those applicable to consumer contracts) and intellectual property law.

Copyright in Software and its Ownership

Software is automatically protected by copyright, as soon as the code is expressed in a material form such as writing. The first owner of the copyright in software is its author, except that in the case of software created during the course of employment, it is the employer rather than the employee. Hence, software created by students, freelancers and contractors and sub-contractors, will belong to the creator, and not the HEI or FEI. It is important to note that the default positions stated here can be varied by a valid agreement.

Any substantially new version of a computer program is a new copyright work. Thus, in view of the rapid cycles of development and obsolescence in the software world, any software of current interest will be protected by copyright. Criteria for protection include the requirement for the code to display originality, i.e. not to have been copied from or be substantially based on pre-existing code.

It also provided a number of exceptions to the copyright restrictions, which allowed certain uses and interactions with software without the requirement to seek permission, some of which are mandatory (i.e. cannot be overridden by contract). These exceptions are:

- *Right to make a back-up copy*

A lawful user may create a backup copy which is necessary for the purposes of such lawful use; this exception cannot be over-ridden by any contractual agreement. However, a backup may not be considered necessary if the program is supplied in a sufficiently robust medium such as a CD/DVD.

- *Right to observe, study and test the program*

  A lawful user may observe, study and test the functionality of the program, or ideas and principles which underpin it, as long as these activities are performed during the course of loading, displaying, running, or storing the program which the user is entitled to do. Like the previous exception, this cannot be over-ridden by a contractual agreement.

- *De-compilation right*

  This exception permits de-compilation of a program, i.e. conversion of a program expressed in a low-level computer language into a higher level language, or in the course of so doing copying it, provided that this is done in order to create an interoperable program.

This exception cannot be over-ridden by contract. However, it is subject to a number of conditions which must be satisfied to prevent any such activities from being potentially disputed by the rights holder. These are:

- Any de-compilation activities are carried out by a lawful user;
- Such de-compilation is necessary in order to obtain the information necessary to create a program which is interoperable with that or with another program, and the information is used only for that purpose;
- Such necessary information is not readily available to the user in some other way, e.g. has not been supplied separately by the rights-owner;
- De-compilation must be strictly limited to what is necessary to achieve the permitted purpose, e.g. it is confined to those parts of the original program which are necessary to achieve interoperability, and the information is not supplied to anyone who does not need it for the permitted purpose;
- The information is not used to create a program substantially similar in its expression to the program which has been decompiled, or to do any act restricted by copyright.

If granted and valid, the patent owner has a monopoly right to prevent third parties from making, using, selling or importing any articles which fulfil the functions described in the patent claim, during the patient's lifetime(approx 20 yr). After that, or earlier if the necessary renewal fees are not paid, the patent expires and anyone can make, use, sell or import the invention without fear of being sued for patent infringement. In

addition, the owner can, and often does, license rights under the patent to third parties for a fee. Where a product requires use of patents owned by different persons, it is common to enter into cross licensing agreements. Patents are geographically limited, so to get protection in multiple countries, multiple patent applications have to be made.

If software is also protected by a patent, and if such patent is valid, it would be an infringement to distribute any software which performs a function covered by the patent claim; even if it is not copied (i.e. the software has been independently produced).

Patents have wider application than copyright because whilst to prove copyright infringement, one must demonstrate that the copyright work was actually copied, to demonstrate patent infringement one simply has to demonstrate that the infringer was making, using, etc. the invention, even if that invention had quite independently been developed by the infringer, without any conscious or unconscious copying. There is therefore an obligation on an innovator to check existing patents before making, using, selling or importing an invention. This is much easier today as there are numerous patent databases, many of them free of charge, available for searching online.

Patenting requires a long and expensive registration process, as well as extensive checks, to check whether it is the subject of an existing patent or an application for a patent, and that it has not been described in publicly available literature prior to the application date for the patent.

There are defences against an infringement action, especially that the patent is invalid and should never have been granted in the first place, because, e.g., the invention was known before the application date or the patent owner did not disclose all he/she knew about the invention at the time the patent was applied for, or the making and using is for small-scale research purposes, or the making or using is with the permission of the patentee, or the invention was stolen from the person accused of infringement.

Registered designs and trademark

Computer icons, trading names and project names, software fonts, software-related peripherals, such as dongles and on screen displays are eligible for registered design protection as well as possible trademark protection.

Trademarks are symbols, shapes, words etc., associated with particular goods and services and which are used in the course of business or trade. Whilst there is some protection for unregistered trade marks (often called trade names), the strongest protection for such marks is obtained by applying for and obtaining a Registered Trade Mark. As with patents, this involves making a formal application and paying fees at various stages. Unlike patents, it is necessary to demonstrate that the trademarks are well known to the public, or a

section of the public, before they can be registered. They must be distinctive and not confusingly similar to any other existing trade mark or trade name. Certain types of symbols, e.g., Red Cross, Olympics, and certain names, e.g., Royal, cannot be registered.

One can register trade marks for services, such as search services, as well as goods. Registered Trade Marks have to be kept in use and renewal fees have to be paid for them to continue, but as long as these conditions are fulfilled, a registered trade mark can last forever. The owner can sure any third party who uses the mark "in the course of trade" and without permission. Whilst patents and registered designs are limited by geography, registered trademarks are limited by both geography and by class of goods/services. Thus to get extensive protection, the owner has to make separate applications in many countries, and for many classes of goods and services.

Trade Secrets

Any intellectual work product—a formula, device, pattern, or compilation of data-used for a business purpose can be classified as a **trade secret**, provided it is not based on information in the public domain. Protections for trade secrets vary from state to state. In general, trade secret laws grant a monopoly on the ideas behind a work product, but it can be a very tenuous monopoly. Software that contains novel or unique elements, procedures, or compilations can be included as a trade secret. Trade secret law protects the actual ideas in a work product, not only their manifestation. To make this claim, the creator or owner must take care to bind employees and customers with nondisclosure agreements and to prevent the secret from falling into the public domain.

The limitation of trade secret protection is that, although virtually all software programs of any complexity contain unique elements of some sort, it is difficult to prevent the ideas in the work from falling into the public domain when the software is widely distributed.

Geographical indications

GI is a sign used on goods that have a specific geographical origin and possess qualities or a reputation that is solely due to the place of origin. Such goods enjoy an advantage over competing goods solely because of their geographical origin, which thus becomes a kind of IP and is protected. A GI is different from a trade mark. A trade mark is a sign that distinguishes the product and services of an enterprise from those of another. The owner of a trade mark is entitled to exclude others from using the trade mark. A GI merely tells that a product is produced in a certain place and has certain characteristics which are due to the place of production. All producers who make their products in a place designated by the GI and share the same qualities can use it. Eg: Kolhapuri chappal, Banarsi Saree, Darjelling Tea, Mysore Silk, Assam Tea.

Industrial Design

An *industrial design* is the ornamental or aesthetic aspect of an article; it may consist of three-dimensional features such as shape or surface, or of two-dimensional features such as patterns, lines or colour.

The design serves as a tool for product differentiation and lures customers by enhanced visual appeal. It becomes a kind of IP to be protected. Industrial designs are applied to a wide variety of products of industry or handicraft: watches, jewellery, fashion and other luxury items, industrial and medical implements, house ware, furniture, electrical appliances, vehicles and architectural structures, textile designs, toys etc.

An industrial design is distinguished from trade mark primarily because it is constituted by the appearance of a product, which is not necessarily distinctive. A trade mark is necessarily to be distinctive to serve as a sign for product differentiation. The functions of, and the justification for protecting industrial designs and trademarks are quite different. Designs must relate to the appearance of the object which is not determined by technical or functional necessity. Design enhances the visual appeal and adds to the commercial value of the product; it also facilitates the marketing and commercialisation of the product. For registration, a design needs to be new and original, though the notion of these qualities may vary from country to country. In certain conditions, an industrial design can be protected under copyright law or the law against unfair competition.

15.1.3. Software and licences

Overview of software licences

Most rights-holders permit use of software by means of licence agreement. Licences can take several forms, ranging from those that permit the user to view, alter and redistribute the source code (Open Source Licences) to those which are much more restrictive (Proprietary Licences).

Open Source Licences

For **OSS Watch, the JISC funded service** promoting an awareness and understanding of the legal, social, technical and economic issues that arise when educational institutions engage with free and open source software, open source software is **defined as** software released under an Open Source Initiative (OSI) certified licence.

Each of the licences approved by the OSI meets the conditions of the *Open Source Definition*. That definition includes 10 criteria. The most important of these are the free redistribution of the software, access to the source code, and the permission to allow modifications to the software to be made and distributed. Each licence needs to be read carefully to ensure that its terms can be satisfied and that it fulfils all requirements.

Microsoft licensed software is a good example of software which is distributed without the source code being made available. Generally, permission will be granted to the user via their "click-wrap" consent to terms and conditions, without which access is denied. This usually takes

the form of a dialogue box containing the terms and conditions and a choice of 'Accept' or 'Reject' interface buttons. Other forms of agreement may include a licence on the back of box, terms and conditions on CD and/or DVD or in rare cases, consent to a written agreement. These licences may be supported by technological protection measures, the circumvention of which may itself constitute an infringement of copyright in addition to any infringement that eventually results from the circumvention.

Freeware, as opposed to Open Source material does not as standard permit the user to access or alter the source code. The word "freeware" initially applied mainly to hobbyist-written software, but more recently has come to mean any software available for no cost.

Examples of freeware in this latter usage include Adobe Reader, the Opera web browser and the Skype voice-over-IP client.

15.2 Privacy

Privacy is a vaguely defined term that, in an online context, includes the right of an individual to:

- Determine what information is collected about them and how it is used. Sometimes we are not aware what data are being collected about us (e.g. via 'cookies' on a Web site) or how it may be used. Registering with a Web site (i.e. giving your name, e-mail address, medical registration number, etc. Such information could be passed on to third parties. Some sites publish 'privacy policies' in an attempt to inform users and reduce the chances of patients or healthcare professionals placing their privacy at risk.
- Access information held about them and know that it is accurate and safe.
- Anonymity (e.g. not having your Web-browsing habits tracked).
- Send and receive e-mail messages or other data (e.g. credit card numbers) that will not be intercepted or read by persons other than the intended recipient(s). Encryption is one way of ensuring this.

15.2.1 Internet Privacy

Internet privacy involves the right or permission of personal privacy concerning the storing provision to third-parties, and displaying of information pertaining to oneself via the Internet. Privacy can entail either *Personally Identifying Information* (PII) or non-PII information such as a site visitor's behaviour on a website. PII refers to any information that can be used to identify an individual. For example, age and physical address alone could identify who an individual is without explicitly disclosing their name, as these two factors are unique enough to typically identify a specific person.

Internet privacy forms a subset of computer privacy. A number of experts within the field of Internet security and privacy believe that privacy doesn't exist; "Privacy is dead – get over it" according to Steve Ram bam, private investigator specializing in Internet privacy cases. In fact, it has been suggested that the "appeal of online services is to broadcast personal information on purpose."

15.2.2 Sources of privacy violation

Web users' privacy can be violated in different ways and with different intentions. The four major sources we identified are unauthorized information transfer, weak security, data magnets, and indirect forms of information collection.

- *Unauthorized information transfer*

  Personal information is increasingly viewed as an important financial asset. Businesses frequently sell individuals' private information to other businesses and organizations. Often, information is transferred without an individual's explicit consent.

- *Weak security*

  The Web's inherently open nature has led to situations in which individuals and organizations exploit the vulnerability of Web-based services and applications to access classified or private information. In general, unauthorized access is the result of weak security. A common form of these accesses occurs when foreign entities penetrate (for example, through hacking) Web users' computers. Consequences generally include exposure of sensitive and private information to unauthorized viewers. The consequences are even more important when the attack's target is a system containing sensitive information about groups of people.

- *Data magnets*

  Data magnets are techniques and tools that any party can use to collect personal data. Users might or might not be aware that their information is being collected or do not know how that information is collected. Various data magnet techniques exist:

- *Explicitly collecting information through online registration.*
- *Identifying users through IP addresses.*
- *Software downloads.*
- *Cookies.* A cookie is a piece of information that a server and a client pass back and forth.
- *Trojan horses.*
- *Web beacons.* A Web beacon—also known as a Web bug, pixel tag, or clear gif—is a small transparent graphic image that is used in conjunction with cookies to monitor users' actions.

- *Screen scraping.* Screen scraping is a process that uses programs to capture valuable information from Web pages.
- *Federated identity.* A Web user's federated identity is a form of identity (for example, a user name and password pair) that lets a user access several Web resources.

15.2.3 Internet Privacy issues

There are lots of issues by which privacy became more important.

- Malware is a term short for "malicious software" and is used to describe software to cause damage to a single computer, server, or computer network whether that is through the use of a virus, trojan horse, spyware, etc.
- Spyware is a piece of software that obtains information from a user's computer without that user's consent.
- A web bug is an object embedded into a web page or email and is usually invisible to the user of the website or reader of the email. It allows checking to see if a person has looked at a particular website or read a specific email message.
- Phishing is a criminally fraudulent process of trying to obtain sensitive information such as user names, passwords, credit card or bank information. Phishing is an internet crime in which someone masquerades as a trustworthy entity in some form of electronic communication.
- Pharming is a hacker's attempt to redirect traffic from a legitimate website to a completely different internet address. Pharming can be conducted by changing the hosts file on a victim's computer or by exploiting a vulnerability on the DNS server.
- Malicious proxy server (or other "anonymity" services)
- *Social Networking:* These social networks keep track of all interactions used on their sites and save them for later use. Issues include cyber stalking, location disclosure, social profiling, 3rd party personal information disclosure, and government information collection without the need for a search warrant. The biggest danger to Internet privacy rights over social networks is not from petty thieves and pornographers, it is from advertisers. The same advertisers that provide revenue to the network
- *Cookies:* An Internet cookie is a great way for websites to recognize visitors who repeatedly view the website, by sending some information to the web browser of the visitor.
- *Hacking*

15.2.4 Internet Privacy Challenges

The top five challenges are:

Protecting Privacy: The Internet's great trade-off is that while you get access to the rest of the world, the rest of the world gets access to you. The data collected can add value to the online experience through customized content and advertising – but such an extensive record of personal information can pose risks to consumers. The industry must take steps to expose the privacy debate by establishing global standards, providing transparent policies, and educating consumers on its practices.

Modernizing Copyright Laws: Is it ok to copy an album and give it to a friend? How many paragraphs should one quote from an online news article? Will we ever be able to pass along an e-book to a colleague? As the Web enters its third decade, the answers to these questions remain unclear. The Internet's power as a medium through which creators can distribute their work continues to grow, yet the current copyright laws are hopelessly out of date. For the Internet to fulfill its potential, new and modernized copyright laws must reflect the current relationship between technology and creativity.

Ensuring Net Neutrality: Ensuring that all Internet traffic is treated equally – meaning that data from Amazon.com and data from a teenager's blog move along the pipeline at the same speed – is a worthy and complicated goal. Industry leaders and policymakers need to come together and identify solutions that will guarantee fair treatment of all Internet traffic. However, these solutions must also provide ISPs with enough flexibility to efficiently manage their networks and services.

Maintaining the Open Web: From commenting on articles and sharing videos to crowd-sourcing and user-generated content, the Internet's interactivity and communal power is what makes it such a vibrant and useful medium. While social networks and mobile apps offer rich, interactive and customized experiences, many of their features are often sheltered from the rest of the Web. If the Internet as a whole is greater than the sum of its parts, we must do a better job of maintaining interconnectivity.

Strengthening Internet Security: Until recently, there has been little examination of the consequences of storing large amounts of proprietary information online. The recent spate of high-level incidents – from Wiki Leaks to China's hacking of the Internet – has made the peril of weak online security a tangible issue. Everyone, from governments and businesses to universities and individuals, must re-evaluate how they share, store, and publish sensitive information on the Internet – take steps to ensure it is protected.

15.2.5 Tips for protecting privacy

Use strong password

Try to use creative, strong passwords for all accounts one uses, so that they cannot be guessed. Use different passwords for each account so that if one is compromised the rest remain safe. Always

include a variety of upper and lower case letters, numbers, and special symbols in passwords. Never use a name (your own, someone else's, the name of a place), address, phone number, social security number, birth date, a single word, or a common phrase as a password. Consider using a password manager application to help choose, keep track of, and use your password.

- **Install software updates**

  Install software updates for your computer, Smartphone, or other Internet connected devices promptly, so that the latest security fixes are in place to prevent known bugs from being used to allow unauthorized access to your private information.

- **Close unnecessary accounts**

  Unused accounts are a liability: hackers might use them to infiltrate one's other accounts. Try and get rid of them if possible.

- **Shorten one's Internet friends list**

  Many internet users disclose a lot of important information about themselves online. It is important to regulate who can see this. It is smart only to be "friends" with people one personally knows and trusts, and delete the rest.

- **Delete documents, erase disks and memory, and shred paper documents**

  If you share a computer or access the Internet from a public location such as a library, school, or cyber-cafe, be sure to log out of all applications, delete any documents that you downloaded that you wish to keep private, exit from the web browser, and, if possible, log out before you depart.

  Erase or reformat computer disks and memory before you discard or sell a used computer, smart phone, or other Internet connected device.

  Hard copies of documents, like bank statements or doctors' bills, can contain important information such as social security numbers, and such documents are not always secured. Any paper document citing important information should be shredded before it is discarded.

15.4 Summary

Two factors significantly influence the value of an object as property: insufficiency and knowledge of its use. There is developed a Checklist for dealing with IPR in software use and development. IP has been generally divided into two main categories viz., (a) Industrial Property, (b) Copyright. Privacy is a vaguely defined term that, in an online context, includes the right of an individual. Internet privacy involves the right or permission of personal privacy concerning the storing provision to third-parties, and

displaying of information pertaining to oneself via the Internet. The Sources of privacy violation are unauthorized information transfer, Weak security, and Data magnets. There are lots of issues by which privacy becomes more important. Top five Internet Privacy Challenges are Protecting Privacy, Modernizing Copyright Laws, Ensuring Net Neutrality, Maintaining the Open Web and Strengthening Internet Security. There are tips for protecting privacy: Use strong password, Install software updates, Close unnecessary accounts, Shorten one's Internet friends list, Delete documents, erase disks and memory, and shred paper documents.

15.5 Self Assessment Test

1. Explain intellectual-property law and its motivations and exceptions.
2. Explain how intellectual property rights are challenged by information technology.
3. What are the social motivations for copyright law?
4. What are the sources of privacy violation? How can we protect privacy?
5. Define the different types of Intellectual property law.
6. What are meant by privacy and fair information practices?
7. How is the Internet challenging the protection of individual privacy?
8. Write down the issues of privacy.

15.6 Further Readings

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UNIT-16 Ergonomics

Unit Structure

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16.2 Health and social Issues
16.2.1 Individual's physical and psychological characteristics
16.2.2 Organisation and social environment
16.2.3 Effect of ergonomics on health and safety
16.3 Work Environment
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16.0 Objective

Ergonomics is the study of the relationship between the people and equipment they use and the physical environment in which they work. Ergonomics is a science concerned with the 'fit' between people and their work. It puts people first, taking account of their capabilities and limitations.

16.1 Introduction

Ergonomics aims to make sure that tasks, equipment, information and the environment fit with each worker.

To assess the fit between a person and their work, there is some range of factors, including

- The demands on the worker (activities, workload, work pacing, shift work and fatigue).
- The equipment used (its design in terms of size, shape, controls, displays, and how appropriate it is for the task).
- The information used (how it is presented, accessed, and changed).
- The physical environment (temperature, humidity, lighting, noise, vibration).

16.2 Health and social Issues

16.2.1 Individual's physical and psychological characteristics:

- Body size and shape.

- Fitness and strength.
- Posture.
- The senses, especially vision, hearing and touch.
- Mental abilities.
- Personality.
- Knowledge.
- Training.
- Experience.

16.2.2 Organisation and social environment

- Teamwork and team structure.
- Supervision and leadership
- Supportive management.
- Communications.
- Resources.

A person will find a range of physical and psychological abilities in his own workforce which he may need to take into account in designing the plant and equipment they use, and the tasks he perform.

By assessing people's abilities and limitations, their jobs, equipment and working environment and the interaction between them, it is possible to design safe, effective and productive work systems.

16.2.3 Effect of ergonomics human factors on health and safety

Applying ergonomics to the workplace can:

- reduce the potential for accidents;
- reduce the potential for injury and ill health;
- Improve performance and productivity.

Taking account of ergonomics and human factors can reduce the likelihood of an accident. For example– if a worker is given too much information they may become confused, make mistakes, or panic. In hazardous industries, incorrect decisions or mistaken actions have had catastrophic results.

Ergonomics can also reduce the potential for ill health at work, such as aches, pains and damage to the wrists, shoulders and back, noise-induced hearing loss and work-related asthma.

If person don't follow ergonomics principles, there may be serious consequences for people and whole organisations. Many well-known accidents might have been prevented if ergonomics and human factors had been considered in designing people's jobs and the systems they worked in.

16.2.3 Ergonomics problems?

Consultation involves employers not only giving information to

employees but also listening to them and taking account of what they say before making health and safety decisions. Employees have important knowledge of the work they do, problems they have, and their impact on health, safety, and performance. While talking to them, you could also ask them some specific questions about their work such as:

- are there working postures comfortable (or not)?
- do they experience discomfort, aches, pain, fatigue, or feel unable to keep up with the flow of work?
- is the equipment appropriate, easy to use and well maintained?
- is the person satisfied with their working arrangements?
- do they make the same errors and mistakes repeatedly?
- are they following procedures, and if not, why not?

Hazard spotting

While you walk around your workplace, look for signs of poor or inadequate equipment design such as: improvised tools; handwritten reminders, or handwritten labels on machinery controls; plasters on workers' fingers or 'home-made' protective pads made of tissue or foam.

Review

Review information you may already have about accidents and ill health which may result from human factors problems:

- Look at the circumstances that lead to frequent errors or incidents. Try to identify the root causes of people's mistakes. Use accident reports to identify details of incidents and their possible causes.
- Record and look at sickness absence and staff turnover levels. High numbers may be because of the problems listed earlier and/or dissatisfaction at work.

Talking to employees

Workplaces where employees are involved in taking decisions about health and safety are safer and healthier. Collaboration with your employees helps you to manage health and safety in a practical way by:

- helping you spot workplace risks;
- making sure health and safety controls are

16.3 Work Environment

The physical aspects of a workplace environment can have a direct impact on the productivity, health and safety, comfort, concentration, job satisfaction and morale of the people within it. Important factors in the work environment that should be considered include building design and age, workplace layout, workstation set-up, furniture and equipment design and quality, space, temperature, ventilation, lighting, noise, vibration, radiation, air quality.

16.3.1 Importance of workplace environment

When people are working in situations that suit their physical and mental abilities, the correct fit between the person and the work task is accomplished. People are then in the optimum situation for learning, working and achieving, without adverse health consequences, e.g. injury, illness.

Applying ergonomic principles to the design, modification and maintenance of workplace environments, has a benefit on people's work performance and short- and long-term health and safety.

16.3.2 Typical Ergonomics Problem

Ergonomics is typically known for solving physical problems. For example, ensuring that emergency stop buttons are positioned so that people can reach them readily when they need to. But ergonomics also deals with psychological and social aspects of the person and their work. For example, a workload that is too high or too low, unclear tasks, time pressures, inadequate training, and poor support from managers can all have negative effects on people and the work they do. The following examples highlight some 'typical' ergonomic problems found in the workplace:

Design of tasks

- Work demands are too high or too low.
- The employee has little say in how they organise their work.
- Badly designed machinery guards (awkward to use or requiring additional effort) slow down the work.
- Conflicting demands, e.g. high productivity and quality.
- These problems can lead to employees failing to follow procedures or removing guards, causing accidents, injury and ill health.
- The load is too heavy and/or bulky, placing unreasonable demands on the person.
- The load has to be lifted from the floor and/or above the shoulders.
- The job involves frequent repetitive lifting.
- The job requires awkward postures, such as bending or twisting.
- The load can't be gripped properly.
- The job is performed on uneven, wet, or sloping floor surfaces.
- The job is performed under time pressures and doesn't include enough rest breaks.

These problems may lead to physical injuries, such as low back pain or injury to the arms, hands, or fingers. They may also contribute to the risk of slips, trips, and falls.

Workstation layout

- Items that are used frequently are out of convenient reach.
- Inadequate space under work surface for legs.
- Work surface height inappropriate for the tasks causing awkward and uncomfortable postures.

- Lighting inadequate causing eyestrain when inspecting detail on work items.
- Chair not properly adjusted to fit the person and workstation.

Managing the working day

- Not enough recovery time between shifts.
- Juggling shifts with domestic responsibilities.
- Employees working excessive overtime. These problems may lead to tiredness or exhaustion, which can increase the likelihood of accidents and ill health.

16.3.3 Work environment factors

When assessing the workplace environment, consideration should be given to individual **human characteristics** such as age, sex, experience, physical stature etc., and how well these human characteristics match the physical environment. Appropriate **design** of workplace environments will ensure that they accommodate a broad variety of human characteristics.

The work environment should satisfy the physical and mental requirements of the people who work within it. The necessary adjustments to the work area, in terms of the heights and angles of furniture and equipment, should be made for the comfort and safety of **each** person.

The four main categories of physical characteristic that need to be considered in the work environment are:

- **clearance**, e.g. headroom, legroom, elbow-room, access;
- **arm reach**, which has a bearing on storage of materials;
- **posture**, which has a bearing on the location of materials/ equipment, heights of working surfaces;
- **Strength**.

Physical environmental factors can have an adverse impact on people. The specific physical factors that limit performance will vary depending on both the work environment and individual differences. Those people who are working within an environment are the ones **best able** to identify factors that affect their work. It is important to involve these 'hands-on' people in consultations with supervisors, managers and occupational health and safety personnel when considering options for controlling the risks in question.

The following environmental hazards may require consideration in your workplace:

- **Noise.** Excessive exposure to loud noise can irreversibly damage the ear, resulting in noise-induced hearing loss. 'Nuisance' noise can be annoying and distracting and result in reduced job performance and satisfaction. Noise may also be unsafe if it impairs

communication in the work environment, such as by overpowering auditory alarms.

- **Lighting.** Lighting levels need to be appropriate to the task . Working in dim or overbright work environments can result in eyestrain, headaches, irritability and, inevitably, reduced productivity. Light sources, including the sun, can create unwanted reflections, glare and shadows in the workplace that can cause discomfort and distraction, and can interfere with the performance of visual tasks. Low levels of lighting can cause depression, which for some people may be severe.

- **Ventilation, air quality and thermal comfort.** Ventilation is important for the control of dust, fumes, gases, aerosols, climate and thermal comfort factors. Exposure to different types of dust can result in fibrosis of the lung, allergic reactions and asthma attacks. Various vapours, gases and aerosols have the ability to cause respiratory and skin damage. Extremes of heat can reduce concentration and motivation and cause a number of heat-related illnesses. Extremes of heat can also reduce tolerance to chemical and noise exposure, and increase the risk of heart attacks.

- **Vibration.** Whole body vibration, e.g. from riding a mower, can affect comfort and performance even at low levels and can cause damage to the spine, stomach pain and gastrointestinal complaints. Hand-arm vibration, such as from hand tools, can have negative effects on muscles and the skeleton, and can contribute to carpal tunnel syndrome, low-back pain and vibration white finger, for example.

- **Radiation.** Exposure to ultraviolet radiation from the sun can induce potentially lethal skin cancers. Exposure to direct sun, particularly between the hours of eleven and two, can result in sunburn, headaches and fatigue. Different people have varying degrees of sensitivity to the sun, e.g. fair freckled skin often burns more quickly than olive skin. Precautions for avoiding sun exposure should be followed diligently by **everybody.**

The work area should be set up according to ergonomic design principles. For each task, the following should be considered: frequency and flow of work; materials and equipment required; and the priority of different tasks. Basic guidelines to follow in the design of the work area to enable the efficient management of tasks include:

- **importance** — placing the most important items in the most advantageous or accessible locations;
- **frequency of use** — placing the most frequently used items within the easiest reach;
- **function** — materials and equipment with closely related functions should be grouped together;

- **sequence of use** — materials and equipment that are commonly used in sequence should be grouped together;
- **Work/rest schedules** — work tasks should be varied to change body position and mental activities.
- **optimal positioning** — positioning materials and equipment to reduce physical hazards and increase useability, e.g. placing a document holder in front of a person, if it is viewed more frequently than the monitor, eliminating glare on computer screens by positioning monitors parallel to light fittings and at right angles to windows.

16.3.4 Responsibility for assessing the work environment

Each employee should be conscious of their health in their work environment and record any pain, discomfort, injury or illness that they believe is work-related. This information should be reported to supervisors as soon as possible to allow appropriate corrective action to reduce the risk to health and safety to be taken.

A determination then needs to be made whether the employee and/or supervisor can assess the situation with the available information, or whether information and advice needs to be sought from the district office.

16.3.5 Evaluation of the workplace environment

The risk management process is used to evaluate the workplace environment. This involves:

- **identifying** work environment hazards;
- **assessing the risk** of injury/illness from these hazards;
- **implementing** appropriate **control measures** to prevent or minimise the risks;
- **Checking** that the control strategies are effectively controlling the risks.

To **identify** environmental hazards in your workplace, you can:

- consult with colleagues and supervisors about possible hazards;
- walk through the work site and record any hazards;
- analyse workplace incident, accident, injury and illness data;
- Consult with specialist practitioners, industry associations, unions and government bodies.

In **assessing** the risks associated with the work environment, the following two factors should be considered:

- The **likelihood** of an incident, accident, injury or illness occurring because of the risk — a very high likelihood indicates controls may be necessary;
- The **severity** of the consequences if an incident, accident, injury or illness occurred because of the risk — if there were many fatalities, this would constitute extremely severe consequences.

If a hazard is determined to be a **risk** (based on likelihood of occurrence and severity of consequences), it is advisable to provide time, money and personnel resources to help prevent or minimise the risks.

The risk associated with each hazard can be **controlledby implementing** the following hierarchy of controls:

- **eliminating** the risk from the workplace, e.g. by removing hazardous playground equipment;
- **substituting** a material in the workplace environment with a less hazardous one, e.g. purchasing non-hazardous cleaning equipment, or replacing slippery floors with non-slip flooring;
- **redesigning** the workplace layout to reduce risks, e.g. rearranging furniture to allow easy access to materials and equipment;
- **isolating**, closing off or guarding a particular hazard in the work environment, e.g. keeping medicines in a locked cabinet;
- **administration** — adjusting the time and conditions of an individual's exposure to the risk, e.g. rotating tasks so that employees do not spend too long in hot or cold conditions, or too long performing a strenuous manual task.
- Providing **personal protective equipment** as a last resort, when higher-order controls are not practicable, e.g. providing hearing protection, face shields and sunscreen for janitors/ groundspersons using whipper-snipers and lawn mowers.

16.4 Summary

There are some health and social issues for it. Consultation involves employers not only giving information to employees but also listening to them and taking account of what they say before making health and safety decisions. The physical aspects of a workplace environment can have a direct impact on the productivity, health and safety, comfort, concentration, job satisfaction and morale of the people within it. When people are working in situations that suit their physical and mental abilities, the correct fit between the person and the work task is accomplished.

Ergonomics is typically known for solving physical problems. When assessing the workplace environment, consideration should be given to individual human characteristics such as age, sex, experience, physical stature etc., and how well these human characteristics match the physical environment. The four main categories of physical characteristic that need to be considered in the work environment are: clearance, arm reach, posture and Strength. The following environmental hazards may require consideration in your workplace: Noise, Lighting, Ventilation, air quality, Vibration and Radiation. Each employee should be conscious of their health in their work environment and record any

pain, discomfort, injury or illness that they believe is work-related. The risk management process is used to evaluate the workplace environment.

16.5 Self Assessment Test

1. What work environment factors should be assessed?
2. What action should you do if you identified an ergonomics problem?
3. What is Ergonomics? Why is ergonomics important?
4. What is the responsibility for assessing the work environment?
5. How can ergonomics help my workplace?
6. What can you do to detect and prevent ergonomic hazards at your workplace?
7. How do you control ergonomic risk factors?
8. What types of work are most likely to pose ergonomic hazards?

16.6 Further Readings

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2. Ergonomics for Beginners: A Quick Reference Guide, Third Edition, CRC Press, Jan Dul, B Weerdmeester
3. Office Ergonomics: Practical Applications,CRC Press, Céline McKeown

Block 5

Managing International Information System

Unit 17 5
The Global Environment : business drivers and challenges; developing an international information system architecture

Unit 18 18
Organizing International Information System : Global Strategies; Global Systems; Re-organizing the business

Unit 19 25
Technology Issues and global value chains; managing global software

Unit 20 37
Offshore outsourcing : Opportunities and challenges

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परिमापक

अनुवाद की स्थिति में

मूल लेखक	अनुवाद
मूल सम्पादक	भाषा सम्पादक
मूल परिमापक	परिमापक

सहयोगी टीम

संयोजक Dr. Gaurav Sankalp, SoMS, UPRTOU, Allahabad

Block Introduction

Block five deals with four units . Unit seventeen deals with global environment, business drivers and challenges developing an international information system. Unit eighteen deals with organizing international information system. Unit nineteen technology issues and global value chains, managing global software. Unit twenty deals with off shore outsourcing opportunities and challenges.

Unit - 17 The Global Environment

Unit Structure

17.0 Objective

17.1 Introduction

17.1.1 Advantage of globalisation for business, customer and countries

17.1.2 Disadvantage of globalisation for business, customer and countries

17.1.3 The consequences of globalisation

17.1.4 Changes in the international business environment

17.2 Business Drivers

17.3 Business Challenges

17.4 Developing an international information system architecture

17.5 Summary

17.6 Self Assessment Test

17.7 Further Reading

17.0 Objective

Information, communication, and transportation technologies have created a global village in which communication (by telephone, television, radio, or computer network) around the globe is no more difficult and not much more expensive than communication down the block. The cost of moving goods and services to and from geographically dispersed locations has fallen dramatically

17.1 Introduction

Information, communication, and transportation technologies have created a *global village* in whichcommunication (by telephone, television, radio, or computer network) around the globe is no more difficult and not much more expensive than communication down the block. The cost of moving goods and services to and from geographically dispersed locations has fallen dramatically.

Six Tracking global trends, looks at six broad, long-term developments that are shaping our world:

- Emerging markets increase their global power
- Cleantech becomes a competitive advantage
- Global banking seeks recovery through transformation
- Governments enhance ties with the private sector

- Rapid technology innovation creates a smart, mobile world
- Demographic shifts transform the global workforce

Global economies are so tightly interconnected that companies, governments and industries will soon be forced to cooperate in ways we could not have imagined just a few years ago.

In fact, Ernst & Young believes the six trends are themselves connected by three underlying drivers that have helped establish each trend and perpetuate it.

1. **Demographic shifts.** Population growth, increased urbanization, a widening divide between countries with youthful and quickly aging populations and a rapidly growing middle class are reshaping not only the business world, but also society as a whole.
2. **Reshaped global power structure.** As the world recovers from the worst recession in decades, the rise of relationships between the public and private sectors has shifted the balance of global power faster than most could have imagined just a few years ago.
3. **Disruptive innovation.** Innovations in technology continue to have massive effects on business and society. We're now seeing emerging markets become hotbeds of innovation, especially in efforts to reach the growing middle class and low-income consumers around the globe.

The growth of powerful communications technologies and the emergence of world cultures create the condition for *global markets*—global consumers interested in consuming similar products that are culturally approved.

The new global markets and pressure toward global production and operation have called forth whole new capabilities for global coordination of all factors of production. Not only production but also accounting, marketing and sales, human resources, and systems development (all the major business functions) can be coordinated on a global scale.

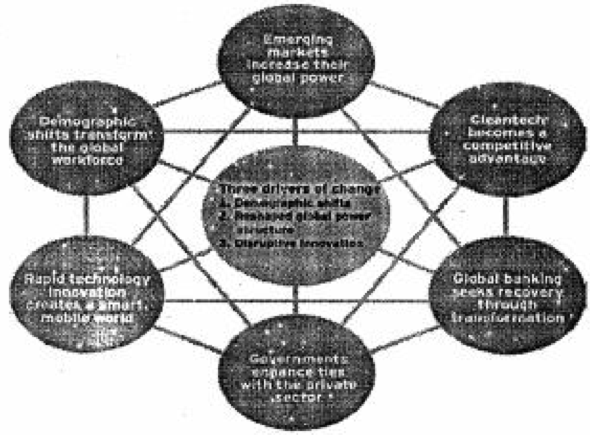

Figure 1.1 Six global trends, interconnected by three drivers of change

Low-cost [illegible] exploited [illegible] they emerge. The result is a powerful strategic advantage to firms that canorganize globally.

Winner and losers

As these trends change the ways in which businesses operate, grow and compete, winners and losers inevitably will emerge.

The winners will be easy to spot:

- They will be the organizations that constantly monitor broad trends in the external environment, embrace technology and look for talent everywhere, especially among previously neglected segments of the workforce such as women, minorities and older workers.
- Regardless of what industry they are in or where they are headquartered, these organizations are looking outward. In so doing, they are navigating multiple jurisdictions and regulatory frameworks while adapting to local environments and attempting to create global workforces.
- They are modifying supply chains to leverage shifting labor cost structures and mitigate raw materials' price fluctuations.
- They are figuring out how cleantech fits into their growth plans and making it an integral part of their future strategy.
- National governments, meanwhile, are seeking ways to meet growth agendas while reducing cost structures and future debt obligations.

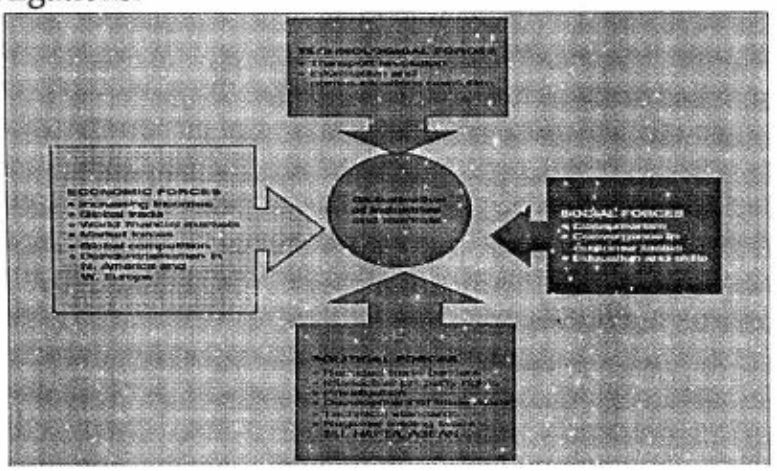

Figure1.2 : Factors that impacts on globalisation

17.1.1 Advantage of globalisation for business, customer and countries:

To Business:

- Access to mass markets increased sales
- Economies of scale and reduced costs
- Access to resources
- Access to finance and tax savings

To customers:

- Lower prices
- Wider choice
- Improved quality

To companies:

Improved living standard in both developing and developed countries. Increased Democracy- fall in communism

17.1.2 Disadvantages of globalisation for business , customer and countries:

To Business:

- Increased competition
- More demanding consumers
- Increasing volatility

To customer:

- Standardisation

To countries:

- Exploitation
- Loss of national culture and identity
- Uneven benefits.
- Environmental factors

17.1.3 The consequences of globalisation

These may include such issues as:

- the size and scale of multinational companies, which gives them significant influenceover policy making of governments;
- increased international competition may necessarily mean that some countries miss out;
- the increasing number and variety of international laws and standards may be difficult for some countries to keep up with;
- Governance issues are coming to the fore, which may cause problems for some countries with less developed legal frameworks.

17.1.4 Changes in the international business environment

These critical environmental trends include:

- globalisation in manufacturing and service provision;
- large-scale geographical changes in the distribution of manufacturing (e.g. vast increase in parts of South East Asia and stable, even declining, outputs in much of North America and Europe);
- some economies specialising in manufacturing while others specialise in service industry and consumption;
- global recession and vastly differential national economic growth rates creating rapidly shifting patterns of global wealth and income distribution;
- growth in the power and influence of economic and political unions, such as the EU, and countries, such as the BRIC economies – Brazil, Russia, India and China;

- the spread of nuclear weapons capability;
- religious fundamentalism;
- the threat of international terrorism;
- changing emphasis from multilateralism (e.g. power lying with the UN) to unilateralism (e.g. power with the USA or others);
- increasing debate on the future role of government;
- failed states;
- the prevalence of long-term unemployment and under-employment;
- the continuing integration of Europe and of other regional blocs;
- atmospheric, water, space, land and noise pollution, resource depletion and water shortages;
- global warming;
- increasing availability of information and ease of communication;
- technological advances, including ICT, biotechnology, genetics, robotics, virtual worlds;
- the demographic transition typified by declining fertility rates and increasing life expectancy leading to an ageing population in most countries – the so-called 'demographic time bomb' – with serious long-term implications for caring for the old, levels of taxation and government and individual indebtedness;
- dynamic national and international cultures, mass migration and cultural interaction, tolerance and intolerance; and
- changing attitudes towards the family, health, crime and society.

This list provides ample food for thought.Many of the issues raised have crucial implications for all governments and organisations, groups and individuals. Collectively, theseenvironmental forces are fundamentally influencing, and being influenced by, patterns ofeconomic growth, employment and investment.

17.3 Business Drivers

A business is always owned by someone. This can just be one person, or thousands. So a business can have a number of different types of ownership depending on the aims and objectives of the owners.

Most businesses aim to make profit for their owners. Profits may not be the major objective, but in order to survive a business will need make a profit in the long term. Some organisations however will be 'not-for-profit', such as charities or government-run corporations.

Types of business organisation

- Sole trader

- Partnership
- Private Limited Company ("Ltd")
- Public Limited Company ("plc")
- Co-operatives
- Franchises
- Public sector

The business drivers in the global environment that are leading all industries toward global markets and competition.The global business drivers can be divided into twogroups:

General cultural factors:

- Global communication and transportation technologies
- Development of global culture
- Emergence of global social norms
- Political stability
- Global knowledge base

Specific business factors:

- Global markets
- Global production and operations
- Global coordination
- Global workforce
- Global economies of scale

There are some drivers that motivate business to participate in global governance, self-regulation, and setting industry standards:

1 Responding to globalization, in particular to the decreasing relative power of states and the increasing relative power of civil society.

2. Staying ahead of the regulatory curve.

3. Market drivers:

- similar customer needs and tastes;
- the existence of global customers;
- Transferable marketing between different countries.

4. Competitive drivers:Enhancing a competitive position within an industry

- competitors' global strategies;
- country interdependence.

5. Cost drivers:

- scale economies and scope including product development costs –experience curve;
- favourable logistics;
- country-specific differences.

6. Government drivers are numerous and include:

- trade policies; tariff barriers; subsidies to local companies; ownership restrictions;
- local content requirements; controls over technology transfer; intellectual property

  regimes; currency and capital flows;
- marketing regulations; host government concerns; technical standards.

17.3 Business Challenges

Although the possibilities of globalization for business success are significant,fundamental forces are operating to inhibit a global economy and to disruptinternational business. The most common and powerfulchallenges to the development of global systems are below.

General:

Cultural particularism: Regionalism, nationalism, language differences

Social expectations: Brand-name expectations, work hours

Political laws: Transborder data and privacy laws, commercial regulations

Specific:

- *Standards:* Different Electronic Data Interchange (EDI), telecommunications standards
- *Reliability:* Phone networks not uniformly reliable
- *Speed:* Different data transfer speeds, many slower than United States
- *Personnel:* Shortages of skilled consultants

17.4 Information System Architecture

Information system architecture is a formal definition of the business processes and rules, systems structure, technical framework, and product technologies for a business or organizational information system. Aninformation system architecture usually consists of four layers: business process architecture, systems architecture, technical architecture, and product delivery architecture.

The architecture of an information system encompasses the hardware and software used to deliver the solution to the final consumer of services. The architecture is a description of the design and contents of a computerized system. If documented, the architecture may include information such as a detailed inventory of current hardware, software and networking capabilities; a description of long-range plans and priorities for future purchases, and a plan for upgrading and/or replacing dated equipment and software.

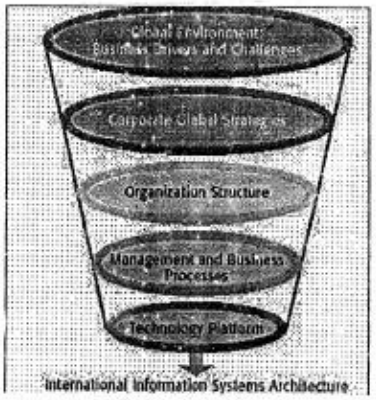

Figure 1.2 : Information Architecture

The major dimensions for developing international information systems architecture are the global environment, the corporate global strategies, the structure of the organization, the management and business processes, and the technology platform.

The basic strategy to follow when building an international system is to understand the global environment in which the firm is operating. This means understanding the overall market forces, or business drivers, that are pushing the industry toward global competition. A business driver is a force in the environment to which businesses must respond and that influences the direction of the business. Likewise, examine carefully the inhibitors or negative factors that create management challenges—factors that could scuttle the development of a global business. Once examined the global environment, and then need to consider a corporate strategy for competing in that environment. We could ignore the global market and focus on domestic competition only, sell to the globe from a domestic base, or organize production and distribution around the globe. There are many in-between choices. After we have developed a strategy, it is time to consider how to structure our organization so it can pursue the strategy. How will we accomplish a division of labor across a global environment? Where will production, administration, accounting, marketing, and human resource functions be located? Who will handle the systems function?

Then consider the management issues in implementing our strategy and making the organization design come alive. Key here will be the design of business processes. How can we discover and manage user requirements? How can we induce change in local units to conform to international requirements? How can we reengineer on a global scale and how can we coordinate systems development?

The last issue to consider is the technology platform. Although changing technology is a key driving factor leading toward global markets, we need to have a corporate strategy and structure before we can rationally choose the right technology.

After completed this process of reasoning, anappropriate international information systems architecture capable of achieving corporate goals.

The architecture should document:

- What data is stored?
- How does the system function?
- Where are components located?
- When do activities and events occur in the system? and Why does the system exist?

The basic information systems required by organizations to coordinate worldwide trade and other activities

17.5 Summary

There are several Advantage and disadvantages of globalisation for business, customer and countries. There are few consequences and challenges of globalisation. A business can have a number of different types of ownership depending on the aims and objectives of the owners. Types of business organisation are Sole trader, Partnership, Private Limited Company ("Ltd"), Public Limited Company ("plc"), Co-operative, Franchises , Public sector, Although the possiiblities of globalization for business success are significant, fundamental forces are operating to inhibit a global economy and to disrupt international business. Information system architecture is a formal definition of the business processes and rules, systems structure, te hnical framework, and product technologies for a business or organizational information system.

17.6 Self Assessment Test

1. What do you mean by Business drivers? How they help in the growth of any business?
2. What is business? Explain the business challenges?
3. What is information system? Define Information system architecture.
4. Explain the advantages and Disadvantages of globalisation.
5. What are the factors responsible for the changes in business environment?
6. What do you mean by business environment?
7. What are the factors affect to the globalisation?

17.7 Further Reading

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2. Management Information System, PHI Publication, by S. Sadagopan
3. Management Information Systems : Managing the Digital Firm (English) 11th Edition,Pearson Publication, by Kenneth C. Laudon & Jane P. Laudon

Unit 18 Organizing International Information System

Unit Structure

18.0 Objective
18.1 Introduction
18.2 Global Strategies
18.3 Global Systems
18.4 Re-organizing the business.
18.4.1 Reasons that need for Reorganizing
18.4.2 Guideline for Reorganizing
18.5 Summary
18.6 Self Assessment Test
18.7 Further Reading

18.0 Objective

The development of information systems is described with regard to the roles of the system user and the data processing specialist.

18.1 Introduction

Organisational needs are best served by coordination efforts, usually handled by a management systems office, which is also responsible for the maintenance and production of an organisational data element dictionary and a uniform code manual. Consideration must be given to production processes dealing with data and files, and their management must report at a high enough level in the organization to accomplish coordinated development at the institutional level between various administrative information systems. A model for a user's group is presented.

The three main organizational issues in globalizing a business are:

- Choosing a strategy
- Organizing the business structure (decentralized, centralized, coordinated)
- Organizing the systems management area

18.2 Global Strategies and Business Organization

Global Systems Strategy has some functions: Define the core business processes: Conduct workflow analysis, identify centers of excellence for these processes Identify the core systems to coordinate centrally: Conquer the core systems and define these systems as truly.

transnational, Choose an approach: Incremental, Grand Design, Evolutionary Make the Benefits Clear.

Four main global strategies form the basis for global firms' organizational structure:

- **Domestic exporter:** This strategy is characterized by heavy centralization of corporate activities in the home country of origin. Nearly all international companies begin this way, and some move on to other forms.
- **Multinational:** This strategy concentrates financial management and control out of a central home base while decentralizing production, sales, and marketing operations to units in other countries.
- **Franchiser:** Franchisers create, design, finance, and initially produce in the home country, but for product-specific reasons must rely heavily on foreign personnel for further production, marketing, and human resources.
- **Transnational:** In this strategy, nearly all the value-adding activities are managed from a global perspective without reference to national borders, optimizing sources of supply and demand wherever they appear, and taking advantage of any local competitive advantages.

18.3 Global System

World Systems Theory - Marxist theory composed of three classes

1. Periphery = global south mostly extracting raw materials that uses much labor and little capital paying low wages.
2. Core = industrialized regions mostly manufacturing goods, work uses more capital, requires skilled labor, and pays high wages.

Global System or World-system refers to the international division of labor, which divides the world into three countries this is called World Systems Theory given by Marxist. and the countries are:

- Core countries, semi-periphery countries and the periphery countries.
- Core = industrialized regions mostly manufacturing goods, work uses more capital, requires skilled labor, and pays high wages
- Periphery = global south mostly extracting raw materials that uses much labor and little capital paying low wages.
- Semi periphery = manufacturing occurs and some capital concentrates, Eastern Europe and Russia examples. Poor states can aspire to join the semi periphery
- Resources are redistributed from the underdeveloped, typically raw materials-exporting, poor part of the world (the periphery) to developed, industrialized core.

- World-system also has four temporal features. *Cyclical rhythms* represent the short-term fluctuation of economy, while *secular trends* mean deeper long run tendencies, such as general economic growth or decline. The term *contradiction* means a general controversy in the system, usually concerning some short term vs. long term trade-offs. For example the problem of under consumption, wherein the drive-down of wages increases the profit for the capitalists on the short-run, but considering the long run, the decreasing of wages may have a crucially harmful effect by reducing the demand for the product. The last temporal feature is the *crisis*: a crisis occurs, if a constellation of circumstances brings about the end of the system.

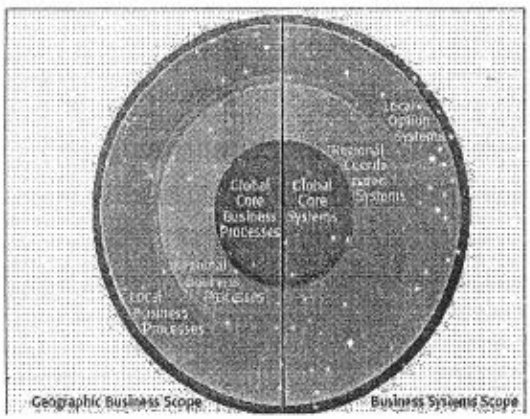

Figure 18.1: Local, Regional, and Global Systems

The configuration, management, and development of information systems tend to follow the global strategy chosen.

The four main types of information systems configuration are:

- **Centralized systems:** Systems development and operation occur totally at the domestic home base.
- **Duplicated systems:** Development occurs at the home base but operations are handed over to autonomous units in foreign locations.
- **Decentralized systems:** Each foreign unit designs its own unique solutions and systems.
- **Networked systems:** Systems development and operations occur in an integrated and coordinated fashion across all units.

SYSTEM CONFIGURATION	Strategy			
	Domestic Exporter	Multinational	Franchiser	Transnational
Centralized	X			
Duplicated			X	
Decentralized		X		
Networked		X		X

Figure 18.2: Global Strategy and Systems Configurations

There are three principles in developing a global company and information systems support structure.

1. Organize and locate value-adding activities or functions along lines of comparative advantage.
2. Develop and operate systems units at each level of corporate activity. Host country systems units should serve local needs; telecommunications and systems development should be handled by regional systems units; and transnational systems units should be established to create linkages across major regional areas.
3. Establish at world headquarters a single officer (CIO) responsible for international systems.

Managing Global Systems: The management solution:

- Agreeing on common user requirements
- Introducing changes in business processes
- Coordinating applications development
- Coordinating software releases
- Encouraging local users to support global systems

18.4 Re-organizing the business

1. Conducting strategic planning to regularly review the purpose of your organization, its overall goals and who should be doing what to meet those goals

2. Using sound principles of employee performance management to regularly review what employees should be doing to produce results, how they're doing toward their results, and what must be done to help them do a better job of achieving results

18.4.1 Reasons that need for Reorganizing:

There are a wide variety of reasons for reorganizing an organization, particularly in today's rapidly changing marketplace. However, there are several reasons for reorganization that seem to keep coming up in small businesses, whether for-profit or non-profit.

These reasons include:

1. An employee keeps complaining (and you agree) that he or she is overloaded with work.
2. Employees complain that their activities overlap.
3. An employee indicates (and you agree) that he or she does not have enough work to do during a work day.
4. Employees complain that they're reporting to more than one boss, or supervisor.
5. An employee complains that their work includes very different tasks. For example, they may have a highly complex and demanding

project (e.g., leading strategic planning) and a large routine, recurring task (sorting a great deal of the organization's daily mail).

6. Management notices a large amount of employee turnover, that is, employees don't stay long enough with the organization.
7. A department, or major function in the organization, has recurring problems.

18.4.2 Guideline for Reorganizing:

Recurring problems often seem to have little to do with the business's overall purpose and goals. However, any attempts at reorganizing may be just fine tuning, or tweaking, if not done with the long term in mind. In fact, the recurring problems may be a symptom of the organization's not having clearly thought out what its overall purpose and goals are. Without visiting the overall purpose and goals, redesign is usually a highly reactive and very short-term fix. Carefully consider conducting a strategic planning process to guide you through reviewing your organization's purpose.

18.5 Summary

Four main global strategies form the basis for global firms' organizational structure : Domestic exporter, Multinational, Franchiser and Transmissional. Global System or World-system refers to the international division of labour, which divides the world into three countries. Re-organizing the business includes conducting strategic planning and using sound principles of employee performance management. There are several reasons and guide-lines for reorganization that seem to keep coming up in small businesses, whether for profit or non profit.

18.6 Self Assessment Test

1. What are the major challenges to the development of global systems?
2. What are the five major factors to consider when building an international information systems portfolio?
3. Describe the four main strategies for global business and organizational structure.
4. Describe the different system configurations that can be used to support different global strategies.
5. What are the major management issues in developing international systems?
6. What are the three principles to follow when organizing the firm for global business?
7. Describe three new technologies that can help firms develop

global systems.

18.7 Further Reading

1. Management Information System ,PHI Publication ,by S.Sadagopan
2. Management Information Systems : Managing the Digital Firm (English) 11th Edition,Pearson Publication, by Kenneth C. Laudon & Jane P. Laudon
3. Global Strategic Management, Second Edition, Palgrave Macmillan ,by Philippe Lasserre
4. Understanding Global Strategy, Cengage Learning ,Susan Segal-Horn and David Faulkner

Unit 19 Technology Issues and global value chains; managing global software

Unit Structure

19.0 Objective

19.1 Introduction

19.1.1 Functions of the value chain

19.1.2 Barriers and their effects

19.2 Advantage of GVC's

19.3 Global Value Chain Challenges

19.4 Global Value Chain Strategies

19.5 Global Value Chain Technology

19.6 Technology Issues and Opportunities for Global Value Chains

19.7 Factors influencing the competition within and between value chains

19.8 Management Opportunities and Challenges in developing global systems

19.9 Summary

1910 Self Assessment Test

19.11 Further Reading

19.0 Objective

The value chain describes the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms. Value chain activities can produce goods or services, and can be contained within a single geographical location or spread over wider areas. The Global Value Chains(GVC) Initiative is particularly interested in understanding value chains that are divided among multiple firms and spread across wide swaths of geographic space, hence the term "global value chain." used.

19.1 Introduction

A *value chain* includes every step a business takes to produce a product or service and deliver it to the customer from its conception to its end use and beyond. This includes activities such as research and design, production, marketing, distribution, and support to the final consumer. All of a firm's individual business processes are represented in the value chain. Research and development, production, distribution,

sales and service are all business processes which most firms consider to be integral aspects of their business strategy. Corporate services act as support mechanisms for these core processes.

Although we may recognize these business processes as facets of our own firm, we may never have thought of them as comprising our own *value chain*. When thinking about our own firm and its value chain, it is useful to think of each business process as a link in the chain which adds value to the entire process, or to the entire value chain.

By managing the chain's activities strategically, a firm can create a competitive advantage for itself. This means ensuring that supply meets projected demand effectively and efficiently, with maximum consumer satisfaction. Productivity, innovation, flexibility and responsiveness to the consumer become critical attributes of the value chain and you must choose the most effective solution for each link in the chain. This may require expanding our vision outside the walls of our firm, morphing our previously domestic/internal value chain into a global value chain.

Global value chains (GVC) are a major driving force of globalization that also promotes integration on multiple levels. This volume is the product of a dialogue with policy makers in the Asian region, where economists, political scientists, management specialists, development thinkers and business executives joined together in an exploration of the multiple dimensions of supply chains, what drives them, how they operate, how they adapt in a rapidly changing world, and what they mean for development and for policy.

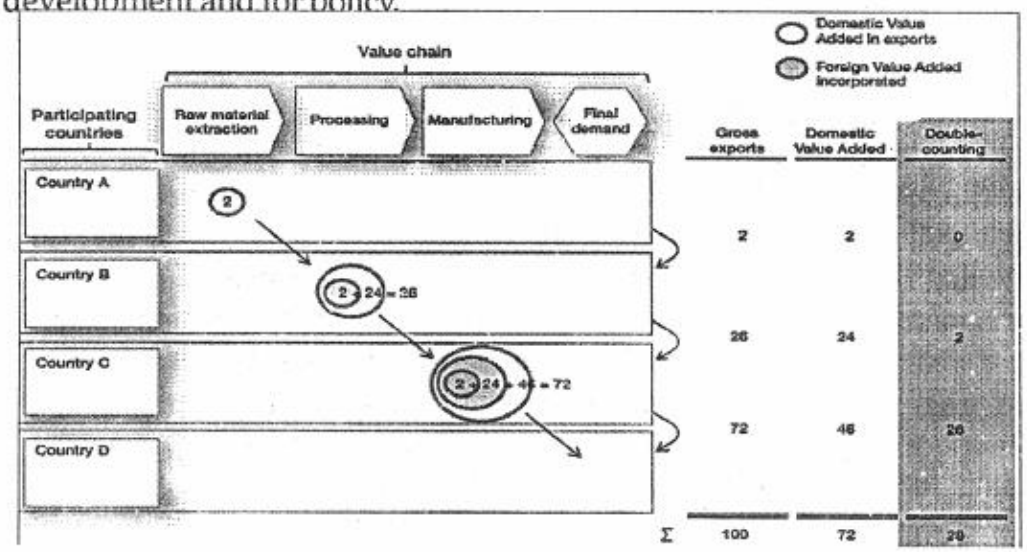

Figure 3.1: Working of GVC

What makes GVCs different?

One important point is that the patterns and effects of GVCs tend to vary in specific industries and places. Because of this, GVC research often has a sectoral or geographic focus. In "The governance of global value chains" (cited above), the co-organizers of the GVC Initiative identify three important variables to look for when studying GVCs in a particular firm, industry, or place:

1. *The complexity of transactions.* More complex transactions require greater interaction among actors in GVCs and thus stronger forms of governance than simple price-based markets. Thus, complex transactions will likely to be associated with one of the three network governance patterns (modular, relational, or captive) or integrated within a single firm (hierarchy).

2. *The codifiability of transactions.* In some industries schemes have been worked out to codify complex information in a manner in which data can be handed off between GVC partners with relative ease, often using advanced information technologies. If suppliers have the competence to receive and act upon such codified information, and if the codification schemes are widely known and widely used, then we would expect to see modular value chains emerge. If not, then lead firms might either keep the function in-house, leading to more vertical integration (hierarchy) or outsource it to a supplier that they tightly control and monitor (the captive network type) or have a dense, idiosyncratic relationship with suppliers (the relational governance type).

3. *The competence of suppliers.* The ability to receive and act upon complex information or instructions from lead firms requires a high degree of competence on the part of suppliers. Only then can the transfer of complex but codified information be achieved (as in modular networks) or intense interaction beworthwhile (as in relational networks). Where competent suppliers do not exist, lead firms either must internalize the function (hierarchy) or outsource it to suppliers that they tightly monitor and control (captive suppliers).

Furthermore, if one of these three variables changes, then value chain governance patterns tend to change in predictable ways. For example, if a new technology renders an established codification scheme obsolete, we might expect modular value chains to become more relational, and if competent suppliers cannot be found, then perhaps captive networks and even vertical integration would become more prevalent. Conversely, rising supplier competence might mean that captive networks move toward the relational type and better codification schemes might prepare the ground for modular networks.

19.1.1 Functions of the value chain:

Six business functions of the value chain:

- Research and development
- Design of products, services, or processes
- Production
- Marketing and sales
- Distribution
- Customer service

19.1.2 Barriers and their effects:

Barriers	*Effect*
1. Quality standards in developed countries like the EU limit access to these markets.	1.Satisfying these requirements makes export more expensive
2. No skilled worker available locally	2. Low level of technology and no innovation in the chain
3. No access to credit and other resources	3. No possibility to finance the necessary Investments
4. Too much local regulation or no appropriate governance structure	4.Too much paperwork is necessary, increasing the cost of production
5. Lack of infrastructure	5. High cost of transportation

Table 19.1: Barriers to value chain development

19.2 Advantage of GVCs

Global Value Chain Readiness Assessment

To successfully compete in the international business environment, it is crucial to be certain that you have the operational requirements necessary. In order to facilitate this evaluation, a readiness assessment may prove useful.

The "3 Cs" Readiness Assessment Model: Clarity, Competency and Compatibility

The 3 Cs readiness assessment model is designed to help evaluate whether or not your firm has what it takes to compete internationally. It does this by identifying three key factors of global value chain success: **clarity, competency,** and**compatibility.** In order to evaluate your firm's readiness, the model asks three simple questions:

1. Does your firm have **clarity** in a strong common vision or business strategy?
2. Do you have competitive core **competencies** which your business can leverage?
3. Is your firm able to build **compatible,** well-functioning business relationships?

In order to answer these questions firms must break down their operations and examine each aspect of their business individually. The 3 Cs model, displayed below, will help you through this process. Proceeding in steps, work through each of the three Cs, checking your firm's operational capacities against the model as you go. When you have completed the exercise you should have a better idea of whether or not your firm is ready to consider competing in the international marketplace.

19.3 Global Value Chain Challenges

- Evaluate challenges of global value chain management.
- Describe legal and ethical issues in global value chain management.
- Examine logistics in the global value chain.
- Examine financial issues in the global value chain.

19.4 Global Value Chain Strategies

- Evaluate techniques to forecast customer requirements.
- Describe inventory models that will add value to the global supply chain.
- Determine appropriate hedging strategies for supply and demand in a global value chain.
- Relate an organization's sourcing, manufacturing, and distribution strategies to its global value chain strategy.

19.5 Global Value Chain Technology

- Assess the impact of the Internet on the global value chain.
- Identify information technology systems common in global value chain management.
- Assess the impact of information technology on the global value chain.

19.6 Technology Issues and Opportunities for Global Value Chains

The technology challenges of global systems include:

- **Computing platforms and systems integration:** How the new core systems will fit in with the existing suite of applications developed around the globe by different divisions, different people, and for different kinds of computing hardware.

Computing platforms and systems integration:

- Develop global, distributed, and integrated systems to support digital business processes spanning national boundaries
- Use of same hardware and operating systemdoes not guarantee integration.
- Establish data and technical standards.
- **Connectivity**: Problems include costs and tariffs, network management, installation delays, poor quality of international service, regulatory constraints, changing user requirements, disparate standards, and network capacity. Firms provide

international connectivity by building their own international private network using proprietary standards or by using Internet technology. However, many countries lack the communications infrastructure for extensive Internet use, and some countries face high costs, government control, or government monitoring.

- **Software:** Building software that can be used by multiple business units from different countries that have unique business processes, languages, cultures, and definitions of data. Unique challenges for application software:
  - o Cost of new interface designs
  - o Integrating new systems with old
  - o User interface design
  - o Differences in language and conventions

Both global and domestic firms increasingly are managing their hardware and software resources using global teams.

- **Offshore software outsourcing:**

In **offshore software outsourcing,** many companies now outsource some of their new systems development work or maintenance of existing systems to external vendors in another country. Any company that outsources its applications must thoroughly understand the project, including requirements, method of implementation, source of expected benefits, cost components, and metrics for measuring performance.

Offshore outsourcing reduces software development costs but companies will not save as much as they initially think. There are hidden costs to offshore outsourcing, and these costs often increase the total cost of ownership (TCO) of offshore-developed software by over 50 percent.

Major cost components of offshore software development:

Major cost components include

- Contract cost
- Vendor selection costs
- Transition management and knowledge transfer costs
- Domestic human resource costs
- Costs of improving software development processes
- Costs of adjusting to cultural differences
- Costs of managing an offshore contract

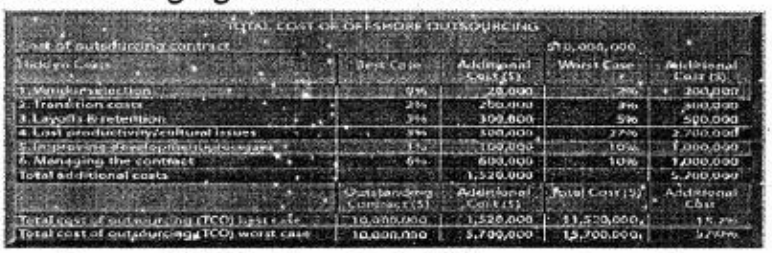

Figure 19.2 :Total cost of offshore outsourcing

If a firm spends $10 million on offshore outsourcing contracts, that company will actually spend 15.2 percent in extra costs even under the best-case scenario. In the worst-case scenario, where there is a drop in productivity along with exceptionally high transition and layoff costs, a firm can expect to pay up to 57 percent in extra costs on top of the $10 million outlay for an offshore contract.

Although offshore software outsourcing might benefit individual firms, its broader social impact is less clear. Companies that outsource their software work may be eliminating jobs of their own employees or employees of the domestic software industry.

The cost of production in a global value chain depends on a number of factors, includingthe organizational structure chosen. Hypotheses concerning the currentproblems in the case of agricultural value chains that can be formulated:

- Inputs are too expensive, or not available, or of the wrong type
- Extension services are too far away from the farmers, or not adapted to theirneeds and possibilities
- Small agricultural producers have no access to finance
- There is a lack of intermediary organizations
- These organizations hinder the development of export
- There are no adequate marketing facilities
- Private operators can play a role in providing inputs and extension services andcan organize the marketing successfully.

19.7 Factors influencing the competition within and between value chains

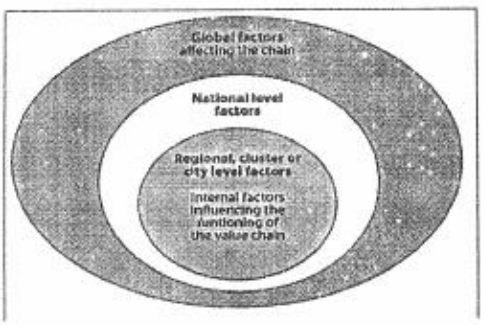

Figure 19.3: Factors affecting the global value chain

Withinvaluechains

Internal factors

- The policy of the government withrespect to this chain
- The business model chosen (theorganizational structure chosen)
- The cost of production andtransportation

External factors

The price of national andinternational transportation

- The plans of neighbouring countrieswith respect to bio fuels International regulation

Betweenvaluechains

Internal factors

- Policies with respect to differentvalue chains
- National regulation
- The profitability of one typeof biofuel chain affects thedevelopment of others**
- The cost of adding reagents to turnbiofuels into biodiesel
- The quality of the product

External factors

Liberalization of agricultural importsin Europe

Innovations in seeds & plants orproduction methods

The price of petrol and of competingproducts, close substitutes of possible replacements

Technological abilities to mixdifferent biofuels with conventionalfuel

19.8 Management Opportunities and Challenges in developing global systems

Ability to lower costs through global scaleeconomies by building international systems forproducing and selling goods and services indifferent regions of the world.

- Finding the right global business strategy
  - * Difficulties of managing change in a multicultural firm
  - * Difficulties of achieving global connectivity and integration
- Agreeing on common user requirements
- Introducing changes in business processes
- Coordinating applications development
- Coordinating software releases
- Encouraging local users to support global systems

19.9 Summary

Value chain activities can produce goods or svrvices, and can be contained within a single geographical location or spread over wider areas. The Global value Chains (GVC) Initiative is particularly interested in understanding value chains that are divided among multiple firms and spread across wide swaths of geographic space, hence the term "global

value chain" used. The co-organizers of the GVC Initiative identify three important variables to look for when studying GVCs in a particular firm, industry, or place: The complexity of transactions, the condifiability of transactions, and the competence of suppliers. There are six business functions of the value chain : Research and development, Design of products, services, or processes, Production, Marketing and sales, Distribution, Customer service. The technology challenges of global systems include: Computing platforms and systems integration, Connectivity, Software, Offshore software outsourcing. There are several Factors influencing the competition within and between value chains.

19.10 Self Assessment Test

1. What do you mean by global value chain where it is used
2. What is the advantages and disadvantages of global value chains
3. Define some factors that affect global value chain.
4. What are the GVC technologies? Also define the technologies issues and opportunity for GVC.
5. Define the role of GVC in world class business.
6. Explain the strategies and barriers and their effects in GVC.

19.11 Further Reading

1. A Text on International Business, by N.V. Badi
2. Supply Chain Management: Strategy, Planning, and Operation,PHI,by Sunil Chopra and Peter Meindl
3. Supply Chain Management: For Global Competitiveness, Macmillan, Sahay, B
4. Essentials of International Business,by N.-V. Badi

Unit 20 Offshore Outsourcing: Opportunities and Challenges

Unit Structure

20.0 Objective

20.1 Introduction

20.1.1 Key Factors of outsourcing and offshoring

20.2 Advantages and Disadvantages of Outsourcing

20.3 Risks of offshore outsourcing

20.4 Challenges of offshore outsourcing

20.5 Offshore Outsourcing Capabilities

20.6 Tips for successful outsourcing

20.7 Summary

20.8 Self Assessment Test

20.9 Further Reading

20.0 Objective

Offshore outsourcing is one of the hot topics influencing the global environment, politically, economically, and socially. While offshore outsourcing is associated with several benefits, these ventures also pose many risks.

20.1 Introduction

"Outsourcing" refers to the transfer of non-core operations from internal employees to an external organization. This transfer of non-core operations allows the company that outsources the work to focus on its core business. The organization that the work is outsourced to will typically have expertise in a given area, allowing it to add value and provide cost savings. For instance, many companies outsource payroll to one of the many available payroll vendors. The payroll vendors are able to add value in the area of payroll in a way that internal payroll departments can't achieve. Another example is human resources departments that outsource background checks to vendors specializing in this area rather than driving to courthouses and checking criminal records themselves.

The term "offshore" refers to where the work is being performed geographically. In other words, if a task is "offshored," then the task is being performed in another country.

Offshore outsourcing - "Offshore outsourcing" means that work is being performed by an external company in another country overseas. Many people simply refer to this as "offshoring." Offshoring is taking place all over the world. The more common locations are India, China, the Philippines, Eastern Europe and South America. A derivative of offshore is "near shore" where work from the U.S. is performed in Canada or Mexico.

Offshore outsourcing is the practice of hiring an external organization to perform some business functions in a country other than the one where the products or services are actually developed or manufactured. It can be contrasted with offshoring, in which the functions are performed in a foreign country by a foreign subsidiary. Opponents point out that the practice of sending work overseas by countries with higher wages reduces their own domestic employment and domestic investment. Many customer service jobs as well as jobs in the information technology sectors (data processing, computer programming, and technical support) in countries such as the United States and the United Kingdom - have been or are potentially affected.

The current offshore outsourcing trend started in the 1970s when large multinational companies like General Electric began sending manufacturing overseas. White collar jobs such as programming came next and then companies began outsourcing their call centers to overseas vendors. Offshoring has become much easier to do and as we shall see, now even small companies hire offshore staff in order to achieve their business goals.

A variety of jobs are offshored, including some that many people never could have imagined going overseas. Not only are jobs in finance, information technology, human resources, scientific fields, and graphic design commonly offshored, but now lawyers are doing research and doctors are reading x-rays remotely. The variety is staggering. It seems that any position that can be offshored is being offshored.

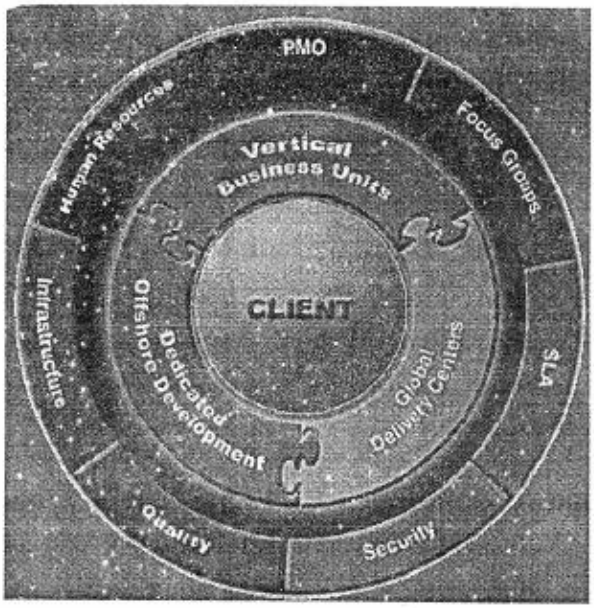

Figure 20.1 :Vast area of Offshore outsource

Work done for a company by people in another country that it typically done at a much cheaper cost. Outside of costs, offshore outsourcing may be used to complete tasks that the company may not be equipped to handle in-house. Call centers are a popular service that is often outsourced to other countries. Offshore outsourcing is often blamed for increasing unemployment in a specific country due to the lack or elimination of jobs.

Manufacturing or assembly in another country, typically one with lower wages or less strict labour regulations, of products for domestic sale or use. Many businesses use offshore production to take advantage of wage gaps between developing and developed nations, keeping prices low and profits high by lowering labour costs.

An affiliate or subsidiary company set up in a foreign country with relatively low taxes, which imports products produced by the parent company and exports them to other countries. The establishment of offshore trading companies can help a corporation to avoid tariffs and duties targeted at destination markets, by routing trade goods through a nation with less restrictive trading policies.

Outsourcing is an allocation of specific business processes to a specialist external service provider. Most of the times an organization cannot handle all aspects of a business process internally. Additionally some processes are temporary and the organization does not intend to hire in-house professionals to perform the tasks. Once the task is

outsourced to the service provider, he will take the responsibility of carrying out the tasks and maintaining the organization's assets.

However prior to outsourcing any component of your business to a third-party vendor, it is essential to understand the advantages and disadvantages of outsourcing. Although outsourcing presents a variety of benefits to your organization, it could also pose difficulties if not outsourced to the right service provider.

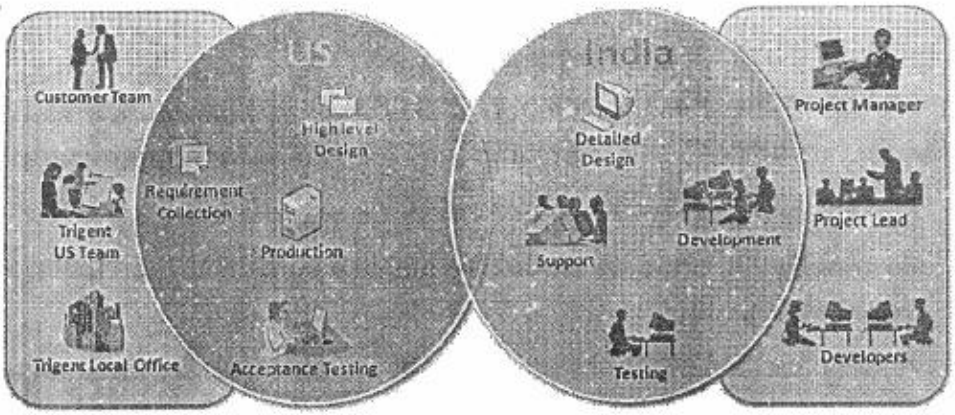

Figure 20.2: Outsourcing Vs offshoring

The most commonly outsourced streams of business include:

- IT outsourcing
- Legal outsourcing
- Content Development
- Web Design and Maintenance
- Recruitment
- Logistics
- Manufacturing
- Technical/Customer Support

Responsibilities

- Develop a vision for the role and contribution of technology in the organization.
- Define an overall hardware and software architecture to include platforms and communications.
- Coordinate developmental activities across the organization.
- Develop and implement security plans.
- Develop and implement contingency plans.
- Manage technology transfer and infusion.
- Manage vendors.

- Rationalize funding and manage expectations.
- Manage turnover.
- Promote innovation.
- Support users.
- Provide guidelines for information systems use and application.
- Develop and mentor IS expertise.
- Ensure alignment with organizational goals and objectives.
- Ensure regulatory compliance.
- Ensure security and privacy of personal information.

The key factors which have led to a growing trend of outsourcing are:

- Lack of expert-labour in some portions of the business process
- Availability of cheaper labour, whilst not comprising on the quality of output
- Ability and feasibility to concentrate on the other crucial business process

20.1.1 Key Factors of outsourcing and offshoring

Outsourcing Factors

- Cost economics
- Inadequate internal expertise and talent pool
- Rapid technology change
- Poor chargeback systems for information systems services
- Emphasis on core competency
- Top management discomfort with technology
- Management innovation
- Management imitation
- Changing goals and objectives

Offshoring Factors

- Bandwidth growth and telecommunication
- Scarce human expertise
- Increased demand
- Available global talents
- Routine tasks
- Changing goals and objectives
- Innovation

- Imitation

20.2 Advantages and Disadvantages of offshore Outsourcing

Offshoring and outsourcing has several pros and cons. Most of the time, the advantages of outsourcing overshadow the disadvantages of outsourcing.

Advantages of Outsourcing

- **Swiftness and Expertise:** Most of the times tasks are outsourced to vendors who specialize in their field. The outsourced vendors also have specific equipment and technical expertise, most of the times better than the ones at the outsourcing organization. Effectively the tasks can be completed faster and with better quality output
- **Concentrating on core process rather than the supporting ones:** Outsourcing the supporting processes gives the organization more time to strengthen their core business process.
- **Risk-sharing:** one of the most crucial factors determining the outcome of a campaign is risk-analysis. Outsourcing certain components of your business process helps the organization to shift certain responsibilities to the outsourced vendor. Since the outsourced vendor is a specialist, they plan your risk-mitigating factors better.
- **Reduced Operational and Recruitment costs:** Outsourcing eludes the need to hire individuals in-house; hence recruitment and operational costs can be minimized to a great extent. This is one of the prime advantages of offshore outsourcing.

There are numerous benefits to firms that engage in offshoring:

- *Access to talent* - For certain occupations there is a greater availability of highly skilled and experienced employees overseas. The U.S. has 4-5% overall unemployment and for certain in-demand positions there is practically zero unemployment. Offshore outsourcing provides another way for companies to get the job done.
- *Cost savings* - Companies can save 30-50% compared to the cost of a U.S.-based employee for the same level of performance, and oftentimes the offshore employees are more committed, grateful for the work.

- *Speed (filling open positions quickly)* - If you are recruiting a U.S. employee, it can take a month or more to fill certain positions. However, given the availability of offshore employees, open positions can typically be filled more quickly.
- *Elimination of recruiting costs* - Many companies pay recruiting fees to help find the most qualified employee. These fees are eliminated if you are using an offshore vendor to fulfill a certain function.
- *Time savings* - By using an offshore employee, you eliminate the time you would normally spend on searching job boards, recruiting, interviewing, orientation, managing vacation time and absenteeism, career coaching, and managing employee morale and motivation.
- *Reduction of legal exposure* - Employee issues can be time-consuming and can escalate into legal liabilities. Using offshore staff eliminates certain legal exposure to employment liabilities.
- *Flexibility* - Unlike traditional employee relationships, offshoring eliminates hiring and termination costs, allowing companies to quickly expand and contract their overseas staff in accordance with business needs.
- *Retention and loyalty* - Many times companies are rewarded with higher levels of retention and loyalty from offshore staff because overseas employees typically consider working for an American company to be prestigious.

Disadvantages of Outsourcing

- *Risk of exposing confidential data*: When an organization outsources HR, Payroll and Recruitment services, it involves a risk if exposing confidential company information to a third-party.
- *Synchronizing the deliverables:* In case you do not choose a right partner for outsourcing, some of the common problem areas include stretched delivery time frames, sub-standard quality output and inappropriate categorization of responsibilities. At times it is easier to regulate these factors inside an organization rather than with an outsourced partner.
- *Hidden costs:* Although outsourcing most of the times is cost-effective at times the hidden costs involved in signing a contract while signing a contract across international boundaries may pose a serious threat.

Lack of customer focus: An outsourced vendor may be catering to the expertise-needs of multiple organizations at a time. In such situations vendors may lack complete focus on your organization's tasks.

With all these pros and cons of outsourcing to be considered before actually approaching a service provider, it is always advisable to specifically determine the importance of the tasks, which are to be outsourced. It is always beneficial for an organization to consider the advantages and disadvantages of offshoring before actually outsourcing it.

These factors have specifically contributed to most of the outsourced partners across different locations in the world. Expertise in communication capabilities, technical expertise and favourable financial packages are the most important advantages of outsourcing to India.

20.3 Risks of offshore outsourcing

Risk of offshore outsourcing are as follows.

1. **Cost-Reduction Expectations:** The biggest risk with offshore outsourcing has nothing to do with outsourcing - it involves the expectations the internal organization has about how much the savings from offshore will be. Unfortunately, many executives assume that labor arbitrage will yield savings comparable to person-to-person comparison (e.g., a full-time equivalent in India will cost 40% less) without regard for the hidden costs and differences in operating models. In reality, most IT organizations save 15%-25% during the first year; by the third year, cost savings often reach 35%-40% as companies "go up the learning curve" for offshore outsourcing and modify operations to align to an offshore model.

2. **Data Security/Protection:** IT organizations evaluating any kind of outsourcing question whether vendors have sufficiently robust security practices and if vendors can meet the security requirements they have internally. While most IT organizations find offshore vendor security practices impressive (often exceeding internal practices), the risk of security breaks or intellectual property protection is inherently raised when working in international business. Privacy concerns must be completely addressed. Although these issues rarely pose major impediments

to outsourcing, the requirements must be documented and the methods and integration with vendors defined.

Process Discipline (CMM): The Capability Maturity Model (CMM) becomes an important measure of a company's readiness to adopt an offshore model. Offshore vendors require a standardized and repeatable model, which is why CMM Level 5 is a common characteristic. META Group observes that approximately 70% of IT organizations are at CMM Level 1 - creating a gap that is compensated for by additional vendor resources on-site. Companies lacking internal process model maturity will undermine potential cost savings.

4. **Loss of Business Knowledge:** Most IT organizations have business knowledge that resides within the developers of applications. In some cases, this expertise may be a proprietary or competitive advantage. Companies must carefully assess business knowledge and determine if moving it either outside the company or to an offshore location will compromise company practices.

5. **Vendor Failure to Deliver:** A common oversight for IT organizations is a contingency plan - what happens if the vendor, all best intentions and contracts aside, simply fails to deliver. Although such failures are exceptions, they do occur, even with the superb quality methodologies of offshore vendors. When considering outsourcing, IT organizations should assess the implications of vendor failure (i.e., does failure have significant business performance implications?). High risk or exposure might deter the organization from outsourcing, it might shift the outsourcing strategy (e.g., from a single vendor to multiple vendors), or it might drive the company toward outsourcing (if the vendor has specific skills to reduce risks). The results of risk analysis vary between companies; it is the process of risk analysis that is paramount.

6. **Scope Creep:** There is no such thing as a fixed-price contract. All outsourcing contracts contain baselines and assumptions. If the actual work varies from estimates, the client will pay the difference. This simple fact has become a major obstacle for IT organizations that are surprised that the price was not "fixed" or that the vendor expects to be paid for incremental scope changes. Most projects change by 10%-15% during the development cycle.

7. **Government Oversight/Regulation:** Utilities, financial services institutions, and healthcare organizations, among others, face

various degrees of government oversight. These IT organizations must ensure that the offshore vendor is sensitive to industry-specific requirements and the vendor's ability to: 1) comply with government regulations; and 2) provide sufficient "transparency" showing that it does comply and is thus accountable during audits. The issue of transparency is becoming more significant as requirements such as the USA PATRIOT Act and the Sarbanes-Oxley Act place greater burdens of accountability on all American corporations.

Communication and Culture: A representative example: although English is one official language in India, pronunciation and accents can vary tremendously. Many vendors put call center employees through accent training. In addition, cultural differences include religions, modes of dress, social activities, and even the way a question is answered. Most leading vendors have cultural education programs, but executives should not assume that cultural alignment will be insignificant or trivial. It is good practice for companies to embrace cultural differences and train their employees accordingly. As it relates to offshore outsourcing, cultural differences with an offshore provider have the potential to present their own set of challenges.

Turnover of Key Personnel: Rapid growth among outsourcing vendors has created a dynamic labor market, especially in Bangalore, India. Key personnel are usually in demand for new, high-profile projects, or even at risk of being recruited by other offshore vendors. While offshore vendors will often quote overall turnover statistics that appear relatively low, the more important statistic to manage is the turnover of key personnel on an account. Common turnover levels are in the 15%-20% range, and creating contractual terms around those levels is a reasonable request. Indeed, META Group has seen recent contracts that place a "liability" on the vendor for any personnel that must be replaced. The impact of high turnover has an indirect cost on the IT organization, which must increase time spend on knowledge transfer and training new individuals.

Knowledge Transfer: The time and effort to transfer knowledge to the vendor is a cost rarely accounted for by IT organizations. Indeed, we observe that most IT organizations experience a 20% decline in productivity during the first year of an agreement, largely due to time spent transferring both technical and business

knowledge to the vendor. Many offshore vendors are deploying video conferencing (avoiding travel) and classroom settings (creating one-to-many transfer) to improve the efficacy of knowledge transfer. In addition, employee turnover often places a burden on the IT organization to provide additional information for new team members.

Others risk of Offshore Outsourcing are:

- Decline in employee morale
- Loss of innovation and know-how
- Public reaction to corporate citizenship
- Regional instability of host country
- Quality control and standards

According to the above points there are lots of risk exit in offshore outsourcing so we can categorise these in to five categorize; like:

Geo-Political Risks

- Political stability of country
- Civil strife or war in the area of operations
- Political relations with United States

Workforce Risks

- Education of workforce
- Experience of workforce
- Communication differences based on language differences or usage of the same language
- Cultural customs of population or subsets of population

Business Risks

- Tax implications
- Regulatory issues in country and changes to those regulations
- Customs and duties or other licensing requirements that may apply
- Export restrictions on technology
- Limitations or restrictions on import licenses
- Local insurance coverage

Legal Risks

- Legal framework of country and local authorities relating to the services

- Intellectual property rights and enforcement in country
- Limitations on ownership structures (i.e., are 100% owned subsidiaries permitted?)
- Labour laws in country

Logistical Risks

- Travel concerns to and within country
- Ability to obtain visas as needed
- Logistics of setting up operations
- Voice and data communication infrastructure, efficiency and capacity
- Power infrastructure and reliability
- Ease of installation or upgrade to infrastructure
- Infrastructure security standards in country

20.4 Challenges of offshore outsourcing

While there many identifiable benefits of offshoring; it does not come without its challenges, as well:

- *Loss of US jobs* - Offshore outsourcing is a politically charged issue. Most economists believe that offshoring is good for the economy and ultimately results in additional U.S. jobs. The theory is that the lower-level jobs get outsourced and Americans end up doing higher value work. Even assuming the economists' view is correct, having their jobs displaced is painful to those workers impacted. It might take time to retrain and/or land one of these "higher value" jobs.
- *Cost savings that don't materialize* - Expected cost savings might not result from offshore outsourcing. The offshore staff might not turn out to be as productive as expected and/or U.S. workers might end up retaining parts of the job you thought would go overseas, thereby costing you more. In addition, substantial cost inflation has occurred in certain overseas countries, namely India. Overseas wage and overhead inflation (i.e, rent, utilities, etc.) in the long run ends up impacting the cost U.S. customers pay offshore vendors.
- *Data security issues* - You don't need offshore or even offsite employees in order for your data to be compromised (or stolen), and certainly once data leaves your building you are subject to

certain risks. And while it is true that these risks are no greater overseas than if you transfer files between office locations or allow employees to work from home, legal protections in foreign countries are not the same as in the U.S. For instance, you would want to think twice about outsourcing work that involved access to valuable intangible property. If you do decide to outsource sensitive work, you will want to set up controls within the workflow process to protect yourself.

- *Quality of service* - If you are not careful, cost savings can be more than offset by service issues. For instance, Dell closed an Indian call center over customer complaints about the quality of service. To protect yourself against such losses, do a thorough analysis of the functions being considered for outsourcing. You will also want to ensure that the function is suitable for the specific country where you are outsourcing. Finally, perform due diligence on the offshore vendor before moving any function overseas.

20.5 Offshore Outsourcing Capabilities

- Adopt a systematic approach to building offshore outsourcing capabilities.
- Focus on the entire outsourcing life-cycle.
- Recognize the dynamic nature of capabilities.
- Invest in structure and people
- Perform a periodic capabilities audit.

20.6 Tips for successful outsourcing

1. Clearly define the scope and schedule of your project
2. Evaluate a serviceprovider like you'd hire a full-time employee
3. Look for specific experience fit
4. Don't choose a vendor based solely on price
5. Review portfolios and samples
6. Start small
7. Tie payment to clearly defined project milestones
8. Negotiate ownership of work up front
9. Don't forget aboutsupport after the project is complete
10. Get it in writing

20.7 Summary

The term , "offshore" refers to where the work is being performed geographical. In other words, if a task is "offshored," then the task is being performed in another country. Manufacturing or assembly in another country, typically one with lower wages or less strict labour regulations, of products for domestic sale or use. Outsourcing is an allocation of specific business processes to a specialist external service provider. The most commonly outsourced streams of business include: IT outsourcing, Legal outsourcing, Content Development, Web Design, Recruitment, Logistics, Manufacturing and Technical / Customer Support. There are several key factors of outsourcing and offshoring. Advantages of outsourcing are Swiftness, Expertise, concentration on core process, Risk-sharing, Reduced Operational, Access to talent, Cost savings, Speed, Elimination of recruiting costs, Time savings, Reduction of legal exposure, Flexibility, Retention, loyalty. Risks of offshore outsourcing are : Cost-Reduction Expectations, Data Security/ Protection, Process Discipline (CMM), Loss of Business Knowledge, Vendor Failure to Deliver, Scope Creep, Government Oversight/ Regulation, Communication and Culture, Turnover of Key Personnel, Knowledge Transfer. While there many identifiable benefits of offshoring; it does not come without its challenges, as well: Loss of US jobs, Cost savings that don't materialize, Data security issues, Quality of service. There are few tips for successful outsourcing which should be followed.

20.8 Self Assessment Test

1. What business functions can be outsourced?
2. What is offshore outsourcing? Why offshore outsourcing is required?
3. What is the riskassociated with outsourcing?
4. Explain the advantages and disadvantages of offshore outsource.
5. Which types of risk and challenges faced in offshore-outsourcing.
6. Define the field or area where and how offshore outsourcing is used.
7. Explain the key factors of offshore outsourcing.
8. What are the capabilities of offshore outsourcing?

20.9 Further Reading

1. Outsourcing to India: The Offshore Advantage, Springer; 2nd edition, Mark Kobayashi-Hillary
2. How India got back on the Global Business map Offshore Penguin, Basab Pradhan, Gaurav Rastogi
3. Off shoring IT Services : A Framework for Managing Outsourced Projects, TMH, Mohan Babu K
4. Offshore: India's Services Juggernaut, Basab Pradhan, by Basab Pradhan, Gaurav Rastogi