Rai Technology University

ENGINEERING MINDS

Management Information System

Subject: MANAGEMENT INFORMATION SYSTEM **Credits: 4**

SYLLABUS

Information System in Business

Introduction to Information System; System Concepts; System & Sub System; System Feed back; Types of Information System; Applications; System Development Life Cycle (SDLC)

Managing Data Resources

Introduction; Organizing Data in a Traditional File Environment; Data Base Management System; Data Base Environment; The range of Data Base Applications; Integration of Information; Role of Enterprise Resource Planning (ERP); Customer Relationship Management; Work Group Integration; Integration of Different Systems; Information System Organizations & Business Processes.

Management of Information Systems, Technology, and Strategy

The Technology: Computer and Computer Processing; Role of Information Technology in Organization; Information System and Strategy; Strategic Analysis.

End User Computing (EUC)

Introduction; End User Computing Tools; End User Systems Tools; The Information Center, Office Automation; Office Information System (OIS); Aspect of OIS; Applications of Office Automation.

Electronic Communication System

Electronic Conference; Electronic Meeting Systems; Electronic Discussions; Electronic Publishing; Introduction to Networks; Network Basics; LAN Basics; Internet Working; ISDN Basics; Network Management.

Business Telecommunications

Telecommunication and Network; The Internet and World Wide Web (WWW); E Business; Applications on E-Business; Transaction Process System (TPS); Operational Information Systems

Tactical and Strategic Level Information Systems

Introduction; Tactical Accounting and Financial Information Systems; Tactical Marketing Information Systems; Strategic Marketing Information Systems; Strategic Production Information Systems; Tactical Human Resource Information Systems; Strategic Human Resource Information Systems; Managing Knowledge in the Organization.

Enterprise Information System (EIS)

Use of Information systems in Various Business Processes; Role of IS in Cross Functional Systems and EIS;

Information Systems for Managerial Decision Support and Strategic Advantage

Information, Management and Decision Making; Decision Support Systems (DSS); Group Support Systems; Executive support Systems

Suggested Readings:

1. Management Information Systems by Jaiswal and Mittal, Oxford University Press
2. Decision Support Systems and Intelligent Systems by Turban and Aronson, Pearson Education Asia
3. Management Information Systems by C.S.V.Murthy
4. Management Information Systems by Laudon, Laudon, Dass, Pearson Education Asia.

COURSE OVERVIEW

Management Information Systems represents a managerial approach to information systems concepts and applications. Computers have become pervasive in every aspect of our lives. Networks including the Internet have made computer facilities almost ubiquitous. As a result managers have a major responsibility for determining their information system needs and for designing and implementing information systems that support these needs. At the same time computer technologies have created opportunities for managers to improve customer service, reduce costs, improve productivity, increase market share, and increase profits.

Students who are majoring in Business Administration and Management should understand how information systems technologies support key organization functions, what information resources are available to them, and how MIS and other professional are involved in the System Development Process.

This Course pack has been designed to do the following for satisfying the requirements of the students who are majoring in Business Administration and General Management:

1. Emphasize how managers can and should be involved with Systems Planning, development and Implementation.
2. Emphasize what information systems resources are available to managers for decision support.
3. Emphasize how these resources can be used at all levels of decision making and in the major functional management areas.
4. Show how information technology can be used to support organization strategy without overwhelming students with technical details.

Managers and Information Technology, as these two contrasting scenarios demonstrate continual improvements and advances in information (IT) are encouraging even more changes in business and society. Managers and Professionals who use not only to present and deliver information but also to solve their business problems will reap the rewards while those who do not will be left behind to ponder when went wrong.

Continual changes in IT present two challenges: learning to use it and finding new opportunities to improve management. Most students have taken a hands-on course that teaches them how to use a computer. Many expect the introductory MIS course to more of the same – hands-on computer usage tied with specific needs. However, there are more complex and interesting problems to be solved. Managers need to apply their knowledge of IT tools to solve management problems and find new opportunities to improve their organization.

The units covered in this course pack will give a clear understanding from the concepts of systems and its components to its applications at various levels of organisation and various types of functional business areas. The chapters have been sequentially arranged to the best of my knowledge to ensure a smooth way of learning..

Enjoy Reading!!!

MANAGEMENT INFORMATION SYSTEM

CONTENT

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CONTENT

LESSON 1:
INTRODUCTION TO
INFORMATION SYSTEMS

Learning Objectives

- To explain how IT impacts upon organisations.
- To analyse the necessity for IS in the management of modern, and increasingly global, organisations.
- To recognise that IT professionals need to understand how an organisation operates in order to effectively apply technology to make the organisation more efficient and competitive.
- To explain how an organisation must change in order to successfully capitalise on the use of IS and the consequent impact on organisational structure and employees.
- To identify how the benefits of using IS may be measured and assessed, and contrast with existing practice.

1.1 Introduction

Welcome to the information age. Going shopping? As a consumer, you have instant access to millions of pieces of data. With a few clicks of the mouse button, you can find anything from current stock prices and video clips of current movies. You can get product descriptions, pictures, and prices from thousands of companies across India and around the world. Trying to sell services and products? You can purchase demographic, economic, consumer buying pattern, and market-analysis data. Your firm will have internal financial, marketing, production, and employee data for past years. This tremendous amount of data provides opportunities to managers and consumers who know how to obtain it and analyze it to make better decisions.

There is no question that the use of computers in business is increasing. Walk into your local bank, grocery store, or fast food restaurant and you will see that the operations depend on computers. Go into management offices and you will find computers used to analyze marketing alternatives, make financial decisions, and coordinate team members around the world.

The expanding role of technology raises some interesting questions. What exactly are computers being used for? Who decided to install them? Do computers increase productivity or are they just expensive' paperweights? Are there new uses that you should be considering? Are there some tasks that should be performed by humans instead of computers? How can you deal with the flood of data that you face every day?

The speed with which Information Technology (IT) and Information Systems (IS) are changing our lives is amazing. Only 50 years ago communication was almost limited to the telephone, the first word processors came out in the mid-sixties and the fax entered our offices in the 1970's. Today information systems are everywhere; from supermarkets to airline reservations, libraries and banking operations they have become part of our daily lives.

The first step in learning how to apply information technology to solve problems is to get a broader picture of what is meant by the term information system. You probably have some experience with using computers and various software packages. Yet, computers are only one component of an information system. A computer information system (CIS) consists of related components like hardware, software, people, procedures, and collections of data. The term information technology (IT) represents the various types of hardware and software used in an information system, including computers and networking equipment. The goal of Information System is to enable managers to make better decisions by providing quality information.

The physical equipment used in computing is called hardware. The set of instructions that controls the hardware is known as software. In the early days of computers, the people directly involved in are tended to be programmers, design analysts, and a few external users. Today, almost everyone in the firm is involved with the information system. Proce-dures are instructions that help people use the systems. They include items such as user manuals, documentation, and procedures to ensure that backups are made regularly. Data-bases are collections of related data that can be retrieved easily and processed by the computers. As you will see in the cases throughout our book, all of these components are vital to creating an effective information system.

So what is information? One way to answer that question is to examine the use of in-formation technology on three levels: (1) data management, (2) information systems, and (3) knowledge bases. Data consists of factual elements (or opinions or comments) that describe some object or event. Data can be thought of as raw numbers or text. Data man-agement systems focus on data collection and providing basic reports. Information repre-sents data that has been processed, organized, and integrated to provide more insight. In-formation systems are designed to help managers analyze data and make decisions. From a decision maker's standpoint, the challenge is that you might not know ahead of time which information you need, so it is hard to determine what data you need to collect. Knowledge represents a higher level of understanding, including rules, patterns, and de-cisions. Knowledge-based systems are built to automatically analyze data, identify pat-terns, and recommend decisions. Humans are also capable of wisdom, where they put knowledge, experience, and analytical skills to work to create new knowledge and adapt to changing situations. To date no computer system has attained the properties of wisdom.

To create an effective information system, you need to do more than simply purchase the various components. Quality is an important issue in business today, particularly as it relates to information systems. The quality of an information system is measured by its ability to provide exactly the information

needed by managers in a timely manner. The information must be accurate and up-to-date. Users should be able to receive the information in a variety of formats: tables of data, graphs, summary statistics, or even pictures or sound: Users have different perspectives and different requirements, and a good information system must have the flexibility to present information in diverse forms for each user.

1.2 Data, Information, Knowledge, and Wisdom

Let us consider the case of a retail store that is trying to increase sales. Some of the data available includes sales levels for the last 36 months, advertising expenses, and customer comments from surveys. By itself, this data may be interesting, but it must be organized and analyzed to be useful in making a decision. For example, a manager might use economic and marketing models to forecast patterns and determine relationships among various advertising expenses and sales.

The resulting information (presented in equations, charts, and tables) would clarify relationships among the data and would be used to decide how to proceed It requires knowledge to determine how to analyze data and make decisions.

Education and experience create knowledge in humans. A manager learns which data to collect, the proper models to apply, and ways to analyze results for making better decisions. In some cases, this knowledge can be transferred to specialized computer programs (expert systems).

Wisdom is more difficult to define but represents the ability to learn from experience and adapt to changing conditions. In this example, wisdom would enable a manager to spot trends, identify potential problems, and develop new techniques to analyze the data.

1.3 Data Versus Information

Often the words data and information are used interchangeably. Yet they don't mean the same thing. It is important to understand the difference between data and information.

- Data is raw material.
- Data that is analysed, summarised or processed only becomes information if the user understands it.
- Data means the words, numbers, graphics that are entered into the computer by the user to describe people, events, and things.
- Information is knowledge and understanding that is usable by the recipient. It must reduce uncertainty and have a surprise value. If it doesn't have these attributes, as far as the user is concerned, it contains processed data, not information.
- Information means the words, numbers, graphics that are displayed or printed as the basis for making decisions. Often information is the result derived by processing data.

Data capture, handling, entry, processing and dissemination incur costs and do not directly produce value. Value only occurs when information is used to improve decision-making.

Value of information = change in decision making caused by the information being available minus the cost of producing this information.

That is why information has to be managed as a company resource, just like raw materials, people or energy.

1.4 Characteristics of Information

Now, let us discuss about the characteristics of good information

- **Timeliness:** Information must reach the user in a timely manner, just when it is needed; not too early, because by the time it is used it would be out-of-date; not too late because the user will not be able to incorporate it into his/her decision-making.
- **Appropriateness:** Information must be relevant to the person who is using it. It must be within the sphere of his/her activities so that it can be used to reduce uncertainty in his/her decision-making.
- **Accuracy:** Accuracy costs. We don't always need 100% accurate information so long as we know the degree of accuracy it represents (eg: + or - 5%). (Remember the value of information).
- **Conciseness:** Information should always contain the minimum amount of detail that is appropriate for the user. Too much detail causes information overload.
- **Frequency:** Frequency is related to timeliness. Too often the information presented is linked to the calendar (end of the week, beginning of the month); its frequency should be synchronized with the timing of the decision making of the user.
- **Understandability:** The *format* and *presentation* of information are very important. Some people prefer tabular information, whereas others may need it in a graphical form. Also the use of colors enhances the understandability of what is presented.
- **Relevant:** It pertains to the particular problem. What data is relevant depends on the decision-making model used. E.g. university admissions officials may choose to consider the results of some high-school test irrelevant, if they believe that it does not improve the chances of some applicant later becoming a successful student.
- **Complete:** All the relevant parts are included. E.g. marketing data about household incomes may lead to bad decisions, if not accompanied by consumption habits of the target population.
- **Current:** Decisions are often based on the latest information available
- **Economical:** The costs of gathering information should be justified by the overall benefits

1.5 What is a System?

A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process. System will have the following basic interacting components (functions):

1. Input
2. Processing
3. Output

4. Feedback
5. Control

Let me explain the concept of system with an example. The following example will give you better understanding about System.

Example: Sales Force Automation System (SFAS)
Suppose you are a regional manager who supervises 100 salespersons in Mumbai. Your company's headquarters are located in Chennai. Your performance is daily evaluated by the headquarters. You are compared with managers in other regions such as Delhi, Kolkata etc. Your company publishes various books: encyclopedia, children's books, etc.

In short, the headquarters are not interested in each salesperson's performance. All they care about is your performance, i.e. the regional sales results.

In order to save your job, you have to keep increasing sales. You have to motivate, encourage, help, and discipline salespeople in Mumbai, if they perform, your job is secured. If they don't perform, you will be fired.

Case 1
Each morning, you are supposed to submit a daily report to the headquarters. In the report, you should include the total sales made in Mumbai yesterday, and sub-total of each category (encyclopedia, children's books, etc.).

- At the end of each day, a salesperson submits his sales record to the Mumbai regional office.
- The record is added to compute the total sales, and also summarized in terms of book category.
- The total sales, and sub-total sales in terms of book category, are presented in the daily report.
- Here, the daily record submission indicates "INPUT" in a system.
- Adding and summarizing indicates "PROCESSING" in a system.
- Reporting indicates "OUTPUT" in a system.

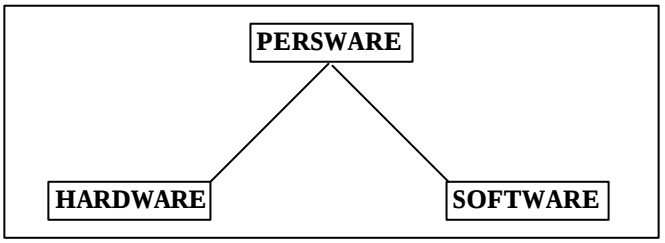
Case 2

- In order to increase sales, you decided to implement a kind of performance evaluation program, which is intended to motivate and discipline the salespersons under your supervision.
- According to the program, if a salesperson makes daily sales greater than one million, he will be awarded a gift certificate of Ebony Department Store. On the other hand, if a salesperson makes daily sales less than one hundred thousand rupees, he will be given a warning. If he makes a sales less than one hundred thousand rupees two days in a row, a more serious warning letter will be sent to him. If he makes sales less than one hundred thousand rupees three days in a row, he will be fired.
- If you manually check all the sales records to comply the new performance evaluation program, most of your time will be occupied by processing the data and paperwork.
- In other words, you will have no time to do anything else: reading a new book, learning new things, or playing golf, etc.
- In contrast, if you develop an information system that can carry out the performance evaluation program, your life will be much easier. The program is now automated with a computer-based information system.
- A major difference between this new system in Case 2 and the previous system in Case 1 is that feedback and control functions are added to the new information system.

1.6 What is an Information System?

Now, it is time to see the real meaning and concept of Information Systems. Too often you hear someone say, "Oh yeah, I know how to use a computer. I can surf the Web with the best of them and I can play Solitaire for hours. I'm really good at computers." Okay. So that person can pound a keyboard, use a mouse at lightning speed, and has a list of favorite Web sites a mile long. But the real question is "Is that person information literate?" Just because you can pound the keyboard doesn't necessarily mean you can leverage the technology to your advantage or the advantage of your organization. An organization can gather and keep all the data on its customers that a hard drive can hold. You can get all the output reports that one desk can physically hold. You can have the fastest Internet connection created to date. But if the organization doesn't take advantage of customer data to create new opportunities, then all it has is useless information. If the output report doesn't tell the management that it has a serious problem on the factory floor, then all that's been accomplished is to kill a few more trees. If you don't know how to analyze the information from a Web site to take advantage of new sales leads, then what have you really done for yourself today?

Most of us think only of hardware and software when we think of an Information System. There is another component of the triangle that should be considered, and that's the people side, or "persware." Think of it this way:



We talk about the input, processing, output and feedback processes. Most important is the feedback process; unfortunately it's the one most often overlooked. Just as in the triangle above, the hardware (input and output) and the software (processing) receive the most attention. With those two alone, you have computer literacy. But if you don't use the "persware" side of the triangle to complete the feedback loop, you don't accomplish much. Add the "persware" angle with good feedback and you have the beginnings of information literacy.

An information system differs from other kinds of systems in that its objective is to monitor/document the operations of some other system, which we can call a target system. An information system cannot exist without such a target system. For example, production activities would be the target system

for a production scheduling system, human resources in the business operations would be the target system of a human resource information system, and so on. It is important to recognise that within a vending machine there is a component/ sub-system that can be considered an information system. In some sense, every reactive system will have a subsystem that can be considered an information system whose objective is to monitor and control such a reactive system.

A Business Perspective on Information Systems

Using feedback completes the information-processing loop. To be a good Information Systems manager, however, you must bring into that loop far more than just the computer data. For instance, your information system reports that you produced 100,000 units last week with a "throwback" rate of 10%. The feedback loop tells you that the throwback rate has fallen 2% in the last month. You can say, that's a pretty good improvement. So far, so good. But if you put that information into a broader context, you're still costing the organization a huge sum of money because each percentage point on the throwback rate averages Rs. 10,000. And when you bring in available external environmental information, your company is 5% above the industry norm. Now that's information you can use - to your advantage or disadvantage!

If you, as a manager, can then take other information from the internal and external environments to come up with a solution to this problem, you can consider yourself "information literate."

Organizations

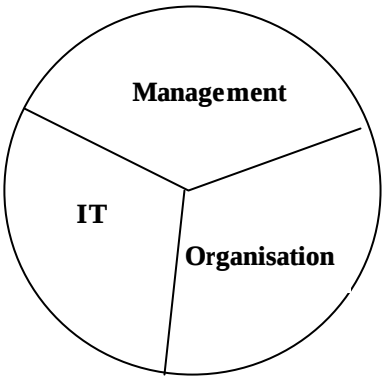
Organizations are funny things. Each one tends to have its own individual personality and yet share many things in common with other organizations. Look us at some of the organizations you may be associated with - cricket team, fraternity, health club, or a child's cricket team. See, organizations exist everywhere and each of them has its own structure, just as workplace organizations have their own structure and personality to fit their needs, or in some cases, habits.

A cricket team needs talented, well-trained players at different positions. Sometimes, the success of the team depends on a good, well-informed coach or manager. So too with the workplace organization. Business organizations need many kinds of players with various talents, who are well-trained and well-informed, in order to succeed.

Every organization requires tools to help it succeed. If the baseball team uses bats that are 25 years old against a team whose bats are 2 years old, they will have to work harder on their own to make up for that disadvantage. If your child's cricket team uses balls with torn seams, they're going to have a harder time hitting the ball into the boundaries. So if your organization is using older equipment or uses it the wrong way, it just stands to reason it is going to have a harder time beating the odds.

Management

Every good organization needs a good manager. Pretty simple, pretty reasonable. Take professional cricket coaches. They don't actually play the game; they don't hit the run, catch the ball for the wicket, or hang every decoration for the celebration party. They stay on the sidelines during the game. Their real role is to develop the game plan by analyzing their team's strengths and weaknesses. But that's not all; they also determine the competition's strengths and weaknesses. Every good coach has a game plan before the team even comes out of the dressing room. That plan may change as the game progresses, but coaches pretty much know what they're going to do if they are losing or if they are winning. The same is true in workplace organizations.



Business Perspective of Information Systems

Technology

Do you own a Digital Video Disk? Probably not, since it's only been on the market for a short time. How old is your car or truck? Manufacturers are constantly offering us new vehicles, yet we tend to upgrade only every few years. Your personal computer may be a year old or three years old. Do you have the latest gadgets? Chances are you don't. Face it, you just can't keep up with all the new stuff. No one can. Think about how hard, not to mention expensive, it is for an individual to acquire everything introduced to the marketplace. Think how difficult it is sometimes to learn how to use every feature of all those new products.

Now put those thoughts into a much larger context of an organization. Yes, it would be nice if your company could purchase new computers every three months so you could have the fastest and best technology on the market. But it can't. Not only is it expensive to buy the hardware and the software, but the costs of installing, maintaining, updating, integrating, and training must all be taken into account. We'll look at the hardware and software sides of the Information Systems triangle in upcoming chapters, but it's important that you understand now how difficult it is for an organization, large or small, to take advantage of all the newest technology.

1.7 Components of an IS

In an organization, information systems consist of the following components. These components will formulate a system, which will help us to gather the required information for making decision in various levels of management. We will now see these components in brief and discuss them in detail in the later lectures.

- **Data** - Input that the system takes to produce information
- **Hardware** - Computer itself and its peripheral equipment: input, output, storage devices; includes data communication equipment

- **Software** - Sets of instructions that tell the computer how to input, process, output and store data
- **Communication networks** - Hardware and software specializing in transmission and reception of electronic data
- **People** - IS professionals and users who design, construct, operate and maintain IS
- **Procedures** - Rules to process data, e.g. priorities in running different applications, security measures, routines for malfunctioning IS, etc.

1.8 Information System Resources

Every Information System is equipped with the following resources. The goals of information systems can be easily achieved by employing these resources to their optimum level by keeping in view that the purpose of using IS in an organization.

- **People Resources**
  - End users
  - IS specialists
- **Hardware Resources**
  - Machines
  - Media
- **Software Resources**
  - Program
- Operating Systems (OS)
- Examples: Windows, Unix, etc.
- Application Software
- Examples: Excel, Access, MS-Word, etc.
- Application software that makes people buy computers that can run the software.
- Example 1: Lotus 1-2-3 (a spreadsheet program): In early 1980s, personal computer market was dominated by Apple (about 90% Apple, about 10 % IBM and its compatibles); Lotus 1-2-3 was introduced and it could be run on only IBM's MS-DOS operating system; Companies all over the world were impressed with Lotus 1-2-3, and wish to use the software. In order to run the software, they had to purchase IBM PC or IBM PC compatibles that run on MS-DOS.
- Example 2: email system. To use an email system (software), people buy computers.
- Procedures:
- Operating instructions for the people who will use an information system.
- Examples: Instructions for filling out a paper form or using a software package.
- **Data Resources:**
  - Data vs. Information

1. Data:

- Raw facts, observations, business transactions
- Objective measurements of the attributes (characteristics) of entities (people, places, things, events, etc.)
- Attributes can be last name, first name, gender, etc. for an entity of "people."

2. Information:

- Data that have been converted into a meaningful and useful context for specific end users.
- Processed data placed in a context that gives it value for specific end users.

1. Its form is aggregated, manipulated, and organized.
2. Its content is analyzed and evaluated.
3. It is placed in a proper context for a human user.

- Network Resources:
  - Communications media
  - Communications processors
  - Network access & control software

1.9 Why Information Systems?

Ask managers to describe their most important resources and they'll list money, equipment, materials, and people - not necessarily in that order. It's very unusual for managers to consider information an important resource and yet it is. This chapter will help explain why you need to manage this resource as closely as any other in your organization.

The Competitive Business Environment

For many years computer technology was relegated to the backrooms or basements of a corporation. Only the "techies" worried about it and were often the only ones who really knew how it all worked. Now computers are all over the organization - one on every desk. It's not enough for you to know how to pound a keyboard or click a mouse. It is not even enough for you to know how to surf the Web. Now every employee, including you, must know how to take advantage of Information Systems to improve your organization and to leverage the available information into a competitive advantage for your company.

Emergence of the Global Economy

Next time you purchase a product, any product, look at the fine print and see where it's made. It could be China, or the Philippines, or India, or even in the USA. You can disagree with the many manufacturing jobs that are being moved from the U.S. to foreign countries. But look at the vast number of jobs that are being created in this country. Maybe they aren't the traditional factory jobs we're used to. In fact, many of our new jobs are in the information industry. Many of them service whole new markets that didn't exist just a few years ago. There was no position called "Webmaster" in 1991 because the Web didn't exist. But now, that particular job category is one of the fastest growing in the overseas. The global economy I am talking about is being made possible by technology. And that's why it's so important that you understand how to use Information Systems Technology instead of just computer technology. There's a big difference between the two, and we'll talk about it more.

Transformation of Industrial Economies

"In a knowledge- and information-based economy, knowledge and information are key ingredients in creating wealth." Think

back to the early 1900s when the horse and buggy were the main form of transportation. Along came a guy named Ford who built a whole new industry around the automobile. Many jobs, such as horse groomers, horse shoers, and buggy manufacturers, were lost forever. Now think about all the new jobs that were created - not just in the factories but all the other businesses associated with the car. The people in the horse and buggy industry adapted, retrained for the new jobs, and the whole country changed.

The same thing is happening now with the information industry. Many of the new jobs that are being created have better working conditions, better pay, and more advantages than the old jobs had. You just have to be equipped to take advantage of the situation. You have to take advantage of retraining opportunities. You have to gain the skills necessary for the transformation of the industries that have been a mainstay of this country. It's not that hard - it just takes a lot of hard work.

We often think of industries such as manufacturing and financial institutions as information-based. But even farmers and ranchers in this country are learning information-based skills so that they can become more efficient and cut costs. They are taking advantage of the technological explosion by using computers and Global Positioning Systems on their farms and ranches to increase crop yields or reduce workloads. They're catching on to the idea that Information Systems are a key to success.

Transformation of the Business Enterprise

You can't help but know about the entire job cuts occurring in our country. It seems like every week we hear about thousands and thousands of people losing their jobs. Back in the 80s most of the job losses were in the blue-collar sector. In the 90s it seems many of the cuts are being made in the white collar, management jobs. Why? Think about it. Technology, to a large extent, has driven organizations to change the way they operate and that includes the way they manage. We're going to take an in-depth look at how organizations work and how they've been transformed by technology.

But it isn't always bad! You just have to ask yourself this question: "With all the job losses in the last few years, many driven by technological changes, why has the Indian unemployment rate dropped to it's lowest in decades and remained so low?"

1.10 Contemporary Approaches to Information Systems

There are several different approaches to Information Systems: technical, behavioral, socio-technical. Think of this analogy: A "techie" looks at most things associated with computing as a series of zeroes or ones. After all, everything in a computer is ultimately reduced to a zero or a one. So using the technical approach, you could say that 2 + 2 = 4. The behavioral approach, on the other hand, takes into account the very nature of human beings. Nothing is totally black and white. Therefore the behavioral approach to the same equation would be "2 + 2 = maybe 4 or perhaps 3.5 to 5.5, but we'll have to put it before the committee and see what the next quarter's figures say." Neither approach is better than the other, depending on the situation. Neither approach is more right than the other, depending on the situation.

An organization can't afford to view its information resources as belonging to either the techies (technical approach) or the non-techies (behavioral approach). Responsibility for information belongs to everyone in the organization. This is the sociotechnical approach, that is, a combination of the two. Everyone has to work together to ensure that Information Systems serve the entire organization.

To help you understand the importance of viewing Information Systems through the sociotechnical approach, look at what the current trade journals are saying. David Haskin, writing in the April 1999 issue of Windows Magazine, quotes Steve Roberts, vice president of information technology for Mind Spring Enterprises, an Atlanta-based Internet service provider: "The gap in understanding between technical and non technical people is the biggest challenge I've seen." Haskin goes on to say, "Because technology is the bedrock on which successful businesses are built, the stakes in making this relationship work are high. Failing to use the correct technology can put you at a competitive disadvantage, and glitches in existing technologies can bring a business to a grinding halt."

Information Systems and the use of technology belong to *everyone* in an organization. This concept is best carried out through a sociotechnical approach, which allows both the technical and behavioral approaches to be combined for the good of the organization.

1.11 Information System as a Strategic Resource

Information can be exploited as a strategic resource at three different levels:

- National
- Company
- Individual

National Level

Developed nations have adopted the diffusion of information systems and technologies as a national policy. There appear to be two approaches at the national level. Countries like Japan and the United Kingdom have invested in the technical infrastructure first whereas France has determined educating people on how to use IS as a priority in order to enable them to leverage the power of information and communication technologies.

Company Level

Many companies have attained higher product and service quality, shorter product cycles, lower costs and better responsiveness to customer requirements through the use of IS. Information systems allow the automation of certain functions (eg: inventory management or sales order processing), provide critical information for decision making and integrate business processes. Successful companies leverage the power of information as a competitive weapon.

Individual Level

Managers and Information Systems

You will be exposed to information systems as a business professional in whichever field you are working in, be it sales, manufacturing, accounting, finance, banking or consultancy. This is inevitable.

You will not only be users of information systems but you will also be expected to analyse the system to identify its strengths and weaknesses, recommend changes for improvement and participate in their implementation.

But don't forget information systems are a means to an end, not an end in themselves. Information systems are powerful valuable tools but not magic. If you automate a business process that is a mess, you end up with an automated mess!

Managers must take IS in the context of business activities and purposes and use information as a resource, like money, equipment or energy.

Managers must use IS to:

- Access information
- Interprete information
- Incorporate information in decision making

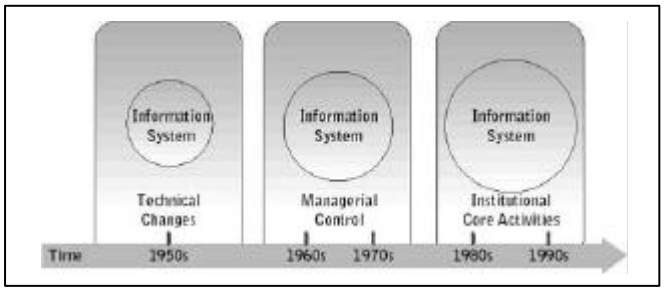
Managers must exploit IS because of:

- Rapid changes in technology
- Intense international competition
- Faster product life cycles
- More complex and specialised markets managers:
- Are responsible for investments in IS
- Need to be proactive and selective
- Must understand how IS are used in the functional areas of business.

1.12 The New Role of Information Systems in Organizations

Managers can't ignore technology any more and pass it off to secretaries or clerical workers or the Information Technology department. Information Systems are critical to the success of an organization at all managerial levels.

The Widening Scope of Information Systems



If you take a look at the above figure you can understand the evolution of Information Systems in organizations. Technology was considered, well, too technical for the rest of us to understand. Computers were relegated to the back room with a few technicians running around in white coats. No one else understood what these people did or how they did it. It was a different world and actually seemed disconnected from the mainstream operations of the company.

As the time line indicates, technology and its associated Information Systems are now integrated throughout the organization. Everyone is concerned about technology's role and impact on their work activities. End users take on greater responsibilities for the success of Information Systems and are actually doing a lot of the work that once belonged to the techies. Even the executive levels of an organization can no longer ignore the technology and pretend that it belongs to someone else.

We are constantly bombarded with new tools, new technology, and new methods of doing business. It almost seems as though just as you master a word processing program, here comes a whole new program you have to learn from scratch. But the plain fact is that organizations, especially larger ones, just can't change as fast as the technology. Companies make huge investments not just in hardware, but in software and persware. Training people, building new operating procedures around technology, and changing work processes take far longer than the technological pace will allow.

The introduction of new technology can severely disrupt organizations. Productivity naturally slips. Learning curves cost time and money. Most system installations or changes used to affect mainly data workers or production workers. Now they affect every level of the organization, even the management and strategic levels. Every part of the organization is involved in the introduction or change of technology and everyone plays a part in its success.

The Network Revolution and the Internet

Even though the Internet as a whole has existed since 1969, the World Wide Web didn't exist until around 1993-1994. That's less than 10 years. Now you can't pick up a magazine or a newspaper, turn on the television or radio, even drive by a billboard, without some kind of reference to "dot com." Businesses are rushing to the Internet in an effort to keep up with the competition or to create whole new businesses. Now organizations struggle with such issues as how to design and develop a Web site or how to determine a fair email policy for employees.

The fastest and biggest change in modern computing is the Internet. To say that the Internet is transforming the way we live, work, and play is probably the greatest understatement in years. Businesses can create new opportunities but they can also lose opportunities just as quickly. Now an organization has to design new systems, or transform old ones, with not just the company in mind, but 100 million other users of the Internet, Extranets, and Intranets. They have to decide how much or how little information to provide in what way, with what level of access, how best to present it, etc. It's a huge job!

New Options for Organizational Design: The Networked Enterprise.

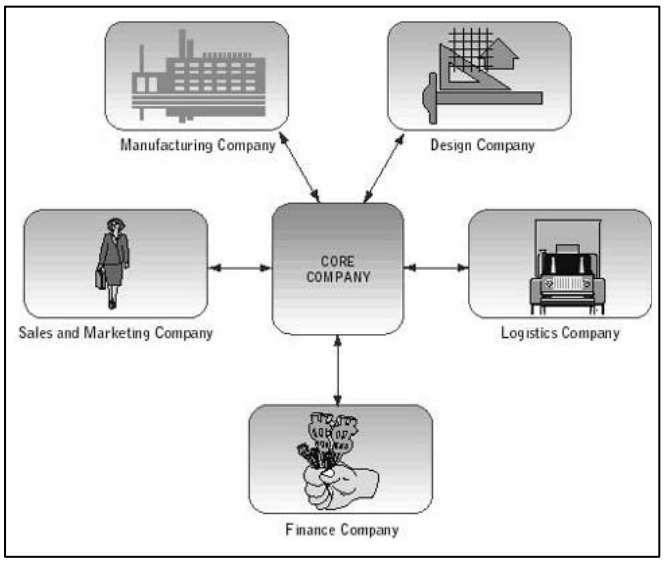
Many of the job losses of the 1990s occurred because technology allowed organizations operate efficiently with flatter organizations - with fewer levels of bureaucracy. One manager can now oversee a larger group of people. More important,

technology increases the span of communication a manager can accomplish with a single email. You can make information available to a greater number of people much more easily than ever before.

But wait. You can make that information available to more people, but you have to train them how to use it, and when it's appropriate to use it and with what latitude they can use it. Again, it all comes back to the "persware" portion of the triangle. Yes, your hardware enables more people to connect to the Information System, and the software is becoming much easier to use and more widespread than ever before. But you still have to concentrate on the people who are using the software to connect to the hardware.

Technology now allows workers to work from anywhere. It's becoming common for companies to literally shift their work through time zones. That is, the person in New York will shift blueprints for a new product to a worker in California. The Californian can then collaborate on the product for an additional three hours before zipping it to another person across the ocean who will work on it while the others sleep. Talk about telecommuting!

Technology now allows companies in foreign countries to merge their organizations in ways never before possible. Think of Daimler from Germany and Chrysler in Michigan. Opportunities for new products and new production methods exist with this merger. However, think of the challenges it poses to management information systems and employees.



The figure you see depicts the possibilities of virtual organizations. XYZ and ABC companies can team up, work on a project, and then go their separate ways. ABC could then seek out LMN corporation to develop a new technology from which both will gain but which neither could accomplish on their own. This is happening more and more in technology companies. In November 1998, America Online purchased Netscape. At the same time AOL announced a collaboration with Sun Microsystems to develop and deliver enhanced technology that AOL couldn't produce on its own. A few years ago, virtual organizations were difficult to develop and even more difficult to manage. New technologies and new management information systems now make such partnerships easier and more productive than ever before.

As we'll see in future chapters, new technology allows businesses to reorganize their workflows, allowing them to become more efficient and to meet new challenges. The potential for saving money is tremendous, and so are the opportunities to better meet customer demands.

A few years ago we couldn't imagine having Levi Strauss make a pair of jeans just for us. It wasn't possible for a gardening company to produce a catalog strictly for our own backyard. There was no way for an airline reservation company to know your favorite city to visit and send you special ticket deals for a weekend getaway in a weekly email message. All that is now possible thanks to the newer management information systems. But with all these new opportunities come new challenges and problems.

Enterprise Resource Planning, which we'll talk about in other chapters, is only possible through new and improved technology. Companies are realizing that they can't afford "islands of information" and must have the means to share information resource across all boundaries. And speaking of boundaries, most of those are either rearranged or eliminated because of technological changes. Suppliers, customers, and governmental agencies are now linked electronically to organizations that increase the efficiency and decrease the cost of operations in what are called **inter organizational systems.**

One common mistake with many organizations wanting to do business on the Internet is the idea that they can simply throw up a Web site, add an email software program for customer communication, and they are ready to do business in cyberspace. They haven't addressed any of their internal processes and possible changes to the way they do business. They've spent hundreds of thousands or millions of dollars and can't get enough sales to support a day's worth of expenses.

Electronic markets are allowing businesses to take advantage of technology to create new methods of buying and selling. For a while it seemed as though the middleman was going out of business because of the direct connection between customers and merchants. While this is true in some industries, new opportunities are springing up for the middleman in other areas. We'll look at this issue in more detail later.

Amazon.com, the largest retailer on the Internet selling books and CDs, loses millions of dollars a year and yet is one of the best success stories in E-commerce. Its fiercest rival, Barnes & Noble Books, has also spent millions of dollars converting traditional retailing operations to the Internet. Unfortunately, Barnes & Noble's efforts at E-commerce are considered somewhat of a failure. Why? Because Barnes and Noble hasn't fully changed its core processes to accommodate the changes required for doing business on the Web.

There are many opportunities offered by the Internet, Extranets, and Intranets. Yet there are many problems associated with developing a company's electronic commerce and electronic business. It is easy to put up a Web site - a snazzy, colorful Web site that looks very pretty and may even be easy to

use. But you must consider how you're going to incorporate that part of your business with the other, more established methods of doing business. What internal processes must you change or adapt? What new processes must you establish? What training must you do with the people who will run the E-business, both technical and non-technical?

Employing new Information Systems in an organization requires changes to old methods and processes. Managing the changes is as important to the success of the new technology as managing the system itself.

1.13 Learning to Use Information Systems: New Opportunities with Technology

Is this new technology worth the headaches and heartaches associated with all the problems that can and will arise? Yes. The opportunities for success are endless. The new technologies do offer solutions to age-old problems. Improvements are possible to the way you operate and do business.

The rest of the lessons in this book and this course will give you tools you can use to be successful with the current and future Management Information Systems.

1. **The Strategic Business Challenge:** Companies spend thousands of dollars on hardware and software, only to find that most of the technology actually goes unused. "How can that be?" you ask. Usually because they didn't pay attention to the full integration of the technology into the organization. Merely buying the technology without exploiting the new opportunities it offers for doing business smarter and better doesn't accomplish much. Think and rethink everything you do and figure out how you can do it better. Change is inevitable, and information must be managed just as you would any other resource.
2. **The Globalization Challenge:** The world becomes smaller every day. Competition increases among countries as well as companies. A good Management Information System meets both domestic and foreign opportunities and challenges. How does Daimler/Chrysler integrate its organizations and cultures into one - or almost one?
3. **The Information Architecture Challenge:** You have to decide what business you are in, what your core competencies are, and what the organization's goals are. Those decisions drive the technology, instead of the technology driving the rest of the company. Purchasing new hardware involves more than taking the machine out of the box and setting it on someone's desk. Remember the triangle of hardware, software, and persware. Take care of the people and they will take care of the rest! **Information architecture** describes how to incorporate technology into the mainstream processes in which the business is involved. How will the new Information System support getting the product produced and shipped? How will Advertising and Marketing know when to launch ad campaigns? How will Accounting know when to expect payment?
4. **The Information Systems Investment Challenge:** Too often managers look at their technological investments in terms of the cost of new hardware or software. They overlook the costs associated with the non-technical side of technology. Is productivity up or down? What is the cost of lost sales opportunities and lost customer confidence from a poorly managed E-Business Web site? How do you determine if your Management Information System is worth it?
5. **The Responsibility and Control Challenge:** Remember, humans should drive the technology, not the other way around. Too often we find it easier to blame the computer for messing up than to realize it's only doing what a human being told it to do. Your goal should be to integrate the technology into the world of people. Humans do control the technology, and as a manager, you shouldn't lose sight of that.

Management's focus must continually change to take advantage of new opportunities. Changes should take place throughout the organization. They require lots of attention and planning for smooth execution.

Information Literacy is more than just clicking a mouse, pounding the computer keyboard, or surfing the Web. It's about integrating various elements of an organization, technical and non-technical, into a successful enterprise. As a successful manager you must concentrate on all three parts of the Information Systems triangle (hardware, software, and persware) and integrate them into a single, cohesive system that serves the needs of the organization, the wants of the customer, and the desires of the employees. The more complex, the harder to manage, but the greater the payoff.

Review Questions

1. Why is it important to understand the difference between Computer Literacy and Information Literacy?
2. What are the three elements of an Information System that managers must consider?
3. What are some of the factors managers must consider when considering changes in technology?
4. What are some of the new roles Information Systems are playing in organizations?

Discussion Questions

Discuss the Benefits of Information Technology in doing successful business across the world? List down the advantages and disadvantages and explain how IT is giving competitive edge to companies with an Example.

Application Exercises

1. Interview a local manager (or a student who has recently graduated) to discover how he or she uses computers on the job. How does the business use the Internet for e-commerce or e-business?
2. Using the resources of your library (government data, annual reports, business publications, etc.), find statistics to document at least two business trends. Draw graphs to reveal the patterns.
3. Choose one large company. Using annual reports, news articles, trade journals, and government data, research this company. Identify any changes that have been made in the last few years.

LESSON 2 : SYSTEMS CONCEPTS

Leaning Objectives

1. To understand the concepts of Systems and its components
2. To Know about the Information Systems used as a system in Enterprises
3. To study about the various types of Systems
4. To Explain the Specification of Information Systems
5. To understand the Framework of Information System
6. To know the System approach in Problem Solving

2.1 Introduction

When you begin the study of information systems, you should be-come acquainted with a theoretical framework for understanding their use, develop-ment, and effect on organizations; that is, you need to have an understanding of sys-tems concepts as a foundation for further study. A system is a collection of people, machines, and methods organized to accomplish a set of specific tasks. Information systems-which are a major topic in this text-have the same components and characteristics as systems in general.

This lesson introduces the concepts of systems, their characteristics, and their interaction with the environment. As a manager, you'll constantly be dealing with sys-tems, and you'll need feedback about their performance. Information is the feedback you need to determine if systems are achieving their objectives, operating with the necessary components, and meeting the necessary standards. Information systems are designed to give managers the information they require as feedback.

In this lesson you will learn about the systems approach to problem solving also. As a manager, you will be dealing with many types of systems, and you will be responsi-ble for improving their performance. For example, you'll determine if procedures, per-sonnel, and equipment need to be changed to achieve objectives. Or you'll need to as-sess the effect of new equipment on current work methods, procedures, and organization. The systems approach to problem solving will help you deal with these kinds of tasks.

Finally, this chapter explains how organizations operate as systems, with unique characteristics, information flows, and decision processes. You will learn about the components of organizations and about different types of organizational structures. You will need to recognize the structures of organizations to understand the decision making processes that occur within different types of organizations.

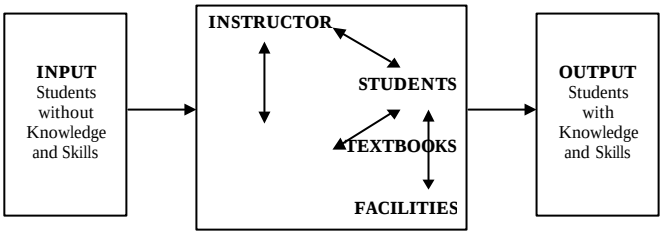
2.2 Systems Concepts

Let us see the very simple meaning of any system. A system is a set of inter-dependent components (some of which may be systems in their own right), which collectively accomplish certain objectives.

In other terms we can say that a system is an integrated set of components, or entities, that interact to achieve a par-ticular function or goal. Systems have characteristics such as boundaries, outputs and inputs, methods of converting inputs into outputs, and system interfaces. Systems are composed of interrelated and interdependent subsystems.

Examples of systems are all around us-in fact; an excellent example is your class. The components of the classroom situation, including an instructor, the students, textbooks, and facilities, all interact to make the accomplishment of learning goals possible.

Example: A Classroom System



A business is also a system. A business uses resources such as people, capital, ma-terials, and facilities to achieve the goal of making a profit. Business procedures, such as order handling, marketing research, financial planning, and manufacturing, are the interactions that need to be managed to achieve this objective.

Let us now see the components of a system which are common to all kinds of system in detail.

2.2.1 System Boundaries

Every system has a boundary that defines its scope of activities. For example, the ac-tivities in your class include lectures, discussion, continuous evaluation, grading, and preparation of as-signed course work. These activities may represent the boundary of the system for which a teacher is responsible. Within the system of the classroom, the teacher is re-sponsible for organizing class time, assigning homework to students, and evaluating student progress. The boundary, then, delineates an area of responsibility. When defin-ing a system, you must establish a boundary.

System boundaries are also established within a business system. A sales manager may be responsible for managing, motivating, and evaluating the performance of a sales organization. The owner of the business, however, faces different boundaries and may develop a financial plan, a marketing strategy, and a long-range business plan.

2.2.2 Systems and Sub Systems

Systems may consist of numerous subsystems, each of which has elements, interac-tions, and objectives. Subsystems perform specialized tasks related to the overall ob-jectives of the total system. For example, an educational system may consist of

indi-vidual courses that are subsystems. Each course provides specific knowledge that is a part of the overall educational system and contributes to its goals.

In a business system, various functions are subsystems. Marketing, finance, and manufacturing, for example, are subsystems. Within the marketing subsystem, the sales order-entry and credit-checking functions are subsystems. Each subsystem uses its resources to meet specific objectives. Successful achievement of these goals re-quires good manage-ment of internal resources. For instance, in managing the sales order-entry function, the supervisor needs to develop sales order procedures, main-tain sales order records, and train sales order personnel.

2.2.3 Outputs and Inputs

The inner workings of a system or subsystem are organized to produce outputs from inputs. In this conversion process, some value or utility should be added to the inputs. For example, a training program should produce trained employees with certain skills, knowledge, or behavior from its inputs-untrained employees

The outputs of one subsystem usually become inputs into the next. The outputs of a course in introductory data processing concepts, for instance, become inputs into the next course in Java programming.

As you would expect, the outputs of a subsystem have to adhere to certain standards to be acceptable to the next. If students coming out of the introductory data processing course don't understand basic concepts of file organization and file pro-cessing, they won't have the prerequisite skills needed for Java. If they were not per-mitted to enter Java until they meet certain standards, though, the problem would be alleviated. The more exactly standards are adhered to; the easier it will be to inter-face the two courses, or subsystems.

2.2.4 Subsystem Interface

An interface is a connection at system or subsystem boundaries. An interface serves as a medium to convey the output from one system to the input of another system. An example will help clarify this concept. Two typical business systems that in-terface with each other are inventory control and purchasing. If inventory levels drop below a certain level, then additional stock of these items should be purchased. Pur-chasing will need to know what quantity of a particular item to obtain to replenish the stock and information on sales and inventory turnover to learn which items are in greatest demand so these items can be replenished on a timely basis. An inventory control system will provide information on stock to be reordered based on sales and inventory turnover trends.

However, if the inventory control subsystem triggers erroneous information about the amount of stock to be reordered, then inputs into purchasing will be wrong. This problem can be partially overcome by establishing an economic order quantity, or the quantity of an item that is most economical to buy, for each item in in-ventory. This quantity, derived from order history and inventory turnover rate, can serve as a standard and prevent reordering too much or too little stock.

2.2.5 Interface Problems

In the previous section we mentioned that adhering to standards can alleviate some interface problems. However, you might encounter other types of interface problems. Sometimes the output of one subsystem is not sufficient to accommodate the needs of the next subsystem. For example, the production subsystem may not be able to produce enough stock to meet sales demands during certain peak periods. One way of handling this interface problem is through the use of slack resources. In this situation a business can build excess inventory during slack times to meet the demand for inventory at peak times.

Another system interface problem can occur between the authoring subsystem and the editorial subsystem in the development of a textbook. Authors who wait until the last minute to finish their writing may not be able to produce a manuscript fast enough to meet production schedules, which involve editing, artwork, layout and de-sign, typesetting, and proofreading tasks. The publisher can avoid this problem in sev-eral ways. First, the publisher can ask the author to complete several chapters before production activities begin. This procedure is another example of using slack re-sources.

Second, the publisher can ask the author to adhere to certain standards for input into the production subsystem. For example, the author can create and store all text using a word processing package that can be transported to a computer-based type-setting system without reeking.

Third, the author could hire a library researcher, photo re-searcher, and typist to provide a support subsystem to expedite the development of manuscript. This method creates a new subsystem to solve a system interface problem.

Another situation in which designing a new subsystem can solve a system inter-face problem occurs at a college when it accepts some students with deficiencies in their academic backgrounds. To bridge the gap between high school and college, the college can create a remedial subsystem to help students develop prerequisite skills for college work. For instance, the college may require students deficient in basic writing skills to take a remedial writing class to learn spelling, grammar, punctuation, and composition skills before they can enroll in literature classes.

2.2.6 System and its Environment

The system's environment consists of people, organizations, and other systems that supply data to or that receive data from the system. Not surprisingly, different man-agers perceive the environment differently. A sales manager, for example, may envi-sion the system environment to be the company's customers and vendors of the products and services being marketed. On the other hand, the owner of the business may perceive the environment to include the firm's competitors, financial institutions that provide resources for expansion, and government agencies with jurisdiction over company plans and products. Moreover, various kinds of systems may interact with the environment in different ways.

Open systems operate in an external environment and exchange information and ma-terial with that environment. The external environment consists of the activities exter-nal to the system boundary with which the system can interact. An open system needs to receive feedback to change and to continue to exist in its environment. For example, a marketing system, which is an open system, operates in an environment of competi-tion. If a competitor introduces new technology by providing customers with on-line order-entry terminals, the marketing function must adapt to the change in the environ-ment or remain at a competi-tive disadvantage. One way of accommodating the change in the environment is to offer a similar on-line order-entry service. The same type of ad-justment is necessary when an airline offers a new service, such as a frequent flier bonus program. Though the new service may temporarily give the air carrier a com-petitive advantage, the other airlines soon follow suit and offer similar programs.

In Contrast, a closed system is relatively self-contained; it doesn't exchange in-formation with its environment. Closed systems don't get the feedback they need from the external environment and tend to deteriorate. For instance, if a training pro-gram administrator doesn't respond to the needs of the business environment for trained graduates, students may no longer be able to get jobs and may go elsewhere for training. Eventually, the training program may be discontinued.

You might wonder why closed systems exist at all. More often than not, partici-pants in a system become closed to external feedback without fully being aware of it. For example, a university may offer graduate courses only during the daytime hours because it has always scheduled these courses in this way. Without recognizing the growing number of working adults wishing to enroll in evening graduate programs, the university may find registrations dwindling and may even have to discontinue cer-tain courses. If university officials had been more responsive to student needs, how-ever, the school might have enjoyed booming enrollments among the population of adult evening students.

2.2.7 System Feedback

A system needs feedback to do its job. Feedback is an indicator of current perfor-mance rates when compared to a set of standards. With effective feedback, continu-ing adjustments in the activities of a system can be made to assure that the system achieves its goals. Measuring performance against a standard is an effective control mechanism. Employees need feedback to learn how well they are achieving job goals. Students receive grades or other kinds of evaluations from instructors that show whether the students are meeting course objectives.

The good thing about feedback is that it usually increases effort. For example, tennis players often perform better when they are keeping score. When salespeople receive positive feedback, it increases their motivation to achieve a sales quota. Nega-tive feedback may also serve a useful purpose. Negative feedback is designed to cor-rect or guide activities that are not consistent with achieving the goals of the system. If salespeople are not achieving quotas, they may want to rethink current sales tech-niques or reorganize their time. Similarly, if students receive low grades, they may need to improve study habits, obtain tutoring, or enroll in courses that better match their abilities or back-grounds.

Product managers also need feedback on how well new products fare in certain markets. They conduct market research studies in test markets to compare new prod-ucts with estab-lished products. They can use feedback from these market tests to re-design a new product or identify target markets for which the product is suitable be-fore its introduction. Products such as shampoos, honey-roasted peanuts, and detergents are all market tested in this way. Sometimes a company receives enormous amounts of feedback after introducing a new product. When Coca-Cola introduced new Coke, negative feedback from customers forced the company to reintroduce its original formula as Classic Coke.

Trainers in companies also need feedback about how well their programs are equipping trainees for job tasks. Feedback from supervisors may provide suggestions on what skills trainees need to perform successfully on the job. For example, employ-ees who take a training program to learn how to use Lotus 1-2-3, a popular microcomputer spreadsheet program, may not be taught how to copy formulas from one cell to a range of cells and may experience difficulty performing this procedure on the job. Trainers can use this feedback to build more exercises on the copy com-mand into training classes.

It also shows how managers to modify or improve the system's internal workings can use feedback from the external environ-ment.

So far we've emphasized the constructive aspect of feedback. Sometimes, how-ever, the wrong kind of feedback is provided. For example, if students are rewarded for the number of book reports they complete, rather than for the quality of the re-ports, they may skim books to get just enough information to complete and submit each report without developing compre-hension and reading skills-the real objec-tives of the exercise. Or if employees get the wrong kind of feedback, they may in-crease their efforts in areas that aren't useful in achieving the objectives of the system. For example, if salespeople are rewarded for the number of sales calls they make, in-stead of the number of sales they close, they will try to fit in as many calls a day as they can, rather than spending the time with each customer to make a sale. As a result, the company may lose business and not achieve its objectives.

Such considerations make it clear that managers must design feedback mecha-nisms for effective control of business functions within an organization. In a business setting, an inventory manager needs to manage the inventory levels of hundreds of items to avoid shortages of items in demand and to prevent excess inventory levels of items that do not turn over frequently. The inventory manager needs feedback to con-trol these inventory levels and determine when to order new stock of certain items. An inventory control system can automatically generate a purchase order for stock replenishment when an item in inventory falls below its reorder point. (The reorder point is the inventory level of an item that signals when that item needs to be or-dered.) This reorder system is an effective control device because if inventory levels fall below a

safe level, the company cannot fill incoming customer orders. This system also reduces excess inventory, which ties up cash unnecessarily.

In short, many information systems provide managers with information they need to allocate their resources to achieve business goals. By having information about cur-rent business activities, managers can control production, inventory, and marketing re-sources and invest these resources in the most profitable ways. 'For example, man-agers can use information on planned versus actual sales to detect slow-moving items and cut production appropriately. Fast-moving items should trigger production so the sales function can take advantage of market demand.

2.2.8 System Entropy

Systems can run down if they are not maintained. Systems entropy corresponds roughly to chaos or disorder - a state that occurs without maintenance. If employees do not have opportunities to learn new concepts and techniques, the skills they apply to performing job tasks will become out of date. The process of maintaining a system is a process of decreasing entropy or increasing orderliness. Sending auto-mobile mechanics to training classes to learn new diagnostic techniques is an exam-ple of decreasing entropy. Orderliness can be achieved through preventive mainte-nance checks, such as a yearly physical examination for an employee or a routine tune-up for an automobile, and then taking action as a result of these regular checks. These checks provide valuable feedback to help detect faults or problems when none have been antici-pated. Diagnostic tools for equipment and machinery help pre-vent downtime, which may cause delays in production and cost thousands of dollars in lost business.

2.2.9 System Stress and Change

Systems change over time. Some of these changes occur because of identified prob-lems, new business opportunities, and new management directives. Systems may also change as a result of stresses. The achievement levels needed to meet existing goals may change. For example, because of reduced profit margins on sales, a division sales manager may insist on a sales increase of 10 percent instead of 7 percent to achieve the same profits. The tendency is to localize the stress so that only one subsystem, in this case the division sales force, feels most of the pressure for adjusting to new demands.

It is easier to deal with change within one subsystem than within the total system because stress may require rethinking existing work methods and organization. In this case the sales manager may have to develop more effective procedures to im-prove the profitability of sales. The sales manager may recommend cutting down calls to smaller customer accounts and substituting telemarketing to service their needs. Sales-people might need to reallocate their time so they can pay special attention to customers who purchase the most profitable product lines and encourage customers who purchase less profitable lines to look at high-margin products. All these proce-dures require a close analysis of the current system, changes in work procedures, and effective time management.

Another source of system stress occurs if inputs cannot be monitored but the sys-tem is expected to produce the same quality of output. Many colleges and universities screen applicants using standardized test scores, high school grades, and references. Some educational institutions, however, have open admissions policies that allow all high school graduates to apply and be admitted. Because admitting candidates with-out the necessary academic skills for college study places undue stress on the entire educational system, colleges with open admissions policies typically localize this stress by establishing remedial programs and hiring specially trained teachers for these stu-dents. Students are expected to pass remedial course work before entering regular college courses.

In a business situation, the same thing happens. New workers participate in train-ing programs before they begin to work in the firm. During the training period, they learn specific job-related practices so they can become productive in the work envi-ronment as soon as possible. After training, they receive jobs and responsibilities con-sistent with their skill levels and backgrounds. This orientation and training process helps minimize the stress that might occur if the new employees were pl4ced directly into positions within the firm.

Although one way to deal with stress is by changing the activities of a subsystem, it is also important to remember that the subsystem is a part of the whole system and interacts with other subsystems to achieve the organization's overall objec-tives. Therefore, managers may need to consider the entire system in responding to a prob-lem and to modify activities in other subsystems as well.

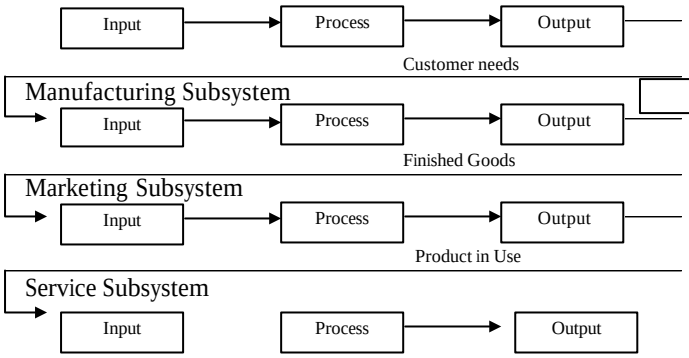
2.3 Systems concepts in Business

Now that you have a general picture of how a system works, it will be helpful to look more closely at business systems. The systems approach is a way of analyzing business problems. This approach views the business organization as a system of interrelated parts designed to accomplish goals. Each subsystem is both a self-contained unit and a part of a larger system. Managers must understand the goals of the total system and design the function and subsystems within the total system to accomplish the goals.

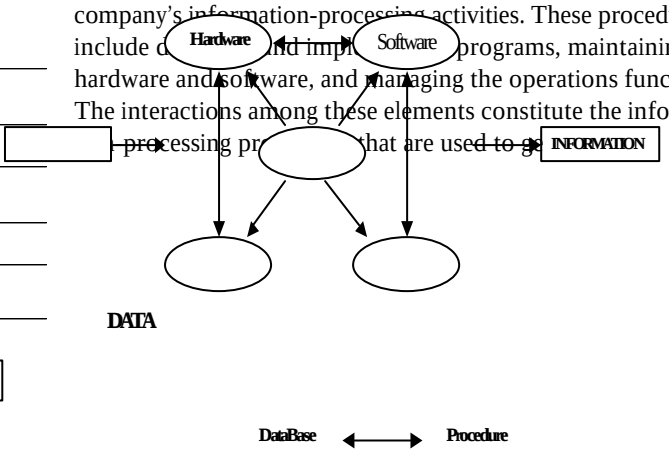
More specifically, management is the practice of organizing resources including people, materials, procedures and machines to achieve objectives. In other words, it entails organizing subsystems to accomplish specific tasks. Using a system approach, a manager organizes various activities of the business into separate organizational subsystems.

To consider an example, the market research subsystem of the business may obtain information from the customers about modifications that about to be made in the firm's products and services. The market research subsystem can transmit this information to the manufacturing subsystem that builds product design changes into its processes. Finally, the marketing subsystem sells the finished products to the customers. If technical problems occur, the service subsystem may need to provide follow-up support. The interactions among these functional subsystems are depicted in the following figure.

Market Research Subsystem



company's information-processing activities. These procedures include d and implementing programs, maintaining hardware and software, and managing the operations function. The interactions among these elements constitute the informa- processing pr that are used to ge



2.4 Information System as a Sub System

In many ways, information systems have the same characteristics as systems in gen-eral. The major purpose of an information system is to convert data into informa-tion - information is data with meaning. In a business context, an information system is a subsystem of the business system of an organization. Each business system has goals, such as increasing profits, expanding market share, and providing service to cus-tomers. Information systems that provide information that lets management allocate resources effectively to achieve business objectives are known as tactical systems. Finally, information systems that support the strategic plans of the business are known as strategic planning systems. To sum up our dis-cussion so far, information provides managers with the feedback they need about a system and its operations-feedback they can use for decision-making. Using this in-formation, a manager can reallocate resources, redesign jobs, or reorganize proce-dures to accomplish objectives successfully.

An information system consists of components that interact to achieve the ob-jective of providing information about day-to-day activities that managers can use to control business operations. Information systems can also provide information to en-able managers to allocate resources and establish long-range business plans. An infor-mation system contains such elements as hardware, software, personnel, databases, and procedures to accomplish its objectives. The hardware consists of the computer and computer-related activities. Software consists of the instructions that the hardware uses to process information. Software includes both application software and system software. Application software consists of the programs written to support specific business functions, such as order entry, inventory control, and accounts receivable. System software enables the hardware to run application software. System software consists of the programs that handle such functions as sorting data, converting pro-grams into the machine language the computer can understand, and retrieving data from storage areas.

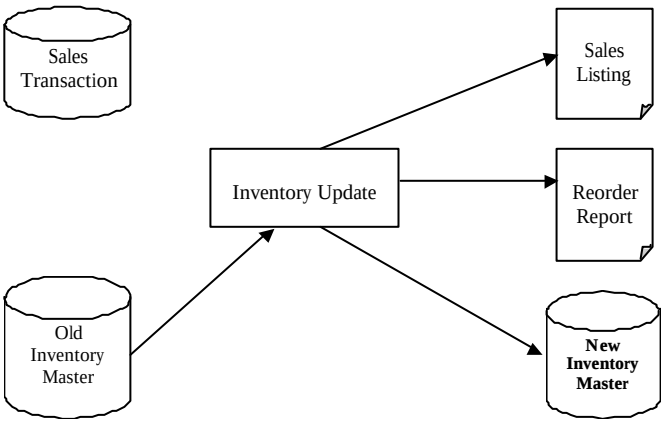
Information-processing personnel, such as systems designers and programmers, design and write the application programs to support information processing activi-ties. Operations personnel, such as data entry operators and equipment operators, handle day-to-day operations activities. Finally, all personnel have to follow specific procedures to organize and manage a information needed for decision-making. A general model of an information system is shown below.

Subsystems

Operational systems, which are designed to provide information about day-to-day activities, are composed of subsystems that accomplish specialized tasks. A mail-order business, for example, needs a system to process customer orders. The order-process-ing system actually consists of subsystems set up to handle incoming orders, update inventory levels, and bill customers. Other subsystems are created to purchase new stock, to handle accounts payable transactions, and to apply cash receipts from customers to outstanding accounts receivable balances. Each subsystem performs a specialized task that supports the business objectives of increasing sales and provid-ing customer service. You can see how these subsystems are organized in the following figure.

If one of these subsystems breaks down, the overall business will feel the effect. For example, if the mail-order company does not maintain sufficient inventories, cus-tomers may become frustrated with constant back orders and shift their business to other companies.

Outputs and Inputs



An information system, like any other system, receives inputs of data and instructions, processes the data according to these instructions, and produces outputs. This information-processing model can be used to depict any information system. An in-ventory update system is shown below.

In an inventory update procedure, the inputs are sales order transactions and an old inventory master file. During the update procedure, the item quantities for each item on a sales order transaction are subtracted from the existing inventory level for that item in stock. The new inventory level is then written to the new inventory master file. The outputs of this system are an updated inventory master file, a reorder report, and a sales listing. A reorder report lists any items in inventory that have fallen below their desired inventory level and provides a purchasing manager with feedback about items that need to be reordered.

Hierarchy of Subsystems

The subsystems within an information system can be organized into a hierarchy to represent their functions within the overall system. Each subsystem performs a spe-cialized function. In the inventory update example, one subsystem may record sales transactions as input, another subsystem may check customer credit, and another may check inventory availability. Other subsystems may update inventory, generate a re-order report, produce information for billing, and so on.

System Feed Back

An information system provides system feedback to a manager about day-to-day activ-ities and about deviations from planned activity. The manager can use this information to supervise daily operations, such as credit checking and billing, and to reorganize re-sources to achieve objectives more effectively. In the inventory control example, one of the outputs was a reorder report indicating which inventory items need to be re-ordered. A purchasing manager could use this report to reorder additional stock on a day-to-day basis.

Middle managers might want feedback about which items in inventory are mov-ing rapidly and which items are moving slowly so they can reallocate the investment in inventory to minimize waste and maximize profitability. The information systems providing feedback that can be used to allocate resources effectively, such as inven-tory and personnel, are called tactical systems.

Subsystem Interface

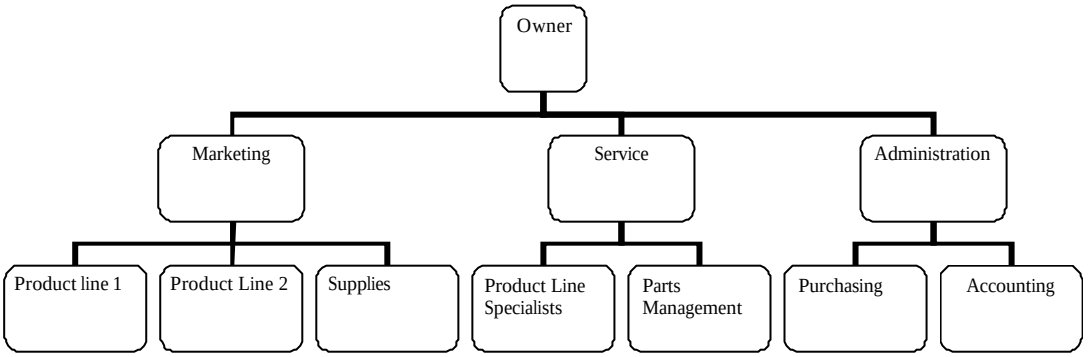
As with other systems, interfaces exist between the subsystems of an information sys-tem. Again, the outputs of one sub-system become the inputs into the next. For exam-ple, the outputs of a sales order entry system become the inputs into an invoicing system. If the outputs of one system are not correct, however, the next subsystem will be affected. If the price of an item is entered incorrectly during order entry, then the charges to the customer may be incorrectly calculated during billing.

Internal Controls

Good information systems also have internal standards to make sure that data are processed accurately. Input controls, for example, ensure that input data are valid be-fore they are processed. Another type of control is a password security procedure de-signed to protect against unauthorized access and update of data. All in all, standards make sure the system works properly. Without controls, the data printed out on re-ports may be inaccurate, and managers may not be able to trust the information system to provide valid results. If unauthorized users update data files or if input data are not valid, managers may not even know that the output generated in reports is invalid, and thus they may make decisions using erroneous information.

2.5 The Structure of an Enterprise

As we know, the entire enterprise has been organized into subsystems, including the marketing subsystem, the service subsystem, and the administrative subsystem. The marketing subsystem promotes and markets microcomputer products and services. When cus-tomers have problems with their microcom-puters or need preventive maintenance, they use the service subsystem. Finally, the administrative subsystem takes care of billing customers, purchasing equipment and supplies from vendors, paying vendors, and handling accounting activities. The organizational structure of the dealership is depicted in the following figure.

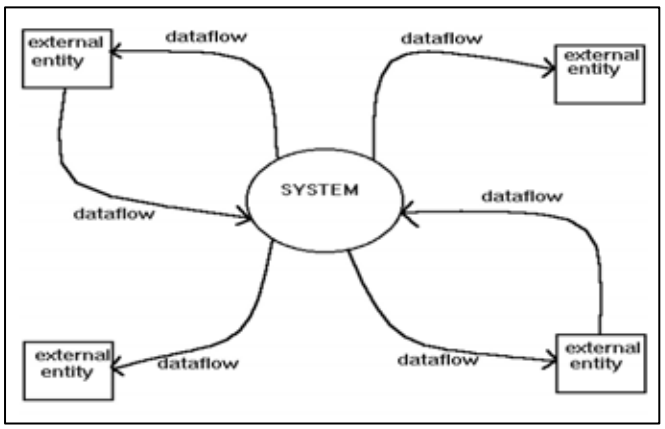


The marketing subsystem of the dealership is managed by a sales manager who recruits salespeople, including experienced veterans and new trainees, to demon-strate and sell the equipment. These salespeople are trained to follow certain proce-dures, such as giving equipment demonstrations and making follow-up calls. These procedures are an important part of the “system” of selling microcomputer hardware and software. When they are not followed, profitability suffers.

The sales manager needs an information system to provide feedback on how the system is working. On a day-to-day basis, he may receive information about sales-people who have successfully closed sales, about customers who are complaining, and about technical problems with equipment. This feedback makes it possible to re-view the procedures and activities of the current system. For example, if a particular

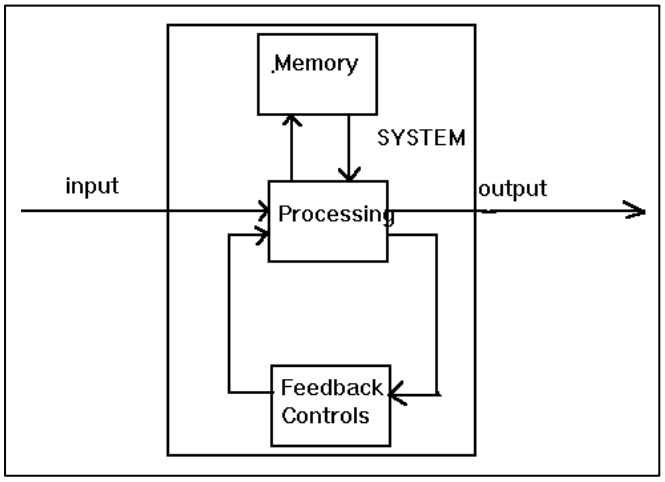
A Contextual view

Any system operates by interacting with its environment. The contextual view describes graphically the interaction of the



system with the various entities in its environment. The interactions consist of dataflows from and to such entities.The contextual view clarifies the boundary of the system and its interfaces with the environment in which it operates.
Contextual View

A Control View
Any system must manipulate certain variables in order to achieve its objectives. It determines the manipulation needed by processing its outputs/states in relation to certain control parameters.



Control View

Frequently, complexity takes the form of a hierarchy, whereby a complex system is composed of interrelated sub systems that have in turn their own subsystems, and so on, until some lowest level of elementary components is reached. The choice of what components in a system are primitive is relatively arbitrary and is largely up to the discretion of the observer of the system. Intra-component linkages are generally stronger than inter-component linkages (components of a system are loosely coupled, but components themselves are cohesive). Hierarchical systems are usually composed of only a few different kinds of subsystems in various combinations and arrangements (same components can be reused). A complex system designed from scratch never works and can not be patched up to make it work. You have to start over, beginning with a system that works.

2.6 Some basic concepts and strategies in the study of systems

- **Abstraction:** We have developed an exceptionally powerful technique for dealing with complexity. We abstract from it. Unable to master the entirety of a complex object, we choose to ignore the inessential details, dealing instead with the generalized, idealized model of the object.
- **Formality:** Rigor at each stage in the development of a system.
- **Divide and conquer**: Divide a complex problem into a set of simpler problems that can be solved.
- **Hierarchical ordering:** Order the simplification of the problem in “divide & conquer” in hierarchies.
- **Cohesion & coupling:** Modularise the system such that interactions within components (cohesion) is maximised and interactions between components (coupling) is minimised. This way, the impact of errors, when they arise, is localised and does not cascade through the system. Diagnosis of offending components is also made easier.
- **Information hiding**: Each module (or subsystem) must have available to it just the information that is needed by it.
- **Conceptual integrity:** Consistency in design.
- **Completeness**: Ensuring that the design meets all the specifications.
- **Logical independence:** Emphasis on the statement of system objectives in terms of logical functions independent of physical implementation.
- **Correctness & Efficiency:** Correct in the sense that the design meets all the user requirements. Efficient is that the system accomplishes the objectives with minimum computing resources.

2.7 Types of Information Systems

Information systems can be classified in many ways, but for our purposes here, we will consider their classifications based on the mode of processing, on the system objectives, and on the nature of interaction of the system with its environment.

2.7.1 Classification by mode of processing

- **Batch processing systems**: The transactions are collected as they occur, but processed periodically, say, once a day or week.
- **On-line batch systems:** The transaction information is captured by on-line data-entry devices and logged on the system, but it is processed periodically as in batch processing systems.
- **On-line Real-time systems:** The transaction data capture as well as their processing in order to update records (and generate reports) is carried out in real-time as the transaction is taking place.

2.7.2 Classification by System Objectives

- **Transaction Processing Systems:** Their objective is to process transactions in order to update records and generate reports, i.e., to perform score-keeping functions.

- **Decision Support Systems**: Their objective is to support the managerial decisions. Usually, these systems are based on a model of the decision-making domain, and utilize techniques from management science, finance or other functional areas of business in order to build such models. These systems are also used often for attention-directing purposes, i.e., for directing the attention of managers to a problematic aspect of operations.
- **Expert Systems**: These systems incorporate expertise in order to aid managers in diagnosing problems or in problem solving.

2.7.3 Classification based on the Nature of Interaction with Environment

- **Transformational Systems**: These are systems that transform inputs received from the environment in order to generate reports (output).
- **Reactive Systems:** These are systems characterized by being, to a large extent, event-driven, continuously having to react to external and internal stimuli.

The components of accounting systems such as payroll, general ledger are, it should be obvious, usually batch processing systems, and also transaction processing systems that are transformational systems. Systems for determination of sample sizes for audit testing, on the other hand may be decision support systems. Systems aiding provision for doubtful accounts (or loan loss reserves for financial institutions) may be expert systems.

2.8 Specification of Information Systems

Specification of any system before its development is crucial. Specifications perform for information systems the same function that blue-prints and engineering specifications perform for physical structures. Specifications serve as benchmarks for evaluating designs as well as their implementation. They also facilitate quality assurance via verification (are we building the system right, ie., do the design and implementation meet the specifications?) and validation (are we building the right system, ie., does the system meet the user needs?).

2.8.1 Formal Vs. Informal Specifications

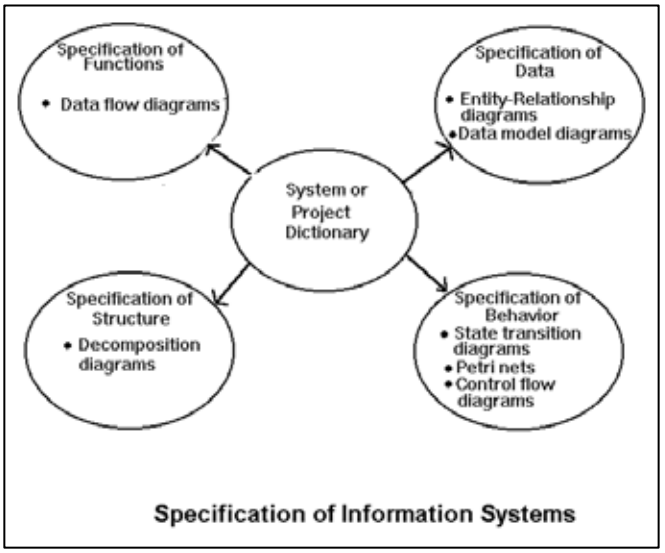
In the development of information systems in business, informal specifications through graphical modeling have been used at least since late 70s. We shall be studying many of these modeling tools. Recently, formal specification languages (such as Larch, VDM, Z, FOOPS and OBJ) have been developed. While their use in business systems development is in its very early stages, they are expected to play an important role in the future. These formal specification techniques attempt to mathematically specify structure, function, and behavior of information systems.

2.8.2 Components of specifications

Specification of an information system is given by their:

- Structure: How it is organised.
- Function: What it does.
- Behavior: How it responds to events and stimuli.
- Data: Its meaning and organization.

Most tools co-ordinate information systems projects through a project or system dictionary. The function of the dictionary is to standardise the use of terms throughout the organisation and to serve as a repository of all common information in the project. It enforces consistency as well as (relative) completeness of the specifications, and facilitates verification & validation of such specifications. It also serves as a means of communication between the different persons on the information systems building team. The figure below shows the various components of the specifications and the modeling techniques utilised. We will be studying some of those techniques in this course.



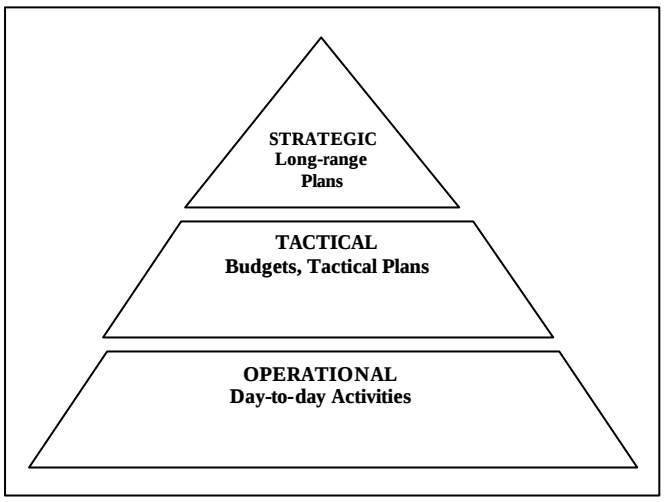
Specification of Information Systems

2.9 A Framework of Information Systems

The activities of an organisation are of three kinds: operational, tactical and strategic planning. Operations are the day-to-day activities of the firm that involves acquiring and consuming resources. First-line supervisors must identify, collect and register all transactions that result in acquiring and expending these resources. When sales are made or goods are shipped, a department manager needs to record these vents. These day-to-day transactions produce data that are the basis for the operational systems.

The tactical function of an organisation is the responsibility of its middle-level managers. They review operational activities to make sure that the organisation is meeting its goals and not wasting its resources. The time frame for tactical activities may be month to month, quarter to quarter, or year to year. For example orders for raw materials might be monitored monthly, productivity might be assessed quarterly, and department budgets might be reviewed annually. Managers responsible for control have to decide how to allocate resources o achieve business objectives. Data that can be used to predict future trends help managers make these resource allocation decisions.

The top management of the organisation carries out strategic planning. Though managers responsible for operational and tactical decision making are primarily involved in reviewing internal data, the managers responsible for planning are also interested in external information. They need to set the organization's long range goals, for example, by deciding whether to introduce new products, build new physical plant



facilities, or invest in technology. For making these decisions they need to know the activities of the competing firms, interest rates, the trends in government regulations. Strategic planners address problem that involves long-range analysis and prediction and often require months and years to resolve.

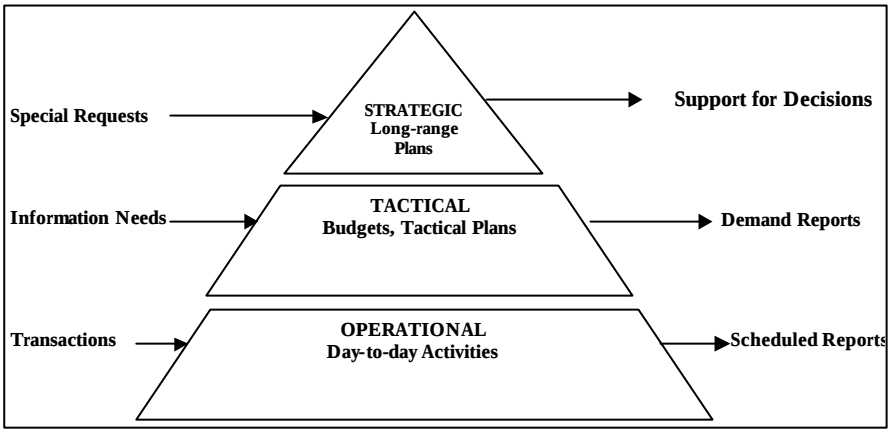
The Activities of an Organisation

2.9.1 Operational Systems

At the operational systems level the primary concern is to collect, validate, and record transactional data describing the acquisition or disbursement of corporate re-sources. Financial data on accounts receivable; accounts payable, payroll, and cash receipts must be recorded as they occur. When a sale occurs, data on the items or-dered are recorded, the inventory level for these items is adjusted, a shipping label and packing slip are prepared, and an invoice is generated. The original transac-tion-the sale of the item-creates numerous transactions in order processing, in-ventory, and billing.

Operational-level information systems often have the following characteristics.

- **Repetitiveness.** The information operational-level information systems produce is usually generated repetitively at periodic intervals, such as daily, weekly, or monthly.
- **Predictability.** The information usually does not contain any surprises or unex-pected results for the manager or other users of the system. That is, people are paid what they were expected to be paid, and customers are billed for what they pur-chased during the month.
- **Emphasis on the past.** The information usually describes past activities of the or-ganization. For example, the output of a payroll system describes employees' past work. The checks to vendors describe past purchases by the organization. Customer invoices describe past sales to them. Stock reports describe past changes in inventory.
- **Detailed nature.** The information is very detailed. That is, paychecks provide de-tailed information on the workweek of each employee and the specifics of each em-ployee's gross and net pay. Customer invoices specify details regarding purchases made during the period, the terms under which the purchases must be repaid, and the total amount, including taxes and other charges, due.
- **Internal origin.** The data for operational systems usually spring entirely from in-ternal sources. That is, the data for paychecks come from internal documents such as time cards and employee master records. The data for customer invoices come from sales orders and shipping documents.
- **Structured form.** The form of the data used as input and the form of the informa-tion produced by operational-level systems are usually very structured. That is, the data on time cards are carefully formatted in identical fashion on each, or the data on each customer invoice are carefully formatted in identical fashion. In short, the form and for-mat of the data input and the information output of the systems are highly structured.
- **Great accuracy.** The accuracy of the data used as input to such systems and of the output produced by such systems is usually very high. The data input and information output are carefully checked.



2.9.2 Tactical Systems

Tactical information systems differ from operational informa-tion systems in their basic purpose: the purpose of tactical information systems is not to support the exe-cution of operational tasks, but to help the manager control these operations. As a re-sult, the types of data used as inputs and the information produced as outputs also dif-fer from the types of data involved in operational information systems. Tactical information systems often have these characteristics. The second level in the framework consists of tactical systems. Tactical systems pro-vide middle-level managers with the information they need to monitor and control operations and to allocate their resources effectively.

Tactical information systems may also produce information when it is needed, that is, on an ad hoc basis. For instance, once the credit manager has identified a problem with overdue accounts, he or she may wish to query the accounting system database to find out what customer data, if any, correlate with those who have credit problems. For example, is there a relationship between family income and credit dif-ficulty? Is there a connection between location or address and credit

difficulty? Is there a relationship between age and credit difficulty? Is there a link between the number of years that customers have resided in the same home or apartment and credit difficulty? Is there a connection between home ownership versus renting and credit difficulty?

The answers to these questions, and others' that the credit manager pursues by querying the accounting system records, may assist in identifying the problem or propos-ing new credit limitations or requirements for credit status within the organi-zation.

In tactical systems, transactions data are summarized, aggre-gated, or analyzed. Tactical systems generate a variety of re-ports, including summary reports, exception reports, and ad hoc reports.

1. **Summary Reports** provide management with important totals, averages, key data, and abstracts on the activities of the organisation. An example of a summary report might be a list of the total regular and overtime hours earned at each plant for the week by job classification. Another example is the list of total weekly sales, by salesperson, by product, and by sales region.
2. **Exception Reports** warn managers when results from a particular operation exceed or do not meet the expected standard for the organisation. An example of an exception report is a list of all plants that have logged more overtime hours than expected for a week. Another example is a list of those sales personnel whose sales fall in the top and bottom 10% of the organisation.
3. **Ad hoc reports** are reports that managers need, usually quickly, that may never be needed again. Ad hoc reports present information that the manager needs to solve a unique problem. An example of this type of report might be a list of the total num-ber of employees absent during the week arranged by plant and by job title along with the hours or days missed. Another example might be a report that presents the production record of each plant for the week. A manager might request these reports only when an exception report shows high overtime earnings at certain plants. The manager may ask for a number of ad hoc reports such as these to identify the nature of the overtime problem

- **Periodic nature.** The information from a tactical system is sometimes produced periodically. For example, a branch credit manager for an organization may receive a weekly report showing the total dollar amount of accounts that are more than 60 days
- **Unexpected findings.** A tactical information system may produce unexpected in-formation. For example, in querying the .accounting system database, the credit man-ager may find that the major customer characteristic correlating with credit difficulty is the relationship between type of position and type of employer. Further investiga-tion may reveal that organizations in a particular industry have cut their workforces and have laid off selected workers in certain positions. Such findings may lead to a re-view of all customers who work in similar positions in that industry to find ways to solve or ease their credit problems and to prevent them from becoming bad debts to the organization.
- **Comparative nature.** The information is usually comparative in nature rather than merely descriptive. Tactical information systems should provide managers with infor-mation that alerts them to variance~ from accepted standards or to results that are out-side the normal range so that they can take remedial action swiftly. This type of tacti-cal information system is analogous to process control systems that monitor output constantly and provide feedback when output parameters are at variance with ac-cepted standards.

An example of this type of feedback is a home heating system. As long as the temperature of the air in the house falls within the range specified on the thermostat, the heating system remains inactive. When the air temperature falls below the ther-mostat setting, however, the thermostat sends a signal to the furnace to turn on. When the air reaches the temperature on the thermostat, it sends a signal to the fur-nace to turn off.

With comparative overdue account information from other branches and other periods, the credit manager can determine whether the amount overdue is normal or beyond acceptable limits. In some cases, top management sets the standard. That is, top management may have set a credit goal of no more than 5 percent bad debts. Re-ports comparing the actual bad debts to this standard help the manager spot credit problems quickly.

- **Summary form.** The information is usually not detailed, but in summary form. The credit manager is not interested in a detailed listing of each customer account and its balance. In large organizations, that would be an enormous quantity of data and would not, therefore, be useful information to the manager. The manager needs only summary information relating to credit performance or balances of accounts that are overdue or in collection.
- ·**Both internal and external sources.** The data used for input to the system may extend beyond sources internal to the organization. In our example the credit man-ager compared the information pertaining to problem customers to other branches, to other periods from the same organization, or to a goal set by top management. The credit manager might also have compared the branch's credit information with the av-erage overdue account experience reported for the whole industry of which the or-ganization is a part. Such a comparison might show that though the branch is experi-encing an increase in credit problems, so is the whole industry. Further investigation may reveal that a downturn in the economy is the likely culprit, not any unusual credit policies of the organization.

Thus tactical information systems differ from operational information systems not only in their intended purpose but also in the regularity with which information is pro-duced, the predictability of the results, the comparative nature of the information, the amount of detail produced, and the rigidity of the structure of the information.

2.9.3 Strategic Planning Systems

The third level in the framework for information systems is strategic planning. Strategic planning information systems are designed to provide top managers with in-formation that assists them in making long-range planning decisions for the organiza-tion. The distinction between strategic planning

information systems and tactical in-formation systems is not always clear because both types of information systems may use some of the same data. For example, when middle-level managers use budgeting information to allocate resources to best meet organizational goals, budgeting be-comes a tactical decision activity. When top management uses budgeting information to plan the long-term activities of an organization, budgeting becomes a strategic plan-ning activity. In either case, accurate budget information delivered in a timely fashion to managers is an important function of the financial information system of the orga-nization. However, the key differences between the systems have to do with who uses the data and what they are using it for.

Top management ordinarily uses strategic planning information systems for set-ting long-term organizational goals. Middle managers typically use tactical informa-tion systems to control their areas of supervision and to allocate resources to meet or-ganizational goals set by top management. Though the data used in tactical and strategic planning information systems sometimes overlap, usually differences exist in the data that the two information systems use. Strategic planning information systems often have these characteristics.

- **Ad hoc basis.** The information may be produced either regularly or periodically. For example, top management uses periodic accounting system reports such as the income statement, balance sheet, statement of sources and uses of funds, and capi-tal statement in its planning function. However, strategic planning information is more often produced on an ad hoc basis. For example, organization planners may request marketing analysis information pertaining to a new product or to a new cluster of stores when they are considering the addition of several new stores in a new region.
- **Unexpected information.** The system may produce unexpected information. For instance, economic forecast information may be requested for the economy as a whole and for the industry in particular. The results of the economic forecast may be a surprise to organization planners. Or the marketing survey described above may produce store locations that the planners had not predicted or expected.
- **Future Perspective** These systems are future oriented and predictive in nature. For example, forecasts of future economic conditions, projections of new product sales, and forecasts of the changing demographic characteristics of target customer groups are all forms of strategic plan-ning information that help planners make decisions.
- **Summary form.** The information is usually not detailed, but in summary form. Long-range planners are not usually interested in detailed information; they are usually concerned with more global data. For instance, long-range planners are not ordinarily concerned about the details of customer invoices. They are more likely to be inter-ested in the overall buying trends reflected in the summaries of sales by product group. In addition, long-range planners are not usually interested in the specific de-mographic characteristics of a particular customer. They are more likely to be con-cerned with the overall demographic characteristics of groups of customers.
- **External data.** A large part of the data used for input to the system may be acquired from sources external to the organization. For example, information pertaining to in-vestment opportunities, rates of borrowed capital, demographic characteristics of a market group, and economic conditions must be obtained from data maintained out-side the organisation.

MIS personnel may help long-range planners select various on-line external data-bases to find the information they need quickly and in a form that can be manipulated further: Long-range planners may wish to access databases containing economic data from which they can make forecasts, for example. They may also wish to access data-bases that contain census data from which they can draw demographic trends and forecasts.

- **Unstructured format**. The data used for input to the system may contain data that are unstructured in format. For instance, forecasts of future market trends may use the opinions of store buyers, salespeople, or market analysts obtained in casual con-versations.
- **Subjectivity.** The data used for input to *the* system may be highly subjective and their accuracy may be suspect. For example, forecasts of future stock market trends may be based partly on rumors reported by brokers. Forecasts of the expected mar-ket share of your organization within the industry might use the opinions of industry observers who are basing their information on rumors and on conversation~ held with industry personnel.

2.10 Using the Systems Approach in Problem Solving

An owner of a business like the microcomputer dealership must constantly ana-lyze problems and reorganize the resources of the system to deal with these problems effectively. The systems approach is a valuable method of problem solving that takes into account the goals, environment, and internal workings of the system. The systems approach to problem solving involves the following steps:

- Define the problem.
- Gather data describing the problem.
- Identify alternative solutions.
- Evaluate these alternatives.
- Select and implement the best alternative.
- Follow up to determine whether the solution is working.

We can understand how the systems approach works by applying it to a problem that the microcomputer dealer might experience.

Define the Problem

The first step in the systems approach to problem solving is to define the problem. Defining the problem is one of the most important parts of the system study, because if the wrong problem is identified, the entire effort to change the system will be off track. At the outset, some of the problems that are identified may be symptoms of the real problem. In order to distinguish between symptoms and problems, it is neces-sary

to gather data describing the problem. Let's say that in this case the owner is concerned about the fact that many of the salespeople are not meeting their quotas. She decides to start a systems study by collecting more information about the problem.

Gather Data Describing the Problem

The owner may study the environment, current standards, management, input re-sources, and internal procedures to gain an understanding of the problem. The first place the owner might look is the environment. The environment of the microcom-puter dealer includes its vendors, its customers, its competitors, and the local community. From this investigation, the owner might learn that local competitors are selling comparable microcomputers at prices 10 percent to 15 percent less the firm can offer.

Next, the owner might look at the dealership's standards to determine if they are valid in the face of the competitive environment. It might turn out that a goal of increasing gross sales by 10 percent for the year is unrealistic when the competition is cutting prices. Another area the owner can analyze is management. The owner needs to learn if the sales manager is doing a good job. If the sales manager is not providing salespeople with effective training and feedback regarding their performance, they may feel frustrated.

Input resources are another area that should be analyzed. The owner needs to find out if new sales and technical representatives are being recruited and if these em-ployees are trained to demonstrate computer equipment and software. If new recruits lack knowledge of the technical features of the equipment, for example, they will fail to win new business. If sales materials are not kept up-to-date, customers may not learn about new product features. Work methods and procedures also need to be studied. If salespeople are not trained to follow up on new prospects, the company could lose valuable business. If technical support personnel cannot diagnose and solve service problems on a timely basis, customers may hesitate to purchase more equipment.

One of the major problems identified in this case is that competitors are charging lower prices for comparable products. Many of the difficulties the dealer has identi-fied are symptoms of this fundamental problem. To address it, the owner has to iden-tify and evaluate some alternatives.

Identify Alternative Solutions

Given the fact that competitors have dropped their prices on comparable microcom-puters, the owner needs to identify some alternatives responses. These alternatives might include the following:

Alternative 1: Investigate alternative manufacturers of microcomputers to obtain products at a lower cost per unit.

Alternative 2: Decrease the cost of sales by introducing mail-order sales supported by telemarketing. Use salespersons for large accounts only. Cutting the cost of sales efforts would make it possible to reduce machine prices to a more competitive level

Alternative 3: Differentiate the dealership's products by offering on-line diagnostic support services for machine failure, service response time within 5 hours on a 24-hour basis, and annual service checks.

Each alternative supports a slightly different strategy. Finding lower-cost manu-factured goods represents a cost-cutting strategy. The second alternative, using mail -order sales and telemarketing, also supports a low-cost strategy because the cost of mail-order sales would be less than the cost of a large sales staff. Finally, introducing on-line diagnostic support services provides a "value added" feature. Upgraded tech-nical support would justify slightly higher equipment costs.

Evaluate the Alternatives

The owner evaluates the extent to which each alternative enables the organization to achieve its objectives. As we saw, the owner's objective was to increase the overall performance of sales personnel. Purchasing lower-cost products from suppliers would enable the owner to cut prices, as suggested in the first alternative, but would create difficulty at the service end if these microcomputer products were less reliable. This strategy might make it more difficult for salespeople to meet their ob-jectives. Introducing a mail-order program would cut the cost of sales overhead. How ever, the mail-order program would require creating a database of customer prospects and developing specialized promotional materials. This strategy might free sales rep-resentatives to concentrate on direct sales to high-potential accounts while using a less costly strategy to maintain the business of smaller accounts.

The final alternative would offer customers additional levels of service and tech-nical support that add value to the firm's products. Because service is one of the key criteria for microcomputer selection, this strategy might work. However, it is costly and might not satisfy the needs of economy-conscious small businesses that represent a large potential market share.

Select and Implement the Best Alternatives

Let's say that the owner decides to develop and implement a mail-order program to re-duce the cost of sales overhead to smaller accounts and to enable sales personnel to focus on high potential accounts. This new strategy would require the owner to recruit new customer service representatives or train current employees for telemarketing. The owner would also have to develop and establish customer prospect databases, as well as a system for shipping merchandise, billing, and authorizing credit transactions.

Follow up to determine whether the solution is working

The last step in the systems approach to problem solving is follow-up. In the case of the mail-order sales alternative, the owner needs to determine if the system is meeting its goals. If not, she has to make changes in management, standards, resources, and procedures to achieve the objectives. If either one of the other two alternatives is se-lected, the owner also needs to follow up to determine if the approach is improving sales. As you can see from this example, the systems approach to problem solving is an important technique for the manager. Every manager needs feedback to determine if the goals of the system are being achieved. One of the most difficult tasks in a systems study is identifying information that managers can use to determine how the system is working. This problem is as

true in an organization with a simple structure as it is in a more complex organization. The next section discusses the characteristics of organizations with various structures.

2.11 Summary

This lesson introduces systems concepts hat provide a foundation for understanding information systems in general and management information systems in particular. Managers have to understand systems, their objectives, their components, and their activities. Information about how a system is working provides tem with the feedback they need to allocate resources to achieve their business objectives. Depending on the objectives of a system, its components, standards, and interactions may differ. We have seen that an information system provides feedback about the activities of the business. Information Systems have the same characteristics as the other systems, including inputs and outputs, processes hat transform inputs into outputs and methods of system control. In designing an information system, the outputs must be defined to provide feedback for the business system. Managers use this feedback to reorganize, simplify, and improve activities in the business system so that the system can achieve goals more effectively. In the information-based organization, managers must define their information needs and use information as feedback.

Review Questions

1. Explain the concept of systems and its components.
2. Analyse the business as a system and identify the components of a business system
3. Explain the different types of information systems
4. Discuss the characteristics of information systems in various levels of the organisation
5. Explain the system approach in Problem Solving

Discussion Questions

1. What kind of tactical information would be useful to a branch manager of a Pepsi or Coca-cola distributorship?
2. What kind of strategic information would be useful to the CEO of a Telecom company?

Application Exercises

1. Choose a specific industry. Read news articles and trade journals to identify the major companies in that industry. Extend your research to include the primary international firms in the industry. Compare the growth rates of the two types of firms during the last five years.
2. Choose a specific industry and identify three common decisions within it. Identify one decision at each level (operations, tactical, and strategic).
3. Interview a recent graduate in your major (or a relative or friend). Find out what they do on a daily basis. Ask what his or her managers do. Do managers have operations tasks to perform as well as management duties? For instance, does a manager in an accounting firm work on tax returns?
4. As an entrepreneur, you decide to open a fast food restaurant. You can purchase a franchise from one of the established corporations (like the McDonald's) or create your own restaurant. Compare the choices by identifying the decisions you will face with each approach. What data will you need to collect?

LESSON 3 :
SYSTEM DEVELOPMENT LIFE CYCLE (SDLC)

Learning Objectives

1. To know how information systems are built
2. To understand the problems encountered when you develop information systems
3. To learn the strengths and weaknesses of development methodologies.

3.1 Introduction

In the last lesson we have seen thoroughly about the concept of System and its components. Let us have some insight now into the Development and Implementation of such systems as one of the major responsibilities of any Manager is to develop the system through which he can exercise the functions of management.

We know that information is an organizational resource which must be managed as carefully as other resources. Costs are associated with information processing. It must be managed to take full advantage of its potential.

The following paragraphs will give you some fundamentals you need to keep in mind while developing information Systems.

- A **system** is a combination of resources working together to transform inputs into usable outputs.
- An **information system** is an arrangement of people, data, processes, interfaces, networks, and technology that interact to support and improve both day-to-day operations (data processing, transaction processing), as well as support the problem-solving and decision-making needs of management (information services, management information systems, executive support).
- A **computer application** is a computer-based solution to one or more business problems or needs. One or more computer applications are typically contained within an information system.

I could say that development of systems will begin with identifying the problems and ending with the implementation and its maintenance.

- **Systems Analysis and Design** is a systematic approach to identifying problems, opportunities, and objectives; analyzing the information flows in organizations; and designing computerized information systems to solve a problem. Systems Analysts act as outside consultants to businesses, as supporting experts within a business, and as change agents. Analysts are problem solvers, and require good communication skills.
- A **problem** is an undesirable situation that prevents the organization from fully achieving its purpose, goals, and objectives. An **opportunity** is the chance to improve the organization even in the absence of specific problems. (Some might argue that any unexploited opportunity is, in reality, a problem.) A **directive** is a new requirement imposed by management, government, or some external influence. (Some might argue that a directive until it is fully complied with is, in reality, a problem.)

3.2 System Development Life Cycle

There is a fundamental dilemma faced by anyone developing a computer application. Most problems are so large they have to be split into smaller pieces. The difficulty lies in combin-ing the pieces back into a complete solution. Often each piece is assigned to a different team, and sometimes it takes months to complete each section. Without a solid plan and con-trol, the entire system might collapse. Thousands of system development projects have failed or been canceled because of these complications.

Partly because of the problems that have been encountered in the past, and partly be-cause of technological improvements, several techniques are available to develop com-puter systems. The most formal approach is known as the **systems development life cycle (SDLC).** Large organizations that develop several systems use this method to coordinate the teams, evaluate progress, and ensure quality development. Most organizations have created their own versions of SDLC. Any major company that uses SDLC also has a manual that is several inches thick (or comparable online documentation) that lays out the rules that MIS designers have to follow. Al-though these details vary from firm to firm, all of the methods have a common founda-tion. The goal is to build a system by analyzing the business processes and breaking the problem into smaller, more manageable pieces.

Improvements in technology improve the development process. The powerful features of commercial software make it easier to build new applications. Programmers and designers can work with larger, more powerful objects. For example, instead of programming each line in Java, a report can be created in a few minutes using a database management sys-tem or a spreadsheet. **Prototyping** is a design technique that takes advantage of these new tools. The main objective of proto typing is to create a working version of the system as quickly as possible, even if some components are not included in the early versions. The third method of creating systems, **end-user development** relies on users to create their own systems. This method typically uses advanced software (such as spreadsheets and database management systems) and requires users who have some computer skills.

It is important to be careful when you implement any new system. Case studies show that major problems have arisen during implementation of systems. In fact, some organizations have experienced so many problems that they will deliberately stick with older, less useful systems just to avoid the problems that occur during implementation. Although changes can cause problems, there are ways to deal with them during implementation.

There have been some spectacular failures in the development of computer systems. Projects always seem to be over budget and late. Worse, systems are sometimes developed

A systems analyst facilitates the development of information systems and computer applications. The systems analyst performs systems analysis and design. Systems analysis is the study of a business problem or need in order to recommend improvements and specify the requirements for the solution. System design is the specification or construction of a technical, computer-based solution as specified by the requirements identified in a systems analysis.

Personal qualities helpful to systems analysts include:

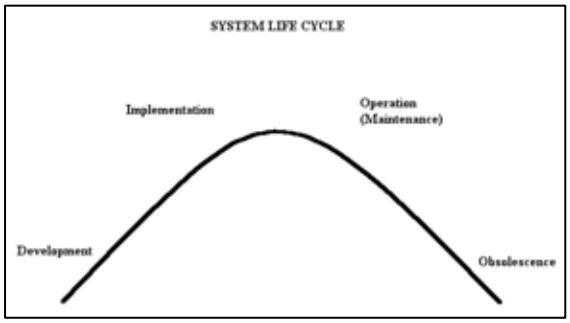
- Problem-solving abilities
- Communication skills
- Computer/IT experience
- Self-discipline and Self-motivation
- Project management capabilities

Systems are enhanced for a number of reasons:

- Adding features to the system
- Business and government requirements change over time
- Technology, hardware and software are rapidly changing

3.3 System Life Cycle – Stages and Activities

Before proceeding further, let us have a quick look at the stages every system is going through in its lifetime in any organization.



If we are analyzing these stages we might come across the following activities done in developing, implementing and maintaining a system. These activities are sequential in happening during the process of developing any type of systems.

1. Identify problems, opportunities, and objectives
2. Determine Information Requirements
3. Analyze System Needs
4. Design the Recommended System
5. Develop and Document the Software
6. Implement and Evaluate the System
7. Maintain the System

Once we know the activities involved in the Development of Systems, it becomes necessary to know how these activities are carried out by the companies. There are various methods or options a company can have for developing and implementing its information systems. Let us see some of the practices mainly followed by many of the successful companies.

3.4 Build IS Vs. Buy IS

Although most of the companies capable enough to develop their own systems, an increasingly popular alternative is to acquire systems developed by an outside vendor.

The advantage of developing your own system in-house is that it can be customized to the exact requirements of your own organization. When you purchase it from an outside party it may be a bit more generic and the organization may have to adapt its ways to the limitations of the software and other tools used.

However, by purchasing systems off the shelf or from a vendor the organization avoids the costs of in-house development. To some extent the development costs are spread out among all of the vendor's customers. Also, the organization may have the benefit of buying systems that already has a proven track record in similar organizations.

Even so, selection of new system for an organization is never a trivial matter. Alternative solutions must be evaluated carefully, studying costs and benefits and making a determination of feasibility. The same knowledge and experience that an analyst would use to design a new system must be used to select a system that most closely meets the needs and objectives of the organization. And, regardless of whether the software is written in-house or purchased from the outside, the transition to a new system is always a serious challenge for any organization.

A more recent variation is the idea of neither building nor buying, but rather "renting" solutions from an Application Service Provider (ASP). Unlike traditional software licensing in which an organization takes possession of a copy of the software and runs it on its own computer, the distinguishing characteristic of renting this from an ASP is that the system remains at the vendor's site, runs on the vendor's hardware, and is used over a wide-area network or the Internet. An Application Service Provider, then, is an independent third-party provider of software-based services which are delivered to customers across a network. An ASP is a supplier who makes applications available on a subscription basis. An ASP rents the use of an application, providing all aspects of deployment and maintenance.

While this kind of arrangement frees the organization from having to be concerned about the expense (in money, time, and human resources) of software upgrades and maintenance, a major concern becomes network bandwidth. Since the application is run across the network, instead of on a local machine, any network congestion or slowdown will directly affect response time for the end user.

Another concern is data security. Businesses are sensitive to the matter of personal customer data and proprietary information traveling over network lines. And, depending on the nature of the application, unless it is possible to isolate or partition the executable from the data, an organization's data may end up being stored on off-site computers. If so, is the data secure and protected against loss or improper access?

Now you are having a clear idea about the ways we can develop our information systems and the areas to consider in making a decision about it. Let us now proceed with the System Development Activities in Detail.

3.5 Typical Tasks in the Development Process Life Cycle

Professional system developers and the customers they serve share a common goal of building information systems that effectively support business process objectives. In order to ensure that cost-effective, quality systems are developed which address an organization's business needs, developers employ some kind of system development Model to direct the project's life cycle. Typical activities performed include the following:

- System conceptualization
- System requirements and benefits analysis
- Project adoption and project scoping
- System design
- Specification of software requirements
- Architectural design
- Detailed design
- Unit development
- Software integration & testing
- System integration & testing
- Installation at site
- Site testing and acceptance
- Training and documentation
- Implementation
- Maintenance

After seeing all the above activities, it is time to know about the methodology or approach which can be used in System Development. All these methodologies are using some of the above tasks through which they all achieve 100 % in System Development.

3.6 Approaches in System Development

3.6.1 Ad-hoc Development

Early systems development often took place in a rather chaotic and haphazard manner, relying entirely on the skills and experience of the individual staff members performing the work. Today, many organizations still practice Ad-hoc Development either entirely or for a certain subset of their development (e.g. small projects).

I can point out that with Ad-hoc Process Models, "process capability is unpredictable because the software process is constantly changed or modified as the work progresses. Schedules, budgets, functionality, and product quality are generally (inconsistent). Performance depends on the capabilities of individuals and varies with their innate skills, knowledge, and motivations. There are few stable software processes in evidence, and performance can be predicted only by individual rather than organizational capability."

Even in undisciplined organizations, however, some individual software projects produce excellent results. When such projects succeed, it is generally through the heroic efforts of a dedicated team, rather than through repeating the proven methods of an organization with a mature software process. In the absence of an organization-wide software process, repeating results depends entirely on having the same individuals available for the next project. Success rests solely on the availability of specific individuals provides no basis for long-term productivity and quality improvement throughout an organization.

3.6.2 The Waterfall Model

The Waterfall Model is the earliest method of structured system development. Although it has come under attack in recent years for being too rigid and unrealistic when it comes to quickly meeting customer's needs, the Waterfall Model is still widely used. It is attributed with providing the theoretical basis for other Process Models, because it most closely resembles a "generic" model for software development.

The Waterfall Model consists of the following steps:

- **System Conceptualization.** System Conceptualization refers to the consideration of all aspects of the targeted business function or process, with the goals of determining how each of those aspects relates with one another, and which aspects will be incorporated into the system.
- **Systems Analysis.** This step refers to the gathering of system requirements, with the goal of determining how these requirements will be accommodated in the system. Extensive communication between the customer and the developer is essential.
- **System Design.** Once the requirements have been collected and analyzed, it is necessary to identify in detail how the system will be constructed to perform necessary tasks. More specifically, the System Design phase is focused on the data requirements (what information will be processed in the system?), the software construction (how will the application be constructed?), and the interface construction (what will the system look like? What standards will be followed?).
- **Coding.** Also known as programming, this step involves the creation of the system software. Requirements and systems specifications from the System Design step are translated into machine readable computer code.
- **Testing.** As the software is created and added to the developing system, testing is performed to ensure that it is working correctly and efficiently. Testing is generally focused on two areas: internal efficiency and external effectiveness. The goal of external effectiveness testing is to verify that the software is functioning according to system design, and that it is performing all necessary functions or sub-functions. The goal of internal testing is to make sure that the computer code is efficient, standardized, and well documented. Testing can be a labor-intensive process, due to its iterative nature.

Problems associated with the Waterfall Model

Although the Waterfall Model has been used extensively over the years in the production of many quality systems, it is not without its problems. In recent years it has come under attack, due to its rigid design and inflexible procedure. Let me tell you the problems associated with the waterfall model below:

- Real projects rarely follow the sequential flow that the model proposes.
- At the beginning of most projects there is often a great deal of uncertainty about requirements and goals, and it is therefore difficult for customers to identify these criteria on a detailed level. The model does not accommodate this natural uncertainty very well.
- Developing a system using the Waterfall Model can be a long, painstaking process that does not yield a working version of the system until late in the process.

3.6.3 Iterative Development

The problems with the Waterfall Model created a demand for a new method of developing systems which could provide faster results, require less up-front information, and offer greater flexibility. With Iterative Development, the project is divided into small parts. This allows the development team to demonstrate results earlier on in the process and obtain valuable feedback from system users. Often, each iteration is actually a mini-Waterfall process with the feedback from one phase providing vital information for the design of the next phase. In a variation of this model, the software products which are produced at the end of each step (or series of steps) can go into production immediately as incremental releases.

Problems associated with the Iterative Model

While the Iterative Model addresses many of the problems associated with the Waterfall Model, it does present new challenges. Let us see them as follows:

- The user community needs to be actively involved throughout the project. While this involvement is a positive for the project, it is demanding on the time of the staff and can add project delay.
- Communication and coordination skills take center stage in project development. Informal requests for improvement after each phase may lead to confusion — a controlled mechanism for handling substantive requests needs to be developed.
- The Iterative Model can lead to "scope creep," since user feedback following each phase may lead to increased customer demands. As users see the system develop, they may realize the potential of other system capabilities which would enhance their work.

Variations on Iterative Development

A number of Process Models have evolved from the Iterative approach. All of these methods produce some demonstrable software product early on in the process in order to obtain valuable feedback from system users or other members of the project team. We will see them below.

3.6.4 Prototyping

The Prototyping Model was developed on the assumption that it is often difficult to know all of your requirements at the beginning of a project. Typically, users know many of the objectives that they wish to address with a system, but they do not know all the nuances of the data, nor do they know the details of the system features and capabilities. The Prototyping Model allows for these conditions, and offers a development approach that yields results without first requiring all information up-front.

When using the Prototyping Model, the developer builds a simplified version of the proposed system and presents it to the customer for consideration as part of the development process. The customer in turn provides feedback to the developer, who goes back to refine the system requirements to incorporate the additional information. Often, the prototype code is thrown away and entirely new programs are developed once requirements are identified.

There are a few different approaches that may be followed when using the Prototyping Model:

creation of the major user interfaces without any substantive coding in the background in order to give the users a "feel" for what the system will look like, development of an abbreviated version of the system that performs a limited subset of functions; development of a paper system (depicting proposed screens, reports, relationships etc.), or use of an existing system or system components to demonstrate some functions that will be included in the developed system.

Now, we will see the various steps involved in Prototyping.

- **Requirements Definition/Collection.** It is Similar to the Conceptualization phase of the Waterfall Model, but not as comprehensive. The information collected is usually limited to a subset of the complete system requirements.
- **Design.** Once the initial layer of requirements information is collected, or new information is gathered, it is rapidly integrated into a new or existing design so that it may be folded into the prototype.
- **Prototype Creation/Modification.** The information from the design is rapidly rolled into a prototype. This may mean the creation/modification of paper information, new coding, or modifications to existing coding.
- **Assessment.** The prototype is presented to the customer for review. Comments and suggestions are collected from the customer.
- **Prototype Refinement.** Information collected from the customer is digested and the prototype is refined. The developer revises the prototype to make it more effective and efficient.
- **System Implementation.** In most cases, the system is rewritten once requirements are understood. Sometimes, the *Iterative* process eventually produces a working system that can be the cornerstone for the fully functional system.

Problems associated with the Prototyping Model

Like other methods, prototyping is also having the following problems.

- **Prototyping can lead to false expectations.** Prototyping often creates a situation where the customer mistakenly believes that the system is "finished" when in fact it is not. More specifically, when using the Prototyping Model, the pre-implementation versions of a system are really nothing more than one-dimensional structures. The necessary, behind the-scenes work such as database normalization, documentation, testing, and reviews for efficiency have not

been done. Thus the necessary underpinnings for the system are not in place.

- **Prototyping can lead to poorly designed systems.** Because the primary goal of Prototyping is rapid development, the design of the system can sometimes suffer because the system is built in a series of "layers" without a global consideration of the integration of all other components.

Variation of the Prototyping Model

A popular variation of the Prototyping Model is called **Rapid Application Development (RAD)**. RAD introduces strict time limits on each development phase and relies heavily on rapid application tools which allow for quick development.

3.6.5 The Exploratory Model

In some situations it is very difficult, if not impossible, to identify any of the requirements for a system at the beginning of the project. Theoretical areas such as Artificial Intelligence are candidates for using the Exploratory Model, because much of the research in these areas is based on guess-work, estimation, and hypothesis. In these cases, an assumption is made as to how the system might work and then rapid iterations are used to quickly incorporate suggested changes and build a usable system. A distinguishing characteristic of the Exploratory Model is the absence of precise specifications. Validation is based on adequacy of the end result and not on its adherence to pre-conceived requirements.

The Exploratory Model is extremely simple in its construction; it is composed of the following steps:

- **Initial Specification Development.** Using whatever information is immediately available, a brief System Specification is created to provide a rudimentary starting point.
- **System Construction/Modification.** A system is created and/or modified according to whatever information is available.
- **System Test.** The system is tested to see what it does, what can be learned from it, and how it may be improved.
- **System Implementation.** After many iterations of the previous two steps produce satisfactory results, the system is dubbed as "finished" and implemented.

Problems associated with the Exploratory Model

There are numerous criticisms of the Exploratory Model:

- It is limited to use with very high-level languages that allow for rapid development, such as LISP.
- It is difficult to measure or predict its cost-effectiveness.
- As with the Prototyping Model, the use of the Exploratory Model often yields inefficient or crudely designed systems, since no forethought is given as to how to produce a streamlined system.

3.6.6 The Spiral Model

The Spiral Model was designed to include the best features from the Waterfall and Prototyping models, and introduces a new component - risk-assessment. The term "spiral" is used to describe the process that is followed as the development of the system takes place. Similar to the Prototyping Model, an initial version of the system is developed, and then repetitively modified based on input received from customer evaluations. Unlike the Prototyping Model, however, the development of each version of the system is carefully designed using the steps involved in the Waterfall Model. With each iteration around the spiral (beginning at the center and working outward), progressively more complete versions of the system are built.

Risk assessment is included as a step in the development process as a means of evaluating each version of the system to determine whether or not development should continue. If the customer decides that any identified risks are too great, the project may be halted. For example, if a substantial increase in cost or project completion time is identified during one phase of risk assessment, the customer or the developer may decide that it does not make sense to continue with the project, since the increased cost or lengthened timeframe may make continuation of the project impractical or unfeasible.

The Spiral Model is made up of the following steps:

- **Project Objectives.** Objectives are Similar to the system conception phase of the Waterfall Model. Objectives are determined, possible obstacles are identified and alternative approaches are weighed.
- **Risk Assessment.** Possible alternatives are examined by the developer, and associated risks/problems are identified. Resolutions of the risks are evaluated and weighed in the consideration of project continuation. Sometimes prototyping is used to clarify needs. **Engineering & Production.** Detailed requirements are determined and the software piece is developed.
- ·**Planning and Management.** The customer is given an opportunity to analyze the results of the version created in the Engineering step and to offer feedback to the developer.

Problems associated with the Spiral Model

Due to the relative newness of the Spiral Model, it is difficult to assess its strengths and weaknesses. However, the risk assessment component of the Spiral Model provides both developers and customers with a measuring tool that earlier Process Models do not have. The measurement of risk is a feature that occurs everyday in real-life situations, but (unfortunately) not as often in the system development industry. The practical nature of this tool helps to make the Spiral Model a more realistic Process Model than some of its predecessors.

3.6.7 The Reuse Model

The basic premise behind the Reuse Model is that systems should be built using existing components, as opposed to custom-building new components. The Reuse Model is clearly suited to Object-Oriented computing environments, which have become one of the premiere technologies in today's system development industry.

Within the Reuse Model, libraries of software modules are maintained that can be copied for use in any system. These components are of two types: procedural modules and database modules. When building a new system, the developer will "borrow" a copy of a module from the system library and then plug it into a function or procedure. If the needed module is not available, the developer will build it, and store a copy in

the system library for future usage. If the modules are well engineered, the developer with minimal changes can implement them.

The Reuse Model consists of the following steps:

- **Definition of Requirements.** Initial system requirements are collected. These requirements are usually a subset of complete system requirements.
- **Definition of Objects.** The objects, which can support the necessary system components, are identified.
- **Collection of Objects.** The system libraries are scanned to determine whether or not the needed objects are available. Copies of the needed objects are downloaded from the system.
- **Creation of Customized Objects.** Objects that have been identified as needed, but that are not available in the library are created.
- **Prototype Assembly.** A prototype version of the system is created and/or modified using the necessary objects.
- **Prototype Evaluation.** The prototype is evaluated to determine if it adequately addresses customer needs and requirements.
- **Requirements Refinement.** Requirements are further refined as a more detailed version of the prototype is created.
- **Objects Refinement.** Objects are refined to reflect the changes in the requirements.

Problems Associated with the Reuse Model

A general criticism of the Reuse Model is that it is limited for use in object-oriented development environments. Although this environment is rapidly growing in popularity, it is currently used in only a minority of system development applications.

After seeing the various approaches and alternatives of System Development, now we can discuss how to combine two are more models in Developing a System. This will help us to overcome the problems associated with individual models.

3.7 Creating and Combining Models

In many cases, parts and procedures from various Process Models are integrated to support system development. This occurs because most models were designed to provide a framework for achieving success only under a certain set of circumstances. When the circumstances change beyond the limits of the model, the results from using it are no longer predictable. When this situation occurs it is sometimes necessary to alter the existing model to accommodate the change in circumstances, or adopt or combine different models to accommodate the new circumstances.

The selection of an appropriate Process Model hinges primarily on two factors: organizational environment and the nature of the application. Frank Land, from the London School of Economics, suggests that suitable approaches to system analysis, design, development, and implementation be based on the relationship between the information system and its organizational environment.

There are four categories of relationships are identified which I am explaining below:

- **The Unchanging Environment.** Information requirements are unchanging for the lifetime of the system (e.g. those depending on scientific algorithms). Requirements can be stated unambiguously and comprehensively. A high degree of accuracy is essential. In this environment, formal methods (such as the Waterfall or Spiral Models) would provide the completeness and precision required by the system.
- **The Turbulent Environment.** The organization is undergoing constant change and system requirements are always changing. A system developed on the basis of the conventional Waterfall Model would be, in part; already obsolete by the time it is implemented. Many business systems fall into this category. Successful methods would include those, which incorporate rapid development, some throwaway code (such as in Prototyping), the maximum use of reusable code, and a highly modular design.
- **The Uncertain Environment.** The requirements of the system are unknown or uncertain. It is not possible to define requirements accurately ahead of time because the situation is new or the system being employed is highly innovative. Here, the development methods must emphasize learning. Experimental Process Models, which take advantage of prototyping and rapid development, are most appropriate.
- **The Adaptive Environment.** The environment may change in reaction to the system being developed, thus initiating a changed set of requirements. Teaching systems and expert systems fall into this category. For these systems, adaptation is key, and the methodology must allow for a straightforward introduction of new rules.

So far, we have discussed about the various models and approaches in System Development. Most of the models are developed around the basic activities in System Development what we have seen earlier. Now, for clear and complete understanding we will see them in detail.

3.7.1 Problem Detection, Initial Investigation, Feasibility Study

The system development cycle is driven by the realization that there are deficiencies in the system and these problems need to be addressed. A problem is a gap (variance) between expectation and reality; variance is large enough that it falls outside defined tolerance limits, and therefore is worth the effort/resources/cost needed to be expended to fix it.

There are two major problems for which we could do system development.

- Maintenance: on an existing system
- Development: building a new or replacement system

If the development cycle is driven by the detection of problems, how do we detect them?

When we observe:

- lack of relevancy lack of completeness lack of correctness(accuracy)
- lack of security lack of timeliness lack of economy
- lack of efficiency lack of reliability lack of usability
- throughput: number of error-free transactions per unit of time.

How do we observe these things?

- users may tell us (complaints)
- take surveys (e.g., questionnaires)
- managers may tell us (complaints)
- audits by outsiders
- we can ask (scouting)
- lower sales, loss of revenue
- continuous measurement of variances (TQM approach)

The purpose of the Initial Investigation is to make a recommendation:

- Take no action. (not a valid problem)
- Provide training/instruction/information to the end user to resolve the problem.
- Defer action to later. (adding an enhancement rather than fixing a deficiency)
- Do Maintenance to correct minor problem.
- Consider major modification or system replacement.

As a systems analyst, you must be able to handle project initiation, determine project feasibility and project scheduling, and manage activities and systems analysis team members.

Feasibility study

There are few questions which we can answer through feasibility study

- Is the proposed project worth doing?
- Is it possible to do?

For answering these questions Feasibility Study has to be done in the following kinds.

- economic feasibility (cost-benefit analysis) (*tangible* economic benefit)
- technical feasibility
- operational/social feasibility

A feasibility study assesses the economic, technical, and operational merits of the proposed project. A project is economically feasible if costs do not overshadow benefits. A project is technically feasible if the technology is available and capable of meeting users' requests. A project is operationally feasible if the proposed system will operate and be used once it is installed.

Important criteria for project selection are:

- that the requested project be backed by management
- that it be timed appropriately for commitment of resources (adequate time frame)
- that it moves the business toward attainment of its goals
- that it is practicable (adequate resources on the part of the analyst and the organization)
- that it is important enough to be considered over other projects (worthiness of the project)

What are the objectives of the proposed project? Acceptable objectives include

- reduce errors/improve accuracy
- reduce costs
- integrate subsystems: reduce complexity, streamline processes, combine processes
- shorten time requirements (speed up processes)
- reduce redundancy in storage, output
- improve customer service
- automate manual processes in support of the above

Unacceptable objectives include

- Ego-related (personal or organizational ego)
- To gain power
- To gain respect, admiration
- "Because it's Cool!"
- Automation for automation's sake alone

Information Gathering

After done the feasibility study, we can realize whether the project or proposed system is feasible to be developed. Then, the next step is to collect information required for developing the new system. This particular activity will be done with an objective of the available data and the future requirements of the organisation to be collected. This can be done by employing the following methods:

Interviews

- a planned, formal, scheduled meeting. (make an appointment)
- Used to gather information.
- Interactive, flexible, adaptable, flexible.
- Time consuming; non-standardized responses may be difficult to evaluate.
- The interviewer should have basic objectives.
- Explain objectives to subject.
- Give subject time to prepare.
- Interview should be held in subject's own office or department.
- Interviewer comments should be noncommittal; neutral, non-leading questions.
- Avoid premature conclusions, selective perception.
- Be careful not to accept negative responses too readily.
- Beware of subjects who try too hard to please.
- Listen!!

Questionnaires

- Impersonal, often mass-produced.
- Response rate may be low (discarded and not returned).
- Suitable when number of respondents is large.
- Cheaper, faster than interviewing when number of respondents is large.
- Useful when the same information is required from all respondents.
- produces specific, limited accounts of information.
- If the population is very large, it can be sampled.

- Samples must be random, not convenient.
- Same information can be sought in different ways through multiple questions.
- Redundant questions can be compared for consistency of information/responses.
- Standardized responses: fill-in-the-blank, multiple choice, rating scales, rankings.
- Open-ended responses: more difficult to tabulate
- Standardized responses can be tabulated rapidly and analyzed using statistical distribution techniques.

Observation

- A qualified person watches, or walks through, the actual processing associated with the system.
- Performance of the people being observed may be affected by the presence of the observer.
- Avoid taking notes: can affect the process performance if workers notice notes are being taken.
- Information gathered relates directly to observed performance: facts, not opinion.

Reviewing Existing Documentation

- Often there is little to tell you what is happening within the current information system.
- Keeping documentation up to date is not always a high organizational priority. Documentation may be out of date.
- Many organizations have undocumented/informal procedures. (Formal organization chart vs. what is *really* happening)

The Work Environment

- Physical arrangement of work areas will provide additional details associated with work flows and job performance.
- Information gathered should describe the physical movement of documents, forms, people, or transmitted data within offices where work is done.
- One method is to depict the floor plan of the office and trace the work flow onto it.
- New systems may disrupt existing work flows.
- Human factors: personal relationships may have developed around existing work flows.

Direct and Indirect Probes

- Direct probe (e.g., questionnaires, interviews, in-person observation)
- Indirect probe (review existing documentation; taking random samples)

Why indirect probes? Measurement itself can affect what is being measured. Direct investigation can be an interruption to the process or a distraction. Human factors: direct (overt) observation can impact on the performance of the workers.

3.7.2 System Analysis

In order to prepare the systems proposal in an effective way, systems analysts must use a systematic approach to identify hardware and software needs – ascertaining hardware and software needs, identifying and forecasting costs and benefits, comparing costs and benefits, and choosing the most appropriate alternative.

In ascertaining hardware and software needs, systems analysts may take the following steps:

1. Inventory computer hardware already available in the organization.
2. Estimate both current and projected workload for the system.
3. Evaluate the performance of hardware and software using some predetermined criteria.
4. Choose the vendor according to the evaluation.
5. Acquire the hardware and software from the selected vendor.

When inventorying computer hardware, systems analysts should check such items as type of equipment, status of the equipment (on order, in use, in storage, in need of repair), estimated age of equipment, projected life of equipment, physical location of equipment, department or individual responsible for equipment, and financial arrangement for equipment (owned, leased, rented).

When evaluating hardware, the involved persons, including management, users, and systems analysts, should take the following criteria into consideration: time required for average transactions (including time for input and output), total volume capacity of the system, idle time of the central processing unit, and size of memory provided.

When evaluating hardware vendors, the selection committee needs to consider hardware support, software support, installation and training support, maintenance support, and the performance of the hardware.

When evaluating software packages, the selection committee needs to take the following factors into consideration as well as total dollar amount to purchase them. They are: performance effectiveness, performance efficiency, ease of use, flexibility, quality of documentation, and manufacturer support.

Systems analysts should take tangible costs, intangible costs, tangible benefits, and intangible benefits into consideration to identify costs and benefits of a prospective system. To select the best alternative, systems analysts should compare costs and benefits of the prospective alternatives.

Through the use of effectively organizing the content, writing in a professional style, and orally presenting the proposal in an informative way, the analyst can create a successful systems proposal.

After analyzing all these aspects, now being a system analyst or a MIS manager, you have to develop a System Proposal which comprises of the following:

1. Cover letter
2. Title page of project
3. Table of contents
4. Executive summary (including recommendation)
5. Outline of systems study with appropriate documentation
6. Detailed results of the systems study

7. Systems alternatives (3 or 4 possible solutions)
8. Systems analysts' recommendations
9. Summary
10. Appendices (assorted documentation, summary of phases, correspondence, etc.)

When writing a systems proposal, systems analysts should use examples, illustrations, diagrams, tables, figures, and graphs to support main points of the proposal.

Some guidelines for effective use of tables:

- Type only one table per page and integrate it into the body of the proposal.
- Try to fit the entire table vertically on a single page.
- Number and title the table at the top of the page. Make the title descriptive and meaningful.
- Label each row and column.
- Use a boxed table if room permits.
- Use an asterisk if necessary to explain detailed information contained in the table.

Some guidelines for the effective use of figures:

- Whenever possible, integrate the figure into the body of the proposal itself.
- Always introduce figures in the text before they appear.
- Always interpret figures in words; never leave them to stand on their own.
- Title all figures, label each axis, and provide legends where necessary.
- Use more than one figure if necessary, so that the visual does not become cluttered.

Some guidelines for effective use of graphs:

- Draw only one graph to a page unless you want to make a critical comparison between graphs.
- Integrate the graph into the body of the proposal.
- Give the graph a sequential figure number and a meaningful title.
- Label each axis, and any lines, columns, bars, and pieces of the pie on the graph.
- Include a key to indicate differently colored lines, shaded bars, or crosshatched areas.

Line graphs are used primarily to show change over time. Column charts can depict a comparison between two or more variables over time, but more often they are used to compare different variables at a particular point in time. Bar charts are used to show variables or variables within certain classes or categories during a specific time period. Pie charts are used to show how 100 percent of a commodity is divided at a particular point in time.

To make presentations more persuasive, the systems analyst may use white space, headings and subheadings, effective page numbering style and position, relevant references and appendices.

Presentation software, such as Microsoft PowerPoint, is available that allows the analyst to use a PC for a slide show. This allows the presentation to be enhanced by the use of clip art, video clips, animation, and sound.

When delivering the oral presentation, systems analysts need to keep the following points in mind:

- Project loudly enough so that the audience can hear you.
- Look at each person in the audience as you speak. (eye contact)
- Make visuals large enough so that the audience can see them.
- Use gestures that are natural to your conversational style.
- Introduce and conclude your talk confidently.

To overcome anxiety:

- Be yourself.
- Speak naturally.
- Breathe deeply before your presentation.
- Be prepared.

3.7.3 System Design and Modularity

Systems design is the evaluation of alternative solutions and the specification of a detailed computer-based solution. It is also called physical design).

The key to understanding the design phase is to realize you are shifting your focus from understanding the problem to figuring out a cost-effective solution to the problem. Design is especially challenging because you usually have to devise a solution despite all sorts of constraints. For example, you might be told the solution can't cost more than $100,000, or that it must be implemented in 4 months, or that it must run across the Win, Mac, and Unix platforms, etc.

You normally proceed with design in two major steps. First you need to determine a general direction such as building a custom technology solution or buying a packaged one (general design). Second you need to figure out all the details for going ahead with your general direction such as how to integrate the purchased application into your existing environment or how to build it to meet requirements in a way that minimizes cost of system over its full life cycle (detailed design). This includes both the cost of initial implementation and much larger cost of long term support.

At this stage of Design, we should consider the following important concepts which will avoid the flaws in our design. Majority of the system failures happening today are only due to the poor design of systems.

- **Modularity** is important because: (1) it allows assignment of different programmers and analysts to separate tasks; (2) small sections can be developed independently; and (3) maintenance causes minimal disruption.
- **Cohesion** is how well activities within a single module are related to one another.
- **Optimizing** is the process of seeking the perfect solution. **Satisfying** is the process of seeking a better, but not necessarily perfect, solution.
- There are no perfect systems. And, there are always constraints. So, satisfying, not optimizing is the goal of system design.

Four Categories of System Flaws

- Major anticipated flaws are system functions that were not included in the design because of constraints such as time or cost.
- Major unanticipated flaws are the most serious type of system shortcoming which indicates major design and testing deficiencies.
- Minor unanticipated flaws are the most prevalent of system shortcomings and are handled by maintenance.
- Minor anticipated flaws should not exist.

Three tactics to use for giving a System Design a Future Orientation:

- Build redundancy into the current system.
- Maintain a future file on every system.
- Develop documentation.

After considering all these concepts, we could proceed with the system design which is happening in two phases. The first part is to develop a blueprint of the system and to define the dataflow and controls in the form of diagrams and other representations. After that we will write the computer programs to physically create the system as software package. In this part we will design the form of input, output and the user interface. Let us see them in brief below:

Logical Design

- Produces a system blueprint
- General rather than technical format

Physical Design

- Converts the blueprint into the specific detail required to construct the code
- Includes specifying complete descriptions of files, input, and output.

The systems blueprint may include charts, graphs, and data layouts that describe output documents and reports, input documents that the system will process, computer records required to store processed data, and the sequence and method by which output, input, and storage are linked. Output is the primary purpose of any system. A senior systems analyst is usually in charge of project scheduling for systems design in the case of small projects; a project leader for larger projects. Users should always participate in the design phase because it fosters ownership. Clerical users should be involved in the design of business information systems. At periodic intervals managers and supervisors should give their stamp of approval.

The advantage of design teams is that design can be completed in modules. Structured walkthroughs are valuable because they force the analyst to explain step-by-step logic of design; design colleagues provide new ideas or spot flaws that the analyst has overlooked/not noticed; provides an opportunity for analyst to practice explaining the system.

Joint Application Design (JAD) is the design of systems by groups of people meeting together in multiple sessions. Design teams are cross-functional and include both users and designers. Designs are completed more quickly with JAD than through traditional sequential methods. JAD involves a significant amount of planning and coordination.

CASE design aids include: graphics (data flow diagrams, structure charts, etc.), screen and document design, file design, rapid prototyping, and code generation.

Standard information systems are applicable across a wide range of industries. Tailored information systems must match the specific characteristics of a firm or individual decision makers within the firm. In the top-down approach the designer begins with the total concept and decomposes to further levels of detail.

Modules

A module is a bounded contiguous group of statements having a single name and that can be treated as a unit. In other words, a single block in a pile of blocks can be called as Module. Cohesion: how well the activities within a single module relate to one another. Separate modules should be relatively independent (loosely coupled). This facilitates development, maintenance by teams; reduces chance of unintended *ripple effects* on other modules when changes made to a module.

Guidelines for Modularity

- Make sure modules perform a single task, have a single entry point, and have a single exit point.
- Isolate input-output (I-O) routines into a small number of standard modules that can be shared system-wide.
- Isolate system-dependent functions (e.g., getting date or time) in the application to ease possible future conversions to other computer platforms or to accommodate future operating system revisions.

Any system always represents some kind of *tradeoff* between functionality (meeting the business needs) and the resources available (constraints). The goal of design is an improved system, one that better meets the needs of the organization.

Design: Input, Output, User Interface

Output Design

Output is the primary purpose of any system. These guidelines apply for the most part to both paper and screen outputs. Output design is often discussed before other aspects of design because, from the client's point of view, the output is the system. Output is what the client is buying when he or she pays for a development project. Inputs, databases, and processes exist to provide output.

- Problems often associated with business information output are information delay, information (data) overload, paper domination, excessive distribution, and no tailoring.
- Mainframe printers: high volume, high speed, located in the data center Remote site printers: medium speed, close to end user.
- COM is Computer Output Microfilm. It is more compact than traditional output and may be produced as fast as non-impact printer output.
- Turnaround documents reduce the cost of internal information processing by reducing both data entry and associated errors.

- Periodic reports have set frequencies such as daily or weekly; ad hoc reports are produced at irregular intervals.
- Detail and summary reports differ in the former support day-to-day operation of the business while the latter include statistics and ratios used by managers to assess the health of operations.
- Page breaks and control breaks allow for summary totals on key fields.
- Report requirements documents contain general report information and field specifications; print layout sheets present a picture of what the report will actually look like.
- Page decoupling is the separation of pages into cohesive groups.
- Two ways to design output for strategic purposes are (1) make it compatible with processes outside the immediate scope of the system, and (2) turn action documents into turnaround documents.
- People often receive reports they do not need because the number of reports received is perceived as a measure of power.
- Fields on a report should be selected carefully to provide uncluttered reports, facilitate 80-column remote printing, and reduce information (data) overload.
- The types of fields which should be considered for business output are: key fields for access to information, fields for control breaks, fields that change, and exception fields.
- Output may be designed to aid future change by stressing unstructured reports, defining field size for future growth, making field constants into variables, and leaving room on summary reports for added ratios and statistics.
- Output can now be more easily tailored to the needs of individual users because inquiry-based systems allow users themselves to create ad hoc reports.
- An output intermediary can restrict access to key information and prevent unauthorized access.
- An information clearinghouse (or information center) is a service center that provides consultation, assistance, and documentation to encourage end-user development and use of applications.
- The specifications needed to describe the output of a system are: data flow diagrams, data flow specifications, data structure specifications, and data element specifications.

Output Documents

Printed Reports

- External Reports: for use or distribution outside the organization; often on preprinted forms.
- Internal Reports: for use within the organization; not as "pretty", stock paper, greenbar, etc.
- Periodic Reports: produced with a set frequency (daily, weekly, monthly, every fifth Tuesday, etc.)
- Ad-Hoc (On Demand) Reports: irregular interval; produced upon user demand.
- Detail Reports: one line per transaction.
- Summary Reports: an overview.
- Exception Reports: only shows errors, problems, out-of-range values, or unexpected conditions or events.

Input Design

- A source document differs from a turnaround document in that the former contains data that change the status of a resource while the latter is a machine readable document.
- Transaction throughput is the number of error-free transactions entered during a specified time period.
- A document should be concise because longer documents contain more data and so take longer to enter and have a greater chance of data entry errors.
- Numeric coding substitutes numbers for character data (e.g., 1=male, 2=female); mnemonic coding represents data in a form that is easier for the user to understand and remember. (e.g., M=male, F=female).
- The more quickly an error is detected, the closer the error is to the person who generated it and so the error is more easily corrected.
- An example of an illogical combination in a payroll system would be an option to eliminate federal tax withholding.
- By "multiple levels" of messages, I mean allowing the user to obtain more detailed explanations of an error by using a help option, but not forcing a lengthy message on a user who does not want it.
- An error suspense record would include the following fields: data entry operator identification, transaction entry date, transaction entry time, transaction type, transaction image, fields in error, error codes, date transaction reentered successfully.
- A data input specification is a detailed description of the individual fields (data elements) on an input document together with their characteristics (i.e., type and length).
- Be specific and precise, not general, ambiguous, or vague. (BAD: Syntax error, Invalid entry, General Failure)
- Don't JUST say what's wrong—— Be constructive; suggest what needs to be done to correct the error condition.

Top of Form

Bottom of Form

- Be positive; Avoid condemnation. Possibly even to the point of avoiding pejorative terms such as "invalid" "illegal" or "bad."

Top of Form

Bottom of Form

- Be user-centric and attempt to convey to the user that he or she is in control by replacing imperatives such as "Enter date" with wording such as "Ready for date."
- Consider multiple message levels: the initial or default error message can be brief but allow the user some mechanism to request additional information.
- Consistency in terminology and wording.
    - place error messages in the same place on the screen

- use consistent display characteristics (blinking, color, beeping, etc.)

User Interface

- The primary differences between an *interactive* and *batch* environment are:
  - interactive processing is done during the organization's prime work hours
  - interactive systems usually have multiple, simultaneous users
  - the experience level of users runs from novice to highly experienced
  - developers must be good communicators because of the need to design systems with error messages, help text, and requests for user responses.
- The seven step path that marks the structure of an interactive system is

1. Greeting screen (e.g., company logo)
2. Password screen — to prevent unauthorized use
3. Main menu — allow choice of several available applications
4. Intermediate menus — further delineate choice of functions
5. Function screens — updating or deleting records
6. Help screens — how to perform a task
7. Escape options — from a particular screen or the application

- An intermediate menu and a function screen differ in that the former provides choices from a set of related operations while the latter provides the ability to perform tasks such as updates or deletes.
- The difference between inquiry and command language dialogue modes is that the former asks the user to provide a response to a simple question (e.g., "Do you really want to delete this file?") where the latter requires that the user know what he or she wants to do next (e.g., MS-DOS C:> prompt; VAX/VMS $ prompt; Unix shell prompt). GUI Interface (Windows, Macintosh) provide Dialog Boxes to prompt user to input required information/parameters.
- Directions for designing form-filling screens:
  - Fields on the screen should be in the same sequence as on the source document.
  - Use cuing to provide the user with information such as field formats (e.g., dates)
  - Provide default values.
  - Edit all entered fields for transaction errors.
  - Move the cursor automatically to the next entry field
  - Allow entry to be free-form (e.g., do not make the user enter leading zeroes)
  - Consider having all entries made at the same position on the screen.
- A default value is a value automatically supplied by the application when the user leaves a field blank. For example, at SXU the screen on which student names and addresses are entered has a default value of "IL" for State since the majority of students have addresses in Illinois. At one time "312" was a default value for Area Code, but with the additional Area Codes now in use (312, 773, 708, 630, 847) providing a default value for this field is no longer as useful.
- The eight parts of an interactive screen menu are:

0. Locator - what application the user is currently in
1. Menu ID - allows the more experienced user access without going through the entire menu tree.
2. Title
3. User instructions
4. Menu list
5. Escape option
6. User response area
7. System messages (e.g., error messages)

- Highlighting should be used for gaining attention and so should be limited to critical information, unusual values, high priority messages, or items that must be changed.
- Potential problems associated with the overuse of color are:
  - Colors have different meanings to different people and in different cultures.
  - A certain percentage of the population is known to have color vision deficiency.
  - Some color combinations may be disruptive.
- Information density is important because density that is too high makes it more difficult to discern the information presented on a screen, especially for novice users.
- Rules for defining message content include:
  - Use active voice.
  - Use short, simple sentences.
  - Use affirmative statements.
  - Avoid hyphenation and unnecessary punctuation.
  - Separate text paragraphs with at least one blank line.
  - Keep field width within 40 characters for easy reading.
  - Avoid word contractions and abbreviations.
  - Use non threatening language.
  - Avoid godlike language.
  - Do not patronize.
  - Use mixed case (upper and lower case) letters.
  - Use humor carefully.
- Symmetry is important to screen design because it is aesthetically pleasing and thus more comforting.
- Input verification is asking the user to confirm his or her most recent input (e.g., "Are you sure you want to delete this file?")
- Adaptive models are useful because they adapt to the user's experience level as he or she moves from novice to experienced over time as experience with the system grows.
- "Within User" sources of variation include: warm up, fatigue, boredom, environmental conditions, and extraneous events.

- The elements of the adaptive model are:
- Triggering question to determine user experience level
- Differentiation among user experience
  - Alternative processing paths based on user level
  - Transition of casual user to experienced processing path
  - Transition of novice user to experienced processing path
  - Allowing the user to move to an easier processing path
- Interactive tasks can be designed for closure by providing the user with feedback indicating that a task has been completed.
- Internal locus of control is making users feel that they are in control of the system, rather than that the system is in control of them.
- Examples of distracting use of surprise are:
  - Highlighting
  - Input verification
  - Flashing messages
  - Auditory messages
- Losing the interactive user can be avoided by using short menu paths and "You are here" prompts.
- Some common user shortcuts are: direct menu access, function keys, and shortened response time.

Golden Rules of Interface Design

- Strive for consistency.
- Enable frequent users to use shortcuts.
- Offer informative feedback.
- Design dialogs to yield closure.
- Offer error prevention and simple error handling.
- Permit easy reversal of actions.
- Support internal locus of control.
- Reduce short-term memory load.

3.7.4 Data Entry and Data Storage

The quality of data input determines the quality of information output. Systems analysts can support accurate data entry through achievement of three broad objectives: effective coding, effective and efficient data capture and entry, and assuring quality through validation. Coding aids in reaching the objective of efficiency, since data that are coded require less time to enter and reduce the number of items entered. Coding can also help in appropriate sorting of data during the data transformation process. Additionally, coded data can save valuable memory and storage space.

In establishing a coding system, systems analysts should follow these guidelines:

- Keep codes concise.
- Keep codes stable.
- Make codes that are unique.
- Allow codes to be sortable.
- Avoid confusing codes.
- Keep codes uniform.
- Allow for modification of codes.
- Make codes meaningful.

The **simple sequence code** is a number that is assigned to something if it needs to be numbered. It therefore has no relation to the data itself. **Classification codes** are used to distinguish one group of data, with special characteristics, from another. Classification codes can consist of either a single letter or number. The **block sequence code** is an extension of the sequence code. The advantage of the block sequence code is that the data are grouped according to common characteristics, while still taking advantage of the simplicity of assigning the next available number within the block to the next item needing identification.

A mnemonic is a memory aid. Any code that helps the data-entry person remember how to enter the data or the end-user remember how to use the information can be considered a mnemonic. Mnemonic coding can be less arbitrary, and therefore easier to remember, than numeric coding schemes. Compare, for example, a gender coding system that uses "F" for Female and "M" for Male with an arbitrary numeric coding of gender where perhaps "1" means Female and "2" means Male. Or, perhaps it should be "1" for Male and "2" for Female? Or, why not "7" for Male and "4" for Female? The arbitrary nature of numeric coding makes it more difficult for the user.

Date Formats

An effective format for the storage of date values is the eight-digit YYYYMMDD format as it allows for easy sorting by date. Note the importance of using four digits for the year. This eliminates any ambiguity in whether a value such as 01 means the year 1901 or the year 2001. Using four digits also insures that the correct sort sequence will be maintained in a group of records that include year values both before and after the turn of the century (e.g., 1999, 2000, 2001).

Remember, however, that the date format you use for storage of a date value need not be the same date format that you present to the user via the user interface or require of the user for data entry. While YYYYMMDD may be useful for the storage of date values it is not how human beings commonly write or read dates. A person is more likely to be familiar with using dates that are in MMDDYY format. That is, a person is much more likely to be comfortable writing the date December 25, 2001 as "12/25/01" than "20011225."

Fortunately, it is a simple matter to code a routine that can be inserted between the user interface or data entry routines and the data storage routines that read from or write to magnetic disk. Thus, date values can be saved on disk in whatever format is deemed convenient for storage and sorting while at the same time being presented in the user interface, data entry routines, and printed reports in whatever format is deemed convenient and familiar for human users.

Data Entry Methods

- Keyboards
- Optical character recognition (OCR)
- Magnetic ink character recognition (MICR)
- Mark-sense forms

- Punch-out forms
- Bar codes
- Intelligent terminals

Tests for validating input data include: test for missing data, test for correct field length, test for class or composition, test for range or reasonableness, test for invalid values, test for comparison with stored data, setting up self-validating codes, and using check digits. Tests for class or composition are used to check whether data fields are correctly filled in with either numbers or letters. Tests for range or reasonableness do not permit a user to input a date such as October 32. This is sometimes called a sanity check.

Database

A database is a group of related files. This collection is usually organized to facilitate efficient and accurate inquiry and update. A database management system (DBMS) is a software package that is used to organize and maintain a database.

Usually when we use the word "file" we mean traditional or conventional files. Sometimes we call them "flat files." With these traditional, flat files each file is a single, recognizable, distinct entity on your hard disk. These are the kind of files that you can see cataloged in your directory.

Commonly, these days, when we use the word "database" we are not talking about a collection of this kind of file; rather we would usually be understood to be talking about a database management system. And, commonly, people who work in a DBMS environment speak in terms of "tables" rather than "files."

DBMS software allows data and file relationships to be created, maintained, and reported. A DBMS offers a number of advantages over file-oriented systems including reduced data duplication, easier reporting, improved security, and more rapid development of new applications.

The DBMS may or may not store a table as an individual, distinct disk file. The software may choose to store more than one table in a single disk file. Or it may choose to store one table across several distinct disk files, or even spread it across multiple hard disks. The details of physical storage of the data is not important to the end user who only is concerned about the logical tables, not physical disk files.

In a **hierarchical** database the data is organized in a tree structure. Each parent record may have multiple child records, but any child may only have one parent. The parent-child relationships are established when the database is first generated, which makes later modification more difficult.

A **network** database is similar to a hierarchical database except that a child record (called a "member") may have more than one parent (called an "owner"). Like in a hierarchical database, the parent-child relationships must be defined before the database is put into use, and the addition or modification of fields requires the relationships to be redefined.

In a **relational** database the data is organized in tables that are called "relations." Tables are usually depicted as a grid of rows ("tuples") and columns ("attributes"). Each row is a record; each column is a field. With a relational database links between tables can be established at any time provided the tables have a field in common. This allows for a great amount of flexibility.

3.7.5 System Implementation

Systems implementation is the construction of the new system and its delivery into 'production' or day-to-day operation.

The key to understanding the implementation phase is to realize that there is a lot more to be done than programming. During implementation you bring your process, data, and network models to life with technology. This requires programming, but it also requires database creation and population, and network installation and testing. You also need to make sure the people are taken care of with effective training and documentation. Finally, if you expect your development skills to improve over time, you need to conduct a review of the lessons learned.

During both design and implementation, you ought to be looking ahead to the support phase. Over the long run, this is where most of the costs of an application reside.

Systems implementation involves installation and changeover from the previous system to the new one, including training users and making adjustments to the system. Many problems can arise at this stage. You have to be extremely careful in implementing new systems. First, users are probably nervous about the change already. If something goes wrong they may never trust the new system. Second, if major errors occur, you could lose important business data.

A crucial stage in implementation is final testing. Testing and quality control must be performed at every stage of development, but a final systems test is needed before staff entrust the company's data to the new system. Occasionally, small problems will be noted, but their resolution will be left for later. In any large system, errors and changes will occur, the key is to identify them and determine which ones must be fixed immediately. Smaller prob-lems are often left to the software maintenance staff.

Change is an important part of MIS. Designing and implementing new systems often causes changes in the business operations. Yet, many people do, not like changes. Changes require learning new methods, forging new relationships with people and man-agers, or perhaps even loss of jobs. Changes exist on many levels: in society, in business, and in information systems. Changes can occur because of shifts in the environment, or they can be introduced by internal change agents. Left to themselves, most organizations will resist even small changes. Change agents are objects or people who cause or facilitate changes. Sometimes it might be a new employee who brings fresh ideas; other times changes can be mandated by top-level management. Sometimes an outside event such as arrival of a new competitor or a natural disaster forces an organization to change. What-ever the cause, people tend to resist change. However, if organizations do not change, they cannot survive. The goal is to implement systems in a manner that recognizes resis-tance to change but encourages people to accept the new system. Effective implementa-tion involves finding ways to reduce this resistance. Sometimes, implementation involves the cooperation of outsiders such as suppliers.

Because implementation is so important, several techniques have been developed to help implement new systems. Direct cutover is an obvious technique, where the old system is simply dropped and the new one started. If at all possible, it is best to avoid this technique, because it is the most dangerous to data. If anything goes wrong with the new system, you run the risk of losing valuable information because the old system is not available.

In many ways, the safest choice is to use parallel implementa-tion. In this case, the new system is introduced alongside the old one. Both systems are operated at the same time until you determine that the new system is acceptable. The main drawback to this method is that it can be expensive because data has to be entered twice. Additionally, if users are nervous about the new system, they might avoid the change and stick with the old method. In this case, the new system may never get a fair trial.

If you design a system for a chain of retail stores, you could pilot test the first implementa-tion in one store. By working with one store at a time, there are likely to be fewer prob-lems. But if problems do arise, you will have more staff members around to overcome the obstacles. When the system is working well in one store, you can move to the next lo-cation. Similarly, even if there is only one store, you might be able to split the implemen-tation into sections based on the area of business. You might install a set of computer cash registers first. When they work correctly, you can connect them to a central com-puter and produce daily reports. Next, you can move on to annual summaries and payroll. Eventually the entire system will be installed.

Let us now see the Process of Implementation which involves the following steps:

- Internal or outsourcing (trend is “outsourcing”)
- Acquisition: purchasing software, hardware, etc.
- Training: employee (end-users) training, technical staff training. SQL training in 5 days costs around $2000, + airplane, hotel, meals, rental car ($3000 to 5000); evaluation
- Testing:
  - a bigger system requires more testing time
  - a good career opportunity for non-technical people who wish to get in the door in the IT jobs.
- Documentation:
  - backup
  - knowledge management system
- Actual Installation
- Conversion: Migration from the old system to a new system
- Maintenance: very important; if you don’t maintain the new system properly, it’s useless to develop a new system.
  - monitor the system,
  - upgrade,
  - trouble-shooting,
  - continuous improvement

3.7.6 System Maintenance

Once the system is installed, the MIS job has just begun. Computer systems are constantly changing. Hardware upgrades occur continually, and commercial software tools may change every year. Users change jobs. Errors may exist in the system. The business changes, and management and users demand new information and expansions. All of these actions mean the system needs to be modified. The job of overseeing and making these modifications is called **software maintenance.**

The pressures for change are so great that in most organizations today as much as 80 per cent of the MIS staff is devoted to modifying existing programs. These changes can be time consuming and difficult. Most major systems were created by teams of programmers and analysts over a long period. In order to make a change to a program, the programmer has to understand how the current program works. Because the program was written by many dif-ferent people with varying styles, it can be hard to understand. Finally, when a programmer makes a minor change in one location, it can affect another area of the program, which can cause additional errors or necessitate more changes

One difficulty with software maintenance is that every time part of an application is modi-fied, there is a risk of adding defects (bugs). Also, over time the application becomes less struc-tured and more complex, making it harder to understand. These are some of the main reasons why the year 2000 alterations were so expensive and time consuming. At some point, a com-pany may decide to replace or improve the heavily modified system. There are several techniques for improving an existing system, ranging from rewriting individual sections to restruc-turing the entire application.. The difference lies in scope-how much of the application needs to be modified. Older applications that were subject to modifications over several years tend to contain code that is no longer used, poorly documented changes, and inconsistent naming con-ventions. These applications are prime candidates for restructuring, during which the entire code is analyzed and reorganized to make it more efficient. More important, the code is organized, standardized, and docu-mented to make it easier to make changes in the future.

3.7.7 System Evaluation

An important phase in any project is evaluating the resulting system. As part of this evalua-tion, it is also important to assess the effectiveness of the particular development process. There are several questions to ask. Were the initial cost estimates accurate? Was the project completed on time? Did users have sufficient input? Are maintenance costs higher than ex-pected?

Evaluation is a difficult issue. How can you as a manager tell the difference between a good system and a poor one? In some way, the system should decrease costs, increase rev-enue, or provide a competitive advantage. Although these effects are important, they are often subtle and difficult to measure. The system should also be easy to use and flexible enough to adapt to changes in the business. If employees or customers continue to complain about a system, it should be reexamined. .

A system also needs to be *reliable.* It should be available when needed and should pro-duce accurate output. Error detection can be provided in the system to recognize and avoid common

problems. Similarly, some systems can be built to tolerate errors, so that when er-rors arise, the system recognizes the problem and works around it. For example, some com-puters exist today that automatically switch to backup components when one section fails, thereby exhibiting fault tolerance.

Managers concern to remember when dealing with new systems is that the evaluation mechanism should be determined at the start. The question of evaluation is ignored until someone questions the value of the finished product. It is a good design practice to ask what would make this system a good system when it is finished or how we can tell a good system from a bad one in this application. Even though these questions may be difficult to answer, they need to be asked. The answers, however in-complete, will provide valuable guidance during the design stage.

Recall that every system needs a goal, a way of measuring progress toward that goal, and a feedback mechanism. Tradi-tionally, control of systems has been the task of the computer programming staff. Their primary goal was to create error-free code, and they used various testing techniques to find and correct errors in the code. Today, creating error-free code is not a sufficient goal.

We have all heard the phrase, "The customer is always right." The meaning behind this phrase is that sometimes people have different opinions on whether a system is behaving correctly. When there is a conflict, the opinion that is most important is that of the customer. In the final analysis, customers are in control because they can always take their business elsewhere. With information systems, the users are the customers and the users should be the ones in control. Users determine whether a system is good. If the users are not convinced that the system performs useful tasks, it is not a good system.

Feasibility comparison	
Cost and budget	Compare actual costs to budget estimates
Time estimates Revenue effects	Was project completed on time?
Maintenance costs	Does system produce additional revenue?
Project goals	How much money and time are spent on changes? Does system meet the initial goals of the project?
User satisfaction	How do users (and management) evaluate the system?
System performance	
System reliability	Are the results accurate and on time?
System availability	Is the system available continually?
System security	Does the system provide access to authorized users?

3.8 Strengths and Weaknesses of SDLC

The primary purpose of the SDLC method of designing systems is to provide guidance and control over the develop-ment process. As summarized in the following table, there are strengths and weaknesses to this methodology. SDLC manage-ment control is vital for large projects to en-sure that the individual teams work together. There are also financial controls to keep track of the project expenses. The SDLC steps are often spelled out in great detail. The formality makes it easier to train employees and to evaluate the progress of the development. It also ensures that steps are not skipped, such as user approval, documentation, and testing. For large, complex projects, this degree of control is necessary to ensure the project can be com-pleted. Another advantage of SDLC is that by adhering to standards while building the sys-tem, programmers will find the system easier to modify and maintain later. The internal con-sistency and documentation make it easier to modify. With 80 percent of MIS resources spent on maintenance, this advantage can be critical.

In some cases the formality of SDLC causes problems. Most important, it increases the cost of development and lengthens the development time. Remember that often less than 25 percent of the time is spent on actually writing programs. A great deal of the rest of the time is spent filling out forms and drawing diagrams

The formality of the SDLC also causes problems with projects that are hard to define. SDLC works best if the entire system can be accurately specified in the beginning. That is, users and managers need to know *exactly* what the system should do long before the system is created. That is not a serious problem with transaction-processing systems. However, con-sider the development of a complex decision support system. Initially, the users may not know how the system can help. Only through working with the system on actual problems will they spot errors and identify enhancements.

Although some large projects could never have been completed without SDLC, its rigid-ity tends to make it difficult to develop many modern applications. Additionally, experience has shown that it has not really solved the problems of projects being over budget and late. As a result of this criticism, many people are searching for alternatives. One possibility is to keep the basic SDLC in place and use technology to make it more efficient. Other sugges-tions have been to replace the entire process with a more efficient development process, such as prototyping. Consider the assistance of technology first.

Strengths	**Weaknesses**
Control	Increased development time
Monitor large projects	Increased development costs Systems must be defined up front Rigidity
Detailed steps	Hard to estimate costs, project overruns User input sometimes limited
Evaluate costs and completion targets Documentation	
Well-defined user input	
Ease of maintenance	
Development and design standards Tolerates changes	
in MIS staffing	

3.9 Summary

The evolution of system development Process Models has reflected the changing needs of computer customers. As customers demanded faster results, more involvement in the development process, and the inclusion of measures to determine risks and effectiveness, the methods for developing systems changed. In addition, the software and hardware tools used in the industry changed (and continue to change) substan-tially. Faster networks and hardware supported the use of smarter and faster operating systems that paved the way for new languages and databases, and applications that were far more

powerful than any predecessors. Numerous changes in the system development environment simultaneously spawned the development of more practical new *Process Model*s and the demise of older models that were no longer useful.

Review Questions

1. What are the Phases of System Development Life Cycle?
2. What activities occur during the problem definition phase of the system development life cycle?
3. Why is system maintenance a large percentage of the life span of an information system?
4. What are the main advantages and disadvantages of In-house system development?
5. Explain the various stages of the System Development.
6. Write an essay about the various approaches in System Development.

Discussion Questions

1. What are some of the reasons organisations choose outsourcing as a method of system development?
2. Why should a manager prepare a request for System Proposal for new Information Systems?
3. Name three factors that must be considered in determining whether an information system can be created using a software package, prototyping, or user development. Suggest the benefits and problems associated with each method.
4. What kinds of human factors can cause resistance to the System Implementation? Find out the ways to overcome it.

Application Exercises

1. Find at least three B2B sites. Hint: you will probably need to use a magazine or newspaper search. You will not have access to most of the sites. Identify the current status of the site and whether it is a common means of conducting business in that industry, or merely a secondary channel. Where possible, identify the costs and which participant pays them.
2. Choose a local retail firm and identify three models that could be used by the manager to run the company. Which of these models is the most important to this firm? List the assumptions, input and output variables, and processes involved for this model.

LESSON 4:
MANAGING DATA RESOURCES

Learning Objectives

1. To analyse the reasons for organisations having trouble in finding their required information.
2. To understand the benefits of database management system in .improving the organisation of information
3. To learn the various types of database models affecting the way a business can access and use information
4. To know about the requirements of a database environment

4.1 Introduction

Effective use of information depends on how data are stored, organised and accessed in an organisation. Proper delivery of information not only depends upon the capabilities of computer hardware and software but also on the organisation's ability to manage data as an important resource. After seeing the various methods and approaches of System Development, now, let us have some understanding of how important are the data resources in an organisation and how the information system we developed is going to handle them.

It has been very difficult for organizations to manage their data effectively. In trying to do so, we have to meet two very big challenges which are standing out. Implementing a database requires a widespread organisational change in the role of information and information managers, the allocation of power al senior levels, the ownership and sharing of information, and patterns of organisational agreement. A database management system (DBMS) challenges the existing power arrangements in an organisation and for that reason often generate political resistance. In a traditional file environment, each department constructed files and programs to fulfill its specific needs. Now, with a database, files and programs must be built that take into account the full organization's interest in data. Although the organisation has spent the money on hardware and software for a database environment, it may not reap the benefits it should if it is unwilling to make the requisite organisational changes.

Moving to database environment can be a costly long-term process. In addition to the cost of DBMS Software, related hardware, and data modeling, organizations should anticipate heavy expenditure for integrating, merging and standardizing their data that will populate their database to eliminate inconsistencies, redundancies and errors that typically arise when overlapping data are stored and maintained by different systems and different functional areas.

You should understand the managerial and organisational requirements as well as the technologies for managing data as a resource. Organizations need to manage their data assets very carefully to make sure that the data can be easily accessed and managed by the managers and employees across the organisation.

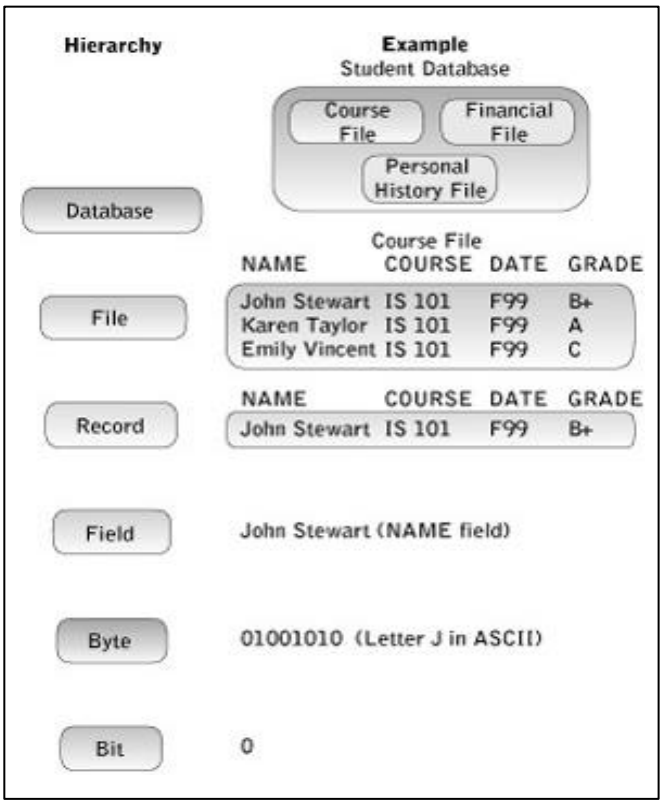
First, we describe the typical challenges facing business trying to access information using traditional file management technologies. Then we describe the technology of database management systems, which can overcome many of the drawbacks of traditional file management systems and provide the firm wide integration of information required for digital firm applications.

4.2 Organizing Data in a Traditional File Environment

Information is becoming as important a business resource as money, material, and people. Businesses are realizing the competitive advantage they can gain over their competition through useful information, not just data.

Why should you know about organizing data? Because it's almost inevitable that some day you'll be establishing or at least working with a database of some kind. As with anything else, understanding the lingo is the first step to understanding the whole concept of managing and maintaining information. It all comes down to turning data into useful information, not just a bunch of bits and bytes.

4.2.1 File Organization Terms and Concepts



The data hierarchy in traditional file management system

The first few terms, **field, record, file, database,** are depicted in Figure 8.1, which shows the relationship between them.

An entity is basically the person, place, thing, or event about which we maintain information. Each characteristic or quality describing an entity is called an attribute. Each record requires a key field, or unique identifier. The best example of this is your PAN Number: there is only one per person. That explains in part why so many companies and organizations ask for your PAN Number when you do business with them.

Suppose you decide to create a database for your newspaper delivery business. To succeed, you need to keep accurate, useful information for each of your customers. You set up a database to maintain the information. For each customer, you create a record. Within each record you have the following fields: customer name, address, ID, date last paid. Smith, Jones, and Brooks are the records within a file you decide to call Paper Delivery. The entities then are Smith, Jones, and Brooks, the people on whom you are maintaining information. The attributes are customer name, address, ID, and date last paid. The key field in this file is the ID number; perhaps you'll use their phone number, since it will be unique for each record. This is a simplistic example of a database, but it should help you understand the terminology.

4.2.2 Accessing Records

When we were describing secondary storage, we talked about magnetic tape and disk storage for computer data. To understand how information is accessed from these mediums, think about the difference between a music cassette tape and a music CD. If you want to get to a particular song on a cassette tape, you must pass by all the other songs sequentially. If you want to get to a song on CD, you can go directly to that song without worrying about any of the others. That is the difference between sequential and direct access organization for database records.

Sequential file organization, in conjunction with magnetic tape, is typically used for processing the same information on all records at the same time. It is also good for processing many records at once, commonly called batch processing.

Direct or random file organization is used with magnetic disks. Because of increased speed and improved technological methods of recording data on disks, many companies now use disks instead of tapes. The other advantage that disks have over tapes is that disks don't physically deteriorate as fast as tapes do. There is less danger of damaging the surface of the disks than there is of breaking a tape.

Indexed Sequential Access Method

To explain the indexed sequential access method (ISAM), let's go back to the example of the cassette tape. A cassette tape label has a printed list of the songs contained on it which gives you a general idea of where to go on the tape to find a particular tune. So too with computer records on a sequential access tape using the key field. It gives the computer a pretty accurate idea of where a particular record is located. That's why it's so a important to have a unique ID as the key field. You and your customer could have a difficult time if the key field is duplicated among several records. Each key field and the ultimate location of that record on the storage device is maintained in the index.

Direct file access method

This access method also uses key fields in combination with mathematical calculations to determine the location of a record. If you order something by phone from a mail order catalog, the person taking your order does not have to wait for the computer to randomly select your record; using the direct file access method, the computer can find you very quickly.

Here, you van understand that the records are not stored sequentially but at random. The transform algorithm uses the value in the key field to find the storage location and access the record.

4.2.3 Problems with the Traditional File Environment

Many problems, such as data redundancy, program-data dependence, inflexibility, poor data security, and inability to share data among applications, have occurred with traditional file environments.

We've spoken about "islands of information" before. Building and maintaining databases is where this situation is most evident and most troublesome. Usually it begins in all innocence, but it can quickly grow to monstrous proportions.

For instance, after you move and change addresses, you notify everyone of your new address, including your bank. Everything is going smoothly with your monthly statements. All of a sudden, at the end of the year, the bank sends a Christmas card to your old address. Why? Because your new address was changed in one database, but the bank maintains a separate database for its Christmas card list and your address was never changed in it.

If you received two Christmas cards, you're probably a victim of data redundancy. That is, your information is now in two separate databases with duplicate records. In this instance, each database file has different data on the same record. That can be a nightmare on Main Street.

Even more troublesome is when several departments or individuals decide to set up their own islands of information. This usually happens because they find the main system inflexible or it just doesn't fit their needs. So they set up their own fields and records and files and use them in their own programs to manipulate data according to their needs. Now each department is spending dollars and time to establish and maintain separate islands of information.

Even worse, the fields and records for Marketing probably don't have the same structure and meaning as the fields and records for Accounting, or those for Production. Each record describes basically the same entity (customers or products), but it is very possible that each database file will have different information, or attributes, in records concerning the same entity.

All of this may have happened with the best of intentions. All the departments began with the goal of making their part of the organization more efficient. Eventually these good intentions can cost big dollars to bring the islands together, resolve data conflicts between them, and retrain people to understand the new database structures.

Managers and workers must know and understand how databases are constructed so they know how to use the

information resource to their advantage. Managers must guard against problems inherent with islands of information and understand that sometimes resolution of short-term problems is far costlier in the long term.

4.3 Database Management Systems

The key to establishing an effective, efficient database is to involve the entire organization as much as possible, even if everyone seemingly will not be connected to it or be a user of it. Perhaps they won't be a part of it in the beginning, but they very well could be later on.

You've heard the old saying, "Don't put all your eggs in one basket." When it comes to data, just the opposite is true. You want to put all your corporate data in one system that will serve the organization as a whole. A Database Management System (DBMS) is basically another software program like Word or Excel or Email. This type of software is more complicated: it permits an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs.

A DBMS has 3 components, all of them important for the long-term success of the system.

- **Data Definition Language (DDL)**. Marketing looks at customer addresses differently from Shipping. So you must make sure that all users of the database are speaking the same language. Think of it this way: Marketing is speaking French, Production is speaking German, and Human Resources is speaking Japanese. They are all saying the same thing, but it's very difficult for them to understand each other. Defining the data definition language itself sometimes gets shortchanged. The programmers who are creating the language sometimes say "Hey, an address is an address, so what." That's when it becomes critical to involve users in the development of the Data Definition Language.
- **Data Manipulation Language (DML)**. This is a formal language used by programmers to manipulate the data in the database and make sure they are formulated into useful information. The goal of this language should be to make it easy for users. The basic idea is to establish a single data element that can serve multiple users in different departments depending on the situation. Otherwise, you'll be tying up programmers to get information from the database that users should be able to get on their own.
- **Data Dictionary.** Each data element or field should be carefully analyzed to determine what it will be used for, who will be the primary user, and how it fits into the overall scheme of things. Then write it all down and make it easily available to all users. This is one of the most important steps in creating a good database.

Why is it so important to document the data dictionary? Let's say Suvidha, who was in on the initial design and building of the database, moves on and Joe takes her place. It may not be so apparent to him what all the data elements really mean, and he can easily make mistakes from not knowing or understanding the correct use of the data. He will apply his own interpretation, which may or may not be correct. Once again, it ultimately comes down to a persware problem.

4.3.1 Logical and Physical Views of Data

Physical views of items are often different from the logical views of the same items when they are actually being used. For instance, assume you store tablets of paper in your lower right desk drawer. You store your pencils in the upper left drawer. When it comes time to write your request for a pay raise, you pull out the paper and pencil and put them together on your desktop. It isn't important to the task at hand where the items were stored physically; you are concerned with the logical idea of the two items coming together to help you accomplish the task.

The physical view of data cares about where the data are actually stored in the record or in a file. The physical view is important to programmers who must manipulate the data as they are physically stored in the database.

Does it really matter to the user that the customer address is physically stored on the disk before the customer name? Probably not. However, when users create a report of customers located in Indiana they generally will list the customer name first and then the address. So it's more important to the end user to bring the data from their physical location on the storage device to a logical view in the output device, whether screen or paper.

Database Management Systems have three critical components: the data definition language, the data manipulation language, and the data dictionary. Managers should ensure that all three receive attention. Managers should also make sure that end users are involved in developing these three components.

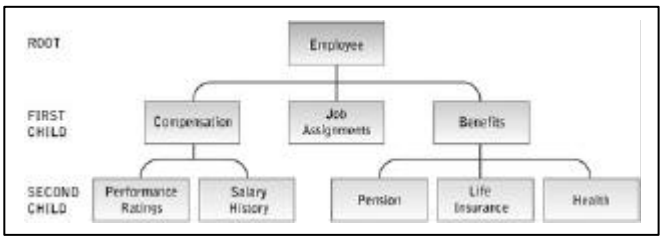
4.3.2 Designing Databases

Every tool has its job. You wouldn't use a screwdriver to pound a nail in the wall (or maybe you would), nor would you use a hammer to turn a bolt. Each type of database that we discuss in this section has its own advantages and disadvantages, so you should choose the right type of database for the job you want to do.

Hierarchical Databases

The hierarchical data model presents data to users in a treelike structure.

Think of a mother and her children. A child only has one mother and inherits some of her characteristics, such as eye color or hair color. A mother might have one or more children to which she passes some of her characteristics but usually not exact ones. The child then goes on to develop its own characteristics separate from the mother.



A hierarchical database for a human resources system.

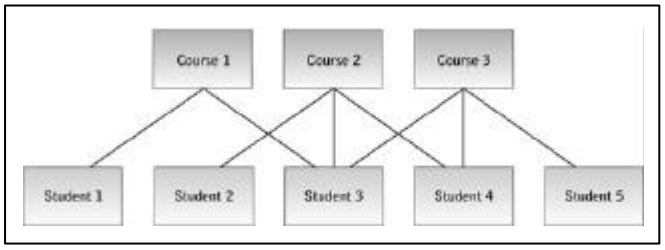
In a hierarchical database, characteristics from the parent are passed to the child by a pointer just as a human mother will

have a genetic connection to each human child. You can see how this database pointer works by looking at the above figure..

Network Database

A network data model is a variation of the hierarchical model.

Take the same scenario with one parent and many children and add a father and perhaps a couple of stepparents. Now the parents aren't restricted to only one (the mother) but to many parents. That is, a parent can have many children and a child can have many parents. The parents pass on certain characteristics to the children, but the children also have their own distinct characteristics.



The network data model.

As with hierarchical structures, each relationship in a network database must have a pointer from all the parents to all the children and back, as the above figure demonstrates.

These two types of databases, the hierarchical and the network, work well together since they can easily pass data back and forth. But because these database structures use pointers, which are actually additional data elements, the size of the database can grow very quickly and cause maintenance and operation problems.

Relational Data Model

A relational data model uses tables in which data are stored to extract and combine data in different combinations. The tables are sometimes called files, although that is actually a misnomer, since you can have multiple tables in one file.

In a relational database, each table contains a primary key, a unique identifier for each record. To make sure the tables relate to each other, the primary key from one table is stored in a related table as a secondary key. For instance, in the Customer table the primary key is the unique Customer ID. That primary key is then stored in the Order Table as the secondary key so that the two tables have a direct relationship.

Customer Table		Order Table	
		Order Number	Primary Key
Customer Name	Self Explanatory	Order Item	Self Explanatory
Customer Address	Self Explanatory	Number of Items Ordered	Self Explanatory
Customer ID	Primary Key----->	Customer ID	Secondary Key
Order Number	Secondary Key		

Use these three basic operations to develop relational databases:

- Select: create a subset of records meeting the stated criteria
- Join: combine related tables to provide more information than individual tables
- Project: create a new table from subsets of previous tables

The biggest problem with these databases is the misconception that every data element should be stored in the same table. In fact, each data element should be analyzed in relation to other data elements with the goal of making the tables as small in size as possible. The ideal relational database will have many small tables, not one big one. On the surface that may seem like extra work and effort, but by keeping the tables small, they can serve a wider audience because they are more flexible. This setup is especially helpful in reducing redundancy and increasing the usefulness of data.

Advantages and Disadvantages

Hierarchical and network databases can be very efficient as long as you plan ahead. But as you know, needs change, and neither one of these databases offers a lot of flexibility to change with business needs. It's sort of like parents and children; once you establish the tie, it's pretty hard to amend.

Relational database management systems are more flexible, especially if you keep the tables small. It is much easier for non-techies to create the query language in a relational system. It's also easier to add new data elements, although if you do, you'll have to go back and fill in the missing information for the old records or just forget them altogether.

Type of Decisions	Processing Efficiency	Flexibility	End-user friendliness	Programming Flexibility
Hierarchical	High	Low	Low	High
Network	Medium-High	Low-Medium	Low-Medium	High
Relational	Low but Improving	High	High	Low

4.3.3 Comparing of Database Alternatives

The above table compares these alternatives on several dimensions to show you the advantages and disadvantages of each.

What you should remember is that none of these databases is very good if you don't keep the end user in mind. If you're not careful, you'll wind up with lots of information that no one can use.

4.3.4 Creating a Database

First, you should think long and hard about how you use the available information in your current situation. Think of the good and the bad of how it is organized, stored, and used. Now imagine how this information could be organized better and used more easily throughout the organization. What part of the current system would you be willing to get rid of and what would you add? Involve as many users in this planning stage as possible. They are the ones who will prosper or suffer because of the decisions you make at this point.

Determine the relationships between each data element that you currently have (entity-relationship diagram). The data don't necessarily have to be in a computer for you to consider the impact. Determine which data elements work best together and how you will organize them in tables. Break your groups of data into as small a unit as possible (normalization). Even when you say it's as small as it can get, go back again. Avoid redundancy between tables. Decide what the key identifier will be for each record. See, you've done all this and you haven't even touched the computer yet!

Give it your best shot in the beginning: it costs a lot of time, money, and frustration to go back and make changes or corrections or to live with a poorly designed database.

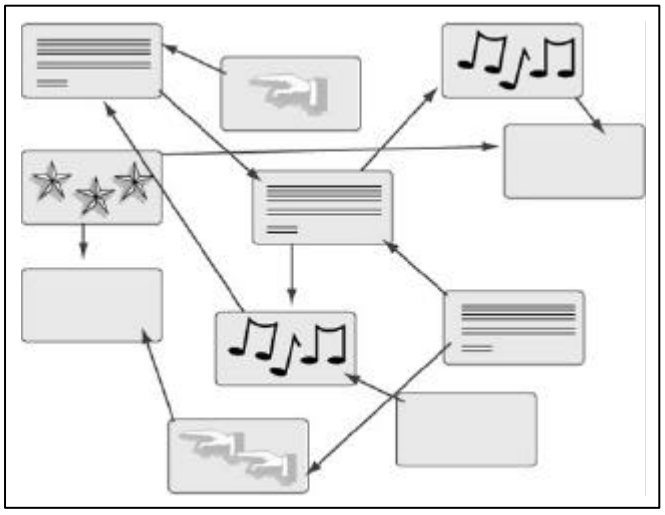
There are three types of databases: hierarchical, network, and relational. Relational databases are becoming the most popular of the three because they are easier to work worth, easier to change, and can serve a wider range of needs throughout the organization.

4.4 Database Trends

Recent database trends include the growth of distributed databases and the emergence of object-oriented and hypermedia databases.

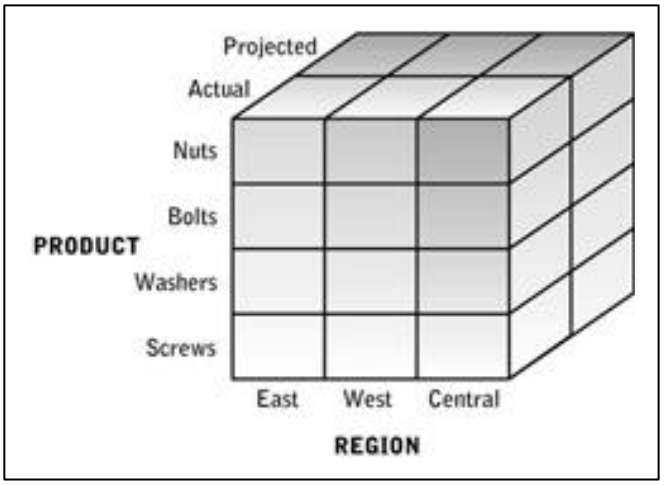
- **Distributed databases** are usually found in very large corporations that require multiple sites to have immediate, fast access to data. As the book points out, there are lots of disadvantages, so you should be careful in determining if this is the right way for you to run your business.
- **Object-Oriented and Hypermedia Databases:** Many companies are steering away from strictly text-based database systems. Data as objects can be pictures, groups of text, voice, audio, etc. Object-oriented databases bring the various objects from many different sources and get them all working together.

As we move away from strictly text-based information systems and incorporate video and sound, graphics and text, the hypermedia database will become more common. The below given figure helps explain the concept of a hypermedia database by showing how the various elements are networked. The attraction to this type of database is that it allows the user to decide which path to follow from one node to another.



Hypermedia database

- **Multidimensional Data Analysis:** As technology improves, so does our ability to manipulate information maintained in databases. Have you ever played with a Rubik Cube - one of those cute little multicolored puzzle boxes you can twist around and around to come up with various color combinations? That's a close analogy to how multidimensional data analysis or on-line analytical processing (OLAP) works (see the Figure given below). In theory, it's easy to change data around to fit your needs.



Multidimensional data model.

- **Data Warehouses:** As organizations want and need more information about the company, the products, and the customers, the concept of data warehousing has become very popular. Remember those islands of information we keep talking about? Unfortunately, too many of them have proliferated over the years, and now companies are trying to rein them in using data warehousing.

No data warehouses are not great big buildings with shelves and shelves of bits and bytes stored on them. They are huge computer files that store old and new data about anything and everything a company wants to maintain information on.

Since the data warehouse can be cumbersome, a company can break the information into smaller groups called **data marts**. It's easier and cheaper to sort through smaller groups of data. It's still useful to have a huge data warehouse, though, so that information is available to everyone who wants or needs it. You can let the user determine how the data will be manipulated and used. Using a data warehouse correctly can give management a tremendous amount of information that can be used to trim costs, reduce inventory, put products in the right stores, etc.

4.5 Linking Databases to the Web

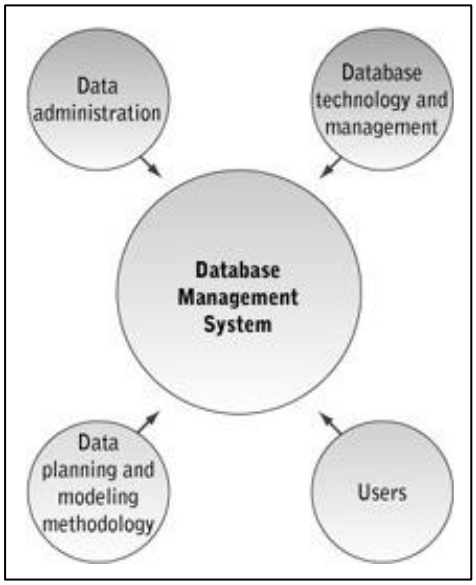
Even though Web browsers have been around for only a few years, they are far easier to use than most of the query languages associated with the other programs on mainframe computer systems. That's why many companies are starting to link their databases to a Web-like browser. They are finding out that it's easier to provide their "road warriors" with Web-like browsers attached to the computer at the main office. Employees anywhere can have up-to-the-minute access to any information they need. It's also proving cheaper to create browser applications that can more easily link information from disparate systems than to try to combine all the systems.

There are many ways to manipulate databases so that an organization can save money and still have useful information. With technological improvements, companies don't have to continually start from scratch but can blend the old with the new when they want to update their systems.

4.6 Management Requirements

Key organizational elements in the database environment.

Nothing is ever as easy as it sounds. As the above figure shows,



there is a lot more to a viable, useful database than just its structure.

4.6.1 Data Administration

Ask any manager what his resources are and he's likely to list people, equipment, buildings, and money. Very few managers will include information on the list, yet it can be more valuable than some of the others. A data administration function, reporting to senior management, can help emphasize the importance of this resource. This function can help define and structure the information requirements for the entire organization to ensure it receives the attention it deserves

Data Administration is responsible for:

- Developing information policies
- Planning for data
- Overseeing logical database design
- Data dictionary development
- Monitoring the usage of data by techies and non-techies

No one part of the organization should feel it owns information to the exclusion of other departments or people in the organization. A certain department may have the primary responsibility for updating and maintaining the information, but that department still has to share it across the whole company. Well-written information policies can outline the rules for using this important resource, including how it will be shared, maintained, distributed, and updated.

4.6.2 Data Planning

At the beginning we said that as many users as possible should be brought together to plan the database. We believed it so much then that we'll say it again here. By excluding groups of users in the planning stages, no matter how insignificant that group may seem a company courts trouble.

4.6.3 Database Technology, Management, and Users

Change isn't just something you experience by chance; in all likelihood, it will be required throughout the corporate structure. You need to get the non-techies talking and working with the techies. Users will take on more responsibility for accessing data on their own through query languages if they understand the structure of the database. Users need to understand the role they play in treating information as an important corporate resource. Not only will they require a user-friendly structure for the database, but they will also need lots of training and hand holding up front. It will pay off in the long run.

Database administration functions can:

- Define and organize database structure and content.
- Develop security procedures to safeguard the database.
- Develop database documentation.
- Maintain the database management software.

As with any other resource, managers must administer data, plan their uses, and discover new opportunities for the data to serve the organization through changing technologies.

4.7 The Database Environment

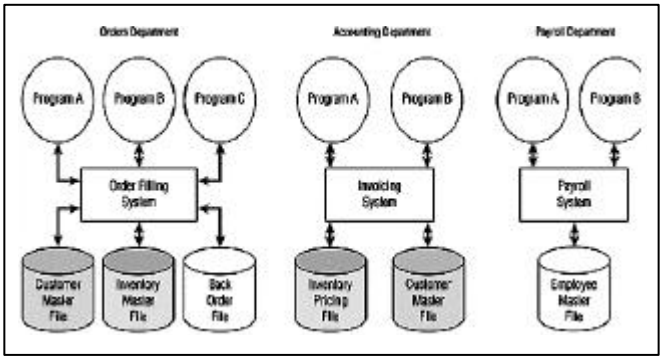
Now, we are having basic understanding about the databases and the requirements of the management and the organisation. Let us continues by knowing the database environment which will give you a clear idea about how it is performing.

Let us recall what we learned earlier in this chapter. Database is an organized collection of logically related data. Information is data that was processed to increase the knowledge of the person who uses it.

Example, your credit card company is collecting data about your purchases (date, amount, merchant). The monthly statement contains information about your account. The credit card company maintains a database of related data such as your name and address, the merchant you bought the merchandise from and the credit card transaction information.

Let me explain the advantages we are enjoying by having database environment by an example.

The (PVFC) is a manufacturer of high quality all wood furniture. The product line includes: computer desks, entertainment centers, dinette set, book cases and wall units. The figure below illustrates how the information systems were developed for each department to run their own applications, without an overall database design for the entire company. Each file is designed to meet a specific application such as: order entry, accounting and personnel.



To emphasize the redundancies of the application approach, let us review another example related to banks.

Bank Example: Consider a new customer, Smith, opening a savings account. The personal data and the account information are entered into the Savings file. At a later time, Joe opens a money market account with the Money Market Department. Same information is entered. Finally, same information is entered again by the Loan Department where Joe obtains a car loan. These files are shown below:

Savings File in the Savings Department

Account Number	Depositor Name	SSN	Address	Phone	Deposit $amount
S-100	Smith, Joe	111-11-1111	100 Main St., Phila, PA 19100	(215) 204-1234	$1.000
S-101	Doe, Jones	222-11-1234			

Money Market File in the MM Department

Account Number	Depositor Name	SSN	Address	Phone	Deposit $amount
MM-320	Smith, Joe	111-11-1111	100 Main St., Phila, PA 19100	(215)204-1234	$500.

Loan File in the Loan Department:

Account Number	Depositor Name	SSN	Address	Phone	Loan $amount
LD-123	Smith, Joe	111-11-1111	100 Main St., Phila, PA 19100	(215)204-1234	$2500.

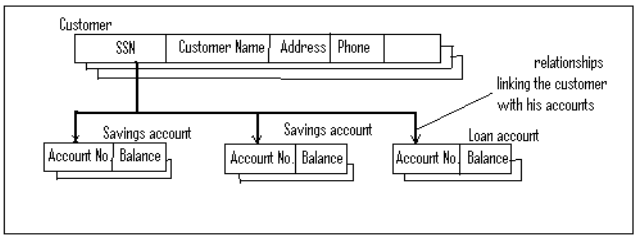
By seeing the above example we may conclude the disadvantages of the file system as the following:

- Duplication of Data (Customer and Inventory data is repeated in each application)
- Limited Data Sharing (One department can't access the files of other departments)
- Program-Data Dependence (Data definition is hard coded in each program. Thus a change in the data characteristics requires a change in all programs using this data)
- Lengthy Development Time and maintenance (Because there are many duplicated programs to process same data)

Now, try to answer to the following question.

How would you intuitively 'Redesign' the PVFC and the bank file system?

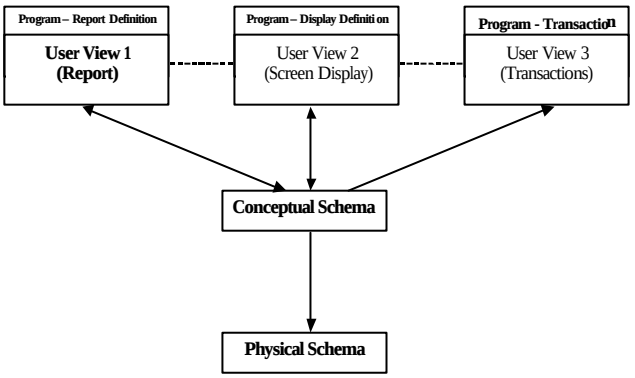
Just observe the following database design where the above listed disadvantages of file system are completely eliminated.



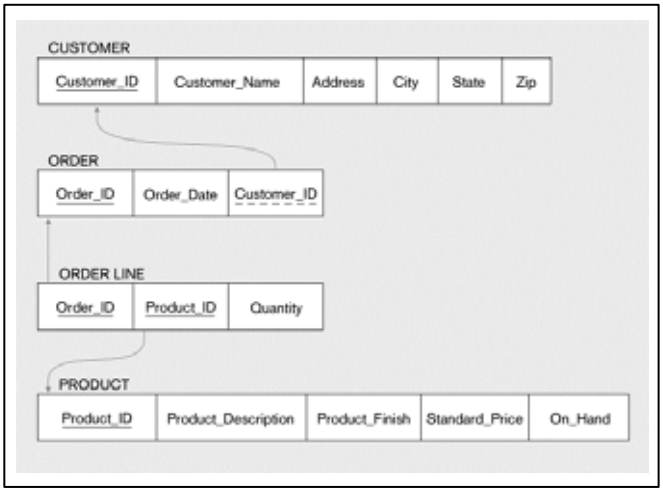
Compare this database design with the previous 'traditional' file bank example, and note how the redundacies were removed and that the customer record has to be related to the accounts of the same customer.

4.7.1 How are these Relateioned Databases Developed?

We begin by analyzing the user's requirements. In the process of the analysis we develop the data model (conceptual schema) represinting the data requirements. The conceptual schema is independent of the database type used. Finally we convert the conceptual schema into a physical schema which is peculiar to the database management we use.



Part of conceptual schema for the PVFC example would actually look like this.

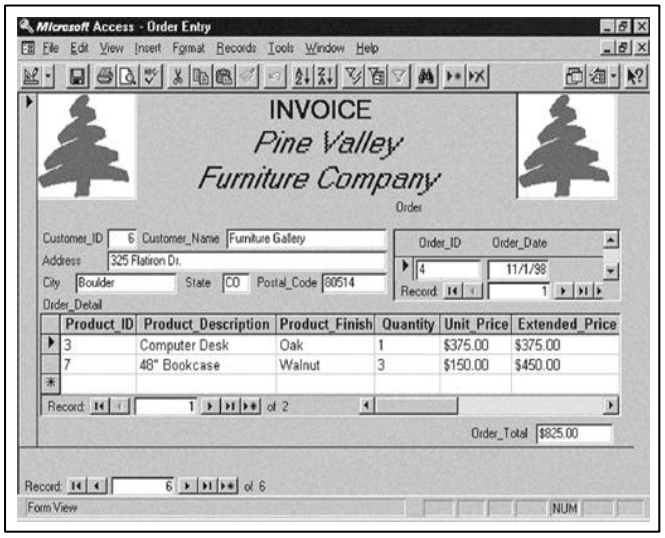


Note that what we have here is a list of attributes for each entity (only some of the entities are represented here) along with a designation of primary keys (underlined) and foreign keys (dotted underlines) and links. (Note that ORDER LINE used to be ORDERED PRODUCT and the two IDs really should be considered as foreign keys for what we are doing now. But for now these are minor details.)

So — how do we build the schema above?

As an example, consider the invoice below. It is the **user's view** of the invoice data. It is a piece of paper representing one possible output or report from a software system.

The user thinks of it as one 'entity', and we might view it initially as a single entity. In the end, however, in the database it is likely to be stored in multiples tables.



We would take this output and start to build a conceptual schema from it. Then we would build the physical schema. The **conceptual schema** represents the overall logical structure of the database. It is contains all entities and the list of attributes for these entities. The conceptual schema is used as the bases for representing primary and foreign keys, and drawing links among the entities. The conceptual schema is also later used in normalization — in seeing the need for normalization and in carrying out the normalization tasks.

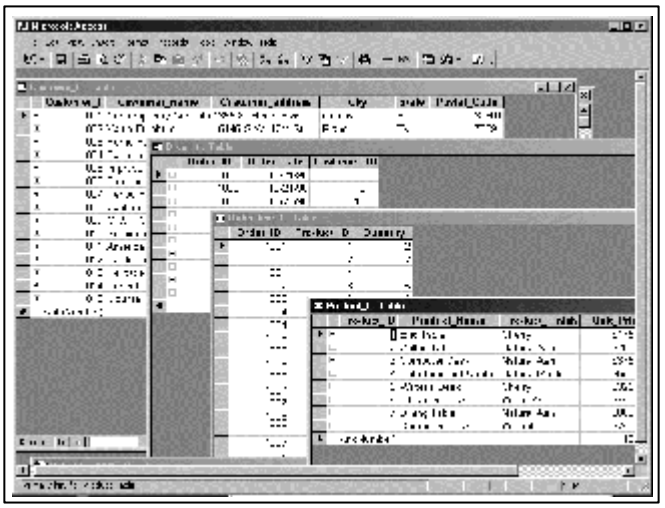
Building the conceptual schema requires a careful analysis of ALL output requirements for a system. This analysis CAN-NOT be carried out if you do not clearly understand the business parameters or rules that govern the use of the system. You have to understand the problem domain, not just what is needed. You need to know

- What is needed?
- What is possible?
- What is not possible (or at least not likely)?

In the problem domain area.

Physical Schema (or physical view) is the way the data is defined and stored in the database and on the disk storage. As we will see, the data for the invoice is derived from four separate entities, as shown on the data model, namely: Customer_t, Order_t, Order_line_t, Product_t.

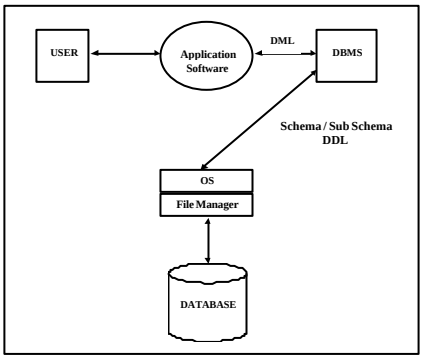
The tables shown below and their relations make up the physical schema, in a format unique to Microsoft Access.



Before we go on — let's make sure we have a few **definitions** straight. These are all in the book. You should look them up and learn them.

- **Schema**: Definition of the entire database; entities, attributes, relations.
- **Subschema**: Portion of the schema. It defines the portion of the schema (database) which is accessible to certain users based on password.
- **Data Dictionary**(encyclopedia): holds the entire information about the database, including the tables, relations, design comments.
- **Catalog:** multiple schemas (Oracle terminology)
- **DBA**: (Database Administrator): manages the database for the organization.
- **DDL** (Data Definition Language): Used to generate the schema. It can be created via the GUI interfaces in Access or SQL commands.
- **DML** (Data Manipulation Language): are the SQL commands for processing data

DBMS (Database Management System — this requires a little more explanation):
A DBMS is a set of programs that manages a database. It is an additional layer of software, such as Access, between the computer and the user and offers significantly more capabilities than the conventional 'file manager', such as random access).



Database Environment

The A database environment, such as the one shown below, became quite sophisticated and user friendly during the last decade. It enables users to query the database, developers to create new applications and the DBA to manage the database.

The 'User Interface' represent the menus, languages and 'GUI' (Graphical User Interface) which users query the databases and developers develop programs with it.

CASE (Computer Aided Software Engineering) tools are automated tools for the analysis, design and development of the database and application programs. e.g., the earlier figure of the Enterprise Data Model, was developed by such a CASE tool. The tools not only assist in the drawing of the diagram but it also automatically generate SQL scripts for building schemas, provide for data standards and analyze the data for completeness.

A database repository is a knowledge database for storing information about the enterprise database, such as all data definitions, relationships, screen and report formats.

The 'DBMS' is typically the commercial software such as Microsoft's ACCESS, Oracle's Oracle, and IBM's DB2 for managing the database . And the database symbol represents the disk storage where the entire data is stored.

4.7.2 Advantages of the database approach

- Program-data independence
- Minimal data redundancy
- Improved Data Consistency
- Improved Data Sharing
- Increased Productivity of Application Development
- Enforcement of Standards
- Improve data quality (validation, integrity checks)
- Improve data accessibility and responsiveness
- Reduce Program Maintenance
- Security
- Data recovery

4.7.3 Costs and Risks

If databases technology is so powerful, why do will still find many companies using the old file processing system?

- Cost of purchasing the database software (DBMS) is high. Depending on the system platform and number of user, it could be a six digits figure
- Conversion of the old systems (referred to as legacy systems) from COBOL to SQL is expensive
- The usage of DBMS requires sophisticated computer professionals
- Organizational Conflict (politics)
- It required management commitment, budgets, agreements among participants

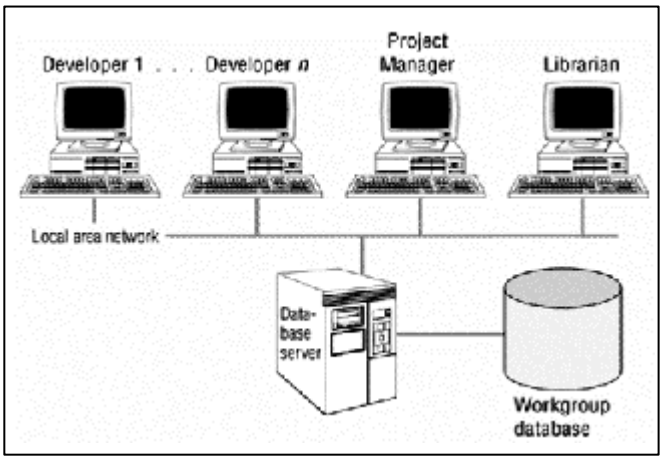
4.8 The Range of Database Applications

Let us explore where DBMS is used.

A database Application is a set of programs that were developed to support the needs of the database users. The application is used to perform the basic function of adding new data, modifying or deleting data, or reading data to create meaning full information, such as the invoice shown above. Database applications are divided into five categories; from a single user on a personal databases, to workgroup, departmental, enterprise, and Internet/Intranet/Extranet databases.

- **Personal databases:** Designed to support one user and are used for simple applications, typically developed by the end user

Workgroup Database : Small team of professionals who collaborate on the same project. e.g., a team of systems analysts developing an information system will share a common database to create their schema, programs and documents. The workgroup members use PCs that are linked by the way of a local area network (LAN). The database is managed by a computer, calle database server, which is part of the network.



- **Department Databases :** A department is a function within the organization such as accounting, and marketing. The databases are designed to support the function of the organization. For a marketing department the database would tracks data concerning customer, orders, and salespersons. Typically the departmental databases are not linked.

The CIS Department Database

- **Enterprise Database:** An enterprise database supports the entire enterprise (all the departments). At times a single enterprise database isn't practical, so multiple databases are maintained. This is due to performance issues, diverse needs of users, and complexity of systems. Enterprise databases include:
  (1) Enterprise resource planning (ERP) and (2) Data warehousing.
- ·**ERP systems** have evolved from the material requirement (MRP) and manufacturing resource planning (MRP II) systems of the 1970s and 1980s. The ERP systems include additional functionality such as customer resource management, and personnel.

Because of the complexity of ERP systems, a database is a must work with current operational data of the enterprise, data in the **data warehouse** are derived by extracting and

summarizing data from the individual databases on a periodic basis. Users work with the historical data of the warehouse to identify patterns and trends and answer strategic business questions. Data warehousing is discussed later in the course.

· **Internet, Intranet, and Extranet Databases**

The internet is the most recent change that had a tremendous affect on businesses and their information systems and databases. The **internet** is a world wide network that easily enables users with multiple platforms, to connect, using a web browser (Netscape or Explorer). The databases must be made web-enabled to allow customers process data on the databases. Companies also use the internet technology to link their internal databases such as personnel, e-mail. This network is known as **Intranet. I**ntranet is protected by software known as fire wall to protect ii from access by people outside the company.

Using the internet, companies can do business online with their customers, providing better service at reduced cost. E.g., Dell Computers is selling computers primarily online, and Oracle Corporation reported a saving of one billion dollar per year by configuring systems and processing orders via the internet. This interaction is referred to as business-to-customer (B to C).

Using the internet, companies can develop **Extranet** to exchange data with their suppliers and other companies, known as business-to-business (B to B). Typically the access to the company intranet is restricted to only certain companies and restricted data.

4.9 Summary

Selecting an appropriate data model and data management technology for the organisation is the key management decision. Managers will need to evaluate the costs and benefits of implementing the database environment and the capabilities of various DBMS or File Management Technologies. Management should ascertain that organisational databases are designed to meet management information objectives and the organisation's business needs.

The organisation's data model should reflect its key business processes and decision making requirements. Data planning may need to be performed to make sure that the organisation's data model delivers information efficiently for its business processes and enhances organisational performances. Designing a database is an organisational endeavor.

Multiple database and file management options are available for organizing and storing information. Key technology decisions should consider the efficiency of accessing information, flexibility in organizing he information, the type of information to be stored and arranged, compatibility with the organisation's data model and compatibility with the organisations hardware and operating systems.

Review Questions

1. Why is file management important for overall system performance?
2. List and describe some of the problems of the traditional file environment.
3. List some benefits of DBMS
4. What are all the various elements of a database environment?
5. What is hypermedia database? How does it differ from a traditional database?

Discussion Questions

1. Find out the importance of DBMS in E-business environment.
2. Identify a small business for which try to develop the database by determining the tables and fields.

Application Exercise

1. For any business, choose five entities (objects) that might be used as database tables. Identify primary keys for each table.
2. Find at least five e-Business websites that are connected to database management systems. Hint: look for something that indicates it is retrieving business data.
3. Assume that you need to buy a DBMS for a midsize company. Research the components needed and the approximate cost of at least two database management systems

LESSON 5:
INTEGRATION OF INFORMATION

Learning Objectives

1. To know the importance of integration of data in business
2. To learn how ERP systems make business run better through integration of information
3. To understand the workgroup tools which will improve business integration
4. To know the important of data warehouses in integrating data
5. To understand the role of internet in integrating data of different types of systems.

5.1 Introduction

Coordinating the many aspects of business requires a wide variety of information from many sources. Perhaps you need to make a decision about how to market a new product. You would retrieve a variety of customer data from the sales database. You would use reports from the production team and a collection of graphs created from the initial marketing surveys. You could use a spreadsheet to analyze this information along with various marketing strategies. Along the way, you would probably use accounting data to create graphs to dis-play costs and projected profits for the various cases. Finally, you would use a word proces-sor to create a formal report for your supervisors that describes the choices and your analy-sis. The report would contain your writing along with the graphs, spreadsheet tables, and some of the data.

Consider a sample business decision where you are working as a manager at a department store. Three reports are produced by the central computer: .the daily sales report, returned merchandise log and a commission report. At the end of each week, you create a report that evaluates the profitability of each department. You also maintain a line graph that shows the net sales number for each week. At the end of the month you write several pages of comments about the trends and the monthly activities: The report includes copies of the data and your graphs. It is sent to upper management

To see how the use of computer is changing, consider how this report might have been produced by managers at different points in time. In the 1970s, the central computer track sales and printed all the three reports. At the end of the week, the manager computed the net sales by hand and drew the graph on graph paper. A secretary would then type the report on a typewriter and staple the graph at the end of the document.

In the 1980s, personal computers with spreadsheets and word processors were introduced to the business world. At this point, the manager entered the numbers from the reports into a spreadsheet by hand. The spreadsheet did the calculations and created the graphs with only a few commands. A word processor was used to type the report. The spreadsheet printouts and the graphs were stapled in the final report.

In the 1990s, the process was simpler. First a database management system held the sales data. Spreadsheet commands retrieved exactly the data needed, performed the calculations, and produced the graphs. The report was still typed on a word processor; however, the spreadsheets and graphs were automatically copied into the word processor document This process was facilitated by software suites that consist of software packages designed to exchange data.

Managers can buy integrated software to instantly produce all of the reports and graphs, and then click on items to obtain more detailed information. Think about what happens if some of the original data is changed. Just before you send the report to management, someone calls and says that the sales figures for half the items in the housewares department are wrong. In the 1970s example, the manager had to re compute all of the totals, redraw the graphs; and rewrite the report. The 1980s manager had to change the numbers in the spreadsheet, rewrite sections of the report, and print the new graphs. The 1990s manager would simply tell the word processor to reprint the report. The word processor would automatically tell the spreadsheet to get the new data, update the graphs, and transfer the results to the final copy. With a truly integrated system, the data would always be correct, and reports and graphs would always have current values.

Integrating data is only the first step. Modern companies are increasingly based on teams, where individual employees from various departments are assigned to projects. Each person may be assigned separate tasks, but the work must be assembled into a final project evalu-ated and approved by the entire team. You need tools that track the progress of the group, let multiple people work on the same documents at the same time, and track the history of changes.

A difficulty that arises when you are trying to integrate information is the diversity in hardware and software. For example, each software package uses its own format to store data files. As a result, there are more than 50 different formats for word-processing docu-ments. The problem multiplies rapidly when you consider that most of these formats change with each software revision. To integrate these different types of information, you need soft-ware that can read many different file types, or the software needs to use a common format

One trend in software is the adoption of enterprise systems that are designed to hold data in a central database. These systems provide consistent data across the company. A trend in personal productivity software is toward packages that work together by sharing data through links. When the underlying data changes, the software automatically pick up the new data and update the document. The concept is similar to a spreadsheet formula that refers to other cells. The key difference is that you can refer to data in different programs;- such as transferring data from a spreadsheet into a word processor. With a network,

the data can be located in different departments throughout the business.

5.2 Integration in Business

For a business to be successful, it needs to integrate information from all aspects of the orga-nization. Modern management techniques of just-in-time production and mass customization require a high degree of internal integration, as well as strong links to suppliers and customers

As you know, most companies are split into functional departments, with varying degrees of indepen-dence. However, there are always pressures and decisions that affect the entire organization. For instance, changes in products or manufactur-ing schedules clearly affect the marketing department. Because these changes will probably alter the cash flows of the company, the accounting and finance departments also need to be aware of the changes

In the 1960s and 1970s, computer systems were built for individual departments and areas within the company. In many companies, these systems became islands. They were fo-cused on one task and did not share data with each other. For instance, the accounting de-partment collected the basic transaction data and produced the necessary accounting reports.

Anyone in the company who wanted to use this data relied on paper printouts of the standard reports. When spreadsheets arrived in the 1980s, the basic accounting numbers were often re-keyed into spreadsheets in other departments. Besides wasting employee time in retyping numbers that were already stored on a computer, this practice caused more errors from mistyping the data. Additionally, consider that when the accounting department changes the numbers, some users of the data might not get the updated versions, and people would at-tempt to make decisions on outdated data.

Computer use in most companies began with transaction-processing systems. Because transaction systems are structured and there is considerable experience at this level, it is a logical place to begin. However, it is also tempting to treat each transaction separately: (1) Payroll services can be purchased from a specialized data-processing company, so the data will be handled separately from the other corporate data. (2) A sales order processing system might be constructed independently of the inventory control system. (3) Process con-trol systems to handle manufacturing tend to be isolated because the data (e.g., robotic con-trol signals) are different from the data used in the rest of the company. (4) Similarly, the corporate accounting system is often developed as a stand-alone product. Journal entries are created by copying data in reports produced by other systems. Although each of these trans-action systems offers management advantages to their respective departments, it is difficult for managers to use data from other departments. Also, independent systems make it diffi-cult for executives to share data and evaluate interrelationships between the depart-ments.

The amount of data integration needed in a company often depends on the management structure of the firm. Some firms are highly decentralized, so that each business unit makes its own decisions and functions independently of the others. Typically in these situations, only accounting data (profit/loss) are integrated and reported to upper management.

On the other hand, some organizations are much more integrated. In your economics courses you were shown the difference between vertically and horizontally integrated firms. Consider a vertically integrated firm such as an oil company that functions at different levels of production (including oil exploration, drilling, transportation, storage, and retail sales). Although an oil exploration team may not need access to daily fuel sales in Mumbai, they do need to forecast future demand for oil. Likewise, the retail sales division does not need to know the daily costs associated with drilling for oil, yet they might need to track de-liveries and communicate with the corporate office.

Consider a horizontally integrated firm such as Wal-Mart with retail stores in many dif-ferent cities. It achieves lower costs by combining the buying power of all its stores. By co-ordinating sales, warehouses, and distribution, Wal-Mart can negotiate better prices with manufacturers. Additionally, Wal-Mart reduces operating costs by standardizing management practices (and information systems) across all the stores. By integrating infor-mation from all stores, it is easier for Wal-Mart to forecast customer demands. Also, by net-working the store information systems, managers who experience higher sales of certain products can request shipments from stores that are not selling the item as rapidly

Manufacturing firms can gain additional benefits from integrat-ing data. Benefits like just--in-time inventory, total quality management, and mass customization can only exist with the tight integration of data. The National Bicycle Industrial Company of Japan illustrates how integrated data is used to provide customized products to mass markets.

5.3 Role of Enterprise Resource Planning (ERP)

Enterprise resource planning (ERP) is the current state-of-the-art in-integrated information in business systems. The systems incorporate data from financial accounting, logistics, and human resource management. The field is dominated by large, expensive software packages from companies such as SAP, Peoplesoft, Oracle, Lawson, and J. D. Edwards. The systems use databases, processes, and rules to provide up-to-the-minute data on the major financial issues in a firm. One of the key points of ERP systems is that they run on top of a DBMS, hence, all of the data is centralized and accessible via DBMS queries and reports.

ERP systems handle all of the financial accounting systems. They also emphasize pur-chasing, human resource manage-ment, and investment management. The systems are tai-lored for specific businesses and can focus on areas such as manufac-turing, research and de-velopment, and retail sales

One of the primary strengths of the ERP systems is that they were designed to handle data for large companies operating in an international environment. In the late 1990s, many compa-nies chose to install commercial ERP systems, instead of trying to modify their exist-ing systems to handle the year 2000 problem

5.3.1 International Environment

Several features are important to firms operating in an international environment. First, all menus and reports should be available in several languages, so clerks and managers can use the language they prefer. Second, the system should handle currency conversion automati-cally, so managers can view reports in any currency. Similarly, conversions should be capa-ble of being fixed at a point in time, so that when items are transferred they can be valued at the exchange rate in effect at that time, even if the rate changes later.

A more complex feature for the international environment is the ability to produce reports following the rules of individual nations. For example, a company with subsidiaries in many nations would need to produce reports that follow the rules (e.g., depreciation) for each spe-cific nation, and then produce consolidated reports following the rules of the home nation

A third complicating factor arises from taxes. In addition to the rates, the rules and proce-dures vary by nation. The rules are particularly important for payroll and benefit applications. A good enterprise application automatically incorporates the rules for each nation and state.

5.3.2 Financial Systems

The accounting system is a core feature of an ERP. Eventually, all transactions must be recorded in the general ledger accounts. The accounts fulfill the standards required by each nation. They are used to create the standard accounting reports. The systems provide flexi-bility by enabling managers to create their own sub-accounts and sub-ledgers, which are used to create reports on additional topics. An important feature of the accounting system is that standard accounting reports can be generated at any time for any section of the company. The ERP system automatically uses the most up-to-date data.

In addition to standard financial accounting, the systems manage assets and provide com-mon treasury functions such as cash management. The systems also provide basic audit trails and other accounting controls. To make them easier to use, most ERP systems provide enterprise (or executive) information system (EIS) capabilities. Managers can examine data at virtually any level of detail. From summary values, they can drill down to more detail.

5.3.3 Logistics

Logistics consists of the operations required to purchase materials, deliver them to the ware-houses and factories, and sell and distribute products. It incorporates traditional MRP analysis, quality control, accounts payable, and accounts receivable

In today's manufacturing companies, logistics is an important component of just-in-time inventory and demand-driven production. Using an integrated system, the marketing department gets up-to-the-minute data on customer demands. Marketers can cooperate with de-signers and engineers to develop new products. The specifications can be transferred to the production machines and raw material orders can be generated for vendors. Purchasing and payments can be tracked and generated over EDI networks-including the Internet. As or-ders are generated and inventory levels change, the accounting data is automatically updated-providing instant analysis of profitability.

For service-oriented companies, logistics involves service management tasks. The ERP systems can track customers, identify repeat customers, monitor service contracts, help sales-people with call management, and handle automatic billing and accounts receivable issues.

5.3.4 Human Resource Systems

As we all know, payroll is a complicated function, particularly in a multinational environment involving dif-ferent rules and currencies. Even in a single state, the issues of benefits, state and federal rules, and legal issues arising from child support make handling payroll a complex task.

Today's HRM departments handle such additional tasks as recruitment, training, travel, and organizational planning. Each step must be documented and requires a variety of federal and state reports. In addition to these basic tasks, most of the major ERP systems enable HRM departments to offer Web access to basic data. For example, employees can use the Web to check on their taxes, change their withholding status, and sign up for benefit plans and training sessions.

5.3.5 Integration

Integration is probably the most important feature of the ERP systems. All the data is stored in a central database; hence, data is entered only one time (but into a double-entry account-ing system). All reports are generated from the base data. Custom queries and reports can be generated through the DBMS.

Consider a simple example. A manufacturing plant takes an item from inventory. The system instantly adjusts the inventory quantity on hand. It also updates the financial value of the inventory holdings on the general ledger and any sub-ledgers that utilize that figure. New orders can be triggered automati-cally with the orders and payments sent through com-mon EDI mechanisms. All of the changes are made automatically. When managers request reports, the new data is automatically incorporated and displayed using current currency conversions

The key point you have to remember is that all of the transac-tions and accounts are integrated. Managers can request reports by using any combination of data at any time-and each re-port will use the most up-to-date information.

Most of the major ERP systems also utilize distributed hardware and software. Hence, the database can be split into many pieces stored in different locations. As changes occur in one location, they are automatically distributed across the network to the other locations. The company can add a subsidiary with its own processing support. Yet, all of the new data is readily accessible to managers throughout the company.

When a factory uses an inven-tory item, the system reduces the current inventory count. It also changes the inventory valu-ation in the general ledger. The item usage might trigger a purchase through the EDI system, which must also be recorded-along with the accounts payable change. Since the databases are shared across the organization, all changes are automatically included when new reports are generated.

Kindly remember that all of the modules are integrated. So manufacturing schedules developed in the production module automatically provide data to the payroll system and personnel systems. Then the financial data (e.g., wages) is linked back to

the general ledger, which provides updated data for all financial reports.

One important catch with an ERP system is that it requires changes to the way the com-pany operates. In many cases, these changes can be good-for example, it forces everyone to follow the standard accounting procedures. In other cases, the ERP is too inflexible and interferes with the way the company operates. Managers have to carefully evaluate the tradeoffs of integration and flexibility.

5.4 Customer Relationship Management

Although customers are important to all businesses, the Internet and wireless applications add new dimensions to managing customer relationships. One problem is the expand-ing number of customer contact points, from sales representatives, to call centers, to websites, and wireless connections. Customers expect merchants as suppliers to remember actions and decisions that were made earlier regard-less of the method of contact. Consequently, companies need integrated systems that instantly provide all details of customer contacts. The new technologies also provide innovative methods to keep in touch with customers and identify their specific needs to sell additional products and services. Several software tools have been developed to improve customer relationship management (CRM).

5.4.1 Multiple Contact Points

One of the greatest challenges facing a company today is the multiple sources of contact points with customers. Most of the original systems designed to handle these interactions are separate. Salespeople often keep their own records; Internet support systems may not be to-tally connected to the sales fulfillment centers; faxes are rarely integrated into the online customer files. But customers assume that when they talk to one person, that person has records of all the prior interactions.

At first glance, it appears that it would be straightforward to build an integrated applica-tion to hold all customer interaction data. Of course, it would be a lot of data and would take time to build the application. But the real challenge lies in getting everyone to enter all of the data. Consider the situation of a salesperson who has invested time and collected sub-stantial data on product preferences and customer work environments. That information gives an advantage to the salesperson. Why would the salesperson be willing to share it?

Customers with multiple divisions and many different product tracks also add complica-tions to CRM. The system has to be able to track transactions, questions, and issues by a variety of factors (date, product, company, person, and so on). The system also needs a so-phisticated search routine so users can find exactly the pieces of data required.

5.4.2 Feedback, Individual Needs, and Cross Selling

The main purpose of CRM systems is to provide individual attention to each customer to im-prove sales. By tracking prior purchases, you understand the status of your customers. By providing new channels of communication, you improve the ability of customers to provide feedback to comment on products and services and to make suggestions for improve-ments. By identifying patterns in purchases, you can develop new ideas for cross selling, If a group of customers tends to purchase several products, you can search the CRM database to find customers with only part of the solution, and have your salespeople demonstrate the advan-tages of the entire suite—using the other customers as examples and references.

The flip side to CRM is that collecting and coordinating substantial data about the cus-tomer can lead to privacy problems. As long as the data is secured and used internally, few problems arise. But firms still need to be sensitive to customer wishes about unsolicited con-tacts. In fact, customer privacy requests need to be part of the CRM system. The issues are more complex when the selling firm has multiple divisions, and each one wants to push new products to existing customers. The marketing staff needs to use the CRM system to coordi-nate and monitor all contacts.

Wireless applications provide even more options for CRM. Your salespeople can stay in constant contact with the corporate database. They can retrieve current shipping status, or detailed customer information during a sales call. They can forward questions or comments, which can be analyzed and answered immediately.

5.5 Workgroup Integration

Cooperation and teamwork have always been important in managing a company. Today, as firms remove layers of middle management and as they focus on teamwork, integration and sharing become crucial. Making decisions requires input from different people. Problems that arise are solved by creating a team of workers-often from different disciplines.

Picture yourself as a manager in a modem corporation. In addition to your day-to-day tasks, you will be asked to serve on various teams to solve problems. You could be working with three or four different groups simultaneously. How do you organize your work? How do you remember the status of each project? How do you keep in touch with the team mem-bers? How do you keep track of documents, comments, and revisions for each team? How do you know which team members are falling behind and need more help? Now assume that the team members are scattered across different locations. You cannot afford to schedule meetings every week. How do you keep the project moving and make sure that all important ideas are incorporated in the final decision?

Software tools known as groupware have been created to help answer these questions and make it easier for teams to work together. Groupware tools are designed to make it easy for several people to work on a document at the same time, regardless of where each one is located. Lotus (IBM) Notes and Microsoft Exchange are two tools based on e-mail that are often used as a foundation for groupware applications. Essentially all shared data is stored in a giant e-mail database with some links between related messages. Probably their strongest feature is the shared calendars that enable team members to schedule meetings.

On the other hand, Microsoft has slowly been integrating many of the features into the standard Office products (Word, Excel, PowerPoint). Microsoft Office XP did not change much in the way that components worked; however, it did add several

Internet tools to facilitate teamwork. Most of the tools use standard Web protocols, so authorized users can use them even when they are traveling. A special website has to be created to support the tools. Generally, this website should be run on a company server, using stan-dard security precautions. If you want higher security, you can run the website as a se-cure site and encrypt the data transmissions. Small companies might consider obtaining.

5.5.1 Announcements and Lists

It is always amazing to learn how difficult it is to contact everyone on a team. People work on many projects, at different times, in different locations. Consequently, even simple information can be hard to share. Basic announcements are useful for these situations. Announce-ments are short messages that are displayed to everyone-generally they are displayed prominently on the first page. Lists can be created to display timetables for tasks, contact names, or any other category needed by the group.

The power of sharing lists through a website is that members of the team can see the lists at any time. As authorized members make changes, everyone has access to the current data. Additionally, the lists can be organized and searched by various categories, such as deadline, project sponsor, or participant. Some standard lists exist in SharePoint, such as contacts and schedules. Additional lists can be created at any time.

5.5.2 Web Discussion and Surveys

Most students are familiar with Web-based discussion groups. SharePoint implements a basic news-type service where participants can post questions or reply to comments made by other members. Discussion administrators establish topics and can specify the roles of the other team members, such as the ability to read or reply to com-ments. Discussion groups are useful on team projects to discuss issues that arise.

The strength of the computer-assisted discussion is that everyone has ac-cess to the comments, and the en-tire record is available if questions arise later. It also makes it easy to search for specific problems. Dis-cussions can be created on any topic. Common business uses in-clude overall comments on scheduling, sharing research informa-tion, and discussing problems that answer.

Surveys are useful for some business applications. In particu-lar, they come in handy when de-signing new systems. Generally they are used to obtain a quick perspective on individual opinions. Paper surveys are a pain. Web-based surveys are easy to change, easy to fill out, and can instantly report the data. You simply write the ques-tions by selecting a format, enter-ing the question, and identifying the possible responses. When you post the survey to the Share Point site, the other mem-bers of the team enter their selections. The results are immediately available. One advan-tage of the system is that the entire process is done through Web forms. Note that the sur-veys are not available to people unless they are registered in the group, so the technique does not work as well for public surveys. On the other hand, more sophisticated tools can be purchased from other companies to handle public surveys.

5.5.3 Document Libraries

Until recently, most organizations shared files through shared directories on LANs or via e-mail. Document libraries are simply Web-based folders that hold a related collection of documents-such as all work on a particular project. The files are accessed across the Web, so they are accessible to team members anywhere in the world. Additionally, the group leader can establish a template so that all documents have the same look.

Once the site is set up, accessing the documents is easy-through the familiar File and Open commands. Generally, you will create a link to the directory in “My Network Places” so you can find the documents with one click. In a team environment, it is important to store your files in a document library-instead of on your personal machine. That way, everyone in the group can read and contribute to the work. Once the documents are stored in the shared library, some other powerful tools and options can be used to coordinate the team, as described in the next sections.

Some versions of SharePoint can also handle version control. Version control consists of maintaining earlier copies of a document that can be retrieved if needed. Additionally, version control systems support check in and check out of documents, so that only one person can edit a document at a time-minimizing the problem of needing to determine which change to keep. It also tracks who made the changes and which team member is currently using the document. If you want complete version control including the ability to automatically track changes, you will also need Visual Source Safe, Microsoft’s ver-sion control software.

5.5.4 Tracking Changes

Have you ever tried to write a document with two or three people? What happens when you have a draft that is passed around to the others for comment? If it is a paper docu -ment, odds are that each person starts marking changes on the document. Hopefully, each person uses a different color pen and records some notes about why the changes were made. Modern electronic documents can support the same type of editing electronically. Simply turn on electronic protection to enable the document to track changes. Then as each person deletes or adds items, the changes are marked in color. In the end, the person in charge of the document can unprotect the document and quickly go through and accept or reject the changes to produce the final version. Figure 7.12 shows a sample Word doc-ument with marked changes. It also shows how discussion comments can be added to the document.

5.5.5 Subscriptions

Individual team members can set a subscription to entire folders or to individual documents. Whenever a document is changed, the user is notified bye-mail. This feature has many uses for teams. Consider the situation when you need to wait for a team member to finish a section before adding your analysis. You could pester the team member with phone calls until he or she finishes; you could hope that the team member e-mails you directly; or now you can simply let the server notify you as soon as the file is updated. You can control how quickly the notification is sent; for example, immediately for critical

items, or daily for minor items. Subscriptions also tie into the next topic of approvals and work flow control.

5.5.6 Approval Routing and Work Flow Control

Group members rarely work independently. Most businesses establish some type of control procedures. For example, your manager probably wants to review recommendations that you make; purchasing managers are responsible for approving the purchase of major items; and important documents have to be approved by the legal department. Projects tend to have discrete steps. Sometimes the steps are as simple as obtaining an approval and comments from someone before proceeding. Other times, complex business rules have to be followed to ensure the proper input and controls are followed. These more sophisticated systems are known as work flow procedures.

SharePoint makes it relatively easy to support routing documents and obtaining approvals. You can attach a routing list to any document when you send it. The system delivers it to the first person on the list. When done, he or she clicks a button and it is sent to the next person on the routing list. Along the way, each person can add comments. These comments are stored in a discussion board associated with the docu-ment. Additionally, the document can record changes and indicate who made them. Hence, everyone can see the final document, what changes were made, and comments on why the changes are important.

More complicated work flow rules can be created with lists and some minor program-ming. For example, a list can be created to describe the state of a document (draft, ap-proved, final). Then various conditions and triggers can be applied to specify conditions for each state and how the document must be handled. For instance, two specific people must approve a document before it can leave the draft state and move to the next steps. Or, a document must have three completed and approved figures before it is considered to be complete. These rules require some effort to set up, but once established, the system enforces the basic procedures of the business. Additionally, team members can check on the progress of a project to see what steps remain, or identify which team member is hold-ing up a particular document.

5.6 Integrating with Legacy Systems

In many ways, the design and implementation of an information system is easier if you are starting a new company or rebuilding one completely. With older (legacy) systems, existing data and software might be incomplete and inconsistent. Valuable information and processes are embedded in these systems; we cannot just throw them away and start over. Yet, it can be more difficult to retrieve data from these systems and integrate it into new management systems.

As business operations and management change, information systems need to be updated. Management emphasis on teamwork is a significant change in the last few years. The improved integration features of current software fit nicely with the changes in management to--ward teamwork and integration across the enterprise. The problem is that few companies have the opportunity or the money to completely redesign their information system to take advantage of these new features. As a result, they need to use the data stored in their legacy systems. This data must be made accessible to decision makers so it can be analyzed. To meet this need, some companies are creating a data warehouse. A data warehouse is a sin-gle consolidation point for enterprise data from diverse production systems. The data is typi-cally stored in one large file server or a central computer.

Many older online transaction processing (OLTP) systems store data in their own files, without using a database management system. Although transaction systems produce stan-dard reports, managers often need to use the base data to perform additional analyses or in -depth searches. Before the widespread use of networks, managers often entered data from each report into their own spreadsheets. Installing a network offers the ability to share data across the company. However, the data must be stored in a format that is accessible to the managers. Larger database management systems have specific tools and data stor-age methods to create data warehouses. Some companies also create specific data marts that are basically copies of a small portion of the data warehouse designed to feed a specific ap-plication. For instance, a financial data mart might be used by the accounting and finance department just to monitor investments and bank accounts.

5.6.1 Building a Data Warehouse

The goal of a data warehouse is to hold all of the data needed by managers to make decisions. Hence, the first step is to determine the data needs and models that managers use. The next step is to identify the data sources that are available in-the company. This step can be difficult when the data is stored in hundreds of different files, scattered across many different machines. It requires analyzing company data sources in depth and documenting the business processes.

Once the data needs and data sources have been identified, the data must be transformed and integrated so that it can be searched and analyzed efficiently by the decision makers. In many cases, the data warehouse is created as a static copy of the original data. Instead of building a link to the original data files, it is easier to copy the data into new files. Special programs are run periodically to update the data warehouse from the original data.

The next step is to document the data warehouse. Metadata is used to describe the source data, identify the transformation and integration steps, and define the way the data ware-house is organized. This step is crucial to help decision makers understand what data ele-ments are available. It also enables managers to find new data

Once the data warehouse has been defined, programs are written to transfer the data from the legacy systems into the data warehouse. In some cases, managerial applications are cre-ated and distributed. Applications can be written for decisions that occur on a regular basis. For instance, finance decisions involving cash flow must be made every month or every week, and rely on standard data. On the other hand, applications for ad hoc decisions will have to be created as they are needed.

5.6.2 Limitations of Data Ware House

A data warehouse represents a subset of the total data in the company. In most cases, it is a static copy, not a dynamic link. Consequently, managers might not always have the most

current data. Similarly, data not transferred to the data warehouse will still be difficult to find and use. Data warehouses are not always stored in relational database management sys-tems. Instead, they are collections of files and the data items are extracted and transmitted to managers' personal computers. This type of system is .relatively easy to use; managers do not have to learn data access commands (SQL or QBE). However, it is less flexible than using a database management system. Decision makers will be unable to get additional data or to compare the data in some previously unexpected way. The success of a data warehouse depends on how well the manager's needs have been anticipated.

5.7 The Internet: Integration of Different Systems

It is difficult to build systems that integrate data. Hundreds of problems arise even if all of the data lies within one company. The data is often pulled from different software packages running on diverse hardware. The data formats are rarely the same, so data has to be converted. For example, one system might use five-digit ZIP codes and a second might use nine digits. And dates are always a pain because every system stores and displays them differently.

Displaying data and documents developed by different people on many types of comput-ers is exactly why Tim Bernets-Lee developed the early Web browser. He was working with physicists at CERN and needed a method to help them share their data and research. The Web has come a long way since that time, but the emphasis on creating standards to share data is still paramount. Consequently, e-commerce is currently the hotbed for developments in integrating data.

EDI standards were originally developed to help companies share data with their part-ners, suppliers, and customers. But its progress stalled as firms found it difficult to build easy-to-use EDI systems that worked well with their internal systems and procedures. Initial EDI technologies also required that all transaction data be predefined and fit within the framework of the standards. Several firms began to realize that they needed a more flexible method of sharing data.

Technologists are working on systems to make it easier for companies to share data. One useful standard is the extensible markup language (XMU. XML is a method to define and transfer data between companies and applications. As shown in Figure 7.16, all of the data within an XML document is in a specified format and tagged so that a computer program can quickly read the file and identify the data and its purpose. Several companies, including IBM and Microsoft, are developing technologies to use XML to make it easier to share data across companies.

At its foundation, all data is transferred similarly to this example, but XML is considerably more powerful and more complex. Among other things, it supports a version of a style sheet to define and share the structure of the document (the tags). Several industry groups have cre-ated XML definitions for sharing data specific to their industry. These data templates make it easier for you to share data, and easier for programmers to develop applica-tions that automatically send and re-ceive the data. The main advantage of XML is that each message contains a description of the purpose of the data as well as the data itself. Hence, the re-ceiving program can evaluate and understand what was sent.

Standards are a critical process in sharing data. Hundreds of standards exist to enable computers to connect at a phys-ical, electrical, and data level. New stan-dards are being developed every day. Developing standards is not easy, and many arguments arise during the process. Each vendor wants specific protocols and methods in the standard, and many of them would give one vender an advantage over the competitors.

To a manager, the entire issue of computer standards can be confusing. The most basic issue is that it would be wonderful if everyone could immediately agree on a single standard for every definition. That way we could buy hardware and software from anyone and know that it would work together on any of our computers. This utopia will probably never exist because of changes in technology and the constant competition among manufacturers to gain an advantage. In reality, we are forced to guess which technology will succeed and which standard will eventually dominate the others. Choosing incorrectly can result in ownership of *orphaned* products that are no longer supported. You also end up changing hardware, software, and data more often, which results in expensive and disruptive conversions.

Unfortunately, there is no simple rule that will tell you how to choose a direction or stan-dard. Some companies avoid the issue by avoiding new technology and waiting until it is clear which technology will win. Both strategies can cause problems: In particular it means that you will always be a follower instead of a leader. While there are advantages to being a follower, it makes it difficult to use technology to gain an advantage over your competition.

5.8 Summary

Working together and sharing data are crucial in today's companies. MIS can help teams work better with tools designed to integrate data across an organisation. Managers need to know how to use a variety of tools, from data sharing over networks, to dynamic linking, to groupware products.

Enterprise resource planning systems are commercial systems designed to collect and share data across the company. Most of them concentrate on transaction processing data with a special focus on accounting systems. However, the consistent data provides a solid foundation for additional analysis.

Workgroup software like lotus notes combines many features to facilitate work on group projects. It supports communication, document sharing, integration of data types and tracking individual changes.

Integration often requires combining data from different locations. Networks enable you to dynamically link the work done by different people. However, if everyone in a company uses different software, it becomes difficult to combine the information because each software package stores data in a unique format. As a result, companies generally create standards for how the data will be stored and accessed. Although these standards are often necessary, several problems can arise when

some users have special needs or the standard needs to be changed.

Review Questions

1. What do you meant by the concept of integration of information in business? Give an example of problems that can arise if business information is not integrated.
2. How do enterprise resource planning systems integrate data across the company?
3. What tools exist to support workgroup coordination and teamwork?
4. How does a data warehouse support integration? Why are they needed in many organisations?
5. How does the Internet facilitate the integrating systems?

Discussion Questions

1. Find a business situation that could benefit from the use of groupware product. Describe the problems that exist and how they can be overcome with the groupware tools.
2. Discuss the role of Internet in Information Integration.

Application Exercises

1. Using current business publications, find an example of a company that is experiencing problems in integrating data. Alternatively find an example of a company that has an excellent system for integrating information.
2. As a group project, assume that each person in the group is a manager of a different department. Each person creates a spreadsheet to list the salespeople in his or her department (4-10), their hours worked, total sales, and commissions. Compute the totals for each column. Once the individual spreadsheets have been created and stored on separate computers, the group will create a composite spreadsheet that brings in the data from individual sheets. Compute the corporate total and draw pie charts for each column. If possible, use dynamic linking across the network to capture the data from the individual spreadsheets.

LESSON 6:
INFORMATION SYSTEMS, ORGANIZATIONS AND BUSINESS PROCESSES

Learning Objectives

- To understand the relationship between Information Systems and Organisation
- To study the influence of Information systems on Organisations
- To learn how Information Systems changed the business processes

6.1 The Relationship between Organizations and Information Systems

This lesson will describe how organizations and information systems work together, or sometimes against each other. The idea of course is to keep them in sync, but that's not always possible. We'll look at the nature of organizations and how they relate to Information Systems.

The Two-Way Relationship

This figure shows the complexity of the relationship between organizations and information technology. Installing a new system or changing the old one involves much more than simply plunking down new terminals on everyone's desk. The greatest influence, as the lesson points out, could simply be sheer luck!

What Is an Organization?

Now, let us have a brief understanding about Organisation. An organisation is very similar to the Information System described in the earlier chapters. Both require inputs and some sort of processing, both have outputs, and both then depend on feedback for successful completion of the loop.

Information Systems use data as their main ingredient. Organizations rely on people. However, the similarities are remarkable. They are both a structured method of turning raw products (data/people) into useful entities (information/producers).

Think of some of the organizations you've been involved in. Didn't each of them have a structure, even if it wasn't readily apparent? Perhaps the organization seemed chaotic or didn't seem to have any real purpose. Maybe that was due to poor input, broken-down processing, or unclear output. It could very well be that feedback was ignored or missing altogether.

Often times an organization's technical definition, the way it's supposed to work, is quite different from the behavioral definition, the way it works. For instance, even though Sally is technically assigned to the Production Department with Sam as her supervisor on paper, she really works for Tom in Engineering. When a company is developing a new information system, it's important to keep both the technical and behavioral definitions in perspective and build the system accordingly.

6.2 Salient Features of Organizations

This section gives you a perspective on how organizations are constructed and compares their common and uncommon features.

Why Organizations Are So Much Alike: Common Features

The class you're enrolled is an organization of sorts, isn't it? Think about it. Look at the following list describing the structural characteristics of an organization:

- Clear Division of Labour
- Hierarchy
- Explicit rules and procedures
- Impartial judgments
- Technical Qualifications for Positions
- Maximum Organisational Efficiency

When you hear the term bureaucracy, you immediately think of government agencies. Not so; bureaucracies exist in many private and public companies. Bureaucracies are simply very formal organizations with strict divisions of labor and very structured ways of accomplishing tasks. They are usually thought of in a negative way, but they can be positive.

Standard Operating Procedures

How many of these characteristics fit your college class? How many fit any organization you know? Some of the **Standard Operating Procedures (SOPs)**, politics, and culture are so ingrained in organizations that they actually hinder the success of the group. Think about your experiences in groups. You had a leader (hierarchy), a set of rules by which you operated (explicit rules and procedures), and people appointed to perform certain tasks (clear division of labor). You probably voted on different issues (impartial judgments), and you decided on the best person to fill various positions within the group (technical qualifications for positions). Hopefully, the organization was able to fulfill its goals (maximum organizational efficiency), whether winning a softball game or putting on an award-winning play. If your organization wasn't successful, perhaps it was because of the SOPs, the politics, or the culture.

The point is, every group of people is an organization. The interesting question you could ask yourself would be "How would the world look and function without some kind of organization?"

Organizational Politics

Everyone has their own opinion about how things should get done. People have competing points of view. What might be good for Accounting may not be to the advantage of Human Resources. The Production Department may have a different agenda for certain tasks than the Shipping Department. Especially when it comes to the allocation of important resources in an organization, competition heats up between people and departments. The internal competition can have a positive or negative influence on the organization, depending on how it's handled by management. The fact remains that politics exist in every organization and should be taken into account when it comes to the structure of the information system.

Organizational Culture

Just as countries or groups of people have their own habits, methods, norms, and values, so too do businesses. It's not unusual for companies to experience clashes between the culture and desired changes brought about by new technologies. Many companies are facing such challenges as they move toward a totally different way of working, thanks to the Internet.

Why Organizations Are So Different: Unique Features

Would you consider the same organizational structure for a softball team as you would for a theatre production group? While there would be some similarities, the two groups would probably have some major differences. An automobile dealership would have some similarities to a department store (both sell products) and yet they would have major structural differences. Organizations that enter into collaborative partnerships tend to seek out companies with similar structures. It is much easier for the employees to work together if they aren't required to learn a whole different work structure on top of learning new tasks.

Different Organizational Types

Organizational Type	Description	Example
Entrepreneurial structure	Young, small firm in a fast-changing environment. It has a simple structure and is managed by an entrepreneur serving as its single chef executive officer.	Small start-up business
Machine bureaucracy	Large bureaucracy existing in a slowly changing environment, producing standard products. It is dominated by a centralized management team and centralized decision making.	Midsized manufacturing firm
Divisionalized bureaucracy	Combination of multiple machine bureaucracies, each producing a different product or service, all topped by one central headquarters.	Fortune 500 firms, such as General Motors.
Professional bureaucracy	Knowledge-based organization where goods and services depend on the expertise and knowledge of professionals. Dominated by department heads with weak centralized authority	Law firms, school systems, hospitals.
Adhocracy	"Task force" organization that must respond to rapidly changing environments. Consists of large groups of specialists organized into short-lived multidisciplinary teams and a weak central management.	Consulting firms such as the Rand Corporation

This table shows some common organizational structures. Think about your own experiences, in your workplace or your daily life, and try to list some organizations that fit into each category. They're all around you. Remember, just as organizations affect you in many different ways, so too do you affect the organizations.

Organizations and Environments

Some organizations are able to respond faster and better than others. Look back 10 years: The minivan didn't exist. But because of changing consumer requirements and tastes, the minivan is now one of the most popular and best selling vehicles on the road. If the organizations called automobile manufacturers hadn't responded to the changing environment, they wouldn't have been able to capitalize on new car sales. Notice that Chrysler responded faster than the others and gained tremendous market share in the meantime. Its organization is almost as big as those of Ford and GM. Yet those two weren't able to respond as rapidly to environmental changes and hence lost potential sales. The same is applicable here with Reliance Infocomm.

Organizations differ because their ultimate goals differ. Some organizations are small by nature or small by design. Using the same thought process as you did for recognizing the different structures in organizations around you, think about the differences in those organizations. Why are they different: size, goals, environmental factors that restrict their growth?

For instance, contrast a real estate company with an insurance company. The real estate company is constantly looking for new customers (buyers and sellers) and new products (houses or commercial properties) to sell. It may choose to stay small or to go with a nationwide conglomerate. The environmental factors that are likely to influence it are the state of the national economy or the nature of the local economy. Many external factors are out of its control. The employees of the company must respond quickly to potential customers or they simply won't make any money. This type of organization must be creative in the way it generates business and in the systems it uses.

On the other hand, the insurance company has relatively stable customers. People sign up with the insurer and pay their premiums on a regular basis. While customers may come and go, turnover is fairly low. Because most state governments require people to carry insurance, the company and its agents have a stable stream of income from premiums. While the parent company may suffer large losses from a sudden influx of customer claims, the small agency is not as heavily influenced by environmental factors. It doesn't have to devise ingenious ways of using or generating data, and its systems needs are very ordinary.

Both businesses are small and entrepreneurial. But they must respond to employees, customers, and potential customers in very different ways. Each has different business processes it must use to meet the goal of staying in business.

Other Differences among Organizations

The external forces on an organization are tremendous. You're living in a time when these forces are causing many organizations-public, private, and governmental-to reevaluate and alter

their organizations because of the Internet. Some organizations are responding faster and easier than others. Why? Much of the cause can be attributed to the structure of the organization.

If the structure and culture of the organization promotes new ideas, new products, and new methods, the organization can deal with environmental changes faster than a more staid organizational structure. Some companies are simply so big that they can't change their structure as fast as technology demands.

Business Processes

What would happen if you walked into work one day to find the management telling employees they could do anything, anything at all, they wanted to do that day. If Jimmy from Production decided he wanted to work in Sales and Marketing, he could. If Sandya, who normally works in Accounting, wanted to spend the day in Shipping, she could do that too. No one would have to follow any rules, or any set procedures. They could accomplish the work any way they chose.

Mary decides she doesn't want to use FedEx to ship out products that day even though the company has a contract that saves lots of money. She decides to use an alternate shipping service which will cost the company more and slow down the shipment significantly. She doesn't see a need to tell Accounting about the change.

Jimmy decides not to use the same old packing materials when he's preparing glass bowls for movement across the country. He determines that it is faster if he just plops the bowls into a box, closes the lid, and sends it down the line. Unfortunately, his co-worker Tim (who doesn't know anything about Jimmy's decision) is responsible for answering customer complaints.

Brinto in Accounting decides that he needs a pay raise to help pay for his upcoming vacation. Normally he would be required to get his supervisor's approval to change any pay record, but since there aren't any established procedures he can just go ahead and enter the new salary data in the system. While he's at it, he gives ten of his best friends pay raises also. While Brinto's friends may like the idea, the rest of the employees in the company are pretty upset.

You can imagine from this scenario how quickly chaos would reign without established business processes. Processes that deliver the best product for the lowest cost in the most efficient manner are imperative to success. The way a business organizes its workflows, the methods it uses to accomplish tasks, and the way it coordinates its activities among employees, customers, and suppliers determines its business processes. Organizations, from the smallest one- or two-person group to the largest you can imagine, must have orderly processes that all divisions can understand. No part of the organization can work in isolation from any other part.

Some processes may have contributed to the organization's success and now outgrown their usefulness. Information Systems can help an organization recognize processes that need to be changed. An Information System could be used to automate some of those processes or determine that they are no longer needed. And a successful organization will use an Information System to determine which processes are working well.

The key to using Information Systems to analyze, change, automate, or delete processes is that the organization must determine the appropriateness of the recommendations. In other words, if the system says a process should be changed but it truly doesn't make sense to change it, then don't make the change. The system supplies recommendations; humans still have the ultimate decision-making responsibility.

Levels of Analysis

As we discussed, every organization has many separate functions and different levels of management. It wouldn't make good sense for an executive to use a Transaction Processing System to determine whether the company should merge with another. The Production Manager wouldn't want the external data contained in a Decision Support System to help her count the number of candy bars produced.

As you move up the management levels of an organization, the span of consideration widens to include not just a single entity, but multiple departments or divisions. The Information System must respond to this widening circle of interest and supply increased information useful to the level of management using it.

Each organization shares common characteristics. On the other hand, each organization has unique characteristics that should be taken into account when incorporating technology. Let the organization drive the system, not the other way around.

6.3 How Organizations Affect Information Systems

Change is the only constant in the relationship between information systems and organizations. You need to consider:

- How have organizations actually used information systems?
- How has the organizational role of information systems changed?
- Who operates information systems?
- Why do organizations adopt information systems in the first place?

Decisions about the Role of Information Systems

Years ago Information Systems consisted of a huge mainframe computer with a few terminals connected to it. You had to schedule a specific time to use the computer if your company had one at all. All data were kept on one machine, and in some respects the data were available to whoever could access them.

When personal computers were introduced in the early 1980s, it became the norm for most people to have individual computing islands on their desks. The computers weren't connected, so if you wanted to exchange data or information, you had to somehow get the data from your desk to the other person's desk. It wasn't easy.

Now it seems we've come full circle: we've combined the storage and data processing on a central machine with personal computing available on desktops. The data are available to anyone who can use them or has authorized access through a network with links literally all over the world.

The changes that have taken place in computing have affected the business environment in a big way. Over 40% of the equipment investment in the last decade has been for computing equipment. Organizations are finding more efficient ways to

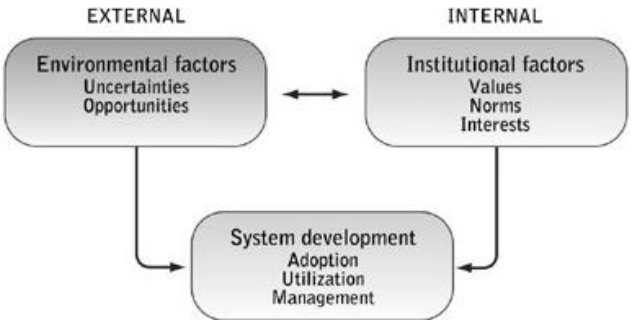
accomplish tasks via networking, either through internal networks or by connecting to external networks. Technology has caused many changes in the way businesses connect to customers and suppliers. We'll examine many of these changes throughout this course.

Information Technology Services

Many new jobs have been created because of technology. Information Systems departments, previously a tiny group of people usually assigned to the financial group, have moved into the mainstream of most companies. Programmers have taken on more important positions within organizations. They must understand not only the technical side of computing, but also the business processes within the company so they can adapt the technology to the needs of the business. System analysts serve as the bridge between the techies and the non-techies. Heading this group of people are the information systems managers. Their importance to businesses has grown as the emphasis on technology's role within organizations has grown. Just as most organizations have a Chief Financial Officer, the position of Chief Information Officer has been created to handle the problems and opportunities businesses face in today's technologically driven environment.

Perhaps the most important role of all is the **end user**. The responsibility for successful integration of Information Systems has extended past the "techies" and become part of everyone's job. No one is isolated from the effects of computers and technology any more.

Why Organizations Build Information Systems



The systems development process

Organizations incorporate technology for many reasons. The most obvious reason should be to save money through improved work processes and reduced manpower requirements, and to beat the competition. Unfortunately, some organizations adopt the latest technology just because the competition has it. The company may not fully understand all the implications of incorporating the new technology into its core business and fail dismally. Some companies use Information Systems to help them create a better mousetrap. That is, they use the advantages of Information Systems to create new services, build better products more efficiently, or invent new products altogether.

But there is more to an organization that what happens internally. Much of what drives change in an organization, good or bad, are external forces **(environmental factors)**. Over the last decade or so, government entities and the public at large have demanded more and more information. Consumers want more information about the products or services companies produce, and the government requires more and more paperwork.

It can be prohibitively expensive for a company to use pencil and paper to gather, process, disseminate, and store all the required information. Information Systems make the whole process easier and more efficient. Ease in dissemination of information is most evident in the many informational Web sites companies have set up.

The very nature of a business may change in such a way that it is possible to carry on only by incorporating an Information System **(institutional factors)**. For instance, all the major airlines offer programs that give customers incentives for flying with their company instead of the competition. The airlines couldn't afford to offer these programs if it weren't for Information Systems. Imagine the number of workers it would take, not to mention the time and paper, to track every customer earning and using the incentives.

6.4 How Information Systems Affect Organizations

We will now discuss two major types of theories about how Information Systems affect organizations: **economic theories and behavioral theories**.

Economic Theories

It's sometimes cheaper to hire a computer than to hire a person. We may not like the idea that machines can replace human beings, but when you think about it, they have been doing this for thousands of years **(microeconomic model)**.

To better illustrate this concept, let's take a look at how a company can find it cheaper to use an Information System to develop and disseminate a Human Resources policy regarding dress codes for employees. The HR assistant may write the first draft of the policy and give it to the HR director on paper. The director will review it and make changes. The assistant then must incorporate the changes and reprint the document. Wait! If there is an Information System, the assistant can submit the draft to the director electronically and the director can make changes to the electronic version of the file and return it to the assistant. Already we've saved part of a tree!

Of course others in the organization must review the new dress code policy. The proposed policy can be printed in fifteen copies, a person can manually send the copies out, track where they went and when, and then track all the changes made to the proposal. Or, the proposed policy can be sent electronically to reviewers who will electronically collaborate on necessary changes. Each of the reviewers can see in "real time" what the others think and the changes they would like to make. We've saved another part of the tree in reduced paper use, but we've also saved a lot of time and effort.

Once the policy is set, it has to be sent to each employee. We could do that through the old method of printing hundreds of copies. Or we could send the policy to each person electronically (email). Everyone would have a personal copy stored on computer. There no need to print it out on paper since it will be stored electronically and can be accessed whenever it is conve-

nient. By acknowledging receipt of the policy via email, the HR department knows everyone has received it.

So what about the people who don't have their own personal computer? You could post the new policy to the company Intranet, which would be available to all employees whenever they find it convenient. Again, time and resources are cut drastically through the use of an Information System. If the policy needs to be revised, the same process can be used to make and send out changes. The revised policy can be posted on the Intranet for all to see.

This is just one example of how technology is helping organizations reduce the costs of doing business. The **transaction cost theory** supports the idea that through technology, businesses can reduce the costs of processing transactions with the same zeal that they use to reduce production costs.

One way that technology in general, and information systems in particular, save companies a lot of money is in the reduced number of managers needed to oversee larger numbers of workers. The technological changes support agency theory, which says that owners hire agents to do work but then must have others supervise the agents to be sure they work in the companyÕs interest. Technology allows a manager to supervise more employees, thus reducing agency cost.

Behavioral Theories

Technology doesn't automatically transform organizations. There is no magic wand companies can wave and have all their problems solved just because they install the latest information system.

People using technology efficiently and effectively, however, can transform organizations. Communications up and down the organization and from one department to another on the same managerial level can be enhanced and increased by using technology. As our example with the dress code policy shows, communications are much faster and better using technology. The lines of communication are shorter, clearer, and more concise.

Technology makes virtual organizations more feasible, cheaper, and easier to set up and tear down than before. If you had a small group of people from each functional area of the company collaborating on a new production method, you can bring them together, hammer out the new methodology, and then return them to their regularly assigned units.

Let's say your company decides to develop a new method of shipping hammers. You would need to draw people from the Production department, the Shipping department, the Packaging department, and the Accounting department to help develop the new procedures. Without an Information System, you would need to have a clerical worker available to record and send out all the information to everyone before and after the meetings. You would have to set up a time and place for team members to meet. Scheduling everyone's time is often a nightmare! Because of the political nature of organizations and people, which we'll talk about later in this chapter, most of those assigned to this team would probably have to be middle managers.

If your company had the proper Information System, much of the hassle and expense of this scenario could be eliminated. By using technology, most of the collaboration and communication throughout the organization, top to bottom, side to side, could be accomplished quicker and cheaper.

One of the biggest benefits would be the fact that the decision-making process can be pushed to lower levels, and management can check progress electronically. Perhaps the managers wouldn't be as afraid to delegate responsibility because they can keep an eye on the committee throughout the process. Everyone in the entire organization could have access to the work of the committee. What about those people not physically located in the same place? No problem: electronically they have the same access to the process as everyone else.

The behavioral theory of the integration of Information Systems in an organization says that the political structure of an organization changes through access to information. The common status symbol in an organization used to be the corner office. Now the status symbol is how much information a person has access to.

When a company introduces change to the organizational structure because of a new or revamped information system, political changes will occur at the same time. Some people will gain and some will lose. Naturally people will resist changes that affect them negatively. It's human nature.

The Internet and Organizations

The example used earlier of posting personnel policies to the company Intranet is but one small example of how businesses are using network technologies to reduce costs and enhance their business processes. Business-to- business commerce is growing at a tremendous pace because of the cost savings the Internet allows. The Internet provides an open platform technology which allows transaction processing between businesses at much cheaper cost plus an easy-to-use interface. The innovative ways organizations are using the Internet, Intranets, and Extranets to improve their business processes are simply amazing.

Implications for the Design and Understanding of Information Systems

The integration of an Information System into an organization naturally causes change for the organization. What isn't so simple to manage is the very fact that many people do not readily accept change. No matter how much technology you employ, it is still the people of an organization who will make or break it. Remember the triangle introduced in Chapter 2, when we discussed hardware, software, and persware? It's back!

Change can be so traumatic to some organizations that they find it easier to keep doing business the same old way for as long as they can get away with it. That's why some organizations seem to be stuck doing business the way they did in 1969.

For some jobs, it's better to employ technology than to employ a person. Companies need to tailor their Information System uses to the needs of the organization, instead of letting the "wonders of technology" drive the organization. Technology can reduce costs and increase the amount of information people have access to. The changes brought about by the introduction

of new technology and new methods must be managed carefully. No successful manager can lose sight of the effect change will have on the people of the organization.

Review Questions

1. Explain the relationship between Information Systems and Organisation and also find out the similarities.
2. Explain the impact of Information Systems on Organisations?
3. Briefly describe how information systems influence the business processes.

Discussion Questions

1. Look at one organization you know. How are decisions made in this organization?
2. Describe the difference between the economic theory and the behavioral theory of how information systems affect organizations.
3. Examine the political structure of an organization to which you know. Determine how the structure would change if it installed a new information system.

Application Exercise

Think of a part-time job you have or have had. How does your manager break down his or her time among categories of communication, traditional management, networking, and human resource management? What issues have you felt your manager has dealt with effectively? On what issues could your manager spend time to improve?

LESSON 7:
MANAGEMENT OF INFORMATION SYSTEMS AND INFORMATION TECHNOLOGY

Learning Objectives

- To understand the role of Information Technology in Organisation
- To know about the Inter-Organisational Systems
- To study the impact of Information Technology in Business Transformation

7.1 Introduction

As a manager you will be in a position to assess how information technology can be used to support business activities. Traditionally data processing applications have supported "back office" operations, such as transaction processing. However the introduction of information systems which electronically linked purchasing personnel with order-entry system proved that businesses could use information technology to gain a competitive advantage. This lesson shows how businesses can use information technology for competitive advantage and how inter-organisational systems have transformed the competitive market place.

No wonder we agree that we are living in an Information Age which is influencing major decisions happening in the Industry Level and very small decision in your personal lives also. The advancement of Technology has given enormous benefits to us by enabling all our practices more competent because of the availability of all kinds of information at a cheaper cost.

Let us see the basic components of Information Technology and its way of working first. The understanding of computer technology is the base really to acquire a better understanding about the Information Systems.

7.2 Computers and Computer Processing

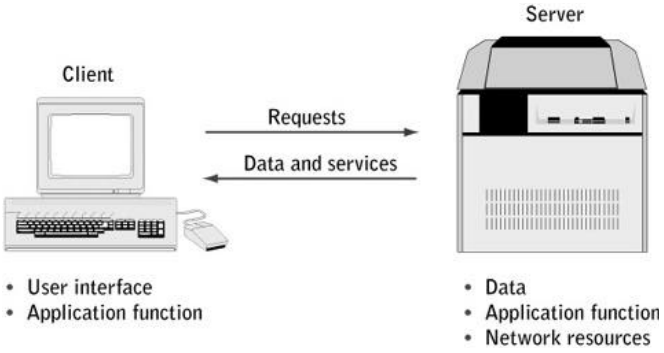
The classification of computers depends on computing capacity and data processing speed. Let's review each of the classifications.

- **Mainframes:** These are the huge computers you see in a big room where people in white coats mill around. Until the mid-1970s they were the only computers available. With the invention of the mini-computer and later the personal computer, many people said mainframes were too big, too expensive, and not needed anymore. The Internet and the advent of computer networks literally saved the mainframe from oblivion. Mainframes have the necessary power and speed to process millions of transactions from the Internet and networks and have the storage capacity needed for all the data captured and processed by larger Information Systems. America Online, the largest Internet Service Provider in the world, uses many mainframes connected together to process all the transactions across its network and to provide Internet access to the 17 million users who subscribe to the AOL service.
- **Minicomputers:** Mini-computers have less power and capacity than a mainframe but more than a personal computer. They were responsible for bringing computing capacity to a level that smaller companies could afford. Now they are used in smaller networks that don't require the power and speed of mainframes. While they are still useful in many cases, they are sometimes replaced by more powerful workstation and personal computers that are connected to emulate the power of a mini-computer.
- **Workstation computers:** The workstation computer can be easily confused with a personal computer (PC) because it is configured much the same way. However, this computer has more computing capacity in its CPU than a typical personal computer. Scientists and engineers are the main users of workstations, although people who process graphics (or pictures) find a workstation necessary, since the processors can handle the huge amounts of data associated with graphic files.
- **Personal computers:** While this class of computer used to be called a microcomputer, and sometimes still is, that label gives a false impression of what the machine can do. The prices of PCs have dropped drastically in the last two years, while computing capacity and power have continued to increase. Many small businesses find it cheaper and easier to connect multiple PCs to form a small network than to purchase more expensive equipment. It's estimated that over 60% of the U.S. population has a personal computer in the home.
- **Supercomputers:** Because computing capacity and power were increasing so fast and so much with mainframes and other types of computers, many people didn't see a need for supercomputers. As with the mainframes, the increasing use of networks, with their insatiable appetite for speed and storage, are allowing supercomputers to make a comeback. There are still situations in which the power of supercomputers is necessary: The National Weather Service uses a supercomputer to store models of weather patterns to help predict storms or sunny days.

A few years ago a computer called "Big Blue," manufactured by IBM, played a series of chess games against Garry Kasparov, the greatest chess player in human history. The interesting part of this match lies in the fact that the computer used a technology called **parallel processing**. That is, it had thousands of processors working together to calculate each move it would make and the countermove Kasparov would make. Kasparov, on the other hand, was only using one processor - his brain - to calculate all the moves by both sides. Kasparov actually beat the computer for a few rounds but ultimately lost the match. It's fascinating to think that the computer, able to process millions and millions of instructions per second, had to use all of its

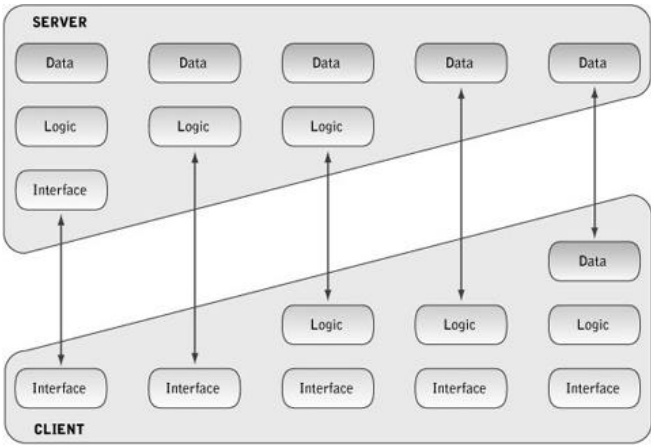
strengths and massive parallel processing to outwit a person using one single processor. Think about it!

Computer Networks and Client/Server Computing



Client/server computing

With the increasing popularity of networks, you need to understand the server/client structure. Think of an octopus, with the body representing the server and the tentacles representing the clients. At the heart of every network is a **server**. It can be a mainframe, mini-computer, workstation, or a souped-up personal computer. It's where some of the data, applications software, and other instructions that network users need in order to communicate with and process transactions on the network are stored. The **client** computer is the node on the network that users need in order to access and process transactions and data through the network. The following figure shows some different types of client/server computing.



Types of client/server computing

There are many different configurations for networks, and the text discusses the difference between distributed processing and centralized processing. Which one works best, you ask? It depends on the requirements, needs, and wants of the people who own and use the network. Managers should analyze their situation and determine the proper configuration to meet their needs.

Network Computers and Total Cost of Ownership

The cost issue is becoming more important to businesses and companies as computer technology and networks grow. Depending on the configuration of the network, a company can save or lose many dollars. What's most important to remember is that the Total Cost of Ownership (TCO) should extend past the hard dollars spent on hardware and software. The cost should incorporate such as items as employee training, their ability to perform necessary functions given the network configuration, and lost productivity when the network is down. The TCO should also include the amount of money spent on communications wiring (telephone wires, fiber optic cable, etc) and security and access issues.

7.3 Information Technology Trends

The speed and computing capacity of technology continues to advance at dizzying speeds and in ways we can hardly imagine. Star Trek is no longer a vision for the 24th century but for next week.

Interactive Multimedia

One trend highly touted by the experts is that of the "information appliance." Do we need to have a separate device for watching television, another one for listening to music, a different one called a telephone, and yet a whole separate device for computing? Some people say we can do all of that with one central appliance with a variety of input and output devices.

If you watch the mergers taking place in the corporate world between the telephone companies and cable TV companies, you can start to understand another major change that may be in store for us. The companies are working toward a convergence of the "entertainment outlets" we know as television and the Internet. Why can't we download a movie off the Internet whenever we're ready to watch it instead of having to follow a TV channel's set schedule? This idea may be a reality in a few years.

The music industry is struggling with the issue of music downloaded from Web sites. How do the musicians protect their copyrighted work while making the music more accessible to the public? How do the music publishing companies protect their business from disintermediation, the process of eliminating the middleman from transactions?

Smart Cards and Microminiaturization

Take a credit card out of your wallet and look at the magnetic strip on the back. The strip may seem too small to hold much data. You might be surprised to learn that through microminiaturization, virtually all of your personal information, from health records to school records to credit records, can be stored on that small area with room to spare. Some states are now including vital medical information on the back of driver's licenses which can be accessed by paramedics if you're ever in an accident and need medical attention. The technology has already saved lives.

Social Interfaces

Bill Gates, Microsoft Corporation, has a vision of the future of computing. Speaking to a reporter for Business Week magazine, May 17, 1999, he says: "Desktop PCs have been incredibly successful. Most businesses have them, and 50% of homes do. And for most people, the PC will remain their key computing tool, but it will also work alongside a lot of other cool devices. That's why we've expanded our vision to giving people the

power to do what they want, where and when they want, on any device. That means on PCs, handheld PCs, phones, or smart TVs such as WebTV."

When asked what he saw on the horizon that will dramatically change people's lives, he replied: "I'm optimistic about what the industry can achieve, but the word ÔdramaticÕ will mean different things to different customers. If you're a large enterprise customer, being able to connect your employees with on-demand videoconferencing for collaboration would be dramatic. If you are head of IT for a large corporation and can deploy software, do updates, and change users on a companywide network of PCs, and never visit a desktop, ever - that's dramatic. If you have a PC at home and use the Web to buy products, such as a car, a TV, or a dishwasher, and if you can use your PC to track the warranties, find the nearest repair center, and have your PC store remind you of all that information - that would be dramatic."

So where are we going with all this technology? Computers that are easier to use and incorporated into our everyday lives are in the near future. Improved technologies for business computing are being introduced each day. Faster and smaller information appliances are coming to a store near you. When it comes to the future of computing, your imagination is the only thing holding us back.

7.3 Role of Information Technologies on the Emergence of New Organizational Forms

During the last years, a consensus is emerging that to survive in the competitive turbulence that is engulfing a growing number of industries, firms will need to pinpoint innovative practices rapidly, to communicate them to their suppliers and to stimulate further innovation. In order to be competitive, companies are forced to adopt less hierarchical and more flexible structures, and to define strategies able to combine reduced costs, high quality, flexibility and a quick answer to customer requirements. Nowadays, there are very few companies with enough resources to form its value chain on their own.

Therefore, some changes are taking place within individual companies and in their relations with other organizations, creating new structures in which relationships between

customers and suppliers are suffering considerable changes. One of these changes is concerned with the formation of networks in which there is a division of labour that allows each company to exploit their distinctive advantages, and be more competitive globally.

In a network model, a set of juridically independent companies establish cooperative long term links in order to achieve a higher level of competitiveness. The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Therefore, the success of this kind of structures is conditioned by the coordination degree obtained along the realization of inter-organizational activities, which requires an efficient communication system among the partners. The Information Technology (IT) represents a supportive element that facilitates the transfer of information across organizational boundaries.

In this paper we analyze the inclusion of the Interorganizational Information Systems (IOS) concept within the network model and discuss the role IT plays in enabling organizational transformation towards emergent forms of organization.

In order to attain relatively low costs in the last two decades the enterprises followed strategies of backward-forward integration, based on the improvement of the effects of the experience curve and the scale economies. We consider that this internal growth may be inadequate to face the new situations appearing in the nineties and, no doubt, those that will appear in the next century. The individual enterprise has less capability for foreseeing the consequences of the different business decisions; however, the need for competing in a more and more complex context requires the adoption of quick decisions, which facilitate the flexibility of the enterprise. New technologies, fast changing markets and global competitiveness are revolutionizing relationships both within and between organizations. Thus, the new environment requires from the enterprises a strategy able to agglutinate reduced costs, high quality, flexibility, and a quick response to the needs of the customer.

Nowadays, the enterprises have to compete in a more and more turbulent scene, which obliges them to adopt less hierarchical and more flexible structures. During the last years, a major transformation in the strategy of many enterprises has been observed with a tendency to disintegration. This is accompanied by a need for increasing the quality of the products or services offered, which requires more interdependency among the different corporate units. As a consequence of it, several transformations both inside the enterprises and in the relationships between them are taking place, which establishes new structures through which the relationships among competitors, customers and suppliers are changing substantially. One of these changes is the cooperation established among different enterprises, which allows them to develop their competitive capability. Companies are forming strategic alliances because there is an increasing acknowledgement that organizations operate in a relational context of environmental connectedness and that organizational survival and performance depend upon connections with other organizations.

The co-operation among enterprises allows their flexibility and their innovative capacity to be increased. Current products are based on so many critical technologies that most of the enterprises cannot keep constantly updated in all of them.

The Network Structure

The concept of the network's form of organization has been particularly popular with management writers for its potential to build the flexible organization with the ability to meet the challenges of a changing and global environment. Despite both the abundant available literature and the existence of a certain consensus on some aspects, there is still too much ambiguity in the concepts used in this area. Taking into account the formation of networks, which is an interesting field of recent development with strong repercussions on the inter-organizational relationships, it is necessary to clear the existing terminological confusions in order to formulate its theory and to improve its implementation.

Starting from the definition, a network is a specific kind of relationship joining a particular group of people, objects, or events. Two factors needed for constituting a network can be obtained from this definition; first, a network is formed by a group of elements; second, these elements establish specific relationships among them. We must show that the establishment of a co-operative network is not a purpose itself but «it must be a dynamic structure that allows consolidating the competitive position of its members».

By means of a network structure, the competitive position of the enterprises can be reinforced as these concentrate on what they do best, and on what maintains their success in the market. In this way, other enterprises make the activities left, in which they have distinctive competences too. The enterprises outsource those activities that are ballast and bureaucratize them.

The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Within the networks, the involved elements belong to independent enterprises and are placed along the value system of a product or service.

All this drives to an organizational structure in which the enterprises generate more value in those areas where they have specific competencies. The success of these emergent organizational forms seems to be based, on a great extent, on an effective co-ordination by means of the use of advanced information systems, which are based on the Information Technologies (IT). There is an increasing interest in the relationship between the emerging organizational ways and the function of the IT/IS insofar as the progresses in each field have influenced the others.

Information Technology On the Emergence of Networks

At the moment, the most spectacular and potentially powerful uses of the information systems technology go beyond the individual borders of the enterprises. In fact, the most important function of IT in the nineties is the better management of the interdependencies among the enterprises. Information Technology has to be the most powerful instrument to reduce the co-ordination costs». While the traditional uses of IT tried to facilitate the internal processes of the enterprises, the Interorganizational Information Systems (IOS) are addressed towards the efficiency of a group of enterprises.

Most of the studies about IOS have focused on the incidence of IT on the flows of information among the organizations, its capability of reducing the transaction costs, and its potential to achieve competitive advantages. Many authors have verified that:

- IT influences the nature, punctuality and detail level of the information shared by enterprises
- IT reduces the transaction costs, while it provides a better management of the risks
- IT reduces the co-ordination costs

In order to benefit from the advantages of IT, the enterprises have to keep in mind that IT cannot be isolated from its organizational context». We do not agree with the existence of causation between the implementation of IT and the organizational changes in the enterprise driving to an increase in the competitiveness of the enterprises. On the contrary the technological and organizational implementations are both sides of the same issue, since they depend on and determine each other». We think that, although IT might have the above mentioned positive effects on the organizations, the will and capabilities of the directors of the company are needed in order to make the most of those advantages.

In order to make the most of the whole potential of the IOS, it will be required that the managing directors get involved with the project, since they have a wider and more strategic view of the company. In this way, a system coherent with the objectives of the company would be implemented. This system would allow taking even more profit from IT, what would have positive repercussions on the enterprise and would facilitate the achievement of its objectives. The active participation of the Management Board in the planning of the IOS brings a problem related to the fact that IT is a relatively new resource that did not exist when most of the current managers were trained. Therefore, they usually do not feel comfortable with these new technologies.

As a proof of this, we will consider an example. McKesson was a dealer company of chemical products. This company knew that its success was linked to that of its customers, which were small stores, so it established a close relationship with them. By means of an appropriate use of Information Technologies, it helped its customers to maximize their profits, since it gave them useful information for competing with the big pharmaceutical chains, which were getting a greater market share. The McKesson Corporation directors' idea was so successful that many other enterprises of the sector tried to imitate it, but they made a terrible mistake. They thought that the network created by McKesson was just a computerized system with terminals connected in other enterprises.

The secret of the success of this company were not the computer links; information technology did not create the network. The network's success was due to the fact that the directors of McKesson were aware of both the relationships along the added value chain and the need to strengthen as much as possible every link within the chain, so cooperative behaviors could be established in order to provide the share of information and the quick response to the changes of the demand.

Another example, widely mentioned in the literature on Information Systems, is the one of the American Hospital Supply Company whose success has shown up the need to consider the network established not only as a mere system of electronic data exchange, but also as a better implementation of the technology found within a context of changes in the commercial relationships between the enterprise and its main customers.

They state that the implementation of this kind of technologies per se does not bring any competitive advantages; on the contrary, they must be accompanied by some particular elements, generally intangible, which facilitate the operation of the organization by means of a better distribution of the informa-

tion and the experience. They also reflect a collaborative attitude among the enterprises.

A positive consequence of the revolution of communication and Information Technologies is that there are more available options for designing the labour now, because the technology can be used to increase the capacities of the workforce, and the information can be transferred to those places were the labour is carried out. Workers do not need to be located according to parameters of time and space to co-ordinate any more.

We consider that technology, although it is not the ground for the emergence of a new and innovative way of organizing the enterprises, plays an important role in its operation. Technology allows doing things in a different way, which provides the directors some organizational possibilities that would be unthinkable without its implementation. Thus, using a mathematical expression, we can state that Information Technologies are necessary but they are not enough to achieve greater business competitiveness.

The Role of IOS within the Network Structure

The enterprises involved in an alliance must decide whether to use the manual management of all the exchanged data, or to complement that management with the interconnection of their respective computer applications. This interconnection may bring, however, compatibility problems in the integration of the data from the different enterprises, since those applications would have possibly been designed without taking into account any requirement of integration among enterprises. The establishment of co-operation networks implies the need for wider communication in the organizational field, as well as the requirement of capability to integrate the information systems from different enterprises.

The enterprises inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances. Within a network, it does not make any sense to restrict the application of modern computer technologies to the individual borders of each enterprise. The Management Board of the enterprises in the network must, on the contrary, consider the possibilities of co-ordinating the processing of data outside the limits of their own organizations by means of an IOS.

The application of the IT which provides the electronic integration among the shareholders of an industry may make easier the outsourcing of activities, as well as be a basic part of the proper operation of the reticular structures. An IOS may play an important role in the coordination of interdependent activities, which would be carried out by distant organizational units. Thus, the enterprises can reduce their dependency on strategies of backward-forward integration in order to ensure the control over the production process.

The concept of network emphasizes the interdependency among enterprises, which is provoked by the presence and the sharing of the following key attributes: objectives, experience, labour, taking of decisions, responsibility, trust, and acknowledgement or reward. The enterprises within a network will adopt a common objective, namely to provide a quicker and better service to the final customer. With this aim in view, independent organizations will have to establish close interrelationships, in which Information Technologies have a vital role to play. In this way, the aim of optimizing the flow of profits along the supply chain could be achieved too. IOSs are, basically, new means to facilitate the relationships among organizations; they are, therefore, a strategic instrument. However, an IOS allows to obtain operative advantages too, such as

- Reducing paper-work and manual operations;
- Reducing the stock levels;
- Accelerating the product and material flow;
- Standardizing of procedures;
- Accelerating the flow of information about changes on the demand;
- Reducing telecommunication costs.

The IT is a basic support that facilitates the co-ordination of different enterprises through EDI systems, shared databases, e-mail, videoconferences, which will allow them to work together. They will be able to share information on the markets, on the needs for materials, on stock levels, production schedules, and delivery programs. A key factor in an efficient exchange of information within a network is the computer connection of its members. The computer links accelerate the transference of information, since it provides the automatic transmission of data between physically distant computers. These links can be used as a strategic instrument to increase the competitiveness of the enterprise, binding it electronically with its customers and suppliers through inter-organizational systems. The electronic connection facilitates the approaching of the linked enterprises, which means that the companies may provide the customers direct access to the internal databases, as well as just-in-time stock control.

Changes in the Business Environment and their Effect on Organizational Design

The powerful worldwide changes have altered the environment of business. These changes in the business environment and climate are classified into political, social, economical and technological categories.

Environmental, organizational, and technological factors are creating a highly competitive business environment where customers are the focal point. Further, environmental, organizational, and technological factors can change quickly, sometimes in an unpredictable manner.

Therefore, companies need to react often and quickly to both the problems and the opportunities resulting from this new business environment. This dramatic change is due to a set of business pressures or drivers. They maintain that in order to succeed (or even to survive) in this dynamic world, companies must not rely only on traditional actions such as lowering cost, but also encourage innovative activities by empowering employees.

Organizations are composed of five major components: IT, organizational structure and corporate culture, management and business processes, organization's strategy, and individuals and roles. These components are in stable condition, called equilibrium, as long as no significant changes occur in the environment

or in any of the components. However, as soon as a significant change occurs, the system becomes unstable and it is necessary to adjust some or all of the internal components since all are interrelated.

IT and Organizational Design

An important and fast growing technological innovation during this century is computer-based information systems. Computer-based information systems (CBIS or only IS) provide an opportunity for businesses to improve their efficiency and effectiveness, and even to gain a competitive advantage. IT is also a catalyst of fundamental changes in the structure, operations and management of organizations. Most businesses in the industrial world could not compete, and many could not even survive without computers and software. Now IT is an integral part of the products and services delivered to customers.

Competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption. By adopting IS, businesses will be able to compete in three ways:

(1) IS can change the industry structure and, in doing so, alter the rules of competition;

(2) IS can also create competitive advantage by offering business new ways to outperform their rivals; and

(3) IS spawns new businesses, often from within existing operations of the business.

IT-enabled Organizational Transformation

There is a growing body of conceptual papers and case studies on IT-enabled organizational transformation in the information systems literature. Most of the studies suggest that the use of IT without concomitant organizational changes is unlikely to yield significant gains in terms of organizational performance.

Four R's of Business Transformation

Business Transformation can be defined as "The orchestrated redesign of the genetic architecture of the corporation, achieved simultaneously – although at different speed – along the four dimensions of reframing, restructuring, revitalization and renewal." By this definition a biological model has been developed that we call the Four

R's of transformation: Reframing, Restructuring, Revitalization, and Renewal.

The meaning of Four R's:

Reframing is the shifting of a company's conception of what it is and what it can achieve with new visions and a new resolve

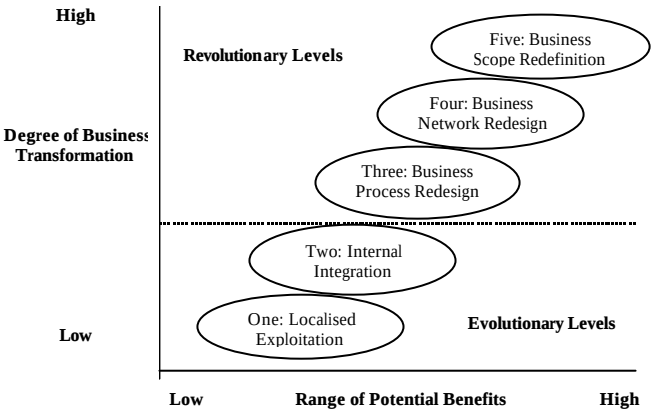
Restructuring is a girding of corporate loins, getting it to achieve a competitive level of performance by dealing with the body of corporation and competitiveness. The need to be lean and fit is the primary consideration.

Revitalization is about igniting growth by linking the corporate body to the environment. **Renewal** deals with the people side of transformation, and with the spirit of the company. It is about investing individuals with new skills and new purposes, thus allowing the company to regenerate itself.

Five Levels of IT-induced Reconfiguration

The above figure is a schematic representation of these five levels along two basic dimensions – the degree of business transformation and the range of potential benefits from IT. Organizations thereby proceed to higher levels of transformation as the demands of competition and value creation for customer increases. The first two levels are evolutionary, requiring relatively incremental changes in the existing organizational processes. In contrast, the other three levels are conceptualized as revolutionary, requiring fundamental changes in the nature of business processes. These five levels are explained as following

- **Level 1:** Localized Exploitation (Automation), which is concerned with the exploitation of IT within business functions.
- **Level 2:** Internal Integration, a logical extension of the first in the sense that IT capabilities are exploited in all the possible activities within the business process. Two types of integration are critical here: technical integration and the organizational integration by using common IT platform to integrate the organization's business processes to enhance efficiency and effectiveness.



- Level3: Business Process Redesign, involving the reconfiguration of the business using IT as a central lever
- **Level 4:** Business Network Redesign concerned with the reconfiguration of the scope and tasks of the business network involved in the creation and delivery of the products and services and
- **Level 5:** Business Scope Redefinition concerned with the underlying principle of a corporation, pertaining to the possibilities of enlarging the business mission and scope (through related products and services) as well as shifting the business (through substitution of traditional capabilities with IT-enabled skills).

Summary

We note that the future organizations would be facing a shortage and a redundancy of information. To solve the problems of "information-glut" arising from the evermore affordable information and communication technologies that provide for evermore high-capacity, fast, long-distance transmission, organizations would need to introduce methods for

"selective dispersion of information" to their various parts. Work tasks would be grouped in organizational units created around a common program for information processing. Improvements in telecommunications will make it easier to control [which will be primarily a matter of information exchange] organizational units dispersed over different parts of the world. Advances in telecommunications [such as videophone], coupled with diminishing costs, would result in increased distance-communication. Indirect communication would be preferred for well-structured information for routinized, "preprogrammed" decision processes.

The design of the organizational structure should take into account and take advantage of the information and information- processing supports which could be designed, and in the not- distant future will be inexpensive. The technology itself is neutral, but it can greatly increase humanity's woe or welfare, depending on how well it is used. What is missing is the full recognition of the strong interactions between this technology and organization design, and the consequent need to take a systems approach to the joint design of organizations and their information support systems.

This decade has brought companies around the world a tremendous increase in competitive pressures. In order to survive, organizations need to be highly flexible and responsive to the rapid twists and turns of markets and technologies. Management theorists rushed to offer alternative organizational models. The transformation in organizational structure may be facilitated by advances in Information Technology. But, IT is not effective if it is not accompanied by an innovation in the human and organizational parts simultaneously. The connection of information systems of distant organizations requires organizational changes in order to improve a wider share of data among them. In our opinion, a co-operative network is the perfect frame in which a major improvement of the potential advantages of an IOS can be obtained.

The network pursues to integrate the distinctive capabilities of different enterprises in it, by means of collaborative agreements which involve closer relationships among them. The network structure allows an enterprise to specialize and to reduce costs in those activities from the value chain that are basic for its competitive advantage, leaving its partners to realize the activities particular to their respective speciality areas.

Review Questions

1. Determine the TOC (total cost of ownership) associated with the technology in your workplace or classroom, even if it is your own home. Use your hourly wage or salary as a basis to figure the persware cost.
2. Describe a client/server network with which you are associated. Remember, Internet Service Providers such as AOL or your local service provider can be part of your personal client/server network.
3. Explain the concepts of Inter-organisational Systems with Examples
4. Explain the benefits companies enjoying out of the Network Models
5. If you could change anything about computer hardware, what would it be? Be as specific as you can and use your imagination.

Discussion Questions

1. How could a financial services company specializing its mortgage loans use information about its customers to gain power over its customers?
2. What applications of Information Technology can have a significant impact on improving customer service?
3. Give three examples of Internet Applications that have the business uses.

Application Exercise

1. Locate at least five sources for additional information about bicycles and bicycle components on the Internet. List and briefly describe the sites
2. Using Internet, financial, and government sources, estimate the size of the market of any product (total sales and number of units) for the last three years.
3. Find out atleast five different Web Sites which are facilitating business and trade. Also analyse the facilities offered by them

LESSON 8 :
INFORMATION SYSTEMS AND STRATEGY

Learning Objectives

- To review the understanding about Business Strategy and its components
- To understand the role of Information Systems in Strategy Formulation and Implementation
- To learn how to use Information Systems for gaining competitive advantage

8.1 What is strategy?

Let us start this session with this question to review what you have known about Business Strategy. According to Mintzberg, the word strategy is used in several ways. Some of them are given below:

- A plan
- A ploy
- A pattern of behaviour
- A position in respect to others
- A perspective

Two important differences:

- Deliberate strategy: preconceived, thought about, explicit, monitored and controlled: a plan
- Emergent strategy: a consistent pattern of behaviour; 'what we are used to doing'

Definition of business strategy:

Strategy is the determination of the basic long-term goals and objectives of an enterprise and the adoption of courses of action and the allocation of resources necessary for achieving these goals. Note the importance of: Objectives, Course of action, and Allocation of resources

8.2 The Strategy Development Process

While developing any strategy, the following questions will come into picture and we must try to answer them by formulating and implementing the strategy.

- Where are we:
  - Internal situation
  - External environment
- Where do we want to go, what do we want to achieve – what are our objectives
- How do we get there, recognising
- That there are forces which restrict us (e.g the state of the economy; strength of the competition)
- Our imagination and will may help us to overcome these restrictions
- The future business situation can never be completely known
- As a business grows it usually becomes more complex

The Process in Outline

- Defining the *mission statement* - what business are we in and what is our vision for it?
- The internal audit
  - where are we
  - and where are we heading?
- The external audit – what environment are we operating in?
- What are our objectives – what should we do to satisfy are stakeholders?
- The strategic options
  - what might we do?
- The strategic choices
  what do we decide to do?
- The action plan
- Implementation:
  - Take the action
  - Review progress and evaluate
  - Change, as necessary

Managing the Process

- There is an existing busy business, with established habits
- Usually, no-one is waiting for planning to begin
- The first time – provisional planning may be useful
  - Doing the best we can with the information available
  - Talking to people to find out what they think needs attention in the company
- It must be driven by the top man
- It must be seen as relevant and helpful – not a collection of theoretical requirements
- It must involve those who are expected to make it work
  - somebody else's plan: lacks interest; easily generates resentment
- It must generate regular feedback, to show that it is working and worthwhile: *not* a once-a –year exercise
- It must allow scope for imagination
- It must allow scope for change when circumstances alter
- Note: plans are uncongenial to much human behaviour:

Remember: Mintzberg: The (management) job breeds adaptive information-manipulators who prefer the live, concrete situation. The manager works in an environment of stimulus-response and he develops in his work a clear preference for live action.

8.3 Information Systems and Business Strategy

Did you ever play a game you intentionally wanted to lose before you started? Usually the answer to this question is no.

It's very unusual for businesses to *want* to fail. Companies have every intention of beating their competition by using **Strategic Information Systems.**

Keep in mind that when we discuss the strategic role of information systems in this section we aren't talking about strategic *level* information systems. Information Systems can play a strategic role in an organization if they are used effectively throughout the company. Two ways to do that are through beating the competition and adding value to products or services. Let us assume a company called WorldWide manufacturing candy bars in the name of Cybernuts. We can use Information Systems throughout WorldWide Candy to make Cybernuts better than any other candy bar, at perhaps a lower price, and to make consumption of the Cybernuts candy bar the "hip" thing to do.

Business-Level Strategy and the Value Chain Model

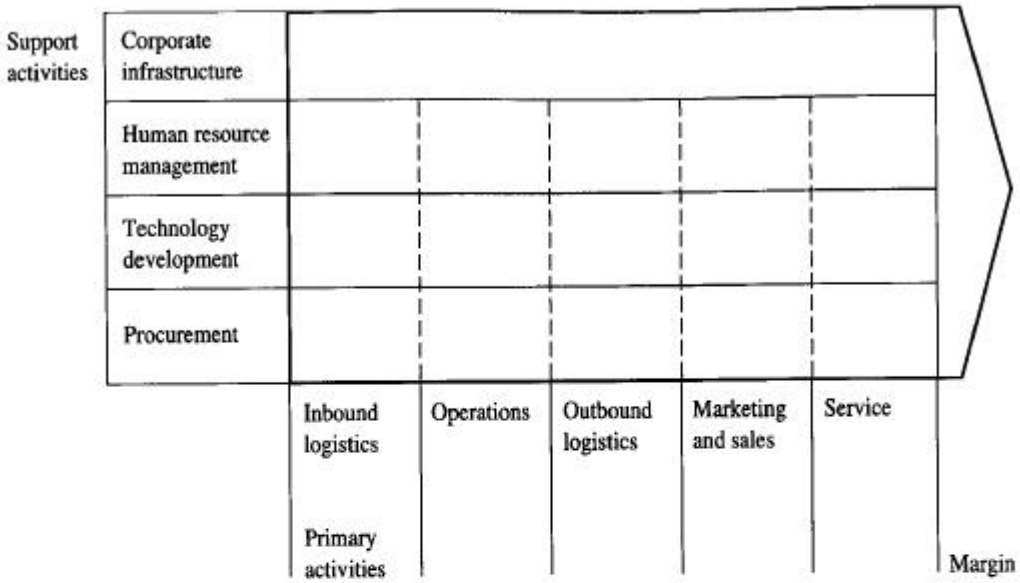
You have to decide where you want your business to fit in the marketplace. Are you going to:

- Become the low-cost producer
- Differentiate your product or service
- Change the scope of competition

Leveraging Technology in the Value Chain

Be better than the competition. That's the mantra of most companies that are serious about winning the game. Areas of the organization most affected by leveraging technology are producing the product, getting it to the stores, and making the customer happy. Think of all the activities that go into getting the Cybernuts candy bar made, from procuring raw materials to actual production. Then consider how the candy bar gets from the factory to the store shelves. And what about all those product commercials? These are primary activities. Just as important are support activities: Human Resources, Accounting, Finance. These functions support the primary functions of Production, Shipping, and Sales and Marketing. The value chain model below will help an organization focus on these activities and determine which are critical to its success.

FIGURE 3–4 The Value Chain



Activity	Definition
Inbound logistics	Materials receiving, storing, and distribution to manufacturing premises.
Operations	Transforming inputs into finished products.
Outbound logistics	Storing and distributing products.
Marketing and sales	Promotion and sales force.
Service	Service to maintain or enhance product value.
Corporate infrastructure	Support of entire value chain, such as general management, planning, finance, accounting, legal services, government affairs, and quality management.
Human resource management	Recruiting, hiring, training, and development.
Technology development	Improving product and manufacturing process.
Procurement	Purchasing input.

Source: Michael E. Porter and Victor E. Millar, "How Information Gives You Competitive Advantage," *Harvard Business Review*, July–August 1985, p. 151.

Information System Products and Services

Cybernuts uses a better recipe for making chocolate than any other candy bar. We know that from our Knowledge Worker System. Sales and Marketing can use that information in promotional campaigns to advertise how much better and different Cybernuts is than any candy bar the consumer has ever eaten. Since our Office Automation System is top-notch and the clerical workers processed the patent information so quickly, our competition can't duplicate the recipe. They are left with the old, icky, bad-tasting chocolate everyone is tired of. **Product differentiation** allows you to bury the competition by making your product and service so different that your competitors can't match them.

Systems to Focus on Market Niche

Through the use of **datamining**, WorldWide's Product Research Department determined that most moms wanted a candy bar that didn't melt so fast and mess up kids clothes or the furniture. Since our Information Systems are integrated throughout the company, our Knowledge Workers were able to alter the recipe for Cybernuts to keep the chocolate in a more solid state. Now we can use **focused differentiation** in our promotional advertising by telling potential customers that the chocolate won't melt so fast.

We also have useful information from our integrated Information Systems that tells us consumers want a bigger candy bar for the same or a lower price. We can now differentiate Cybernuts as being bigger than the competition's candy bars, therefore better, while the price is the same as the competitor's smaller candy bar.

Supply Chain Management and Efficient Customer Response Systems

Because of the tight link WorldWide has developed with SugarSweet Refiners, WorldWide has significantly reduced the cost of its product. Because of the integration of Information Systems throughout the organization, it can reduce costs and price Cybernuts well below the competition's candy bar. And because of the Information System WorldWide has developed with the convenience stores, the stores never have to worry about running out of Cybernuts because WorldWide will know to ship more product when the stock falls to a preset level. **Supply chain management** offers new opportunities for companies to integrate with suppliers and customers and lower costs for everyone.

Since WorldWide Candy doesn't grow its own sugar cane, it must purchase the refined sugar from a supplier, SugarSweet Refiners. WorldWide buys a lot of sugar, as you can imagine. If it develops some kind of link with SugarSweet that is mutually beneficial to both sides, then each one can reduce costs but also develop a pricing policy that gives WorldWide significant cost savings. So WorldWide and SugarSweet decide they will use an integrated Information System that replaces the old-style purchasing paperwork with electronic billing and shipping.

WorldWide Candy now places sugar orders via an electronic system that is tied directly to SugarSweet's electronic shipping system. Neither company has to process paperwork for orders or deliveries. Look at all the time and money both sides are saving, not to mention the reduction in errors that are inherent in any manual system. However, by tying into this method of ordering and delivering, it will be very expensive for WorldWide to find another sugar supplier. It will also be a significant loss to SugarSweet if it loses WorldWide as a customer because now it will have to find another company and set up the same system. So both sides are locked into this mutual system.

On the flip side, WorldWide knows that it costs five times as much money to get a new customer as it does to keep an old customer. It decides to lock in its customers (in this case convenience stores that stock Cybernuts candy bars) by making it more expensive for that customer to switch to the competition. WorldWide offers to keep all the sales statistics for products on its Information System and to give that information to customers when it's convenient and in the format they require. That way the store doesn't have to track data and spend the money to process them into useful information. Through WorldWide's information system it, and not the convenience store, can keep track of stock levels and know when more products are needed. Through this agreement, WorldWide develops a link to customers that the customer finds extremely useful.

You see, **switching costs**, as described in this section, works both ways: between suppliers and companies, and from companies to customers.

8.4 Firm-Level Strategy and Information Technology

Think of a picture puzzle with all its separate pieces scattered on the table. Separately, the pieces don't make a very pretty picture. But if you fit them together, they make quite a beautiful piece of art. So too for businesses. Separately, the various units of a business don't function well and certainly aren't successful on their own. But if you fit them all together, so they work in conjunction, you can create a successful business. Information technology can help you do this.

What does a business do better than anyone else? Does it make the best jeans in the world? Do they produce the best movies? Does it deliver flowers faster and fresher than any of the competition? Whatever its main product or service is, that's its core competency. Successful companies can use information technology to improve their core competencies by sharing information across business units. They can also use technology to expand their core competencies by using knowledge stored in their information systems.

8.5 Industry-Level Strategy and Information Systems: Competitive Forces and Network Economics

Look at the relationship between America OnLine and Microsoft. On one hand, they are fierce competitors, going head to head in attracting Web users to their respective Web sites. On the other hand, they work together to supply Web users with desktop icons for accessing the Web. How is it that they can compete so vigorously in one area and yet cooperate so well in another? Because both make sense and make money for each company.

Information Partnerships

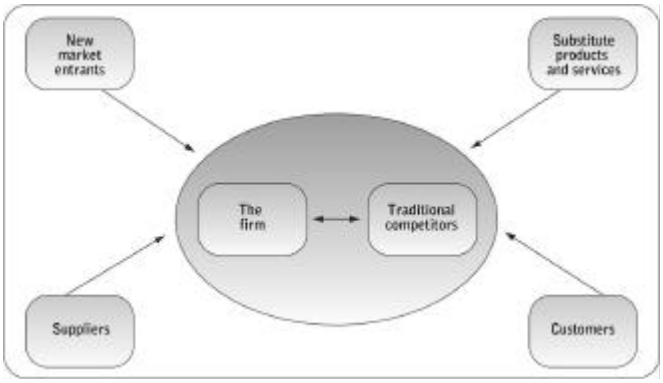
Many times it's more productive and cheaper to share information with other companies than to create it yourself.

Information partnerships between companies, even competitors, can enhance a company's products by aligning them with an industry-wide standard. Vehicle tire manufacturers form information partnerships to share information about standard widths and sizes of tires. Can you imagine how difficult it would be for consumers and other businesses if each tire maker built tires differently?

Other companies form information partnerships to add extra elements to their products which they couldn't offer on their own. Lots of companies offer credit cards with their logo and company information. They then share customer information with the credit card companies. Both companies win because they can offer extra services and products not available if they had to act alone.

8.6 The Competitive Forces Model

One way you can help your company compete is to have more information in a better form than the competition does. If WorldWide happens to know that the price of sugar usually falls in mid-summer, it can plan ahead and get a better price for the ingredient. Simply put, good information in a timely manner can help you win the game.



The competitive forces model

- **Threat of new entrants into its market**. The upstarts can give you fits when you least expect it - Amazon.com is a good example.
- **Pressure from substitute products or services.** Even if they aren't better than your product, substitutes may be cheaper and customers will be enticed by the lower price.
- **Bargaining power of customers.** The Internet offers customers a unique opportunity to quickly and easily compare prices.
- **Bargaining power of suppliers.** New technology offers suppliers the chance to integrate information systems that tie them closer to their customers.
- **Positioning of traditional industry competitors.** Efficient business processes can give companies the edge they need to place themselves in the lead.

Network Economics

You decide to throw a big party and invite a hundred of your closest friends. You buy tons of food and beverages-lots more than you really need. At the last minute, Sam calls and asks if he can bring his brother who unexpectedly dropped by. You agree since you won't have to purchase more food. The marginal cost of one more guest at your party is zero.

That's how **network economics** work. If you build a network for a thousand users, adding one more probably won't cost you anything. However, if you add the second thousand users, you'll incur the cost of adding those extra users. The more users you add, the more your community is enriched. Allowing Sam's brother to attend your party enriched the experience for all, since he is a very popular rock star who plays excellent guitar!

Many companies doing business on the Internet are realizing the value of network economics. They build Web sites to attract customers and then keep them coming back by providing chat rooms and other services for the customers. It doesn't cost much more to add these extra features, since they have already built the Web site and have the hardware available. However, the additional customer information they gather from the chat rooms and information forums is invaluable.

Using Information Systems can help a company beat the competition through differentiation and providing services that are valuable to both customers and suppliers. Companies can also use Information Systems to reduce costs below those of the competition and to improve core competencies.

8.7 Using Systems for Competitive Advantage: Management Issues

Using Information Systems to beat the competition and increase the value of your product is not easy at all. It requires changing processes and methods that probably have been in the organization since time began. The responsibility for successfully developing and then using an integrated Information System will usually fall to the managers throughout the organization.

Managing Strategic Transitions

The changes taking place in an organization affect both the social element and the technical element of the organization and are strategic transitions. When your company installs a new information system, some people will lose their jobs, managers may be reassigned, hopefully you'll gain new customers, and your relationship with your old customers may change. At the very least, when a company installs a new system, the business processes should metamorphose to accommodate the new technologies.

Retail businesses realize the value of vender-managed inventory and are eager to embrace it. Convenience stores and grocery stores give the responsibility for stocking shelves to their vendors. Tying those vendors into the store's information system gives the vendor critical information about stock levels and the pace of sales. Inventory costs for both retailer and vendor are reduced and the quality of information improves for both.

What Managers Can Do?

The important thing to remember is the need to pay attention to the industry to which your business belongs. Look at what others are doing and how they're doing it. What are they doing right? What are they doing wrong? What can you do better than your competitors? What technologies can you exploit that the rest of your industry isn't using? Observe the following

questions that managers should ask when identifying and developing a successful Information System. Take a moment to review them.

- What are some of the forces at work in the industry?
- How is the industry currently using information systems?
- Which organizations are the industry leaders in the application of information systems technology?
- How is the industry changing?
- Should the firm be looking at new ways of doing business?
- Are significant strategic opportunities to be gained by introducing new information systems technology?
- Is the organization behind or ahead of the industry?
- What is the current business strategic plan, and how does that plan mesh with the current strategy for information services?
- Does the firm have the technology and capital required to develop a strategic information systems initiative?
- Where would new information services provide the greatest value to the firm?

A well-developed strategic Information System that is integrated throughout the company can be used to lower costs overall and provide greater value to the company, the supplier, and the customer.

The Challenges in Strategic Management

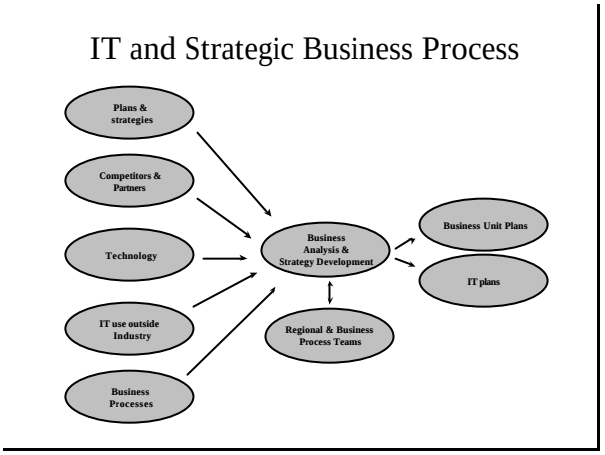
- Management is about:
  - Knowing what you are trying to achieve
  - Getting results
  - Taking decisions
  - Working with, motivating and enthusing people
  - Finding creative ways to achieve new objectives
- Finding creative ways to achieve existing objectives
- Not fundamentally intellectual like the theory of relativity or astrophysics
- But being *intelligently practical*, in the sense of:
  - Getting the outcomes you want when you do not control all the action
  - Rarely having complete information
  - Often having multi-faceted situations with complex links and trade-offs to deal with
  - but then decisions have to be distilled into a few 'bold messages' if real people are going to
- be able to absorb, understand and be motivated to action
  - Having to handle those exciting, creative, disobedient, frustrating things called *people*

So what should students know about in order to be more effective in the 'strategic management' world?

The information systems are designed in such a manner to give answers to all these questions. Once we get the answers we will be in a better position to formulate a successful strategy which will definitely gain a competitive edge over other companies.

Management Fundamentals What is it all about?	**Business Strategy** Where are we going & how do we get there?	**Marketing** How to match our products or services to customer wants?
Products & Markets Do our products & services fit well into available or new markets?	**Finance** Are we profitable? Where do our funds come from & how well do we use them? Are we controlling our cash?	**Project Management** Will the project be on time, within budget & working OK?
Human Resources How do we get the best out of those essential, creative, difficult things called people?	**Management Control** How do we keep control of so many activities to ensure that the results are what we want?	**Environmental Issues** How to make a profit without destroying our surroundings and the planet?
Personality Factors The influence of personality on decisions & on other people	**Ethics** Knowing what is right Doing what is right	**Business Report Writing** Making it clear & persuasive

Points to Ponder



Example: An Oil Refinery Company Used Business Focus Groups to identify the business needs

Business Focus Groups	
New Business Development	New Business Development
Exploration	UPSTREAM
Reservoir Engineering	
Drilling	
Productions & Operations	
Facility Design & Construction	
Facility Management	DOWNSTREAM
Manufacturing, Wholesale & Supply Optimization	
Retail	
Logistics	
Finance / Planning	Integral Processes
Procurement	
Human Resources	
EH&S	
Tax & Legal	
External Affairs	

Improve Processes

Alignment of IT strategy with business strategy requires a comprehensive planning process.

IT Planning Process

Technology Management
- Technology monitoring and transfer process
  - Monitor, research, pilot, operate and retire

Investment Decision Making
- Align business unit and IT
- Common set of investment criteria
- Enterprise investment decisions

Portfolio Management
- Balance IT investment among differentiating, table stakes, commodity and foundation
- Strategy by category for sourcing, resources and competitive positioning
- Benchmark performance

Organizational Approach

IT Board of Directors
- Responsible for IT strategy
- Value, prioritize and approve enterprise & line of business investment opportunities
- Approve IT policies and standards

AIT Management Council
- Strategy Execution

Information Technology Planning Process
- Define information technology vision
- Integrate business and information technology strategies and plans
- Define roles and responsibilities
- Organizational effectiveness

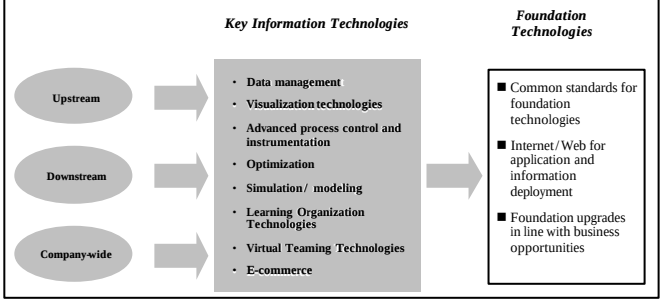
Information Technology : SBU

The SBU set out to answer eight questions...

	Fundamental Questions
Vision	• What is the vision for information technology?
Current Situation	• What are the major strategy differences between the company and the competition? • What are our competitive strengths / weaknesses in IT today? • How does we compare to the competition in IT unit costs?
Technology Trends	• What are the key information technologies for growth today, 2004 and 2010?
Strategic Implications	• How should the company best exploit these technologies or position itself to exploit them? • Should we change the business strategies and plans? • How will we measure IT's progress in business terms?

Key Information Technology

The business opportunities are enabled by a series of information and foundation technologies.



Review Questions

1. How can managers use Information Systems to develop tighter relationships with suppliers and customers?
2. How can managers use Information Systems to play a strategic role in their organization?
3. Explain how a company can use Information Systems to improve its core competencies.

Discussion Questions

1. Provide three examples of IT being used to build a barrier to entry for new products or competitors.
2. Discuss the idea that IS by itself can rarely provide a sustainable competitive advantage.
3. Give two examples that show how IS can help a defending company reduce the impact of the Competitive forces model.

Application Exercises

1. Consider a small service firm such as a physician, dentist, accountant, or lawyer. Is it possible for such an office to use computers to gain a competitive advantage? To start, identify the customers, suppliers, and rivals. Do you think the "natural" switching costs are high or low; that is, how often do customers switch to competitors? Which of the major techniques do you think would be the most successful (barriers to entry, switching costs, quality control, lower prices, ties to customers or suppliers, etc.)?
2. Pick an industry. Find two firms in the industry—one a technology leader, the other a follower. Get the financial information on those firms for the last five years. Find analyst summaries of their operations. Compare the two firms. Are there differences in finances, operating methods, or customers?
3. If you are managing one of many small suppliers building products for an industry dominated by a few large firms (for example, you run an auto parts supply company), what strategies do you have available? In particular, what can you do to protect yourself in a downturn that affects the parent industry?

LESSON 9 : STRATEGIC ANALYSIS

Learning Objectives

1. To know company's interaction with the business environment through external agents
2. To learn the methods of obtaining a competitive advantage
3. To study about the uses of Information Systems in gaining competitive advantage

9.1 Introduction

In some ways, information systems designed for competitive advantage are not much differ-ent from transaction-processing and decision support systems. In many cases, advantages over your rivals can result from changes in the basic transaction processing systems and business methods. The real difference with strategy lies in its goal: to change the way the business operates and gains an advantage over the other firms in the industry.

Creating strategic systems requires that you understand the entire firm and its relation-ships with external agents in the environment, such as suppliers, consumers, workers, and ri-vals. Many systems have been devised to help you analyze and create corporate strategies. A common thread in gaining a competitive advantage is to improve the ties and communica-tion with suppliers and consumers. Electronic communication can provide automatic data collection, minimize errors, and create faster responses.

Information systems can provide a competitive advantage through increasing the barriers to entry and controlling distribu-tion channels. Services from information systems can be used to differentiate, your product from the others in the market or even to create entirely new products. Computer systems might give you an edge through low-cost production or, improved quality management.

Designing strategic systems can be a dangerous task with many opportunities to fail. One complication is that development costs are high. Some strategic systems use new technol-ogy, which carries higher costs and a greater risk of incompatibilities and other problems.

9.2 Competitive Environment

One of the important trends facing most businesses today is the increased level of competition. Improved telecommunica-tions and faster delivery services mean that local firms competition from regional, national, and international firms. Local firms have to compete against national mail-order companies, which offer wide selections, next-day delivery low prices. The Internet, home shopping channels, and toll free phone numbers make it easier for consumers to compare prices, putting pressure on all firms.

Large national retailers and franchises put pressure on-local stores. They also compare against themselves for market territories. Their size gives them leverage in dealing manufactur-ers. By purchasing in large quantities, they can negotiate lower prices. Their volume also makes it easier for them to buy from foreign producers.

Several international trends are creating increased competition. The internet search for lower manufacturing costs puts pressure on firms to cut their costs. For instance, the Japanese have moved production to other Asian nations to build television sets. Decreasing trade barriers throughout the world also creates larger markets.

9.3 External Agents

Competitive advantage can be gained by establishing or changing relationships between firm and its external agents. External agents consist of suppliers, customers, rivals, potential new entrants, substitute products, and sometimes the govern-ment. From a systems perspective, each of these entities is outside the control of the firm. Yet they strongly affect the company. Through proved ties to these agents, they become part of your system, which can be used to improve the competitive position of the firm.

Customers

The intermediate layers also cause confusion about what the customers want because it is hard to identify the customer. To the manufacturer, is the customer the wholesale firm that buys the products, the retailer, or the final consumer? It is often wise to focus on the final consumer, but the manufacturer has to consider the needs of the retailer as well. For exam-ple, in the bicycle industry, one company found a new way to package its bicycles so that they could be assembled (by the retailer) in half the normal time. This particular situation helped both the retailer and the final consumer, but imago what happens when the manu-facturer receives conflicting demands from the various "customers."

An important goal in any company is to satisfy the customers. If there are many layers of buyers between the company and the ultimate consumer, it can be difficult to determine what the customer wants. Similarly, the layers create delays that make it difficult for the re-tailer to order and obtain the products. For example, with older, slower manufacturing processes, mer-chants have to place most orders for the Christmas season around July-five or six months before the sales would occur. What happens if the economy changes or some event causes people to suddenly demand a different product? The retailer, manufacturer, and customers all suffer as a result of these long lead times.

Suppliers

Suppliers can provide individual parts, entire products, or even services (such as a bank that lends money). Three major issues involving suppliers are price, quality, and delivery sched-ules. Just as with customers, problems can arise when there are many layers of suppliers. For instance, increased layers can result in

longer delays between ordering and delivery because the supplier has to contact its supplier, who contacts its supplier.

Rivals, New Entrants and Substitutes

The goal of a strategic approach is to derive a competitive advantage over the rival, or other firms in the industry. There could be many competitors or just a few larger rivals. The competition could take place in a small town, across a nation, or worldwide. One of the first steps in any strategic analysis is to identify the primary competitors and to assess their strengths and weaknesses.

A related issue is the concept of potential competitors or entrants in the business. In some cases, you might identify the major rivals, implement a strategy, and then immedi-ately lose everything as new firms enter your business. Entrants might build their firms from scratch, such as the way Burger King built new stores in the same areas as McDonald's restaurants. Alternatively, other firms may increase the sales of products that are similar to your products. Substitute products are related economically by the de-gree to which consumers are willing to use one product instead of the other. A classic ex-ample comes from the late 1970s, when the U.S. economy faced high inflation rates and banks were subject to limits on the interest rates they could pay on deposits. Merrill Lynch, the stock brokerage firm, introduced a service enabling customers to store their money in a wide variety of financial instruments that paid significantly higher interest rates than did checking accounts, and still write checks on the account. Many larger cus-tomers took their money away from banks and put it in these asset accounts. These new accounts were perceived as close substitutes for traditional bank services, and people transferred huge sums of money out of the banking system

Government Regulations

In any economy, government intervention has a strong influence on the firm. There are myr-iad government agencies, regulations, taxes, and reports. The situation multiplies for multi-national firms that are subject to the regulations of many nations. These agencies and regula-tions can have strong effects on the profitability of a firm. Generally, an individual firm has no control over government regulations, but sometimes suggestions can lead to modifica-tions. For instance, it is now possible to submit some documents to government agencies in computer form. In fact, some reports (such as financial reports) are *required* to be filed electronically. Electronic forms can decrease your storage costs and make it easier to find documents that have been stored for long periods of time.

9.4 IS Techniques to Gain Competitive Advantage

Competitive advantage may be achieved with many techniques in business. Information technology is one area that may provide several opportunities. In general, MIS tech-niques may not be better than other methods. However, some firms have experienced considerable success from using these techniques, so they are well worth considering.

Additionally, the rapid changes in technology often lead to competitive advantages if your firm is the first to find a creative use for the new technology. The other side of the coin is that untested new technologies may not work as planned. Hence, the pioneer is taking a risk: If the project fails, the development costs may put the firm at a competitive disadvantage

The question we wish to examine is how information systems can take advantage of these techniques. The fundamental mechanisms for gaining competitive advantage are barriers to entry, switching costs, lower production costs, product differentiation, control over distribution channels, innovation, and quality control.

Sources of Barriers to Entry

- Economies of scale (size)
- Economies of scope (breadth)
- Product differentiation
- Capital requirements
- Cost disadvantages (independent of size) Distribution channel access Government policy

Barriers to Entry

The additional costs of creating a sophisticated information system make it harder for firms to enter the industry.

- **Distribution Channels:** Control over distribution prevents others from entering the industry. Consumers are reluctant to switch to a competitor if they have to learn a new system or transfer data.
- **Lower Production Costs:** Using technology to become the least-cost producer gives an advantage over the competition.
- **Product Differentiation:** Technology can add new features to a product or create entirely new products that entice consumers.
- **Quality Management:** Monitoring production lines and analyzing data are important aspects of quality control. Improving quality leads to more repeat sales.
- **The Value Chain:** Evaluating the entire production process identifies how value is added at each step. Combining steps or acquiring additional stages of the value chain can lead to greater profits.

9.5 The Search for Innovation

Industry and academic leaders are constantly searching for ways to improve organizations and gain a competitive advantage. Illustrated by Figure 10.8, one method to organize the search is to examine the primary processes of the firm: research, engi-neering and design, manufacturing, logistics and supply, marketing, sales and order management, service, and general manage-ment. Each of these processes has its own inputs, outputs, and objectives. Analyzing them in detail enables managers to spot problems and to search for innovative opportunities

The following sections present general ideas for each of these processes that have generated interest and some success. Most of them use technology to improve the process or to help the processes work together better. Keep in mind that any firm, there can be many ways of im-proving processes. Relying on information technology is not always the best answer

Research

IT support for research takes the form of computer analysis and modeling, statistical analysis of data, project management

and budgeting, and workgroup technologies that make it easy for researchers to collaborate and share information with each other and with man-agers throughout the company.

Research in firms varies enormously depending on the industry and the overall corporate strategy. At a minimum, most firms at least have a product development team that is con-stantly searching for new products or improvements in existing products. Some companies like 3M, DuPont, AT&T, or Intel, spend considerable sums of money on basic research to create entirely new products. To these firms, strategic advantage comes from being the leader in the industry with a constant cycle of new products

Engineering and Design

Engineering and design processes are responsible for converting theoretical research into new products. Engineers establish manufacturing procedures, design new equipment, and coordinate suppliers with production. In particular, the design process must optimize the production line to minimize costs and retain high quality

Manufacturing

There are four key features to production: costs, speed or timing, quality, and flexibility. Competing through lower costs and higher quality are time-honored means of gaining a competitive advantage. They might not be sufficient today. Increasingly, firms are turning to **mass customization** in an attempt to gain market share. Twenty or 30 years ago, the large firms in an industry were content to build huge plants, gain economies of scale, and aim at the mass market. This approach tended to leave niches open for competing firms. The prob-lem with this strategy is that it allows rival firms to gain a toehold, which they might use to build market share and eventually compete directly against your primary market. Today's firms are trying to shift production fast enough so that they can cover virtually all of the niche markets.

Logistics and Supply

The implementation of just-in-time (JIT) inventory systems is largely credited to Japanese manufacturers. Today they are used by manufacturers worldwide. Manufacturers attempt to cut costs by holding minimal inventories. Instead, inventories are maintained by the suppli-ers, who deliver the products to the assembly line just as they are needed. The system can only work if the suppliers and factories are linked electronically-often there is only a one -or two-hour delay between ordering and delivery.

Marketing

A well-known application of IT to improve marketing is the use of frequent-buyer databases that identify major customers. More traditional point-of-sale transaction systems can be lever-aged by identifying preferences and rapidly spotting patterns or trends. At the tactical level, ex-pert systems are used to help analyze data and perform statistical trend analysis. Geographic information systems are being used by leading firms to identify patterns and possibilities for new sales. Information systems can also be used to link firms more closely to external market-ing firms for research data, communication, and development of promotional materials.

Sales and Order Management

Sales and order management are often handled simply as an operations or transaction processing area. However, in the last 10 years, several firms have used technology to gain a competi-tive advantage by improving the way they handle sales and orders. Frito.-Lay's use of handheld computers is a classic example. The systems enable managers to more closely track their own sales, sales of competitors, and other external factors, because salespeople can enter data immediately. For certain industries, the concept can be extended further to in-stalling workstations at the customer sites that tap into your central databases. Federal Ex-press and Baxter Healthcare both used this technology to gain a leadership position.

Service

Service industries and service-based processes (like accounting, MIS, and law) have their own problems and opportunities. Technology is used to support services with on-site, portable computers. These systems enable workers to have complete access to information almost anywhere in the world. Leading companies are building specialized databases to sup-port their service workers, such as the "answer line" databases that support General Electric and Whirlpool customer service representatives.

Management

Executives are also increasingly turning to electronic conferencing tools and workgroup software, even e-mail. Executives can cover more areas and deal with more people with these systems than they can by phone or through face-to-face contact. Some studies have shown that, in traditional conversa-tions, managers spend as much as 50 percent of the time on personal chit-chat. Electronic systems (although they might be less personal) tend to be more efficient. On the other hand, some companies have been restricting employee access to electronic networks (especially the Internet) because they waste too much time on personal communications.

Larger firms are building electronic links to their strategic partners, for instance, by pro-viding electronic access to corpo-rate data to accounting and legal firms. These links enable the external partners to keep a closer eye on the firm, speeding the identification of problems and assisting them in spotting broad patterns and opportunities.

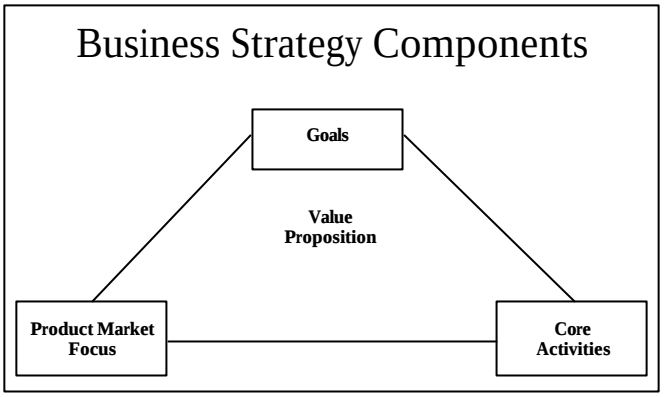
9.6 Summary

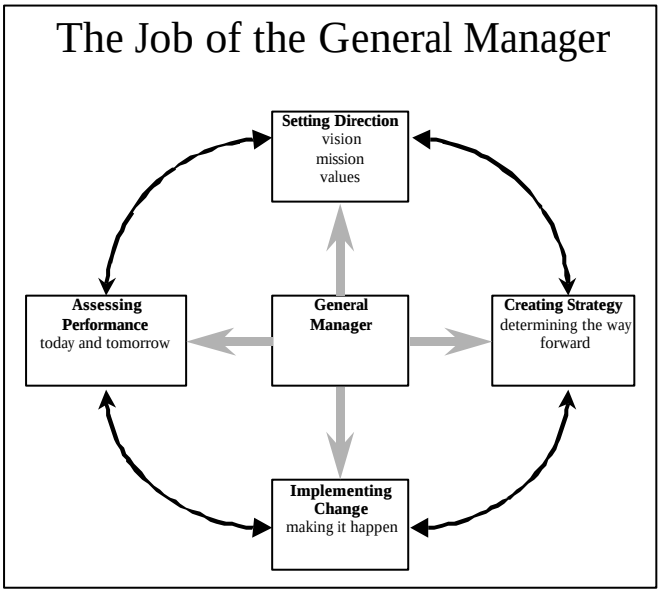
Information systems can provide benefits beyond traditional cost saving. Competitive ad-vantages can be gained by creating barriers to entry and gaining control over distribution channels. Using information systems to build ties to suppliers and customers can provide lower costs and better quality products. Computer systems also provide incentives for customers to remain with your company if they incur costs of learning new systems and transferring data when switching to a competitor. Information systems can also be used to differentiate your products from the others in the marketplace. Similarly, innova-tive services offered with the help of technology can entice customers and expand your market

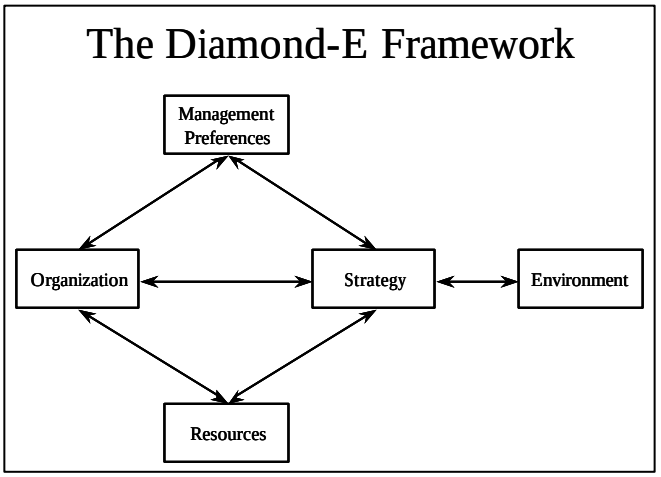
You can search for competitive advantages by examining Porter's external forces of ri-vals, customers, suppliers, substi-tute products, and new entrants. You can also search for

strategies in research, engineering, and design. In manufacturing, you can look for ways to decrease costs and improve logistics. In marketing, potential gains can be found in better un-derstanding of customer wants, as well as sales and order management. Services can be sup-ported through better information flows and workgroup products. Management can be helped with better data and better decision tools

Strategic systems face many risks. They tend to be expensive and difficult to create. Any gains created may disappear when competitors pick up the technology and imitate your of-ferings. Additionally, making strategic changes to your firm might alter the industry, which might adversely affect your firm. And if these problems are not enough to discourage you, remember that attempts to monopolize a market are illegal, so you have to make sure that your plans do not violate governmental regulations.



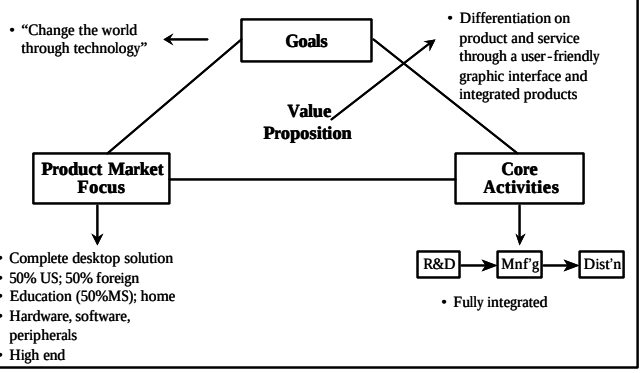




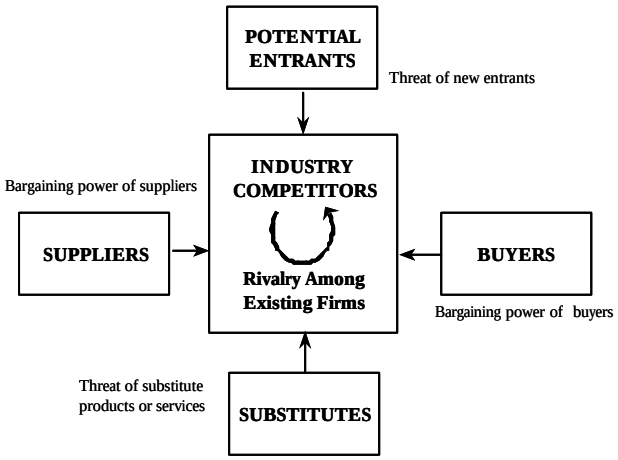
Strategic Risks

	TIME HORIZON: SHORT-TERM	TIME HORIZON: LONG-TERM
ENVIRONMENTAL RISKS	Errors in reading the environment cause strategic failure	Environmental changes make the strategy obsolete
CAPABILITY RISKS	Strategic demands exceed the capacity to execute	Internal capabilities develop inconsistently with strategy

Apple's Strategy



Porter's Five Forces Model



Review Questions

1. Briefly describe four techniques in gaining competitive advantages.
2. What are all the external agents?
3. What are barriers to entry important to gain a competitive advantage?
4. How can information systems be used to gain control over distribution channels?

Discussion Questions

1. Discuss the costs and dangers associated with the Strategies.
2. Try to do the SWOT analysis for a company of your own choice

Application Exercises

1. Identify TWO firms that have chosen to be technology leaders and those that are followers. What other differences can you find between the firms?
2. Identify the leading FIVE companies in any industry and try to know the competitive advantages they enjoyed over each other.

LESSON 10 :
END USER COMPUTING (EUC)

Learning Objectives

1. To study the concept of End-user computing and its application in Information System Development
2. To identify the components of End-User Development

10.1 Introduction

The main objective in introducing this topic is to ensure that you understand the vital role that the concept of EUC can play in the strategic management of organisations if it is managed effectively, and the enormous damage it can do if it is not. Traditionally, the only people who had direct contact with computers were the systems professionals (programmers, systems analysts etc.). The introduction of personal computers, terminals, networks, user-friendly software, databases has altered the position dramatically and has led to the growth of end users

Most people experience computers as "end-users" of packaged programs. Unfortunately the writers of these programs can't know the details of the job you are trying to do. Trying to meet the needs of diverse users, they bloat their programs with hundreds of features most people never use. Life (and programs) would be much simpler if each user could add the functions she wanted.

Providing this capability in a program is not trivial. The programs must be designed to accept user-written components in appropriate places. There must be a way to store and manage them. Most important, since most users do not have the time or inclination to learn the tools and skills of a professional programmer, reasonable compromises are required. The expressiveness and generality of full-fledged programming languages are traded for usability by a variety of metaphors and tricks. Programming can be done much more easily within the metaphor — a desktop with file cabinets and wastebaskets; a formula of spreadsheet locations or mathematical symbols; a sequence of GUI actions; a circuit diagram; an application-specific language — than with conventional programming.

Because the appropriate metaphors, with their capabilities and limitations, differ widely depending on the users and their purposes, there is no one method of end-user programming. Instead there is a variety of techniques, such as Programming by Demonstration, visual programming, and many domain-specific languages and formalisms. Ideally there is a smooth progression from simple but limited metaphors, to more complex and powerful techniques as the user-programmer advances.

Computing usually adds to its provision rather than replacing one approach by another. This is equally true of end-user computing and the end-user is now involved in all of the above ways. This set of notes seeks to address the questions of "who is the end-user", "what kinds of end-user systems are there", "what support should be given to end-user at the various levels of the company", "the need for an adequate human-computer interface for the end-user", "software provision for end-users" and the problems that end-users can generate for the company.

10.2 What is EUC?

We will see the meaning of the term "end user" as a user of an application program. Typically, the term means that the person is not a computer programmer. A person who uses a computer as part of their daily life or daily work, but is not interested in computers as such. When end-users, who have not necessarily been taught how to write code in conventional programming languages, write computer programs. Examples include spreadsheet users who write formulas and macros.

EUC is an environment in which the user has free control and latitude over the process. He may use data that is interchanged through the mainframe of the MIS division, or he may create his own data. But he is in control; he is responsible for the product and the effectiveness of the use of the equipment. It has since been suggested that the only distinction between EUC and corporate computing is the reporting relationship within the Organisation. Computing which reports directly to the Information Systems function is corporate computing; the rest is EUC.

10.3 End-User Development (EUD)

Specifically, the practice of users developing their own information systems, is often but not always with the support of professional systems developers. The practical involvement of end-users in application development necessitates the easy access to computing facilities. This may be

- Timesharing on a centralised mainframe
- The use of stand alone personal computers
- The use of personal computers which are connected to local area networks and mainframes.

In addition to being provided with hardware and software, extra facilities are a necessary condition of successful End user applications development. In particular:

- Education and training on the use of software tools
- Assistance in the technical aspects of writing, testing, and debugging applications
- Availability of reference material
- Aid in accessing the corporate database

10.4 Why End User Computing?

The major advantages attributed to EUC include:

a. Enhanced productivity of professional and white-collar workers.

b. Overcoming the shortage of DP professionals.

c. Provision of user-friendly and responsive systems.

d. Overcoming the implementation problems by transferring this process to the user.

   System implementation has always been a major problem for developers. If users develop their own systems, clearly the implementation problem goes away.

Who are the End Users?

In general an end-user is anyone who has to interface to a computer who is not employed specifically to do so (*ie* is not a data entry clerk or an operator). This includes executives interfacing to EIS facilities, middle managers or technicians who use a PC or a terminal to an on-line system, clerks accessing a central database to download data for local processing, individuals using a PC in stand alone mode for their own work, individuals using a PC in stand alone mode for an activity which the corporate management has decided shall be done by computer (*eg* office automation), clerks interfacing to a computer system which has replaced their manual system (without their having any input) and clerks writing data preparation documents.

Web integration is, however, creating a new class of end-user. (S)he is an end-user in one organisation who, through integration (3-tier client / server), has suddenly become a user of a system in another organisation. A further complication is that now a system may have to cope with two different kinds of end-user at the same time. For example the parcel tracking system at FEDEX could be accessed by both a company employee and an external customer, both trying to track a parcel (though not necessarily the same parcel). We may group them into the following categories:

- Non programming
- Command level
- End-user programmers (including senior management professionals)
- Functional support personnel
- End user computing support personnel
- DP Programmers

This list covers a very wide range of personnel carrying out a wide range of tasks throughout organisation - and the list continues to grow.

Why are they end-users?

When the large data processing type applications (payroll, inventory etc.) had been developed on large machines, a demand arose for Management Information. The users were potentially sophisticated professionals.

As stated above, the traditional IS department development time was too long, and there is a shortage of trained analysts and developers.

IS customers are often dissatisfied with the performance of delivered application systems:

- These systems often take so long to develop that organisational and/or market requirements have completely changed by the time they are made available to the users.
- Even though significant care is taken by trained analysts to ensure that user requirements are well defined, it is often the case that misunderstandings occur.
- The traditional methodologies generally do not allow requirements to be changed during development, whereas in practice, the systems requirements are often unstable, requiring a flexible approach to analysis and design.
- The very fact of the existence of a new system will change the environment in which that system exists, prompting the emergence of changing requirements.

Applications Suitable for End-user Development

Applications suitable for end-user development can be grouped into the following 5 categories:

- One time enquiries
- Simple Reports
- Minor Changes to Reports or Enquiries
- Presentation of Data in Alternate Forms
- 'What if' Analyses

Applications not suitable for end-user development:

- data entry involving organisation files and databases (where the data must be validated for accuracy and reliability)
- high volumes of transactions, requiring processing efficiency and multiple processing steps
- use of 'traditional' computer languages designed for use by professional programmers, requiring detailed statement of processing procedures and controls
- changing of data values in existing databases and files
- applications spanning several departments or divisions in the organisation
- applications requiring formal documentation
- applications requiring a long development process
- applications requiring detailed formal specifications.

Risks in End User Computing

- **Errors in analysis.** Poorly trained End-users often are incapable of correctly analyzing data or systems .Resulting DS software is therefore often of questionable quality.
- **Lack of documentation.** Most End-users are not trained in formal techniques of analysis and design. Documentation is often inadequate or even non-existent, making maintenance difficult and expensive.
- **Faulty Model.** Many Decision Support Systems (DSS) rely on corporate models developed by End-users for use with spreadsheets. Recent research has indicated that as many as 38% of these spreadsheets may contain errors. As these systems are used by senior executives as aids in strategic decision-making, the consequences are not difficult to asses

10.5 End User Computing Tools

There are 2 major classes of End User Computing tools:

- application packages
- fourth generation languages

Application Packages

These are pre-written software packages that are marketed commercially. They are available to support common business functions such as payroll, purchase ledger, sales ledger, production scheduling, inventory control etc. Many of the packages

allow for some customization through specification of key parameters (eg discount % for prompt payment).

Fourth Generation Programming Languages

These languages allow users to develop their own computer programs and even link a series of them together to form a small system. These languages can be run on most types of computer.

There are many classes of fourth generation languages:

- query language/report writers
- graphics languages
- statistical analysis packages
- decision support/financial modelling tools

Implications of EUC

- Levels of end users in terms of capabilities
  - menu-level end users
  - command-level end users
  - end-user programmers
- functional support personnel
- EUC application considerations
- shifts workload so that end-users and information specialists' talents are better used
- reduces communications gap

10.6 The Models of End-User Systems

The above discussions of end-users identify clearly the different kinds of end-user system provision. They may be summarised as follows (the word terminal is used here to distinguish a local facility on which no local processing is done from one on which local processing is done - the form of the device is irrelevant):

a. On-line terminal for specific information provision;

b. On-line terminal for general information provision (*eg* a terminal to an on-line database such as LEXIS);

c. On-line terminal used as part of a self organising group activity, either via a terminal to a mainframe or through a LAN (*eg* diary management, document preparation);

d. On-line terminal which is being used as part of a wider corporate system, such as the manager's terminal in one store of a department store chain or an order entry terminal in an on-line transaction processing system such as a booking system;

e. A PC which is being used for an individual's own work, which may (at some times) be used as a terminal in any of the above ways (the manager in the department store may be doing spreadsheet work as well as reconciling the days takings) - this is the conventional client/server situation;

f. as (d) but where the PC is completely stand alone and, probably, used only for a single task such as word processing;

g. a sophisticated workstation such as a graphics design workstation, where there is interaction with other users but where the operation is more akin to (b) than to (d);

h. a small computer, such as a notebook, used either for mobile use (*eg* British Gas manuals) or intermittently (*eg* a travelling salesperson);

i. devices operated directly by the public, such as an ATM or a kiosk;

j. general purpose terminals, as in (b) or (d), but where the end-user is a member of the public.

10.7 End-User Systems Tools

The following list indicates some of the tools to which end-users have access and for which they may need support.

a. **Text and multimedia handling tools** – word processing, desk-top publishing, web-publishing, presentation software, document management systems, work-flow management systems;

b. **Data handling tools** – spreadsheets, statistical packages, decision support systems, databases;

c. **Communication tools** – electronic mail, voice over IP, fax, WAP, pagers;

d. **Office automation tools** – diary management, electronic notebooks, directories, project management tools, personal digital assistants, bluetooth;

e. **Group systems / computer supported collaborative work** – teleconferencing;

f. **Graphic design** – graphic software, computer aided design;

g. **Knowledge management** – expert systems, data mining, information retrieval, intelligent agents.

Supporting the End-User

The organisation of an MIS department centred on the needs of the end-user was covered earlier in the unit. This section looks at some other aspects of end-user support which follow from the above list of models of use.

(a) End-user computing now includes general purpose office automation. In order to operate effectively this type of application must include top management and must be supported by top management.

(b) Systems are increasingly being used, not by clerks employed specifically for data entry but by staff using them as just another tool in their normal jobs. If the tool is not seen to be effective then it will not be used. It is essential that end-users are much more fully integrated into the system design process and that prototyping methodologies are adopted. The most important aspect of the systems design, after functionality and flexibility, then becomes the interface design.

(c) The Information Centre concept is directed primarily at those end-users who are using PCs for their own personal work. Users who are using stand alone PCs as part of their job (eg word processing in the typing pool) must be given detailed training programmes and must be involved in key decisions (eg on what package to standardise or where to site the communal printers). This includes induction training for new staff.

(d) A particular problem with the Information Centre concept is where the provision of end-user support has been

contracted out to a third party, either as a straightforward outsourcing deal or because the software being used has been provided by a third party and the third party is providing the help to the users of that software.

(e) Users of external information sources need as much support as those in (c). They tend to get forgotten since, usually, they are difficult to track.

(f) Packages such as decision support software (*eg* mathematical modelling, decision support trees, *etc*) may get omitted if not carefully targeted. Where is the control for generating adequate EISs? Again if this is not clearly identified then much needed systems may be ignored.

(g) It is not possible to provide training for end-users who are not members of the "company" (*ie* the general public). It is essential, therefore, that any user interface is both "naive user" and security foolproof, as well as being simple to use. It is important also that any device to be used by the general public provides added-value. If it does not then it will not be used.

(h) New technologies (*eg* Web Services) are emerging all the time. A programme of education is as important as any training.

10.8 The Information Centre

One major requirement which is now needed is support for that class of end-user that is working alone but on a task which is strategic to the organisation. This is normally provided in the form of an Information Centre, which is both a place (often known as the "help-desk") and a group of people. The Information Centre owes its existence to the problems which end users created when PCs first came into offices about fifteen years ago. Now the role has more to do with establishing and enforcing the role of PCs in meeting the IT strategy than just supporting the end-user. For example, the information centre must take the lead in ensuring that personal computers are not the Achilles heel when it comes to data protection. The concept of the Information Centre was launched early in the 1980s when end-users were quite naive. Today, a number of organisations are establishing "self-help" groups from among the more sophisticated of their users. Unless the members of the group are "hybrids", however, they are still going to need considerable IT technical expertise to back them up. With the emergence of the Web and the Intranet much of the work of the Information Centre can be replaced by a suitably designed Intranet Site. On the other hand, access by customers and access by employees of other organisations demands a much higher level of involvement in the support provided. Full details of the background to and the operation of an Information Centre are as follows.

Problems

It became clear very quickly that the managers had bought something that they didn't understand and either had to discard the machine (as happened in many schools who were encouraged by government to acquire computers) or had to be supported to get the most out of their purchases. The particular problems which were posed for the organisations into which these PCs had been introduced were:

(a) Lack of standardisation between the various purchases leading to:
  (i) inability to share data;
  (ii) no economy of scale in purchasing;
  (iii) a variety of requirements for maintenance, in the few cases where the problem had actually been considered.

(b) Lack of control over the requirements of legislation, such as software copyright, data protection, health and safety and the specific legal constraints covering the organisation.

(c) Demands for assistance with:
  (i) systems analysis and design;
  (ii) programming;
  (iii) software procurement;
  (iv) sizing - machines which have been purchased but are too small for the job;
  (v) maintenance;
  (vi) fall-back;
  (vii) lack of documentation;
  (viii) data security;
  (ix) environmental control;
  (x) file conversion and data acquisition;
  (xi) data organisation.

The Information Centre

The term "Information Centre" was conceived by IBM as a way to support not only PCs but also those users who wished to obtain, and process (possibly using fourth generation languages), data which was held on a central corporate database. The Information Centre was to be:

"A small group of specialist personnel whose brief is 'to support and promote the use of personal computing throughout the organisation'".

In particular the Information Centre would:

(a) support personal computing using PCs or 4GLs by:
  (i) offering advice and support to the individual;
  (ii) defining standards and undertaking corporate activities (*eg* arranging maintenance) for the organisation;

(b) organise and supply data to the individual either from the corporate database or from national or international databases.

The Physical Centre

The Information Centre would be a physical entity, not just a conceptual entity. There would have to be a location to which people could go for advice and demonstrations. The Centre would consist of:

(a) A physical centre, which would have:
  (i) a reception area with a desk or window at which to receive enquiries;
  (ii) a demonstration room equipped with a variety of up-to-date PC equipment and software;
  (iii) a library with software and documentation;
  (iv) offices for a manger and systems analysts;

(v) a workshop for technicians.

(b) A group of staff comprising:

(i) an Information Centre manager;

(ii) receptionist(s)/secretary;

(iii) librarian/demonstrator;

(iv) a small group (say 3) of analysts/programmers

(v) a small, group (say 2) of technicians.

The exact composition of the staff would depend on the size and the physical structure of the organisation. The above would be appropriate for a single site organisation with a turn over of about £M100 per annum.

Management Structure

In organisations where the Computer Centre already reports directly to the Board (*ie* there is a Chief Information Officer) the Information Centre is normally part of the Computer Centre. In organisations where the Computer Centre reports to some other function (*eg* finance) the Information Centre is usually independent and reports directly to the Board. A structure which is becoming common now is for the Chief Information Officer (a Board level appointment) to be responsible for:

(i) a strategy group;

(ii) the Information Centre, and

(iii) the Computer Centre.

This arrangement allows the end-users to see the Information centre as independent from the Computer Centre, yet still provide a co-ordination mechanism.

Skill Requirements

The kind of skills needed by computer professionals in the Information Centre is quite different from those working in the conventional data processing department. A deep knowledge of software packages, communications, contract matters and trouble shooting is more important than information gathering, although conventional analyst or technician skills are required to some degree.

System Development

Panko identifies five environments in which development for end-user computing is taking place. These vary from DP systems through single-user systems that can be bought off-the-shelf to systems, which are developed specifically for departments.

(a) Environment 1 - conventional DP systems.

(b) Environment 2 - one-off PC applications.

(c) Environment 3 - large end-user projects in which several people are going to use a system, some of whom might be outside the sponsoring department - the development would still be done by the end users themselves.

(d) Environment 4 - large end-user projects which have to be delegated to computer specialists to develop.

(e) Environment 5 - departmental systems.

All this does, however, involve the development of systems specifically for end-users. Remember that end-users must be involved, through participative design, in any systems in environments one or five.

(a) Safeway introduced a tool whereby a registered customer could record on a personal recorder each item that they put into their trolley. This record could be used to advise the customer of their bill to date and of related special offers and it could be used at the check-out to eliminate the need to scan each item in the trolley, thus saving a lot of time. Both the store and the customer benefited. Because the customer was registered the output from the tool showed the customer's individual purchases each visit. The store could note the purchases made every week and pre-package those before the customer visited. This would create customer loyalty. Note that this was not Web dependent.

(b) British Airways sees each individual customer as his/her own segment. The aim is then to package a product for each individual customer. One way is to maintain a database of customer preferences and use those preferences to tailor price/facilities to what the customer wants. For example, instead of offering a range of tickets for a journey, BA will ask a customer what he wants to pay and will then offer a type of ticket that they think will be attractive to the proposed purchaser.

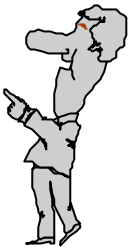
10.9 Summary

An IS Manager is required to supervise three key functions, the development of strategy (both company and IT), support for the end-user and the running of the IT (or DP) department. Strategy. Although extremely important it is a subject about which very little has been written.

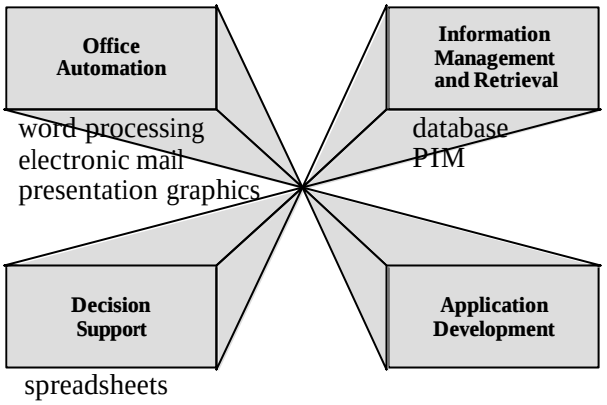
In the 1960s computers worked only in batch. They occupied a large room in the head office of a major company and worked on corporate applications. The only contact which the end-user had with the computer was the requirement to complete a data preparation document and forward this to the DP department. Of course they then had to sort out the erroneous output from the DP department. In the 1970s on-line systems were developed. These sought data input from end-users (on dumb terminals) but did not allow the end-user to do anything other than was allowed by the system design. The end-user had gained some control, however. They now had the ability to render a system unworkable in some cases. Hence it was essential to involve the end-user in the system design process. In the 1980s the PC came along. This now allowed the end-user a further sanction. The end-user could purchase an individual computer and develop an independent system or the end-user could demand an intelligent front end to a central system. Alternatively the end-user could resist the introduction of central systems by local disingenuity (for example if the central management wished to introduce a corporate approach to and standard for office automation this could be blocked). This enhanced user control has led to the gathering momentum of the client/server approach.

End User Computing Growth Factors

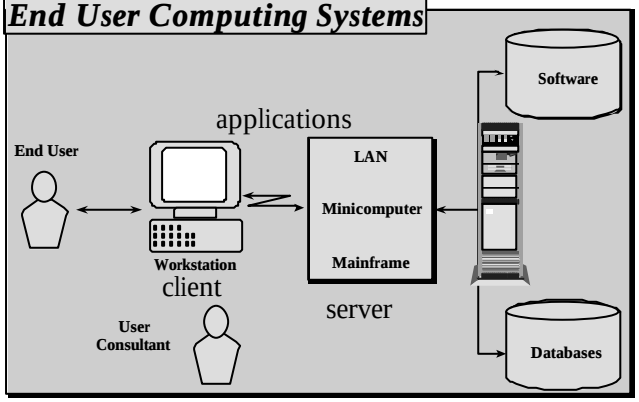
- **Pressure for rapid response**
- **easy-to-use hardware and software**
- **lower prices**
- **more computing power**
- **computer-literate users**



End User Computer Applications



Components of End User Computing Systems



Problems with End User Computing

- **Development errors**
- **Data entry errors**
- **Wrong tools**
- **Job too big**
- **No backups**
- **Document**
- **Ignore standards**
- **Viruses**
- **Personal use**

Review Questions

1. Explain the concept End-User computing and its benefits.
2. Explain the need and implications of End user computing.
3. Describe the various models of End user computing
4. Write a note on Information Center and its purpose.

Discussion Questions

1. What are some of the motivations for users to set up their own departmental data processing systems.
2. Should an organisation encourage end user computing? Why or why not?

Application Exercise

1. Try to find out a company which developed a system through end user development and identify the way they have developed it. Also, draw the advantages and disadvantages they are having now.

LESSON 11 : OFFICE AUTOMATION

Learning Objectives

1. To understand the need and importance of Office Automation Systems
2. To understand the benefits of Paperless Office
3. To know about the components of Office Automation
4. To study the concept of Office Information Systems

11.1 Introduction

The automation of everyday office tasks is one of the key results of the electronic revolution. Word processors, spreadsheets, databases, accounting packages, networks, and e-mail are but some of the innovations that have transformed the way we work in the late twentieth century. Integrated into a smoothly working business system, office automation tools can vastly improve office productivity. Indeed, no modern office can hope to survive without many of them.

Yet the very richness and diversity of these tools is the source of some of our most serious office problems. With tens of thousands of programs running on dozens of different kinds of computers and operating systems, often linked together by a variety of networks, the potential for incompatibilities is great.

Without doubt, the major change in the office scene over the past few decades is the introduction of Information Technology.

Up to the late seventies companies used computers mostly or solely for accounts. Computerization was very costly and meant that only certain key operations could make use of the technology cost effectively.

Now that desktop computers are available at competitive prices (earlier computers consisted of costly and bulky mainframes) installing computers has become cost effective, and in most cases computerisation is seen as a way of reducing operational costs in the long run.

11.2 Defining office automation

Office automation means the complete integration of -

- word processing
- electronic filing
- diary management
- communications, including electronic mail, telex and fax

These functions are the basic requirements of any office or department within an organisation. Office automation aims to organise the functions in such a way that they do not have to be carried out on a variety of equipment.

What are the effects of office automation?

- Office automation reduces the number of clerical workers carrying out routine tasks
- Large firms no longer have to employ typists
- Office employees become more flexible and as a result one person can now do the jobs of several people
- Receptionists can spend more time with clients
- Managers need not necessarily delegate typing, with the secretary's role being redefined to include more Public Relations work.

What is the latest development in office automation?

The latest development is that of electronic mail. Electronic mail has been around for a number of years now, but has become increasingly useful as more and more people have a regularly checked e-mail account.

Will information technology lead to a paperless office?

This is a moot point - some consider the paperless office a myth, others a reality! It depends more or less on the organisation in question. What is certain however is that at this stage of computerisation the ease of using a word processor is leading offices to produce an even larger amount of paperwork - most employees and clients still prefer a hard copy of a document rather than an electronic one! It is a question of a change in mentality coupled with the approval by the business community that electronic commerce is viable and is the way forward.

Background Information

Let us see the components and other tools available in office automation in the following paragraphs.

- **Function** - An action or operation performed electronically by activating a function key or sequence of keys. Examples of functions include copy, delete, move, search, calculate, go to, change font, and print.
- **Software Package** - A program of instructions that interacts with the system's hardware to perform operational or functional tasks. Software packages are comprised of program instructions that are applicable to a specific office requirement such as producing textual documents, developing spreadsheets, establishing databases, or presenting information in graphic form.
- **Software Type** - Software packages that provide similar capabilities are categorized as a particular type of software, e.g., database management, electronic spreadsheet, or word processing. This guide also refers to some of the more commonly used types of software described in the sections that follow.
- **Word Processing** - Word processing software, designed for developing textual documents, permits users to create, format, modify, and print documents electronically. With word processing software, an employee can perform such functions as: add, copy, correct, delete, or move text;

automatically print document identification or other notations at the top or bottom of each page; automatically number pages; create form letters and automatically merge these with mailing lists; check documents for spelling errors; designate some characters as boldfaced or underlined or italic; and search for and change specific text within a document.

- **Electronic Spreadsheet** - Spreadsheet software, used extensively for accounting and financial purposes, is designed for maintaining, manipulating, and calculating numerical data. A typical electronic spreadsheet consists of a matrix of rows and columns similar to the conventional columnar pad. The user can add, delete, or modify the numerical records maintained in these spreadsheets. Spreadsheet software provides formulas, functions, and commands to manipulate or calculate the data to meet multiple report formats.
- **Database Management** - Database management software provides capability for organized electronic storage of information in general categories or files. It allows the user to rearrange the order and number of items of information in printed form, and to search for and display specific items of information.
- **Desk-Top Publishing** - Desk-top publishing software is used to lay out text, graphics, and pictures on a page. With desk-top publishing software, the user can perform such tasks as: integrating text and graphics on a page; increasing or decreasing the size of charts, graphs, or pictures and using multiple styles and sizes of type.
- The distinction between desk-top publishing software and word processing software is diminishing as the latter software packages take on greater capabilities.
- **Graphics** - Graphics software typically allows the creation of charts and graphs based on data provided through a spreadsheet or by the user directly. Some graphics software allows the user to easily switch from one form of presentation to another for different uses. For example, a given set of budget figures might be represented as a bar chart, stacked bar chart, line chart, or pie chart. Most graphics software also allows the creation or selection and placement of pictures and symbols.
- **Project Management** - Project management software permits the user to identify tasks, task relationships, resources, and time requirements of a project; to manipulate that information for planning purposes; to track work progress against the plans; and to report and display information about the project in varied ways. The software automatically adjusts such information as starting, ending, and milestone dates for the project based on changes in assumptions and estimates introduced by the user.
- **Calendar** - Calendar software generally permits the user to schedule events on one or more calendars. Additional functions may include capabilities for such purposes as “to do” lists, short notes and reminders, and recording time spent on various projects.
- **Electronic Mail** - Electronic mail (email) permits sending information to users through their computers’ communication links. For example, memos can be sent to those on designated distribution lists, and the recipients can acknowledge receipt, print copies, and respond through the electronic mail system.

Now let us see some of the examples of Office Automation Systems developed in some organisations.

1. **Document Management** Contract Tracking Database (Semi-conductor Manufacturing Firm)

   Here, they managed the development, implementation and maintenance of an application that kept track of supplier contracts. The application was developed using Lotus Domino, thus making accessible via web browsers. The application is used within the company’s Intranet and users subscribe to the system via on-line registration. User authentication security is used allowing the application to be used nation-wide.

2. **Office Automation** Bar-code Software Library (Consulting Company)

   In this company they managed the development of a system that kept track of software by the use of bar codes. The system keeps track of checked software, manages the number of licenses installed and sends e-mail notifications to remind users of overdue items. The system won a finalist award in the Lotus Partners Beacon Awards in 1996 for the “Best of Show” application.

3. **Art Management** (Food Company)

   Gather requirements, developed functional specifications, co-developed & managed the development & implementation of a web-browser-access based system for a large food manufacturing company. The application connected to several tables in an Oracle database by the use of Notes Pump. Both batch and real time access to the data was provided through a Domino server. Workflow, E-mail notification and document management was used throughout the system.

4. **Restaurant Audit Management System** (Restaurant Chain)

   This system was developed to automate the collection of quarterly Audit Information for a national restaurant chain. The system also will calculate the performance of each restaurant based on the audit evaluation and the weight that each question has. Using this system the Regional Managers, Vice-presidents and the President will have the results of the evaluation in short time and have a visual instrument to compare performance of each restaurant in any of the specific audit section. System was based upon Lotus Notes.

11.3 Office Information Systems

Office Automation is the attempt to use new technology to improve a working environment. But the remaining concern is how to determine what type of automation tools, if any, an office needs.

To determine which technologies may benefit an office, a careful examination of the environment is required. There are two main perspectives that can be used: analytical and interpretist. The analytical perspective has 3 views: office activities, office semantics and office functions. The interpretist office has four views: work role, decision taking, transactional and language.

Analyzing an Office

It is important to understand an office environment before technology can be successfully applied. However, a complete analysis can never be achieved due to the complexity of the multiple dimensions which must be examined:

a. Geographical - the physical placement of the office
b. Temporal - hours of work
c. Activity - tasks that are performed
d. Structural - worker management relations
e. Spatial - area where people work in relation to co-workers
f. Economic - criteria that drive an organization
g. Social - reasons why people become motivated to produce results

Analyzing an office is not only difficult, but also continuous, for as new technologies are introduced, the affects always need to be measured.

Designing Office Systems

Many efforts have been made to develop office programming languages that can express and even automate procedures found in semi- structured offices. A formal methodology for assessing needs and defining office procedures is necessary when using these programming tools.

A methodology to assess needs in individual offices must include these three parts:

- Needs Assessment Methodology
- Procedural Design Methodology
- Procedural Implementation Methodology

A ***Needs Assessment Methodology*** is necessary to identify the crucial needs to be served by automation. If the tools are procedural, then a Procedural Design Methodology and a Procedural Implementation Methodology should be implemented.

Procedural tools are those in which there is a predetermined flow of work involving many steps. The flow may be the same every time, or may include a more complex logic flow. With ***non-procedural tools,*** one can specify a set of functions to be supported but cannot say what functions will be used or in what order. The use of decision support systems, database management systems, electronic spreadsheet systems, the telephone, and word processing tools generally fall into this category. Offices can be grouped into two types:

- **Type 1** offices or departments handle the firms routine information processing. (For example, accounting, payroll, and billing departments) procedures are central in these departments, and the automation of procedures is critical to improved performance.
- **Type 2** offices or departments handle the firms non-routine information processing. (For example, corporate planning departments, marketing departments, and engineering departments). There are comparatively few set procedures in these departments, and support of these procedures is not central to improved functional performance. Work should be supported with non-procedural tools, such as e-mail, decision- support systems, and access to departmental and corporate databases.

Type 2 offices present a major problem to designers of office methodologies. Traditional procedural analysis tools are not likely to be effective in determining the needs of the office. Rather, the strategies that must be designed and supported are likely to depend heavily on the professional content of the work being done.

Goals of Office Information Systems (OIS) Methodologies

1. The first goal of an OIS methodology is to obtain an accurate description of the office. A complete and formal description of all aspects of the office work is not feasible. But, the model used in a methodology should describe as many aspects of the office as possible in an clear and concise way. This description will be useful to the system designer, as well as the potential users of the new system by enabling them to validate the system and suggest possible modifications.
2. A second goal is to locate the functions that are only loosely related to the goals of the company. This is done to separate these functions into two groups: The first group includes functions that are not related to actual office work, but are still necessary for social and organizational reasons; the second groups of functions are those that need to be re-examined. These functions may be obsolete and are only being done out of habit. They should be corrected before the implementation of the new system.
3. The final goal of a conceptual model it that it act as a guide in providing technical solutions, and provide criteria to follow in evaluating possible solutions and in choosing tools for design.

Approaches to OIS Conceptual Design

A crucial element of a methodology is the type of office *conceptual view* that is adopted during the analysis of the office. Different conceptual views will lead to different approaches in the analysis of office work, and should be considered.

- A ***technical view*** examines office work in great detail, by looking at the operations that are performed and measuring them, usually in terms of execution time. The goal of this type of approach is to identify the best methods to perform the work. Productivity is measured mainly in terms of throughputs, instead of considering global office performance.
- In an ***organizational view,*** the global organizational structure of the office is analyzed and business goals are examined. The (hierarcichal) organizational structure of the company is reflected in this type of office model.
- A ***socio-technical*** *view* considers the office in terms of tasks to be performed by each unit of the enterprise. Each unit has some type of control on the work, and has resources and memory on which to base present and future decisions. A set of rules is used to perform controls and to take into consideration goals and constraints in the execution of the tasks.

Aspects of OIS

- **Office data:** The conceptual models on which OIS design is based must be able to consider all office elements. The data used in conventional Information systems, such as character, string, and numeric data, are not enough. Other types of data, consisting of unstructured data contained in messages, mail, and oral communications must also be supported.
- **Time factor:** There must be support for scheduling activities, calendar functions, and control operations.
- **Office activities:** OIS must be flexible. Office tasks can be performed in several ways, and instructions for the completion of a task can differ.
- **Interconnection of elements:** Office activities can be very complex. There are a large number of elements in each office which are related through several connections. In general, the elements of office work are distributed amoung several office workers, thus communication among workers and with the external world is an important function.
- **Office evolution:** Activities can change over time, and ways of processing information grow and change.
- **Usage characteristics:** OIS are highly interactive, and the interface with the users should be adequate to the type of work to be performed.
- **Filtering:** Filtering of large amounts of data is required to provide workers with specific information, related to thier task.
- **Reminding:** In traditional offices, the arrangement of papers, books, and notes have the function of reminding workers of activities to be performed and their different priorities. Information is hidden from the user in an automated office, so the system must provide the function of reminding, and possibly the scheduling of activities.
- **Integration of functions:** A number of functions are performed in an office. These functions such as communication, data processing, information manipulation and retrieval, and task management may be integrated together and used by the same worker in fast sequence (or interleaved together). The system must provide easy transitions between functions.
- **Impact of technology** Methodologies should be as independent as possible of implementation details. This is done so that the impact of technology does not effect the office methodology.

Categories of Office Conceptual Models

Office conceptual models can be classified into categories based on the fundamental elements that they take into consideration.

- **Data-based models** group data into forms, which are similar to paper forms in the traditional office. Types of data and the operations of data are the basic elements of these conceptual models. Office activities are then seen as a series of operations on data. The main purpose of data-based models is to represent the office from the viewpoint of objects manipulated by office workers, in a way similar to traditional offices, where work was primarily based on documents.
- **Process-based models** analyze and describe office work by looking at different activities performed concurrently by the users and the system. The OAM methodology is based on a process-based conceptual model. The goal of process-based models is that of representing office activities in a coordinated way. The approach is founded on an integrated vision of all the activities performed in an office, rather that operations performed by single users as in a data-based model.
- **Agent-based models** are based on the viewpoint of the functions performed by active elements of the office environment, which are the agents. This type of model describes the office by associating a set of functions to the different agents. The description of the office is not only dependent on data and processes, but also the set of office workers and their organizational structure. Its goal is that of examining office workers roles, the delegation of roles in the office, and so on; while data and activities are considered only in relation to their executors.
- **Mixed models** explicitly assume more than one type of element as the basis for system specification, and go on to define the relationships among these elements. One example of a mixed model classifies office elements into three sub-models. One sub-model specifying the data related to the office, the second specifying the operations and activities in the office, and the third sub-model specifying both the normal evolution of office work, and the possible structural modifications of office tasks. When compared to the other models, the mixed model provides a more complete specification of different types of the fundamental elements in the office.

Office Analysis Methodology (OAM)

This methodology is based on the analysis of the activities performed in the organization. It focuses on the first two phases of OIS design: The Requirements Analysis phase, and Requirements Specifications phase.

The goal of OAM is to understand office work in terms of functions, activities, flows, tasks, and so on. The office analysis process investigates why functions are performed, what they do, and how they are implemented. The methodology is directed to the analysis of semi-structured problems at a managerial level in order to identify the business goals of the organization.

Office functions are examined top-down; the office manager and planner are interviewed first, and then office activities are examined in greater detail, following the office hierarchy. In contrast, the integration of the office system with the organization and the other systems is performed bottom-up. The results of the requirements analysis phase are specified in a high-level and problem-oriented language called Office Specification Language (OSL). This description is implementation independent, emphasizing office functions rather than specific operational tasks.

- Here is the general schema of OAM:
- Meet with the office manager
- Organizational context and reporting relationships
- Functions and resources of the office

- Identification of conceptual objects and procedures
- Identification of key personnel
  - Produce initial procedure descriptions
  - Conceptual objects
  - Core procedure steps and major alternate control paths
  - Inputs and outputs
  - Databases
  - Environment and special equipment
- Develop and analyze a draft description
  - Examine for inconsistency and incompleteness
  - Construct list of exception possibilities
- Iterate the interview process
  - Circulate draft description
  - Resolve conflicts and ambiguities
  - Investigate exception-handling procedures
  - Watch for ad hoc decision making
- Review the analysis with the manager
  - Validate intentions behind each procedure
  - Clarify what happens at interfaces with other offices
  - General exception handling
- Finalize the office description

11.5 Summary

Without doubt, the major change in the office scene over the past few decades is the introduction of Information Technology. Up to the late seventies, companies used computers mostly or solely for accounts. Computerisation was very costly and meant that only certain key operations could make use of the technology cost effectively. Now that desktop computers are available at competitive prices (earlier computers consisted of costly and bulky mainframes) installing computers has become cost effective, and in most cases computerisation is seen as a way of reducing operational costs in the long run.

The following are considered as the effects of Office Automation

- Office automation reduces the number of clerical workers carrying out routine tasks
- Large firms no longer have to employ typists
- Office employees become more flexible and as a result one person can now do the jobs of several people
- Receptionists can spend more time with clients
- Managers need not necessarily delegate typing, with the secretary's role being redefined to include more Public Relations work.
- The latest development is that of electronic mail. Electronic mail has been around for a number of years now, but has become increasingly useful as more and more people have a regularly checked e-mail account.

This is a moot point - some consider the paperless office a myth, others a reality! It depends more or less on the organisation in question. What is certain however is that at this stage of computerisation the ease of using a word processor is leading offices to produce an even larger amount of paperwork - most employees and clients still prefer a hard copy of a document rather than an electronic one! It is a question of a change in mentality coupled with the approval by the business community that electronic commerce is viable and is the way forward.

Review Questions

1. Describe the concept of Office Automation in detail with an example.
2. Explain the components of an automation system commonly found in office.
3. Write a detailed note on Office Information Systems and alos explain the methodologies to develop such kind of systems in any organisation.
4. Find out the pro and cons of approaches in developing and implementing Office Automation Systems.

Discussion Questions

1. Find out some Communication Technologies and the impact they have had on office work.
2. Try to know the essential characteristics of Paperless Office.

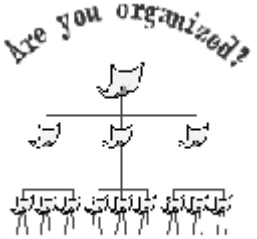
Application Exercises

1. Assume that you own a small business that is growing (e.g., 100 employees). Write a policy that details the use of e-mail and the Internet for your employees.
2. Find a business situation that could benefit from the use of Office Automation products. Describe the problems that exist and how they can be overcome.

LESSON 12 :
TUTORIAL ON APPLICATIONS OF OFFICE AUTOMATION

Paperless office

Some years ago, the idea of the 'paperless office' was popularized as an ideal. We are all familiar with 'paperwork' - such as filling out seemingly useless or unnecessarily complicated forms. Electronic alternatives such as computers seemed to offer the promise of getting a machine to do this busywork. By banishing the paper, we could avoid the hassle.



There is no question that electronic data management *can* be used to reduce administrative burdens. However, paper doesn't cause paperwork, organizations do, and they are still quite with us. Because organizations can process electronic forms more easily than paper ones, it may be that so-called 'paperwork' will even increase in the future, with most of it done on-line. It was never fair to blame the paper, so while we reduce paper use, we should not go overboard and try to avoid paper in those cases where it is the best tool for the job.

Paper is far too useful and satisfying to want to get rid of it. Even if we tried, we wouldn't be successful. A "Paperless Office" makes about as much sense as a "glassless office" or a "metalless office".

The 'paper efficiency' approach acknowledges the usefulness of paper, but recognizes that we can still use considerably less than we do now. The "Paperless Office" is like a starvation fast that just won't last. By contrast, "Paper Efficiency" is like a balanced diet with good physical exercise.

Q: What are the considerations, technologies and steps I should take to make our business paperless?

A: I take it that your business is buried in paper. That's no surprise. You've just hit on one of the most common complaints among both office workers and business owners.

Twenty years ago, the PC was introduced as a tool that would virtually eliminate the paper then choking the average office. But that hasn't happened. In fact, market analysts report that paper use continues to boom-by an incredible 6 to 7 percent annually.

It's no small issue. Hard-copy costs typically eat up 1 to 3 percent of a company's revenue. Meanwhile, worker productivity sinks, as knowledge workers spend 10 or more hours per week just sifting through paperwork. First the bad news: For the foreseeable future, paper is here to stay. But don't be too discouraged. Through information technology, this glut of paper can be held in check.

Best of Both Worlds

Eliminating paper in business certainly is a desirable goal. But, unfortunately, it's not currently realistic, since paper plays important psychological, aesthetic and legal functions in today's business world. Hard copies continue to have many advantages over electronic documents, including better reader comprehension, less eyestrain, greater mobility, superior flexibility and an enhanced comfort level among workers. In addition, U.S. states and foreign countries vary considerably with regard to the legality of electronic documents and signatures.

For the time being, therefore, it's best to combine some use of paper alongside electronic or digital information systems. This approach can substantially reduce, although certainly not eradicate, the reliance on paper in your office. Some of the most effective paper-busting technologies include:

- **Computers:** PCs, laptops and handhelds can be combined for document creation mobility and flexibility, stamping out rampant paper use.
- **Scanners:** Scanners create digital images so that documents can be exchanged electronically and preserved easily. When scanning, remember to employ image compression to maintain network performance, and make sure to choose a single, standardized electronic document format so that images can be indexed and searched easily.
- **E-mail:** E-mail is a great substitute for paper memos. Effective e-mail systems should allow users to filter content and file messages electronically by topic. They also should let workers combine e-mail with fax and voice-mail retrieval in a unified messaging system.
- **Storage systems:** Affordable, robust storage technology is essential for high-speed, centralized electronic information management. Check out low-cost systems built upon RAID (Redundant Array of Independent Disks) technology or iSCSI-based storage-area networks.
- **Fax over IP (Internet protocol):** The boring old fax goes high-tech with a Web- or e-mail-based fax capability that eliminates the need to send hard copies.
- **Wireless local area networks:** Wi-Fi LANs are spreading like wildfire, making electronic information mobile, portable and easily accessible to workers anywhere.
- **Secure remote access:** Virtual private networks (VPNs) ensure that home workers and road warriors get secure, confidential access to the company intranet, abolishing the need to lug around a briefcase full of documents.
- **E-learning systems:** Workers in training can say good-bye to books and binders when they use online or Web-based training systems.
- **Advanced printers:** Printers that print on both sides of a sheet can significantly reduce paper use.

Naturally, each company's needs vary. So companies are advised to take the following steps: Assess current paper usage, determine which electronic systems are most useful, get familiar with and read reviews of available products, and get the best price. To cut paper use most reliably, organizations also should devote resources to training employees on the new technologies and have a method in place to measure return on investment.

So be heartened. There are numerous ways to substantially slash the use of paper, while striving for the ultimate goal of a completely paperless office.

Class Activities

1. Discuss this in your group and try to advocate better solutions to make the office as a complete paperless office. Also, demonstrate an activity how it can be done in paperless office.
2. Find out the merits and demerits of eradicating papers in Office.
3. Discuss the software packages what we can use

LESSON 13 :
ELECTRONIC COMMUNICATION SYSTEMS

Learning Objectives

- To understand the uses of electronic means in performing business activities.
- To know about Electronic Meeting System
- To learn about Electronic publishing and Discussions
- To know how to utilise them in improving our business

13.1 Introduction

We are in the world of advanced Information Technology where things are moving in such a fast phase. The availability of information becomes cheaper and faster and the facilities existing to exchange the information among users all across the world has become more simpler due to the evolving of Information Super Highway. The internet provides fast and inexpensive communication channels that range from messages posted on bulletin boards to complex exchanges among many organisations. It also includes information transfer (among computers) and information processing. E-mail, chat groups, and newsgroups are examples of major communication media. Let us see the major components of Electronic Communication System as follows.

13.2 Electronic Conferencing

Professionals in all fields are looking to Internet technology to find communication methods that encourage greater collaboration and are an efficient way of dispersing helpful and relevant information in a cost effective manner. One method that has become increasingly popular is conferencing, whether it be on "electronic bulletin Boards", listservs, in chat rooms or using web-based meeting protocols.

Conferencing allows a large group to exchange ideas by reading and posting messages which are delivered to a central point and broadcast to the conference participants by special software. This is done in a synchronous or asynchronous mode, that is when all participants gather together at the same time or not! i.e. that conference participants can read and post messages at any time.

Conferencing has its advantages and disadvantages. By far, it is cheaper than using long-distance telephone or fax and the software and hardware needed to run it, a personal computer and an Internet connection, are becoming so readily available that it makes it possible for larger numbers of people to become participants. Conferencing keeps meeting costs down because the costs associated with face-to-face meetings such as travel and accommodations don't exist. And in most modes of Internet conferencing, subscribers can participate at a time that is convenient for them, thus helping in the old "time management" dilemma.

Some people find it difficult to commit the amount of time it takes to make conferencing successful, and others don't like it because of the lack of personal contact. Participation is linked to a person's previous experience with technology and the Internet, his likes and dislikes or her preferred learning styles. Research suggests that auditory learners may feel distanced from discussions in asynchronous conferences and may prefer telephone or face-to-face meetings where they can be heard. Visual learners usually flourish in the on-line environment because they are used to processing large amounts of information in this manner.

Kindhearted learners miss the body language and immediate feedback of personal meetings. Electronic meetings will have about the same number of non-participating members (in this environment called lurkers) as do regular meetings. I have been using computers since the mid-1980s and love the immediacy and speed of electronic communication and the sense of virtual equality it provides. Over the years I have participated in many online conferences. Through the process of trial and error some ideas on how to encourage more participation in electronic conferences have emerged. These suggestions are from a committed amateur!

- **Pre-planning:** Decide on a series of topics and find guest facilitators/moderators who will lead the discussion on a given topic. Determine how long a conference will last—a day, a week, several weeks, a month etc. Spread the dates of the conferences out over a six or eight month period with a good break between conferences (three conferences in this time period would be good). Promote the conferences in advance. This allows people to begin thinking about the topics and the kinds of questions they would like to ask or information they would like to share.
- **Promotion**: Begin sending messages introducing the moderator, giving information about the participants and commenting on different elements of the topic to conference subscribers two weeks before the conference to build anticipation.
- **Introductions:** Ask the guest moderator to introduce him/herself a week or so before the actual start of the conference. During that time, ask the moderator to post the conference agenda and request potential participants to: a) introduce themselves, b) suggest what they'd like to learn from the conference, and c) identify one or two of their favourite resources related to the topic. These are ways to "break the ice" that can contribute to the quality of the conference and, unobtrusively, help the participants feel more comfortable as they get to know and feel at ease with each other and this, for some of them, new manner of meeting.
- **Time Factor:** Consider stretching the conference out over an appropriate period of time and have the moderator post her/his "conference" material every third day or so, depending on the over all length of the conference, to give participants more time to come and go on the system. Adjust this as time goes on, as participants become more

comfortable with this process in general and become more active in their participation.

- **Be Prepared:** There will be lulls in the action: at the beginning, as people are waiting to see how this will develop and at various points during the conference when interest may seem to be waning. Consider preparing a few colleagues to encourage discussion by having them ready to respond to the moderator's postings, ask questions or post their own ideas at times when the action needs to get started or participation is slow.
- **Evaluation:** Have a routine "post mortem" after each conference where participants, by way of an evaluation, can suggest what learnings they may glean and what could have been done to make the conference more helpful, specifically for them.
- **Technical:** Electronic conferences should be held in a venue separate from the one people use for normal discussions. This way, regular users are less likely to feel they are interfering with or interrupting the conference. Electronic conferencing can be enjoyable as well as efficient and convenient. Giving some thought to how the conference will progress before it even starts will help to make it a valuable and enjoyable experience for all.

The most basic form of e-conferencing is what we call "Sync" or synchronous mode. It involves having everyone on-line at the same time like a face-to-face meeting or teleconference. We use a mode called Internet Relay Chat (IRC, or "chat") to all talk together in a common "room" or "channel". Control is kept by following some simple but critically important rules:

- Everyone follows the lead of a facilitator, who controls the flow of the discussion.
- Only one person has the "floor" at a time - that person is determined by the facilitator
- You raise your hand to speak by typing a "C" for comment or "Q" for question, then pressing "enter"
- The facilitator will call on you when it is your turn by sending "GA" (for go ahead), followed by your name.
- When you are "talking" by typing your comments or questions, remember that the others cannot see what you are typing until you press "enter." You can break up a comment or question that takes more than one line by typing "…" at the end of a line, pressing enter, and starting a new line. Three dots at the end of a line tells everyone that you are still "speaking" and you will not be interrupted. "C" or "Q" may be sent by someone during this time, but those people will not get to state their comment or question until you have finished. The end of your last line of your turn should have a period, question mark, or exclamation point (whichever is appropriate) to cue the facilitator that you are finished. If you do not put any punctuation at the end of a line, it may not be clear to the facilitator and other participants whether you are finished or not, and the meeting can be delayed while they determine that fact.

There are some basic overall rules that also must be followed for the meeting to be successful. These are:

- An agenda must be developed and posted before the meeting. This is usually done by the facilitator, working with the "sponsor", or leader of the group that is meeting. In most cases, the sponsor should not be the facilitator of the meeting. The facilitator should not have a personal stake in the meeting so they can be as impartial as possible.
- All reports must be submitted before the meeting and posted or mailed so that everyone can read it before the meeting. Reports may not be "read" to the group at the time of the meeting, as this takes far too long and is just poor meeting practice!
- The meeting must start on time. It is even harder to sit staring at a computer screen than it is to sit in a meeting room with other people around when key people are late.
- Off-topic discussions and "sidebars" (one-on-one conversations) in the meeting "room" will not be tolerated during the meeting. You can have a sidebar conversation with someone by double-clicking on their name in the chat program. This is a totally private talk and does not disturb anyone else. The advantage of this technology is that you can hold this conversation in one window while staying in the regular meeting in another window on your computer screen. Although not recommended for your first few meetings, it is possible to hold numerous conversations and even meetings of subcommittees, etc while the main meeting is on. Just be sure that these distractions do not adversely affect the main meeting! You should also exercise caution by carefully noting in which window you are typing before pressing enter.

13.3 Electronic Meeting Systems

Meetings are a way of life in every business. Meetings can be a source of tremendous frustration. Meetings are also costly: put six people in a weekly staff meeting, and you've eaten up $10,000 worth of time. Total quality management, business process re-engineering, team management, and other techniques of the 90's aren't helping—most of these techniques actually increase the number of meetings people attend. Because meetings are so expensive and so inefficient and so dissatisfying, it's no surprise that there are lots of software developers working on tools to improve meetings.

These tools span a wide range of meeting assistance and support tasks. At the low end, software schedulers keep track of people, appointments, and resources to coordinate meeting times and places. In the middle are tools which help groups by improving communications. This includes conferencing systems and bulletin board packages, which extend "meeting space" outside of the meeting room by letting participants discuss issues without having to sit together. Other mid-range tools are designed to assist communications during a meeting. Video and audio conferencing hardware can be integrated with personal computers to link people in diverse locations for a single meeting. Shared drawing and editing tools also help groups work on a single document or share a visual concept easily.

At the high end are systems with much loftier goals: the complete reinvention of the meeting process. Developers of these systems have developed ways of completely changing the

way meetings are held, and they have numbers from customers proving massive and dramatic improvements in productivity. But these benefits come at a cost—attendees must stop thinking of meetings as a waste of time and start thinking of meetings as an opportunity to make decisions and share information.

Schedulers to Keep You on Track

The low end of the meeting support market focuses mainly on scheduling meetings and managing calendars. Although there are many products available for standalone use or which support only a single platform, only a few vendors have taken an enterprise-wide approach to scheduling. Even so, any organization with truly disparate platforms will find it impossible to find a vendor willing to support all popular platforms for this relatively simple task.

In evaluating group scheduling systems, network managers must keep in mind the underlying politics of scheduling. These are generally more important to the success of a group scheduler than quality of user interface or performance. If the group scheduler cannot successfully emulate people's behavior regarding their own personal calendar, then it will not be accepted into the workplace. Groupware of this type must fit into the organization; it is not reasonable to expect people to change the way they operate simply to accommodate an -appointment-scheduling program.

Spreading the Meeting Room Around

Traditional meetings are same-time, same-place activities everyone has to be in the same room at the same time. Software and hardware, which extends the meeting room across both time and space, can substitute for some face-to-face meetings, empower people in remote locations, and improve face-to-face, meetings by making everyone better prepared.

The oldest alternative to face-to-face meetings is **computer conferencing systems** (sometimes called bulletin boards, although purists make a distinction between the two). These conferencing systems grew out of multi-user systems and often: support both microcomputer and dumb terminal interfaces.

Most conferencing systems do little more than let people exchange information and follow a single message and its associated discussion. The largest multi-platform conferencing system of this type is the Usenet News system. With literally dozens of public-domain and commercial "news readers," and a good selection of minicomputer-based servers, a simple conferencing system can truly encompass all corporate computing platforms, including dumb terminals, all microcomputer systems, on up to window system terminals. Other commercial products which support multiple platforms include Digital's (800/DIGITAL) DEC Notes, Lotus' (800/522-6752) Notes, and Pacer Software's (800/722-3702) PacerForum.

Lotus Notes is one of the few products which can be extended to include additional group conferencing facilities, such as voting on issues, surveys, and anonymity. Conferencing systems with these facilities built-in are found in research projects more than commercial products, such as the New Jersey Institute of Technologys EIES (Electronic Information Exchange System) conferencing system.

The computer-equivalent of an audio-conference or video-conference is also available. Although some tools aim to replace face-to-face meetings with group type-fests, only certain narrowly defined meetings will benefit from these tools. Because typing is so slow compared with talking, a traditional audio or video conference is much more cost-effective than asking meeting participants to type Gin their comments and thoughts rather than simply speaking them. The Meeting Room does replace face-to-face meetings, but supplements them with audio-conferencing capabilities, either through a PC-based software/hardware combination or via a normal audio conference.

Group editing and drawing tools fill a different niche. These are meant to supplement face-to-face meetings or audio conferences by letting participants share a single view of a document or a picture. **Aspects** is a Mac-only version of this which lets networked systems share in the tasks of editing documents and pictures. Their Mac and Windows product, Whiteboard, gives cross-platform compatibility at a price—only shared drawings are supported.

Making Meetings Better

Let me explain how to make the meetings better with a product called GroupSystems. It isn't a single package. It's actually a suite of software tools (sixteen in the DOS version, fewer in the Windows version) which automate and enhance many of the processes which occur in meetings. A meeting using GroupSystems requires a personal computer for each participant and a "facilitator," someone to lead the meeting and choose which GroupSystems tool is most appropriate to the task at hand.

For example, suppose you want to have a meeting to help decide on a new name for your company. In the GroupSystems world, the meeting would look like this. First, participants in the meeting would brainstorm ideas using the Electronic Brainstorming tool. Each participant would enter as many ideas as they could think of during a defined time period, say 10 minutes. As ideas were typed in, GroupSystems would shuffle them around and send them to other participants. By seeing the ideas of others, presumably, you come up with your own possibilities.

GroupSystems advocates claim two advantages over manual meetings: participants can type in more ideas more quickly than anyone could possibly write them down because everyone is typing at the same time. Each idea is evaluated on its own merits, rather than based on who said it. Because tools like Electronic Brainstorming are anonymous, people who are normally afraid to bring up opinions in a meeting will be able to bring their best ideas without fear. ? In most professional meetings, this anonymity is rarely abused.

Once brainstorming was over, the facilitator would use another tool, the Categorizer, to put ideas into different buckets based on group opinion. Since brainstorming would likely have generated hundreds of ideas, it would be important to narrow them down into broad categories, such as "favorites," "maybes," and "disliked." In this phase, normal discussion would prevail—except the process of sorting the ideas would be assisted by computer.

Finally, participants would be asked to vote on the ideas. GroupSystems supports seven different kinds of voting. In this example, participants might be asked to rank their top ten favorite ideas. GroupSystems would tally the anonymous votes present totals on a screen in the front of the room. Before anyone left the one-hour meeting, the top ten names chosen by the group would

Changing the Face

GroupSystems does not augment existing meetings. When a company buys into, they are buying much more than a software package. To properly use the system, facilitators must be trained in maximizing meeting productivity using these tools—because GroupSystems changes the way companies hold meetings. Bringing in GroupSystems is not a trivial investment. GroupSystems requires a PC in front of each user, Windows or DOS, a LAN (any popular microcomputer LAN package will work) to link them together, and a facilitator's station to control the meeting tools. GroupSystems also uses a shared screen at the front of the room which has to be large enough for everyone to see. With a base software and training cost of $25,000, building a meeting room for GroupSystems -usually costs about $100,000.

GroupSystems doesnt require a dedicated room. In theory, it's possible to bring together a bunch of laptop PCs with network cards, stick an LCD panel on an overhead projector, and hold a GroupSystems-assisted meeting. Most companies, though, decide to allocate a space where GroupSystems is always available. If anyone can use the meeting room at any time, the reasoning goes, 1we'll maximize use of the equipment and software.

13.4 Electronic Discussions

We've all heard so much hype about the potential of computer mediated communication to revolutionize teaching that we've begun to dismiss it automatically. We need to recognize, though, that it's not *all* hype. Even once you've discounted the snake oil salesmen selling off-the-shelf electronic course guides, style checkers and "interactive" computer-assisted learning programs, in fact there are still some startling opportunities. There are many reasons to expect that computer-mediated written discussions — to pick the one that I'm most interested in — should afford unprecedented learning opportunities, combining the flexibility and interactive engagement of oral conversation and the power of written language to foster reflection and allow complex ideas to be accumulated, revised, extended and polished.

But there haven't been many demonstrations of this potential. Indeed, the most common consequence of setting up an "electronic discussion group" for a university class or a group of faculty at an institution, or a set of colleagues with common interests, is a flurry of initial greetings ("Hello, everyone, isn't it great to have this new way to communicate"), followed by an enduring silence. The flurry may last somewhat longer for students in class-oriented discussions — especially if participation is made a course requirement — but even in those cases, most often the quality of the participation quickly becomes perfunctory and unengaged . . . usually not long before the instructor quietly allows the requirement to lapse.

To think about why this happens, and what we might do to avoid it, it's important to be clear about what sorts of programs and situations we're talking about. For many people, "it's all e-mail," but that oversimplification masks some distinctions that are worth making.

There are a number of ways we can group such programs to help us think about the characteristics of the different kinds of thing we're talking about here. One is to distinguish between "synchronic" and "asynchronic" types. Synchronic programs work in "real time"; that is, you write, someone reads immediately, and the text is gone, usually scrolling up the screen to oblivion. These include structures ranging from Internet or local "chat rooms" to highly developed sites, where conversations take place in virtual environments which can be fairly richly detailed. On the other hand, "asynchronous" programs like list servers and bulletin boards tend more toward the status of written correspondence — or even publication. Messages persist (for instance, in your incoming mail) until they're read, and in fact can be easily saved after reading, and responded to at your convenience. Most programs used in classes other than computer-dedicated writing classes are of this latter kind.

It's important to remember that these categories aren't neat oppositions: programs aren't simply one or the other. In a synchronic conversation — as in oral conversations — it's possible (but difficult) to go back to something someone said earlier, to re-open a subject, even to save what someone said (with a tape recorder, for instance) and quote it at a later point. Similarly, there are synchronic elements involved in email or listserv exchanges — people can be online simultaneously while "conversing," making the time lag almost negligible. Further (also as in oral conversation), beyond a certain temporal point, subjects get passed by and are no longer opened in practice — in part because they're difficult to get back to; in part because the interest of the group and the momentum of the conversation has passed them by.

It should be obvious that one characteristic of all electronic communication is a tendency toward increased immediacy. It skews discourse, in other words, toward the synchronic. Not since there were multiple daily mail deliveries in 19th century London has it been possible exchange extended written communications at a distance more than a time or two a day. This potentially short time span between utterances is one of the properties of this sort of discourse that we'd expect to foster continuing, sustained conversation, and the kind of learning we think follows on that kind of engagement with literacy and ideas. Why it so rarely works that way is the question I want to try to deal with here.

Another way to categorize electronic discussions is by thinking of them as tending toward either of two extremes which are often characterized as "push" or "pull" technologies. In a "pull" technology, you have to *do* something to access the conversation. In traditional bulletin board program, for instance, you have to log in to the board and read the current messages (usually the program tracks your reading and only shows you the ones you haven't already seen). If you don't think to log in regularly, you drop out of the conversation. It's like having to go to the newsstand to buy your paper rather than subscribe to

it — with the additional complication that sometimes (perhaps most of the time) when you go down to the newsstand there's no paper to buy, and so it's pretty easy to get out of the habit of checking.

At the other extreme, a list server based program (one that redistributes email sent to a central address to everyone subscribed), is a "push" technology, in that messages *come to you*, whether you remember you're subscribed or not. Again, of course, these categories aren't neatly distinguished: you do have to log on to your system and check your email for those messages to come to you, so it's not entirely passive. But anyone who regularly uses a networked computer will probably have many motives for checking her email, so that can be taken as a given, like turning the car radio on. One would expect that "push" programs would generate more regular participation and contribution than "pull" ones; again, however, the difference isn't as strong as we might expect.

There are other important distinctions to be made among various ways of mediating electronic text, but the one with the most important consequences for teaching is one that was first made clear to me when I began to encounter the increasingly widely used programs based on the World Wide Web, which in some ways are a dramatically different kettle of fish. These programs use the graphic capabilities of the Web (especially Hypertext and HTML) to produce interactive sites which combine the advantages of list servers and bulletin boards, and which can be seen both as push *and* pull technologies — that is, you need to go to the site to post, but there is, or can be, email notification of postings as they occur, to remind you that there's a discussion in progress. More important, they do not isolate messages from their context the way the older bulletin board and listserv programs do.

That this was important first came clear to me as I considered that every bulletin board-style program has a built-in process whereby the program keeps track of which items you have already read, and does not present them to you again unless you specifically ask for them (and often getting them is extremely complicated). So, for all practical purposes they're not there, and thus the messages in front of you at any moment appear to have no past. Even to see the message the one you're reading is immediately responding to is it pretty difficult (most programs have conventions for including the text of the message being responded to, but this convention itself poses problems for readers not used to it). To go further back and see what may have come before the immediate message is, for most users, simply impossible in practice.

This is equally true for list server programs. If you're saving all messages, it's possible to get back to them — but very few users do this habitually, or have time or expertise to sort the saved message so they're readily accessible. Sometimes lists are "archived" on a Web or FTP site, and can be searched, but, again, this requires a relatively sophisticated level of computer expertise.

Equally important, the messages have, in one very practical and important way, no future either. As you're reading a message, you usually can't be sure whether someone else has already responded to it. Sometimes you'll be able to see a list of subsequent messages, along with their "subject lines," and be able to infer that one or more of those messages might be later responses to the one you're reading, but when you move on to check, the target message becomes part of that lost past. Once you've read the later messages, you can't easily go back to the one you wanted to respond to. If you're adept with computers, you might have saved it to a file, or printed it out, or moved from one window to another, but most of us don't do this. What in fact happens is that you don't respond to the message — either you find that others have already responded, or that they haven't but you can't get back to it to hold its text in front of you while you respond. After experiencing this a few times, you learn that if you're going to respond, you should do it immediately, before trying to look ahead — so, in practice, messages on bulletin boards and listserv programs have, in practice, no effective past and no effective future.

What this means for most users — and especially for most newer users — is that they don't, in practice, look back or forward at all. Thus their attention is focused on the immediate edge of the wave of discourse creation. And thus either they're dissuaded from entering a conversation (if you'd only heard — or could only remember — the last remark anyone made at a table, you'd be reluctant to jump into the exchange), or to responding immediately and without much reflection. Thus, often they find that the conversation tends to be repetitious and superficial. One of the common complaints of long-standing members of listserv groups is "we've been over that a dozen times," as new members, with no practical access to the past, join in. Another is, "why do I have to read the same trivial comment sixteen times, from sixteen different people?"

It is possible at least to imagine a situation in which the context of utterances is immediately and perceptibly available to the participant in a useful and accessible form, offering more functional information for planning and shaping the discourse: offering, in fact, what I call "back pressure" that is very similar to what a conversational dialogic situation offers to the creation of an oral utterance. It is possible to imagine a program which doesn't insist that you respond now or never, one that fosters reflect ion, using the power of written language to support extended and engaged discourse. It has recently become clear that alternatives are not only conceivable but also possible. New ways of structuring written discussions are appearing, using some of the logic of the traditional programs and adding new elements made possible by the development of the World Wide Web and the various "web browser" programs for navigating it. One program I am aware of which demonstrates this potential is called HyperNews, developed at the University of Illinois and currently available as freeware. Another is Ceilidh, designed by Richard Hughes in San Diego and also available at nominal cost (more information on them, and similar programs, is readily available on the Web. If you're interested, the addresses are listed below).

What such a program offers us, primarily, is a different, and more immediately visual (and more uniform, from user to user), way of presenting the list of read and unread postings, based on the cross-platform flexibility and graphic capabilities of the World Wide Web and web browsing programs. It makes

possible a number of activities that older programs for conducting, constructing and recording text-based discussions don't, and thus addresses these problems — including the disappearance of context.

The fundamental trick is this: instead of one message at a time, these programs present the entire conversation, displayed in outline form, with each message identified by a useful subject line and hot linked to the full text of the message. The structure of the display is very simple: the messages — identified by author and subject line — are arranged in an outline form hierarchy, with the structure of the relations among the messages marked by indentations. It might look rather like this:

- First message (A)
  - Response to message A (B)
  - Second response to message A (C)
- Response to message C (D)
  - Third response to message A (E)
  - Response to message E (F)
  - Response to message F (G)
  - Second response to message E (H)

One consequence of this, obviously, is that chronology becomes less important and the logic of he conversation more so. Another less obvious consequence is that the way the relationship is presented graphically is determined not by what subject lines the writers choose for their message, but by the actual relationship among them: if you respond to a message, your response will appear below it, whenever you choose to do so. This means that subject lines themselves can become more descriptive of the nature of the message. They don't always do so, of course, but the situation allows the reader to signal things about her message and still preserve its position in the graphic display (on a newsreader, changing the subject line would cause the message to start an entirely new category of message, beginning a new chain of message & responses — if, that is, anyone responded without, in turn, changing this new subject line).

What is most important about the fact that the program is based on the World Wide Web is that each message listing is a hot link, meaning that if you click on it, the message it designates appears immediately onscreen, replacing the outline list of postings. Going "Back" with the web browser returns you immediately to the outline; "Forward," to the message again. This ease of navigation back and forth from structure to discourse is an important part of the way such programs promote keeping participants in touch with the past and the future of each message — with, that is, the context of the discussion.

13.5 Electronic Publishing

Traditional publishing involves four steps. First the authors produce their material for review by editors working on behalf of publishers. Material found suitable for a publisher is then sent to be typeset, to format the content into individual pages with a chosen style. These pages are then reproduced in multiple sets by putting ink on paper, and are bound into individual books and journal issues. Finally these are distributed to the audience by post to mailing lists of subscribers, book club members, libraries with standing orders and people who order books on line, or through retail outlets like bookstores and news agents.

Computers have played certain parts in this process for some time. Authors use word processors to build up, revise and print the source material, and more complex typesetting software is used to format pages with humans putting in the required commands to specify type fonts and sizes; pages sizes and partitions; insertion of figures, equations and footnotes; linking parts from different sources, such as chapters by multiple authors or reproduction of existing material, into a complete volume etc.

Most of you would be familiar with MS Word, and some of you may have used Latex, which formats an ASCII text file with embedded type- setting commands, into a DVI file specifying the content of each page, and this is further processed using a DVI to printing file (such as PDF or Postscript) converter which specifies in minute detail what kind of symbol to put onto each page where. Desktop publishing software basically combines word processing with easy to use typesetting software so that an author or editor can produce camera ready pages to be sent to a printer on his own PC, while HTML is a desktop publishing language that specifies the content and format of single pages for output on a computer screen with provision to add colour, sound, video, etc. The old equipment that were used to do the job, typewriters, molten lead typesetting machines, even paper typesetting machines (to produce masters for offset printers) are hardly used these days.

While computers have also played some part in controlling printing machines and in helping with the mailing and selling of printed material, their impact there has been much less fundamental, since they have not changed the basic process of putting ink on paper and distributing the paper piles. This is a highly inefficient process since the paper contributes almost all the weight, but the information is only carried by the ink. It takes organization to record, store and move around all that heavy bulk. In fact, one reason authors have to go through publishers to publish is the latter control the physical distribution system: while authors can produce content and make copies on their own, they lack means to put the copies into the libraries and retail shops, or to use large mailing lists to send copies to readers.

The Internet has radically changed this: Content is now specified as modulations of electromagnetic waves, conducted instantaneously across the world via wires, satellite links and optical fibres, instead of ink on paper moved around on lorries and aeroplanes. With numerous search engines crawling the web looking at every page and cateloging the content, it does not take long before your pages would turn up in a search list of someone looking for related material.

In short, with the help of PC on Internet, anyone can write, format and distribute his writings in the most direct way. However, while this solves one problem, it creates a new sets of issues for authors and publishers: Content represented in this way is also easily reproduced, without any graphical quality loss nor the work of copying, collating and binding. The previous

exclusivity of control is now lost. For commercial publishing, the question is how to get paid when someone reads something you own. For scholarly publishing, the issue is establishing who published a particular piece of work at what time.

It is sometimes said that encryption would protect intellectual property rights: the material is stored on the web in a coded form, which can only be reversed if you know the decoding algorithm. But this is not really effective, because one can always make copies of the decoded result, whether text, picture or music, and give them to others, unless the decoding is embedded into the final display unit so that the user never gets the decoded file itself. However, I can still make copies for other users provided they have the same embedded decoding system which would work on the same undecoded files. To prevent this, you have to have several versions of the embedded decoding algorithms, so that the coded file that works with my system may not work with yours, but then the content provider will have to know which coded file will work for which user, making his system more complicated.

The idea of digital watermarking has also been suggested: a unique pattern is converted into a signal that looks like low intensity background noise, which is added to a picture or music file; when the reverse conversion is applied to the combined signal, the original unique pattern is recovered, so that if someone has a copy of the file, you can prove that the copy came from you by revealing the watermark in it. Unfortunately, this too is not a simple situation: I can take anybody's file, and run a program on it that would add a new watermark, and then claim that he stole the file from me. He will then have to prove that my program is a fake and is adding rather than revealing the watermark. The authentication problem is merely transferred to another domain.

Basically, the ownership issue of electronic publishing remains unresolved, but with most material on the web, the issue does not really arise as the authors/publishers are only too keen to give the content away, either as a kind of vanity publishing, or in hope of building up an advertising market so that income is generated in ways other than payments from the readers.

A small number of publications, such as Wall Street Journal, succeed in getting subscribers to pay annually to register, but expects that some readers will copy and email some of the articles to people who are willing to wait. The Microsoft online journal Slate tried paid subscriptions, but gave up after less than a year and reverted to free access. Some authors have tried putting their books on line a bit at a time asking for voluntary payment and promising to add the next bit after enough money comes in but this too has not worked out very well for those trying it.

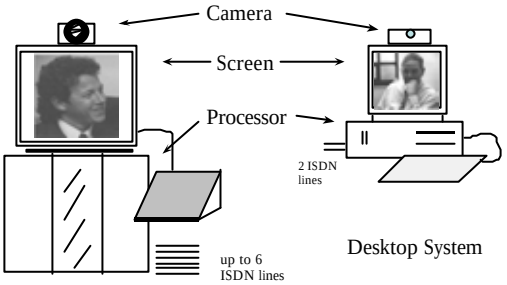
In any case, web publishing for a living remains a doubtful proposition; while printed material, being directly readable without equipment and hence easily portable, remain an important means of communication.

Points to Ponder

Information & Communication Technologies (ICT)

- Video Conferencing
- Electronic mail
- Satellite broadcast
- Computer conferencing
- World Wide Web

Video Conferencing

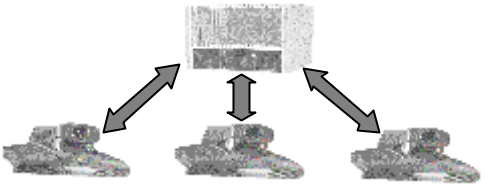


Video Conferencing

- Real time video – not streaming
- Has many uses
  - Business meetings
  - Distance learning
    - Lectures and talks (large groups of people)
    - Tutorial sessions (smaller groups of people)
  - Job Interviews
  - Court Hearings
  - One to one collaboration
- Video conferencing equipment known as endpoints

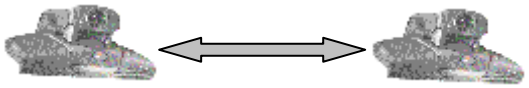
Types of Video Conference Multipoint

- Multipoint
  - Call can involve many endpoints (up to 24 within the APU system but it can run up to the 100's)
  - Requires a device called a Multipoint Control Unit
  - Dials out to sites automatically



Types of Video Conference Point-to-Point

- **Point to Point**
  - **Call involves 2 endpoints only**
  - **Similar to a standard phone call in that one endpoint dials the other directly**



13. 6 Summary

After learning about the various electronic communication systems, we may come to know the ways it uplift the efficiency of each individual in his corporate life and in turn the business activities performed are upgraded to a considerable extent. Of course, we can not forget the role of Internet and Telecommunication Technologies providing the base for facilitating the communication between individuals and organisations..

Review Questions

1. Explain the Importance of Electronic communications system in modern business scenario.
2. Briefly explain about Electronic Discussions and Electronic Conferencing.
3. List down the advantages of Electronic Conferencing.

Discussion Question

1. Discuss the features of electronic communication needed for a company to perform its operations across the world. Try to find out the considerations and cost associated with it. Can the company will get benefits out of this.

Application Exercise

Find out atleast two websites providing electronic conferencing facilities and try to identify the procedures.

LESSON 14 :
INTRODUCTION TO NETWORKS

Learning Objectives

1. To understand the concept of Networking
2. To know about the components available in Network
3. To realize the benefits of Networking
4. To study about the issues in Implementation and Maintenance of Networks

14.1 Introduction

Information and communication are two of the most important strategic issues for the success of every enterprise. While today nearly every organization uses a substantial number of computers and communication tools (like telephone or fax), they are often still isolated. While managers today are able to use applications like word processors or spreadsheets, not very many of them use computer-based tools to communicate with other departments or information retrieval programs. To overcome these obstacles in an effective usage of information technology, computer networks are necessary. They are a new kind (one might call it paradigm) of organization of computer systems produced by the need to merge computers and communications. At the same time they are the means to converge the two areas; the unnecessary distinction between tools to process and store information and tools to collect and transport information can disappear. Computer networks can manage to put down the barriers between information held on several (not only computer) systems. Only with the help of computer networks can a borderless communication and information environment be built.

Computer networks allow the user to access remote programs and remote databases either of the same organization or from other enterprises or public sources. Computer networks provide communication possibilities faster than other facilities. Because of these optimal information and communication possibilities, computer networks may increase the organizational learning rate, which many authors declare as the only fundamental advantage in competition.

Besides this major reason why any organization should not fail to have a computer network, there are other reasons as well:

- cost reduction by sharing hard- and software resources
- high reliability by having multiple sources of supply
- cost reduction by downsizing to microcomputer-based networks instead of using mainframes
- greater flexibility because of possibility to connect devices from various vendors

Because of the importance of this technology, decisions of purchase, structure, and operation of computer networks cannot be left to technical staff. Management as well has a critical need for understanding the technology of computer networks.

14.2 Networks: Meaning

A computer network is a connected set of autonomous computers. Normally each computer has its own operating system, a network operating system. Then the user is aware of the network and the different computers. In a network operating system a user must explicitly connect to other computers in order to communicate with them.

Client/server networks are networks that connect individual computers, known as “clients”, and one or more central computers, called “servers.” There are many types of servers, the most common being a file server. In a client/server network, the file server acts as a shared resource – a repository for files, such as documents, spreadsheets, databases, etc. Instead of storing these files on each individual machine, the file server permits storage on one central computer. In addition to the obvious advantage of reducing the possibility of multiple iterations of a single file, it allows the organization to have one centralized point from which to backup its files, as discussed fully below.

A distributed system is also a connected set of computers, but the system hides the existence of the network and the user is not aware of the different computers. A single system (operating system) runs on all computers and distributes work etc without the user’s knowledge or assistance.

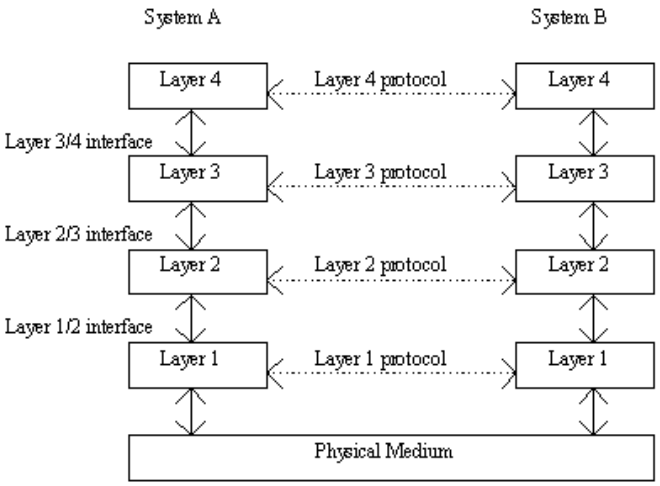
14.3 Network Basics

14.3.1 Standards

Standards play a significant role in the field of computer networks. Special-purpose development of communications hard- and software must be avoided because of its high costs and the need to interconnect devices from various vendors. Therefore some kind of international conventions are needed, which computer vendors can follow. They allow any computer following one of these standards to communicate with another computer following the same standard.

Standards are designed in a highly formal, structured way. To reduce complexity most networks are organized as a pile of layers or levels. The purpose of each layer is to offer certain services to higher layers, which these higher layers can use without knowing how they are implemented (they simply know what is called the interface). Thus, a layer n (service provider) offers a layer n+1 (service user) services, which are composed out of functionality the layers 1 to n provide. Only the same layers of two computers communicate through a so called protocol, which is a set of rules for communication at one layer. Of course, in reality no information is directly transferred between layers; the actual communication happens through a physical medium. A set of layers and protocols is called the network architecture.

Parts of a prototype network architecture



Some of the main design issues of computer networking occur in several or all layers, for example

- an addressing mechanism is needed in order to specify a destination
- rules for data transfer: one direction (simplex communication), two directions, but not simultaneously (half-duplex communication) or both directions at once (full-duplex)
- error detection and control
- control and restoration of right order of data
- synchronization of different speeds of sender and receiver

These and more issues have to be cleared by laying down a standard. Standards are technically implemented by adding control information (a header) to the raw data in every layer. So, actually transmitted are the user data plus some data needed by the network architecture to provide its functionality.

14.3.2 OSI model

The Open System Interconnection (OSI) Reference Model was developed by the International Standards Organization (ISO). It is an attempt to build a framework of layers, in which various protocols in computer networking fit.

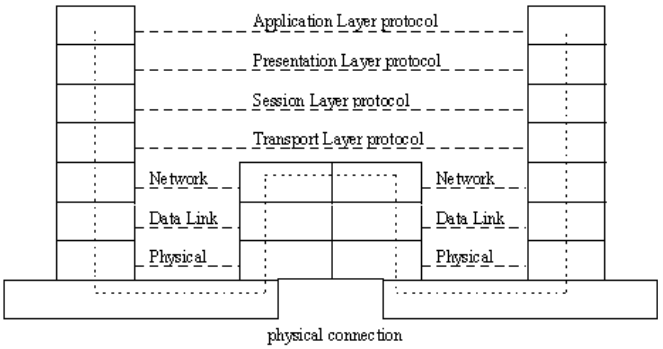
The OSI model consists of seven layers which are:

1. **The Physical Layer:** transmits raw data bits over a communication channel (mostly mechanical and electrical issues)
2. **The Data Link Layer:** guarantees to the network layer that there are no transmission errors by breaking the input data stream up into frames and sending back acknowledgement frames
3. **The Network Layer:** controls the operation of the involved subnet; main issues are routing (determine a way from source to destination) and dealing with problems of heterogenous networks, e.g. different size requirements of transmitted data blocks
4. **The Transport Layer:** splits up data from the session layer if necessary (segmentation) and ensures that the pieces arrive correctly
5. **The Session Layer:** allows users on different computer systems to establish a session between them, i.e. they are able to transfer files or log into a remote system; the conditions of communication are laid down, for example full-duplex or half-duplex
6. **The Presentation Layer:** unlike the layers before it is concerned with the syntax and semantics of the transmitted information; it is concerned with all aspects of information representation such as data encoding, data compression and encryption
7. **The Application Layer:** contains a variety of commonly needed protocols like handling with different terminal types and file systems; a label to identify the communication process, its origin and destination application is added to the transmitted information

Layers 4 to 7 are true end-to-end layers; i.e. the layer on the source system carries on a communication process with the same layer on the destination system. In the lower layers the protocols are between a system and its immediate neighbour, for example the source system and a system “on the way” to the destination.

A communication between two systems via a relay system (another computer or an interconnection device), causes the following flow of information between the OSI architectures of the involved systems:

Communication between two systems according to the OSI model



Note that the OSI model does not lay down the specific protocols used to communicate between two computers on a specific layer. Although ISO recommends which protocols to use with the OSI model, the model itself is in proper speaking no standard of computer networking. Which protocol in a single layer is actually used, depends on several factors like the physical network, the needed reliability, etc.

14.3.3 Classification of networks

Computer networks can be classified based on several factors, for example bandwith, common applications, common hardware. The most known classification is based on the physical size of the network. Such a classification may look like this:

Interprocessor distance	Processor located in same...	Example
0.1 m	Circuit Board	Data Flow Machine
1 m	System	Multiprocessor
10 m	Room	LAN
100m	Building	LAN
1 km	Site	LAN
10 km	City	MAN
100 km	Country	WAN
1000 km	Continent	WAN
10000 km	Planet	Interconnection of WANs

Data Flow Machines are highly parallel computers with many processing units working on the same task. In Multiprocessor systems the single processors communicate via shared memory.

More important in practical use are:

- LANs (Local Area Networks), for example a computer network in a company's department
- MANs (Metropolitan Area Networks), for example a cable television network within a city
- WANs (Wide Area Networks, Long Haul Networks), for example an ISDN network

14.4 LANs: Basics

In today's usage of computer networks Local Area Networks (LANs) are most important. More than 50% of all installed computer systems in organizations are connected to a LAN. This means, on the other hand, that only the organization itself is responsible for the selection and operation of their LAN. Other than with WANs or MANs there are no legal or political restrictions.

LANs can be characterized with the following points:

- the network spreads over a small area, e. g. a single building or a cluster of buildings
- the network consists of one transmission medium used for all operations within the network
- the network runs at a high speed (from 1 Million bits per second to 100 Mbps)
- it is a peer-to-peer network, that is, any device within the network can exchange data with any other device
- it is owned by a single organization, which is responsible for its operation

LANs can be distinguished in four major points:

1. the topology of the network: bus or ring
2. the wiring layout: linear or star
3. the used transmission medium: twisted pair, coaxial cable (baseband, broadband), optical fibre
4. the used medium access control technique: CSMA/CD or token-passing

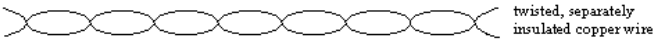
Together these points determine cost, capacity, effectiveness and performance of a LAN. What is more, they determine whether two LANs can be easily connected, a necessity that has become obvious during the last few years. The single points are not independent and cannot be decided in isolation.

14.4.1 Transmission Media

There are three major forms of transmission media used for LANs:

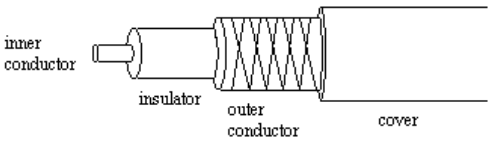
- twisted pair: two insulated copper wires twisted together in a regular spiral pattern; one pair establishes one communication link; it transmits electromagnetic signals. Twisted pairs are distinguished between shielded and unshielded twisted pairs according to their protection against electromagnetic fields

Sketch of a twisted pair cable



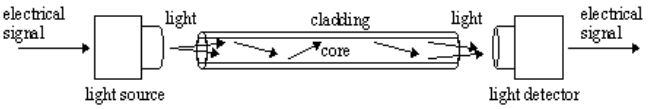
- coaxial cable: a single insulated inner wire is surrounded by a cylindrical conductor which is covered with a shield; it transmits electromagnetic signals. Coaxial cable is classified into two categories: baseband (uses digital signals) and broadband (uses analog signals) coaxial cable

Sketch of a coaxial cable



- optical fibre: consists of three concentric sections, the core (a fibre conducting optical rays), the cladding (reflecting optical rays) and the jacket (surrounding one or many fibres to protect them); transmitts optical signals, which must be transformed to electromagnetic signals

Sketch of an optical fibre

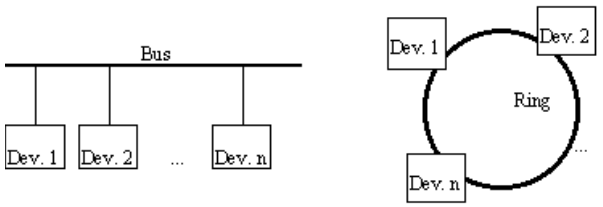


Each transmission media has its own advantages and disadvantages. They differ in costs, capacity, possible length, and electromagnetic isolation. Which media to be chosen depends on three other characterization features of LANs: firstly, which topology is to be implemented. Secondly, which capacity and reliability are needed.

14.4.2 Topologies and Wiring systems

The topology of a network is an abstract representation of how the devices in this network interact. One can think of different kinds of topology (also depending whether the network is a point-to-point or broadcasting one); for LANs bus and ring topologies are most important. The bus topology has the general advantage that it is more flexible to extensions and offers a bigger reliability. Unlike this, the ring topology on principle has a shorter over-all length of communication paths.

Bus and ring topology



In both topologies data is transmitted in form of packets which contain a header which specifies the destination of the packet. For each packet a system wants to send, it waits for its next possibility (determined by the used MAC technique), then sends the packet. The destination system copies the packet, as it is passing by. All other systems let the packet just pass by. With bus topology a packet is absorbed by a terminator at the end of the bus. With ring topology it is removed when it reaches the sending system a second time.

The topology has to be distinguished from the wiring system, i. e. the actual path the cable follows. Although this seems to be an issue that can easily be neglected, it is one of the most difficult problems in data communications. The actual wiring is constrained by physical needs like walls and floors in buildings. Therefore linear wiring (wiring exactly following topology) often is impossible. Alternatively a star wiring can be used, which concentrates all the wiring in one room or closet and uses an individual cable to each device within the network. This method also increases the reliability of ring topologies, but it increases path length as well. A given topology can be transposed in a star wiring system as follows:

There also exists a general wiring standard (EIA/TIA-568) for commercial buildings that supports a multiprotocol, multivendor environment. The goal of this standard is to enable laying out of wiring systems without exactly knowing what telecommunication products will finally be installed.

14.5 Internetworking: The Internet, TCP/IP

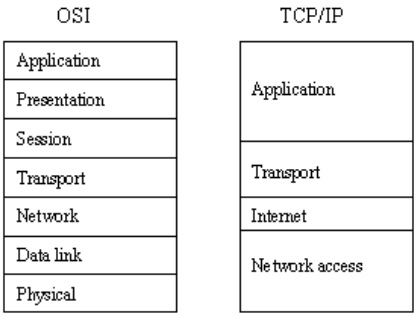
The aim of internetworking is to connect two or even more networks with the result that they look like one single, virtual network to the user. This network is called an internet; the networks it consists of are referred to as sub-networks. To reach this goal different interconnection devices are needed.

Internet with a capital “I” refers to a worldwide internet built of large national backbone networks. So, the Internet is a connection of WANs. The Internet provides the following applications in an international scope:

- **Simple Mail Transfer Protocol (SMTP):** allows to send electronic mail (E-Mail) to thousands of other computers all over the world
- **File Transfer Protocol (FTP):** allows sending and receiving files from one system to the other under user command
- **Telnet:** provides the capability to log on to a remote computer system. The user then is able to act as if directly connected to that system.
- **Network File System (NFS):** enables the user to work with a remote file system, as if it were on the local computer (transparent)

Unfortunately, the Internet does not work with protocols according to the OSI model. Instead it uses its own suite of protocols called TCP/IP (Transmission Control Protocol/Internet Protocol), named after two involved protocols. A comparison between OSI model and TCP/IP protocol suite shows the differences:

Comparison of OSI and TCP/IP

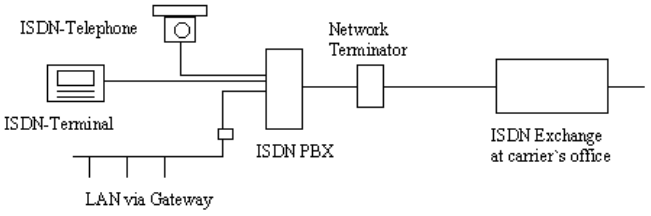


The protocols of the Network access layer are not specified by TCP/IP. A protocol appropriate for a particular network is used. The Internet layer protocol is IP (Internet Protocol); transport is handled by TCP (Transmission Control Protocol). For the Application layer the above mentioned SMTP, FTP, Telnet etc. are laid down.

14.6 ISDN: Basics

For a long time the telephone system has been the primary communication infrastructure. But it was designed to transmit analog voice data und therefore inadequate for other (digital) needs of data transmission, for example fax or video. The major goal of the new Integrated Services Digital Network (ISDN) is the integration of voice and non-voice services via a full digital network, which would replace the telephone system (and therefore is a point-to-point Wide Area Network) step by step. The idea is not to offer the highest possible speed, but a universal connectivity. If higher capacity for one application is needed, several independent connections can be combined to create a single, high-speed end-to-end connection. A possible ISDN configuration may look like this:

Possible ISDN configuration at client's office



The basic idea behind ISDN is the digital bit pipe, an abstract pipe between customer and carrier through which bit flows. It does not matter what kind of source produced the bits. In terms of the OSI model, ISDN provides a physical layer service onto which layers 2 to 7 can be built. ISDN uses the out-of-

band signaling concept, which is quite different from how Local Area Networks work. They use the same cable with interleaved actual data and control data. ISDN transmits actual data and control data in two different ways (normally, on so called B- and D-channels) at data rates up to 2 Million bits per second (most common are two B- and one D-channel, which is 144 Thousand bits per second).

A comprehensive summary of ISDN is available. A special ISDN page contains links to many sources about ISDN, in particular to lists of ISDN products.

14.7 Network Management: Selection and Validation

The selection and validation of networks (which in most cases will be LANs) is a subject which should be handled in a systematic and comprehensive way. The first phase in this decision process is planning the system. This can be done in three steps, similar to the planning process in general.

1. **Defining Objectives:** define what the system is supposed to do. This should be as quantitative as possible and related to the creation, storage, transfer and processing of information. The goals must be based on the present situation, which can certainly be improved. The whole environment of the planned system should be looked at; there should be no restrictions at that point of the process. This leads to some key product goals from which more specific system requirements can be derived.
2. **Describing the System:** describe some options to achieve these goals. There will be no real improvement by only buying new equipment. Organizational and procedural improvements and adjustments are the basis for the implementation and operation of an effective computer network as a technological improvement.
3. **Determine Communication Needs**: explain how information has to be moved, what the network has to do. Network requirements have two major points: compatibility (the possibility to connect the devices) and capacity (maximum performance of the net). Thus, the selection of a network should take into account interconnection with other networks and future growth of the network.

In a second phase possible networks (and vendors) have to be tested to the following selection criteria:

1. total costs must not exceed expected savings
2. the network has to meet the established requirements and to provide the needed services
3. network must be expandable with only incremental costs
4. network is reliable (total network failures are prevented)
5. network can handle equipment supplied by several vendors
6. ease of installation, maintenance, reconfiguration, interconnection
7. software availability

In particular the need to connect two or more networks together should again be emphasized. The selection of a small LAN often is very easy and obvious. Problems occur when this LAN has to be connected to another network.

In the two phases of the selection process the responsible person has to take in a different point of view.

14.7.1 Operation

The task of network management is to manage networks for efficient and reliable operation. This has become necessary because of the increasing complexity and size of networks. Costs for networks have become one of the most significant factors within overall budgets for computing and communication. Like management in general network management means to plan, supervise and control any activity concerning the computer network.

To manage large networks the help of automated network management tools is needed, so that the current status and behavior of the network can be analyzed. Those network management systems show the whole network as a unified system with the possibility to access information and change current behavior of every part of the network. Therefore every network node contains software to collect and store statistical data (network management entity). In addition at least one device in the network works as a network control center, which allows access and change of this data via a user interface.

The International Standards Organization (ISO) has defined a Network Management Architecture that specifies which functions have to be performed by a network management system and defines protocols for the exchange of relevant management data. It consists of five elements:

- **Fault Management**: detect and correct abnormal operation that requires management attention
- **Configuration Management:** control, identify, collect data from, and provide data to managed objects within the network; initializing and shutting down of network
- **Performance Management:** evaluate behavior and effectiveness of network; to accomplish this task appropriate metrics have to be established
- **Security Management:** manage access to network, encryption of data, log facilities
- **Accounting Management**: identify costs and establish charges

Many of today's small and mid-sized nonprofits have yet to take advantage of the numerous benefits of computer networking within their offices. This article will examine the different elements that make up networks suitable for these types of organizations, as well as the associated capital investment and maintenance costs, and other factors to be considered when designing a network.

14.8 What are the benefits of a Network?

Centralized storage of files is often the initial and primary justification for a network. Instead of having multiple iterations of documents and spreadsheets on disparate computers, files can be stored in a centralized location. This then allows another benefit of networking, centralized backup. With a centralized backup system, an organization's files can be backed up daily onto high capacity tapes. This helps ensure the long term integrity of the data.

The use of dial-up services and the Internet has grown tremendously. This growth has often necessitated the installation of a modem on each computer. Using a network, an organization can share a modem or dial-up connection to access the Internet or other dial up services. An inexpensive device called a router facilitates the sharing of your network's dedicated Internet connection, be it via dialup using a modem, ISDN, DSL, Cable Modem or T-1 line.

In addition, networks can help to reduce other capital investment costs as well. For example, modems, printers, scanners, and CD-ROMs are just a few of the devices that can be shared over a network.

A more recently developed benefit of networks with the advent of the Internet is the remote access of email and files. Using technology known as Virtual Private Networking (VPN), an organization can access its network remotely via a secure, encrypted channel by means of either a dialup or Internet connection.

14.9 What are the components of a Network?

Each computer on the network must have a Network Interface Card (NIC). A NIC is the computer's gateway to the network. The NIC attaches to the network via connection medium, usually a wire or cable, which attaches to the other computer. When there are more than two computers, their cables can connect to a hub. A hub is like the center of a tire with spokes emanating from it, each connecting to a separate computer or peripheral device. Hubs come in various sizes, defined by the number of ports or connections they offer. A switch is like an intelligent hub. A hub will broadcast a computer's request to every device on the network, while a switch will direct the request directly to the recipient's port. This helps relieve excess congestion and improve performance on the network.

Most networks also have one or more central computers called servers. A server is a powerful version of a desktop computer. They are designed to be the managers of the network, performing such functions as file, print and email servers.

Many organizations use routers in their offices today. Routers are devices that can connect separate networks together. They can be used to connect remote offices together, or to share an internet connection within the office.

To protect a network, a firewall is often used. Firewalls are devices that sit between your Internet connection and your network. Their function is to protect your network's security and ensure that no one breaks into your network.

Networks require Network Operating Systems. Examples of such Operating Systems include Windows NT, Windows 2000 Server and Novell Netware. Low and no-cost options are readily available as well in the form of the various versions of Linux.

14.10 What are the upfront costs of Networking?

14.11 What are the maintenance costs of a Network?

Network administration can be the most expensive part of managing your network. To properly support a network, it is necessary to have someone perform daily backups, install software, perform operating system upgrades, update virus software regularly and other important maintenance. While many organizations attempt to train an existing staff member to fulfill this role. It is also common to hire an employee on either a full or part time basis whose role is solely to support your network. This role will generally cost between $40,000 and $100,000 per year in recruiting and compensation costs.

In addition to the network support outsourcing mentioned above, an organization can outsource various other network functions to help control costs. Hosted email is growing in popularity. Instead of investing in a dedicated email server, server and client software, these service providers can offer robust email support using Microsoft Exchange for about $10-15 per month per user.

Summary

No organization is too small to reap the benefits of networking. Through the shared use of peripheral devices, centralized storage and backup and the shared use of Internet connectivity, networks can help raise the productivity of any sized organization.

Proper planning and design of an organization's network will ensure it has a system that will evolve with the organization's needs.

You will not become a competent network mangager or system administrator by following this lesson; neither will you become a serious network programmer. You will, however, understand a lot more about how networks work in general and in particular how the TCP/IP protocols (the ones used in Internet) work.

Networking Components

- Servers
- Workstations
- Printers
- Network Cards
- Hubs or MAUS
- Switches
- Routers
- Cabling
- Repeaters

Networking Topologies

- BUS
- STAR
- RING
- MESH

Servers, Workstations, and Printers

- Network Clients
- All Have a network Card of Some Sort
- Communicate via cable

MESH Topology

- All units are connected to every other unit
- Network unaffected by any loss of a unit
- Highest fault tolerance
- Very expensive to implement

What internetworks are

- Start with lots of little networks
- Many different types
  - ethernet, dedicated leased lines, dialup, ATM, Frame Relay, FDDI
- Each type has its own idea of addressing and protocols
- Want to connect them all together and provide a unified view of the whole lot

Review Questions

1. Explain the concepts and networks and its benefits to business organisations
2. Describe the OSI Reference Model and explain the various layers and its applications.
3. Write a short note on LANs.
4. Discuss the various issues related with the implementation and development of Networks.

Discussion Questions

1. Discuss the issues related to the security of data transmission over the network.
2. Find out applications where data is stored and maintained through Networks. Demonstrate the benefits associated with it.

Applications Exercises

1. Using the Internet, find at least two software packages that will back up data across a LAN. Briefly explain how the software functions and what components need to be installed. Estimate the price of the software for a network of four servers and 100 clients.
2. Design a network for University. Identify who will need access to the network; how many workstations you will need (and where to place them), the data, input forms, and reports users will need. Using the existing data, estimate the storage requirements and transmission needs. Specify how changes and growth will affect the type of network needed.

LESSON 15 :
BUSINESS DATA COMMUNICATION AND NETWORKS

Learning Objectives

1. To study the various kinds of networks present in the corporate world.
2. To Learn the concept of business data communication
3. To understand the role of networks in Information Systems of Enterprises

Introduction

In recent years, the world of communications has undergone enormous changes. In fact, the term paradigm shift has become ordinary in the information systems field. However, it is definitely an appropriate descriptor of the communica-tions industry. The primary focus of computer technology in the past was to provide processing power for increasingly hungry but traditional applications, such as word processing, spreadsheet, and database applications. While computing power for application processing is still important, today's computer buyers are paying at least as much if not more attention to the computer's ability to connect to networks. In fact, some computer systems (for example, network PCs and Web TVs) have been devel-oped primarily to connect to networks. These computers rely on other computer sys-tems connected to a network to do most of the processing. This change in emphasis is affecting how computer systems impact individuals, organizations, and society by placing more information, even more computing power, at everyone's fingertips.

Transmission of voice, data, text, sound, and images pervades computer information systems regardless of the size of a manager's computer resources. Consider the diver-sity of organizational tasks that now depend on some form of communications system, The laws governing communications also have been changing rapidly, opening up opportunities for competition between industry giants who had enjoyed monopolies in their areas or were at least restricted from entering other communications areas. The most recent change is the Telecommunications Act of 1996. The basic purpose of this act is to permit any business to compete in any communications market. The law blurs traditional demarcations in industry "turf." For example, cable TV companies used to be confined to offering TV entertainment. These same companies are now considering offering voice communications over their cable system and have already begun to enter the arena of data communications by providing Internet access to their subscribers. At the same time, more and more video and voice conversations are being transmitted over the Internet, and telephone companies have been given the right to provide cable service to their customers. Entertainment firms have begun to purchase or make alliances with telephone, cable, and satellite broadcasting compa-nies. Major TV networks have created alliances with major software firms, and local telephone companies have entered the long-distance telephone market.

Some PHS stations have begun to embed data in their TV broadcasts, allowing PCs with a special card installed to receive the data. Even power companies are considering entering the communications business because of the important rights of way to our homes and businesses that they already possess

After seeing the basics and the components of a network, now we are going to see the various kinds of network available in the corporate world and their benefits.

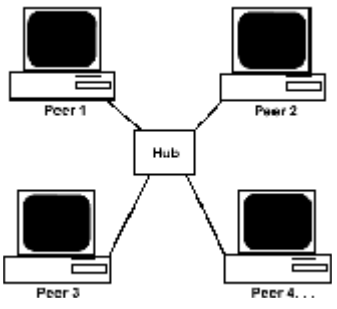
LAN

LAN stands for Local Area Network. These networks can consist of anywhere from two to thousands of computers. Even a simple network of one computer connected to one printer can be considered a LAN. Normally, LAN is a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radio waves.

Most LANs connect workstations and personal computers. Each node (individual computer) in a LAN has its own CPU with which it executes programs, but it also is able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chat sessions.

LANs are capable of transmitting data at very fast rates, much faster than data can be transmitted over a telephone line; but the distances are limited, and there is also a limit on the number of computers that can be attached to a single LAN.

Peer-to-Peer - Sometimes called P2P, these networks are the simplest and least expensive networks to set up. P2P networks are simple in the sense that the computers are connected directly to each other and share the same level of access on the network, hence the name. Computer 1 will connect directly to Computer 2 and will share all files with the appropriate security or sharing rights. If many computers are connected a hub may be used to connect all these computers and/or devices. The diagram below shows a simple peer-to-peer network:

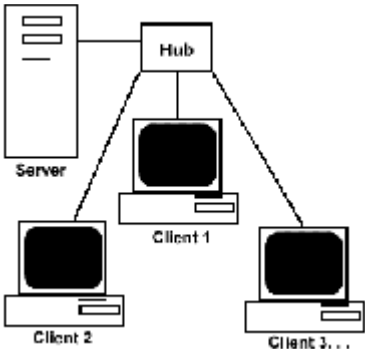


A peer-to-peer network is sometimes the perfect (and cheap) solution for connecting the computers at a small nonprofit.

However, peer-to-peer networking has its limitations, and your organization should tread with caution to avoid headaches (security issues, hardware inadequacies, backup problems, etc.) down the road.

Client/Server - Probably the most common LAN types used by companies today, they are called "client/server" because they consist of the server (which stores the files or runs applications) and the client machines, which are the computers used by workers. Using a client/server setup can be helpful in many ways. It can free up disk space by providing a central location for all the files to be stored. It also ensures the most recent copy of that file is available to all. A server can also act as a mail server (which collects and sends all the e-mail) or a print server (which takes all the print jobs and sends them to the printer, thus freeing computing power on the client machine to continue working).

Establishing the right kind of network for your organization is important to make the most of your time and money. While a peer-to-peer network is often a good choice for small networks, in an environment with more than 10-15 computers, a peer-to-peer network begins to become more trouble than it is worth: your computers start to slow down, you can never find the file you are looking for, and security is non-existent. If this is happening in your organization, it is probably time to switch to a client-server network by bringing in a dedicated server to handle the load. The server is called "dedicated" because it is optimized to serve requests from the "client" computers quickly. The diagram below shows a simple client-server network:



What is a server?

A server is simply a computer that is running software that enables it to serve specific requests from other computers, called "clients." For example, you can set up a file server that becomes a central storage place for your network, a print server that takes in print jobs and ships them off to a printer, as well as a multitude of other servers and server functions.

A server provides many benefits including:

- **Optimization:** server hardware is designed to serve requests from clients quickly
- **Centralization:** files are in one location for easy administration
- **Security:** multiple levels of permissions can prevent users from doing damage to files
- **Redundancy and Back-up:** data can be stored in redundant ways making for quick restore in case of problems

The client-server model of networking is the way to go for larger organizations. Once you have a client-server network set up, it should provide you with more flexibility than a peer-to-peer network as your needs change. For example, as network traffic increases, you can add another server to handle the additional load. You can also consider spreading out tasks to various servers, ensuring that they are performed in the most efficient manner possible. Most importantly, a client-server network is much easier to secure and back up, greatly improving the reliability and confidentiality of your data.

Wireless Networking

Wireless networking products have become more popular in the last few years due to an increase in competition among manufacturers and the emergence of a more dominant wireless technology standard. This section looks at the benefits and drawbacks of wireless networking and provides further resources for research into wireless products. Wireless networking refers to hardware and software combinations that enable two or more appliances to share data with each other without direct cable connections. Thus, in its widest sense, wireless networking includes cell and satellite phones, pagers, two-way radios, wireless LANs and modems, and Global Positioning Systems (GPS).

Wireless LANs

Wireless LANs enable client computers and the server to communicate with one another without direct cable connections. Generally, a wireless LAN is connected to an existing wired LAN, although they can exist without a wired LAN (in this case, users will only be able to communicate with other users on the same subnet).

Necessary components include an access point, Client LAN adaptors and the wired LAN. The access point is a device that translates between the wired LAN and the wireless LAN. The Client LAN Adaptors are PC cards, PCI or ISA boards that plug into laptop or desktop computers equipped with radio transceivers to communicate with the Access point. Other components to a wireless LAN can include Extension Points and Directional Antennas. Extension Points are devices similar to the access point, but not connected to the wired LAN. Extension points serve to extend the range of the wireless network by relaying signals from client computers to the Access point. Directional Antennas serve to connect wireless networks located at a greater distance from one another. Each network would have an antenna targeted at each other (known as a "line of site" connection).

How a Wireless LAN works?

In a typical wireless LAN configuration, the access point connects to the wired network from a fixed location using standard cabling. The access point receives and transmits data between the wireless LAN and the wired network infrastructure. A single access point can support a small group of users and can function within a range of less than one hundred to several hundred feet. End users access the wireless LAN through the wireless-LAN adapters installed in their computers.

Benefits of Wireless LANs

Cost: Wireless LANs can cost less to implement than wired LANs, especially in situations where implementing a wired LAN requires extensive labor and materials to install the wiring and drops. For environments that are difficult to wire (such as schools or temporary spaces) a wireless network can be more cost-effective in the long run than a wired one.

Simple / flexible to Install: Wireless LANs eliminate the time needed with wired LANs for laying and pulling wires, and can reach places that cannot be reached by wires.

Portability: Wireless LAN systems can move physical locations much easier than wired LANs, reducing total cost of ownership for organizations that are on the move.

Mobility: Wireless LAN systems can provide LAN users with access to network information anywhere in their organization.

Scalability: Wireless LAN systems can be configured for small offices and large, with peer-to-peer systems or large established LANs, specific to the localized need of a workgroup or across the whole enterprise. Wireless LAN systems grow easily with the need by adding more access points, client LAN adaptors and extension points. Wireless can be a good solution if you need to connect several buildings without installing a wired connection. Wireless LAN bridges can extend LANs that are typically one to five miles apart. These wireless bridges span multiple-building LANs without incurring the monthly costs of a T1 or higher speed lines.

Drawbacks of Wireless LANs

Cost: In environments with installed wiring or less demanding wiring needs, the up front costs of adopting a wireless LAN system can be more expensive than with wired LANs.

Interoperability: There are several competing technologies used by wireless LAN vendors to communicate data between hardware, with no ability for communication directly between systems using these different standards.

Interference: Most of the wireless devices today operate on 2.4-GHz radio bands, which are also used by cordless phones and most microwave ovens. The potential for interference when used near other devices sharing the same frequency band.

Speed: Most commonly used wireless LAN products are rated for a maximum 11Mbps throughput, and in practice see speeds about 80% less than this - some wireless LAN products are rated for speeds much less than this (HomeRF systems for example). Still quite speedy for most network needs and for broadband Internet sharing, but for larger offices with high network traffic and demands for speed, this should be taken into consideration.

Wide Area Networks (WANs)

Wide Area Networks or WANs are very large networks of computers. These networks span large geographical areas, generally covering a couple miles, sometimes connecting computers thousands of miles apart. A WAN can also be a collection of LANs, bringing together many smaller networks into one large network. A WAN can constitute a very large corporate or government network, spanning the country or even the world. In fact, the Internet is the largest and most common WAN in existence today.

Normally, it means a computer network that spans a relatively large geographical area. Typically, a WAN consists of two or more local-area networks (LANs).

Computers connected to a wide-area network are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites. The largest WAN in existence is the Internet.

Controller Area Network (CANs)

Last modified Abbreviated CAN, a serial bus network of microcontrollers that connects devices, sensors and actuators in a system or sub-system for real-time control applications. There is no addressing scheme used in controller area networks, as in the sense of conventional addressing in networks (such as Ethernet). Rather, messages are broadcast to all the nodes in the network using an identifier unique to the network. Based on the identifier, the individual nodes decide whether or not to process the message and also determine the priority of the message in terms of competition for bus access. This method allows for uninterrupted transmission when a collision is detected, unlike Ethernets that will stop transmission upon collision detection.

Controller area networks were first developed for use in automobiles. Equipped with an array of sensors, the network is able to monitor the systems that the automobile depends on to run properly and safely. Beyond automobiles, controller area networks can be used as an embedded communication system for microcontrollers as well as an open communication system for intelligent devices.

The controller area network, first developed by Robert Bosch in 1986, is documented in ISO 11898 (for applications up to 1 Mbps) and ISO 11519 (for applications up to 125 Kbps).

Campus Area Networks (CANs)

An interconnection of local-area networks within a limited geographical space, such as a school campus or a military base

Metropolitan Area Networks (MANs)

A data network designed for a town or city. In terms of geographic breadth, MANs are larger than local-area networks (LANs), but smaller than wide-area networks (WANs). MANs are usually characterized by very high-speed connections using fiber optical cable or other digital media.

Virtual Private Network (VPNs)

A virtual private network (VPN) is a private data network that makes use of the public telecommunication infrastructure, maintaining privacy through the use of a tunneling protocol and security procedures. A virtual private network can be contrasted with a system of owned or leased lines that can only be used by one company. The idea of the VPN is to give the company the same capabilities at much lower cost by using the shared public infrastructure rather than a private one.

A VPN connects computers located at various places throughout a city, a state, or even globally. It provides a secure network connection for distance computers and does not require laying cable to supply the connection. You can set up a VPN yourself (Windows 2000 server has settings to establish a VPN) or you can purchace one as a service from another company.

Home Area Network (HANs)

A HAN is a network contained within a user's home that connects a person's digital devices, from multiple computers and their peripheral devices to telephones, VCRs, televisions, video games, home security systems, "smart" appliances, fax machines and other digital devices that are wired into the network.

An Introduction to Wireless Networks for the Small/Medium Enterprise (SME)

Wireless Networking, WiFi, is not a new technology, but it is only recently that it has become mainstream. What are the benefits of wireless networks and should you be considering using it?

The advent of portable computing devices is one of the main drivers for the adoption of wireless networking. Today, around 50% of new laptops come wireless enabled out of the box. All of Apple's latest line of laptops comes with both wireless & bluetooth built in. Many Microsoft Windows laptops are similarly wireless enabled.

A powerful alliance of vendors joined together in 1999 to form the WiFi Alliance. You can be assured that any device approved by the WiFi Alliance will interoperate happily with any other approved device. The term WiFi has become corrupted in common usage to mean wireless networks in general, not just devices approved by the WiFi alliance.

Why adopt WiFi?

Today's workforce, equipped with PDAs, laptops and other mobile devices, demand access to your network from wherever they are, without the hassle of a fixed network. WiFi allows your business to deploy a network more quickly, at lower cost, and with greater flexibility than a wired system.

Productivity increases too, since workers can stay connected longer, and are able to collaborate with their co-workers as and where needed.

WiFi networks are more fluid than wired networks. A network is no longer a fixed thing, networks can be created and ripped down in an afternoon instead of the days or weeks required to create a structured cable network.

Architecture

Wireless cards can operate in two modes, Infrastructure and Ad-hoc.

Most business systems use wireless in Infrastructure mode. This means that devices communicate with an access point. Typically the access point also has a connection to the company wired network, allowing users access to servers and files as if they were physically attached to the LAN.

Ad-hoc connections are direct connections between wireless cards. This type of connection is more common amongst home users, but if used by business users could have serious management and security implications.

Management

You can easily connect to a WiFi network anywhere within range of an access point. This is a boon for your workers, but unfortunately, it also brings with it a few headaches for the IT department.

Security

Security is the bane of everybody who puts together a wireless network. access points, using factory default settings, are not secure at all.

So, if security is such a concern does that mean I shouldn't deploy WiFi? No, it doesn't. But it is something that you should bear in mind when in the planning stage.

When talking about security there is no such thing as having a completely secure system. Everything is insecure to some degree or other. The degree of security you require is dictated by the sensitivity of the information you possess.

If you require very high levels of security then you cannot rely on the built in security measures of a WiFi network alone. On the other hand, most small to medium sized companies do not require very high levels of security.

Integrating Enterprise Information on a Global Scale

In today's challenging business environment, companies are encountering levels of growth and change that can quickly make their business information systems obsolete. These enterprises are meeting this challenge by implementing real-time transaction processing systems to reduce cycle time, cut operation costs, and improve responsiveness to corporate users, customers, and vendors alike.

This section highlights the key factors that an organization must address when building a globally integrated business system. It also describes how 3Com Corporation implemented its own state-of-the-art enterprise resource planning (ERP) system using SAP R/3 business application solutions, the Informix OnLine Dynamic Server relational database, and 3Com's own networking systems and products. In addition, the paper touches on the advantages that the partnership between 3Com and Informix offers networking customers.

Thriving in a Volatile Business Climate

Many industries today are characterized by fierce competition, intense time-to-market pressure, and consolidation through mergers and acquisitions. Companies depend on their transaction processing systems to maintain a competitive edge, and to sustain business models that must constantly adapt to changing market conditions.

An effective business system is a marriage between information system (IS) and business process. When laying out a strategic plan and defining the underlying architecture for a new corporate transaction processing system, most organizations seek to achieve these primary objectives:

- Make business operations more responsive to customers and the needs of the enterprise by integrating logistical data into one global system
- Implement real-time transaction processing to provide online information access anytime, anywhere
- Develop processes that reduce cycle time for order fulfillment and minimize inventory and distribution costs
- Design a future-proof solution that can scale easily to accommodate growth
- Leverage technology to reduce long-term IS costs

Information technology has progressed dramatically in the last few years. It is now possible to integrate diverse functions more fully using software that offers better price/performance as well as plug-and-play modularity. The latest technology also makes it possible to combine data in a scalable, high-performance relational database, and to transmit the information globally over a reliable high-speed network.

A business information system may be divided into three major elements: the ERP applications, the database, and the network configuration. Each of these elements is equally important, and all of them must mesh smoothly to ensure a successful implementation.

Success Factors

Here are some key factors that can help ensure successful implementation of a large-scale business system:

1. Keep the network as flat as possible for simplicity and efficiency. Utilize switching for high performance where you can, and use routing where you must at the network's edges and where security is a key issue.
2. Resist the tendency to over design; you cannot cost-effectively design a completely fail-proof network. Rather, design the network so that a failure in one area will not impact the business processes across the entire enterprise.
3. Put all application and database servers on their own Domain Name Service. This will avoid single points of failure. Again, keep the applications environment as flat as possible.
4. Involve the network management organization as a peer member on the business system implementation team from the beginning. Application management and bandwidth management are *both* important.
5. Commit to extensive training for users and managers. In-depth training early in the process will minimize the negative impact on productivity of introducing a new system.
6. Engage a consultant to ensure successful implementation. 3Com benefited greatly from Price Waterhouse's experience in R/3 implementations.
7. Conduct stress testing up front. Be prepared for constant refinement of baselines.

Summary

LANs and WANs in general are similar in the sense that they are collections of computers. However, there are huge differences between the simplest P2P LAN and a WAN. Whereas it is fairly easy to connect two computers to each other and to a shared printer to for a simple P2P LAN, trying to build a safe and secure LAN takes considerable time and resources. Understanding your organization's needs, the size of the network to be built, the complexity, and the fundamental differences between the different types of LANs and WANs will help you to build the most effective network for your organization.

Points to Ponder

Centralized Data Processing

- Centralized computers, processing, data, control, support
- What are the advantages?
  - Economies of scale (equipment and personnel)
  - Lack of duplication
  - Ease in enforcing standards, security

Distributed Data

- Computers are dispersed throughout organization
- Allows greater flexibility in meeting individual needs
- More redundancy
- More autonomy

DDP Pros & Cons

- There are no "one-size-fits-all" solutions
- Key issues
  - How does it affect end-users?
  - How does it affect management?
  - How does it affect productivity?
  - How does it affect bottom-line?

Drawbacks of DDP

- More difficulty test & failure diagnosis
- More components and dependence on communication means more points of failure
- Incompatibility of components
- Incompatibility of data
- More complex management & control
- Difficulty controlling information resources
- Suboptimal procurement
- Duplication of effort

Benefits of DDP

- Responsiveness
- Availability
- Correspondence to Org. Patterns
- Resource Sharing
- Incremental Growth
- Increased User Involvement & Control
- End-user Productivity
- Distance & location independence
- Privacy and security
- Vendor independence
- Flexibility

Networking Implications

- Connectivity requirements
  - What links between components are necessary?
- Availability requirements
  - Percentage of time application or data is available to users
- Performance requirements
  - Response time requirements

Review Questions

1. What are all the different types of networks?
2. What are the differences between the client-server network and peer-peer networks? Which one will give better solution to a e-commerce based company.
3. How to integrate the information globally by making the data communication capability of computers?

Discussion Questions

1. Discuss the uses of networks and submit the merits and demerits.
2. Discuss the role of internet played in data communication.
3. Find out the process of business through Internet and try to know atleast TWO sites doing business through internet? How the data has been communicated from one point to another point

Application Exercises

Find out a company which will receive orders on-line from the customers. Observe the fields of the Order Form. Try to find out use of other items displayed in the same page.

LESSON 16 : TELECOMMUNICATIONS AND NETWORKS

Learning Objectives

1. To know more about the communication channels and the transaction media
2. To study about the telecommunication Technology and its uses in business scenario.
3. To know about the Information Super Highway.

16.1 Introduction

Even as we enter into the new millennium, the digital revolution is profoundly altering our socioeconomic fabric. The fields of data communications, telecommunications, distributed computing and networking has been changing so fast as to blur the distinction between these fields altogether. With phenomenal advances in networking, it is now feasible to link together desktop computers, minis and mainframes distributed across the globe to collaborate and enhance organizational productivity. The advent of numerous broadband technologies, the trend towards digital convergence, the lowering costs and increasing speeds of computer processor chips, the trends toward globalization in the industry are all driving a movement toward distributed computing. Scalability, Interoperability, Connectivity, Security, Agility, are but some of the key issues that a firm needs to focus on while building its networked information systems.

The most important aspect of this digital revolution is that it involves a bewildering array of technologies that are continually in flux; and this offers the manager with a new set of challenges. It is necessary to be able to understand and interpret these technologies, and evaluate them comparatively on a cost-benefit basis, and to see how different technologies may be deployed in a mix-and-match strategy, to make strategic IT investments. The manager who does not understand the trends in the technologies underlying the networks will suffer. Further, the entire spectrum of E-Commerce business models are based on exploiting key advantages offered by the underlying infrastructure. Designing new EC business models, evaluating proposed models, competing against existing models all require managerial insight into the opportunities and constraints posed by the technological infrastructure, as well as the agility to keep track with its changes and adapt quickly.

Thus, unlike ever before, the IS manager of the dot com era must have an elementary understanding of the technology that drives this economy, and an aptitude to continually refresh that understanding, as part of his or her arsenal, for survival. The most important constraint faced by E-commerce ventures is a shortage of managerial manpower, and the cost of interfacing between managerial and technological workforces. IS professionals with the training to meet this challenge will find endless opportunities in the market.

The content of this lesson is geared for the needs of an IS professional – it is not meant to be an engineering knowledge. We will explore pure technical issues as much as they are necessary to form managerial insights into various competing technologies. We will learn how to do evaluations of technologies for specific contexts, and make investment recommendations. We will examine the economic factors that drive convergence and the powerful economic effects of open standards and connectivity. Finally, this is NOT an e-commerce class. But, it will serve as an essential tool to understand e-commerce.

16.2 The Telecommunications Revolution

Anytime, anywhere, any way is the mantra of many computer users. Improving **telecommunications** technologies, the process of electronically communicating information, are making it possible.

The Marriage of Computers and Communications

You simply can't pick up a newspaper or magazine or watch television without hearing about the explosion of telecommunications and networks. Some experts point to the early 1990s and the breakup of the AT&T monopoly as the turning point in this revolution. That one incident, along with the growth in personal computers since then, could very well be how all this started. Those two forces now seem to be changing every facet of our lives.

16.3 The Information Superhighway

You can hardly keep up with the mergers and acquisitions in the telecommunications and entertainment industries. Many people compare the present-day Information Revolution to the Industrial Revolution at the turn of the 20th century. You can easily draw many parallels between the two.

You could also look at the development of our interstate highway system and the changes it brought as another example of how the information superhighway is changing things. Whole towns have sprung up around the interstate highway exchanges. Other towns have literally disappeared because they weren't located close to the interstate. Some businesses make it a corporate strategy to locate only at busy highway intersections.

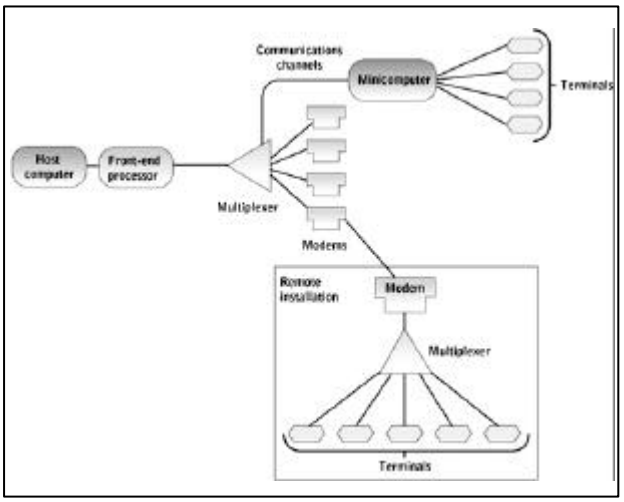
When most people think of the **information superhighway**, they immediately think of the Internet. But the many networks developed by private corporations and public entities are also part of the superhighway. All these networks together are creating what some pundits call "the death of distance." People and companies are developing whole new ways of working, playing, learning, and communicating.

We need to know how these networks are actually constructed and discuss the various elements involved in connecting all these computers. Knowing how it all works can give you insight into the changes that have taken place and an idea of

what the future holds. You can also get ideas about how you can take advantage of the future now!

16.4 Components and Functions of a Telecommunications System

The following Figure shows the hardware and software components of a telecommunication system. We'll be explaining how the pieces fit together throughout this lesson.



Components of a telecommunications system.

Remember that data moving across the Internet and other networks are not limited to text, but also include video, audio, and pictures. This fact alone explains many of the mergers between telecommunications companies and entertainment companies. They are starting to understand that there is a whole new way of delivering not just information, but also entertainment via networks.

Telecommunications System Components

Some people look at networks simply as one computer hooked to another by a piece of wire. Networks are a little more involved than that: There are many, many pieces of equipment between those two computers: look again at the above Figure. We'll dissect and examine the equipment and the functions each element serves.

The major element that gets all the hardware and software working together is the **protocols**. Let's say you attend a football game between the UK and Argentina. Can you imagine how confusing the game would be, not to mention unfair to one side or the other, if UK followed one set of rules while the Argentina used a totally different set? It's the same for computer networks.

Protocols are used to tell the hardware components how to transmit data within a network and between networks. They can also be thought of as a set of rules and procedures for exchanging information between computers in networks. They define how the various communication links are established, how information is transmitted, and how errors are detected and corrected between networks. Most important, the use of protocols allows different makes and types of computers to talk to each other.

Protocols are usually embedded in the software for the particular application that you want to use to complete a function on the network. If you've used the Internet at all, you've used protocols but probably didn't even realize it. Do these sound familiar?

- Hypertext Transfer Protocol or http, used for the Web
- Simple Mail Transfer Protocol or SMTP, used for email
- File Transfer Protocol or FTP, used to transfer files between one computer and another computer
- Transmission Control Protocol/Internet Protocol or TCP/IP, used to connect networks

The last one might have tripped you up a bit because it's not as obvious as the others. TCP/IP is the protocol that allows you to access the Internet itself through your Internet service provider or a direct connection through your school or workplace.

We noted that many companies are building interfaces to their databases that allow employees to pull data from dissimilar systems and assimilate them into a coherent output form. The use of the Internet Protocol within software programs is what allows that to happen.

Types of Signals: Analog and Digital

As we've said many times throughout this course, the computer understands only zeros and ones. Everything going into a computer system must be transformed into **digital signals**. In the networking world, however, most of the data are transmitted over telephone lines. These lines don't recognize zeros and ones. They only understand what are called **analog signals**. To change the signals back and forth between analog and digital transmission methods, you need a **modem**.

The purpose of a modem (modulator/demodulator) is to:

- Change digital signals from computers to analog signals that telephone lines can carry
- Change analog signals back to digital signals that the computer can understand

Communication Channels

A **channel** is the facility through which information is transmitted between physical locations in a network. That's just a fancy way of saying that a channel is the highway on which data travel. Think again about the interstate highway systems. The road surface on which you drive is a good analogy to a channel. The road can be built from concrete, blacktop, or combination of the two. The channels on the Information Superhighway can be built using combinations of materials such as wires, microwave stations, and satellites.

When the telecommunication companies want to wire a building, generally they run one major line from the main fiber-optic cable to the building. Then they can hook up individual computers and telephone lines within that building. When you do the same thing with individual homes, costs increase dramatically.

All the transmission channels discussed in this section combine to give you what seems to be a single clear channel from one physical location to another physical location. In fact, it is very

likely that when you access the Internet and call up the Gardening Web site, you are using a combination of twisted wire, fiber-optic cable, microwave stations, and satellites to get from your computer to the other computer.

When you transmit the latest information from the Garden.com Web site to your personal computer, the speed at which it moves across all the transmission media is measured in bits per second (BPS) or the **baud rate**. The **bandwidth** of a communication channel is measured by the difference between the highest and lowest frequencies that can be transmitted by that channel.

Communications Processors and Software

In most cases you won't use front-end processors, multiplexers, concentrators, or controllers on your personal computer. These pieces of equipment are used on larger networks and are reserved for the techies. They are interesting pieces of the puzzle, though, so let's go ahead and look at them.

Sometimes the host computer on a large network gets overloaded processing data, monitoring transmissions, controlling the system, etc. That's where **front-end processors** come in handy. Front-end processors don't store data or application programs. You can't use them for general computing. This type of computer does nothing but process the electronic transmissions between computers on a network system. It's there to relieve the host computer from transmission processing so the host can serve your basic computing needs.

A **Concentrator** is a telecommunications computer that collects data signals and holds them. When enough signals are collected, the computer sends them on to the host as a batch. A **controller** computer simply processes signals between the CPU and terminals, printers, or other peripheral devices attached to the network.

Multiplexers are similar to front-end processors, but their location inside the network is different. Let's use a hypothetical situation that is becoming more and more common in businesses throughout the world. Suppose your local bank was bought out by a big bank in New York City. New York City, you scream. How can that be? Oh well, you sigh, how will I be affected? Probably not much. The local branch will still exist but will be electronically connected to the big bank. The home office will install a small network of computers, let's say 10 terminals, in the local branch.

Remember that each computer in a network must be connected to the other computers in the network and in turn, each computer must be connected to the host computer in the center of the network. Does it make sense for each of the 10 terminals to be separately wired to the host computer in New York? You'd have to use a separate telephone line for each computer - that's 10 telephone lines. Typically each terminal will only be used a small portion of the day. So if terminal 1 is transmitting only a few times a day, and terminal 2 is transmitting only a few times a day, and terminal 3 is ..... well, you get the idea.

What the New York bank will do is install a multiplexer component in the branch to which each of the 10 terminals will be connected. The multiplexer gathers the signals from each terminal and transmits them to the New York bank over a single transmission line. Now you're talking efficiency.

Routers

How does your Internet Service Provider manage to send your email to the right place? We're talking millions and millions of people sending email every day. If you ever noticed, each computer user connected to a network has a separate, individual address. No two addresses are exactly the same. All of these addresses are stored on various computers placed around the networks. Software stored on **routers** uses these addresses to route the data to the right location. Routers use protocols to help route data around the many networks to get them to their correct destination.

Routers also allow different types of computers on the various networks to "talk" to each other. If you are using a PC with a Windows 98 operating system, and you want to send an email to someone who is using a Macintosh computer with the MAC operating system, you can do that because of the router. Still puzzled? See if this helps: You own a LG television set hooked up to a cable service. Your neighbor owns a Sony television set and uses a satellite to receive programming. How is it that both of you can receive "Star Sports" at the same time? "Back-office" technology allows the signals to be adapted to various makes and models of televisions and to the varying methods of sending those signals through to your television. That's what routers do on a data network

The system of routers and associated transmission media form what's known as a **network backbone**. Think of your own body. Without your backbone, you'd have a tough time standing, sitting and moving. That's similar to a network backbone. All the computers, physical wires, wireless media, processors and software come together in a network backbone to give us a whole new way of communicating.

Protocols are the rules used in networks to ensure that transmissions can pass between the various components. Communication channels consist of wired and wireless media. Processors and software are combined with the protocols and transmission media to form a network backbone. Many small networks can be connected to form larger networks, which in turn can be connected to the Internet.

16.5 More Communications Networks

We have already discussed about the various types of networks in the previous chapters. Here, we will see the rest also in relation with this telecommunication technology.

Private Branch Exchanges (PBX)

In the past, a **private branch exchange (PBX)** was restricted to carrying telephone traffic. Now it's been adapted to carry data also, but only in a very small geographic area. For instance, if you have a small company with perhaps 15 offices in one geographic location, you could use a PBX to link your computers to shared printers and also use it for telephone traffic. It is a little cheaper to use this setup, although it would limit how much data you could send between the computers and any peripheral devices.

Value Added Networks (VANs)

So you're an entrepreneur or a very small company just starting out and don't have a lot of money to sink into computers, processors, and transmission media. You still want the capabilities offered by the technology, though. No problem; hook up with a **value-added network (VAN)** and you're in business. VANs offer the processing capabilities and latest technologies on a contract, pay-as-you-go basis. They are private, multipath, data-only, third-party managed networks used by many organizations. Outsourcing your network hardware requirements to another company can save you a lot of upfront money. Later on, when you're successful and growing, you can increase your processing capabilities with the VAN or go ahead and purchase the technologies on your own. The value added through a VAN is the technical expertise they offer in addition to the hardware capabilities.

Network Services

Think of going to the grocery store and buying a week's worth of food. For some of us that may be 20 packages of Maggi noodles; for others that could be quite a lot of food. You buy all the things, load them all in to your cart, and head for the checkout line. You pay for your food while it is being bagged. Assuming you bought lots of items, not all of them are packed into the same bag. You probably will have four or five bags, maybe more. You take them home, unpack the bags, and reassemble all your goods in the cupboard. You've just experienced packet switching.

Packet switching is a method of breaking large blocks of text into smaller chunks of data and routes them in the most economical way through whichever communication channel is available. When you read this lecture file on the Web, it appears as though all the data came into your client computer together. But they didn't. The data were broken into small packets on their way out of the server computer and then sent to and reassembled on the client computer. It happens so quickly and so efficiently that you don't even notice. Packet switching also checks transmission errors when data travel from one location to another. Make sure you read the text to understand the technical aspects of how packet switching operates.

Frame relay is a cheaper and faster way of sending data. It packages data much like packets but doesn't check for transmission errors. Therefore, you'd want to use frame relay only on very reliable transmission lines.

Many of us complain about the slowness of the transmission lines on our computers, especially if we are using the computer at home. Most telephone lines are slow, and the modems on our home computers are even slower. The telecommunication companies are working hard to remedy this problem and create technologies that will greatly increase the speed at which we access data on the Internet. One of the most promising technologies now is the **Asynchronous Transmission Mode (ATM)**. ATM ties all the disparate parts and pieces of a network into what will appear to the user as one. It is able to process transmissions and all kinds of data more efficiently and at a higher speed.

A few years ago, **Integrated Services Digital Network (ISDN)** was the Holy Grail of fast data transmission. It is a complicated technology to install on computers, especially personal computers, so its appeal has lessened.

The other emerging technology is the **Digital Subscriber Line (DSL)** which will increase the capabilities of the regular telephone lines to process more than just voice data. DSL will be able to carry voice, data, graphics, and video at a greater capacity than the current ISDN lines.

Since many home computer users already have cable TV installed in their homes, the telecommunications industry is using cable modems to pump data into the home via cable TV. Because the technology limits the data flow to one way, cable modem users still need a regular modem to send data out to networks.

Larger organizations, such as universities and corporations, can afford a **T1 line**, which support extremely high rates of data transmission. These lines are capable of carrying voice and data transmissions over 24 channels, which makes them ideal for larger networks. Because T1 lines are expensive, they are not something you'd install in your home.

The important thing to remember with all this new technology is that nothing is standing still. The telecommunications and computer industries are working at breakneck speed to improve and expand the networking experience not just for companies, but also for home users.

16.6 Enterprise Networking and Standards

It's likely that as a company grows, so will its networking capabilities and needs. Through **enterprise networking**, a company can build a new network and connect it to existing, separate networks. We noted earlier how different types of computers can be connected through the use of software so that you don't have to replace your current computers.

One way that companies are increasing and improving their current system technology without purchasing all new information systems is through the use of **TCP/IP protocols**. Remember we mentioned before that companies can create interfaces for different databases to access information without actually combining the data physically in one huge computer. They do so through the use of the Internet protocol (IP). Using this protocol, they can reduce the disruption to the organization and decrease the overall costs of adding to their networks.

Connectivity and Standards

Typically, individuals connect to the Internet through an Internet service provider. However, businesses have to create their own networks. In order to compete, organizations must create their own proprietary networks and measure how well their computers and computer-based devices communicate and share information. This measurement is called **connectivity**.

Computer users often lament the fact that it's difficult to share data between different platforms. Most of this problem is resolved through **open systems**: nonproprietary operating systems, user interfaces, and networking protocols. Open systems allow users to exchange data and information easily and efficiently without worrying about the type of hardware used on the individual computers.

Electronic Commerce and Electronic Business Technologies

Probably no other aspect of computing is proving to be as exciting and as challenging as E-commerce. Just a few years ago many corporations and businesses dismissed E-Commerce as a fad. Just the opposite has happened: E-commerce is growing at a tremendous rate. Companies, large and small, are struggling to develop their E-commerce capability and figure out how to do business on the Internet.

Facilitating Applications

What most businesses are starting to realize is that E-commerce is more than just throwing a nice-looking Web page with fancy graphics out on the Internet. You have to build new processes or change your existing methods. But it is extremely difficult to merge the old, traditional methods with the needs of the Internet. For instance, if you take orders for your business through email, who is going to monitor the email and process the orders? If you establish teleconferencing and data conferencing as a way of reducing travel costs and increasing collaboration with distant locations, what kind of equipment do you need and who will be responsible for maintaining that equipment? In fact, it may very well be more expensive to establish an E-commerce operation than to create or grow an "old-fashioned" business.

More **email** messages are sent each year than are regular letters through snail mail. Email is the most used Internet service. Free email Web sites are springing up every day. Email has the capability of quickly and efficiently relaying information to one or a hundred people. It's fast, convenient, and easily molded to an individual's needs. You can attach documents destined for an important client, the boss, or Grandma!

Voice Mail is available to business and now, to home users. Commercials portray Mom and Dad throwing away the ancient answering machine in favor of a voice mail system which has a separate area for each of the kids. Voice mail is an excellent example of how analog signals (voice) are transformed into digital data, stored on a central computer, and then later transformed back to analog signals when an individual retrieves messages. Just like email, you can keep the message, delete it, or send it to someone else.

With the advent of email and its ability to send documents around the building or around the world, why has the **Fax machine** survived? Because many small businesses and individuals still don't have connectivity to networks or the Internet and find it more convenient to use this technology. Now you can find hyper-machines that combine the technologies of a scanner, printer, copier, and fax machine all in one. They definitely save space on your desk!

Often E-commerce and E-business includes the capability of teleconferencing, data conferencing, and videoconferencing with employees or customers around the world. These may sound like the same technology, but they aren't. Here's the difference:

- **Teleconferencing:** basic technique of conferring simultaneously via telephone or email groupware
- **Dataconferencing:** teleconferencing coupled with the additional capability of working on the same document or data simultaneously
- **Videoconferencing:** teleconferencing with the additional capability of viewing participants via video screens
- **Groupware:** allows many people to work collaboratively across the room or across the world.

Electronic Data Interchange and Electronic Commerce

Electronic Data Interchange (EDI) allows two businesses to send documents to each other electronically instead of using the old-fashioned paper trail. While EDI does decrease the cost of manual systems and greatly reduce the chances of error, it is more expensive to set up than a Web-based system. Both ends of the EDI must have the equipment and software to handle the system and people must be trained in its use. These requirements have made EDI cost-prohibitive for small companies: they are essentially locked out of the opportunity to do business electronically with customers and suppliers. Web-based commerce is much easier for smaller companies because of the use of standard software and because they don't necessarily have to purchase special equipment or software. We'll look at Web-based or Internet-based E-commerce more closely in the next lesson.

The cost of doing business on the Internet is not easily apparent. Many organizational changes must be made which add to the bottom line. E-commerce and E-business involve more technologies than just computers: tele-, data-, and videoconferencing are vital elements of doing business electronically. Email is the most widely used service on the Internet. Businesses must consider using all available technologies and resources when tackling E-commerce and E-business.

16.7 Management Issues and Decisions

The Challenge of Managing Enterprise Networking

The television commercials make it sound so easy; "Just click here and you can start networking tomorrow." They fail to tell you about all the issues, problems, and opportunities you'll have with managing an Enterprise Network. So we'll tell you about some of them now.

As technology invades every facet of our lives, both at work and personally, the average person is becoming well versed in its use. Most of the time you, as a manager, can leverage this to your advantage. After all, what Joe in Production learns on his home computer can very well be incorporated into his computer use at work. However, you increasingly run the risk of renegades creating databases and programs that are incompatible with the rest of your system. It can cost you and the rest of the company a lot of time and money to rein in their efforts and ensure cohesion throughout the organization.

You do have to give the end users some latitude, though, so they don't feel stifled by the system. You just need to impress upon everyone the need to stay in touch with the rest of the organization and the fact that information is a companywide resource.

Organizational issues come into play when you are establishing or changing work methods in conjunction with networks and especially E-Commerce. Organizational cultures are powerful forces that you have to deal with and that have a pervasive influence on any organizational change.

We've alluded to it before, but it becomes very evident with networks that there are a lot of hidden costs. You can't just count the dollar cost of the necessary hardware and software. You have to consider the disruptions to everyday work while you're establishing the network. What about the extra training users require? It's not free! And you have to hire new people who have the expertise to build and maintain the network.

While we're talking about costs, what about the money you could lose if the network quits working **(downtime)** or its security is compromised? As soon as you hear "Oh this is a piece of cake" regarding networks, you need to grab the aspirin. The more complex your network, the more costly it will be. Not just to build it, but to fix it when it breaks down. You, as a manager, have the responsibility to manage your enterprise networking operations just as you would any other operation.

You have to:

- **Manage the changes.** These include reengineering the business processes taking place behind the scenes and the organizational changes affecting the people.
- **Train the people**. Include both the Information Technology staff and the end users in your plan.
- **Manage data as a vital organizational resource.** Determine your organization's vital data, who will be responsible for them, who will have access, and how you will determine accuracy and viability.
- **Plan for the future**. Hopefully your business will grow and so too should your network. Too often managers allow the network to lag behind the rest of the business; don't be one of them.

The Telecommunications Plan

Just as you plan for new opportunities in other areas of your company, you should have a telecommunications plan that spells out how technology can enhance your operations, increase your competitiveness and meet your customers' needs and wants. Approaching enterprise networking haphazardly will cost you time and money.

Where do you start? First, inventory your current equipment, your current processes, and your current needs. Determine where you are before you try to figure out where you're going. Then investigate opportunities your organization can take advantage of using networking technologies.

Your plan should mesh with your overall business plan to provide support for your organization. Compare where you are presently in your core business processes and where you want to go. How well does your telecommunications plan meet your business needs? You might be surprised to find through careful analysis and comparison that the two conflict.

Finally, take a look at the potential for telecommuncations to affect your organization. By giving your sales force better networking equipment, could you reduce the time it takes to process an order? If you increase the efficiency of your network, is it possible to increase the number of loan applications processed by each employee?

Implementing the Plan

Now that you know where you're going, how are you going to get there? To summarize the text:

- Determine the necessary topology: LAN, WAN, VAN, or Network Services
- Determine the type of services offered: Voice mail, email, teleconferencing, dataconferencing
- Determine the type and level of security: private lines, dedicated leased lines, public lines
- Determine the accessibility: multiple access for a thousand workers or limited access for a small number
- Determine the utilization: high-frequency, high-volume, low-frequency, low-volume
- Determine the cost: include development, operations, maintenance, expansion, and overhead
- Determine the installation difficulties: transmission media, hardware, software, and persware
- Determine the connectivity standards: getting all the pieces to work together

Assess your needs according to the information presented in this chapter and match the technologies to them. It's extremely hard work. The more planning you do up front, the more you understand all the issues involved, the less likely you'll later be managing a disaster.

16.8 Summary

While there are many problems associated with establishing and maintaining networks, they are a necessity in today's business environment. Managers have to understand the requirements of their business and then build a network accordingly. They also have to manage the necessary changes and remember to treat information as a valuable resource.

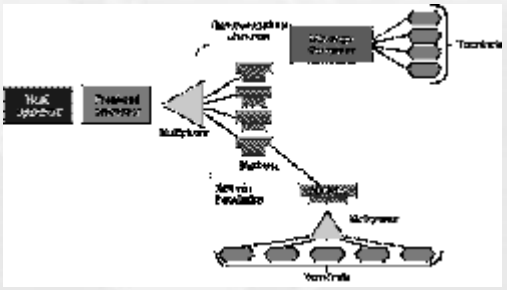
Points to Ponder

THE TELECOMMUNICATIONS REVOLUTION

- **Telecommunications:** Communication of information by electronic means
- **The marriage of computers and communications:** The 1996 Telecommunications Deregulation and Reform Act
- **The Information Superhighway:** High-speed digital telecommunications networks, accessible by the general public

COMPONENTS AND FUNCTIONS OF A TELECOMMUNICATIONS SYSTEM

Components of a Telecommunications System



COMPONENTS AND FUNCTIONS OF A TELECOMMUNICATIONS SYSTEM

Telecommunications System Components

- Computers to process information
- Terminals or any input/output devices that send or receive data
- Communications processors
- Communications software

COMPONENTS AND FUNCTIONS OF A TELECOMMUNICATIONS SYSTEM

Functions of Telecommunications Systems

- Transmit information
- Establish interface between sender and the receiver
- Route messages along most efficient paths

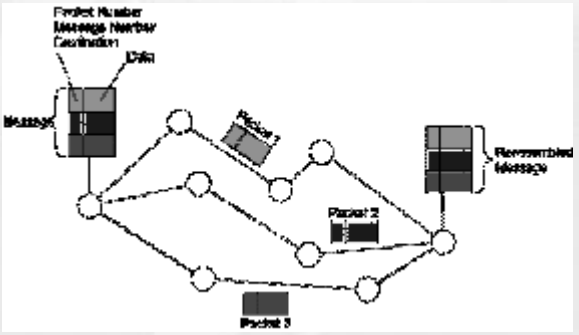
COMPONENTS AND FUNCTIONS OF A TELECOMMUNICATIONS SYSTEM

Functions of Telecommunications Systems

- Perform elementary processing of information
- Perform editorial tasks on data
- Convert message speed or format
- Control flow of information

COMMUNICATIONS NETWORKS

Packed-Switched Networks and Packet Communications



COMMUNICATIONS NETWORKS

Network Services and Broadband Technologies

Value-Added Networks (VANs)

- Private, multipath, data-only, third-party-managed network

Other Network Services

- Packet switching, Frame Relay, Asynchronous transfer mode (ATM)
- Integrated Services Digital Network (ISDN), Digital subscriber line (DSL), Cable modems, T1 line, Broadband

Review Questions

1. Describe a communication channel. Draw a picture of one showing the various transmission media that might be used.
2. Explain the components and functions of Telecommunication System
3. What are the advantages to small businesses in using a VAN? Explain it with an example.
4. What are some of the issues managers must face when they initially consider doing business on the Internet?

Discussion Questions

1. Try to find out the advanced technologies in Telecommunication in India. List down the leading Service Providers.
2. Discuss on the measures you have to consider in making your business through Internet.

Application Exercises

Do a detailed study in the Global Telecommunication Industry and try to find out the leading players in atleast FIVE Regions.

LESSON 17 :
THE INTERNET AND WORLDWIDE WEB (WWW)

Learning Objectives

1. To understand the concept of Internet and its components
2. To know about the capabilities of Internet and the benefits
3. To study the role of Internet in Information Management.
5. To know the role of managers as Internet Strategist

17.1 Introduction

A few years ago, the computer industry was bragging about 10 million people being connected to the Internet. Now that figure exceeds an astonishing 100 million plus people in the United States alone! The Internet is changing the way we work, play, entertain ourselves, and communicate with people all over the world.

17.2 The Internet

The Internet was developed in 1969 for the U.S. military and eventually spread to universities and civilian researchers. Because of its open structure, interest in its use began to grow beyond these exclusive groups. In 1990 a scientist named Tim Berners-Lee created a software program that he called the World Wide Web which allowed people to find documents on the Internet much more easily. This program allowed for the use of hyperlinks, which connect one document to another. In 1991 commercial use of the Internet was permitted for the first time and that is when its use started to explode. In 1994 the Netscape Communications Company (first named Mosaic) was formed by Marc Andreeson and Jim Clark to market a new software application for the Web called a browser. This graphical user interface allowed users to maneuver around the Web using a point-and-click method instead of text commands.

The Internet is best described by what it isn't. There is:

- No single computer
- No single control source
- No single entry point
- No single type of application

The Internet consists of computers spread all over the world, connected through wired and wireless transmission media, which contain software codes that allow them to talk to each other. That's it. If you tried to find a single "front door" to the Internet, you'd be looking for a long, long time.

Small businesses and individuals connect to the Internet through **Internet Service Providers (ISP)** such as AT&T World Net or a commercial online service provider such as Dishnet DSL. With recent mergers in the entertainment and Internet industries, some users can now access the Internet through their cable TV companies.

Internet Technology and Capabilities

As you can see from the following table, many services are available to you through an Internet connection.

Major Internet Capabilities

Capability	Functions Supported
E-Mail	Person-to-person messaging; document sharing
Usenet newsgroups	Discussion groups on electronic bulletin boards
LISTSERVs	Discussion groups using e-mail mailing list servers
Chatting	Interactive conversations
Telnet	Log on to one computer system and do work on another
FTP	Transfer files from computer to computer
Gophers	Locate information using a hierarchy of menus
World Wide Web	Retrieve, format, and display information (including text, audio, graphics, and video) using hypertext links

Email is the most widely used application on the Internet. America Online alone processes an average of 51 million email messages per day, according to the CNet Web site, April 3, 1999. The text explains the construction of an email address. What you need to remember is that the text input is extremely sensitive, so you must be careful when you enter an address. The best way to cut down on errors is to store addresses in an address book and use them instead of typing in an address every time. If you make it a habit to use the Reply function when responding to an email, you also reduce the chance for error.

In March 1999 a malicious virus called "Melissa" was sent throughout the world via email messages. The Computer Emergency Response Team at Carnegie Mellon University called it one of the worst viruses ever released. It created havoc with network servers and shut many of them down because of the tremendous number of emails it generated. This incident demonstrated how pervasive email is and yet how vulnerable it can be to hackers.

The most useful feature of email is the ability to attach files to an email message and send them to colleagues anywhere in the world. This feature alone makes it a valuable tool for telecommuters and for collaboration with co-workers wherever they may be located.

Information Retrieval on the Internet

We keep complaining about information overload, yet we crave more. The Internet provides access to data about any topic you can imagine. Keep in mind that false information is as readily available as true and correct information. Be careful about the source of the information you access.

Another useful technology for collaborative work is the **File Transfer Protocol (FTP)** application. Many companies and individuals use FTP to share documents among geographic locations. It's a little faster and easier than email, but you do need a special software program to use it. Some Web sites offer FTP as a way to move files from a server computer to client computers.

You can get many free software programs for Internet use from various World Wide Web sites. They are very good programs and are easily installed. In fact, many software production companies no longer stock their programs in retail stores and offer them only through their Web sites. This drastically reduces the cost of distribution, packaging and shipping, and allows the company to offer the very latest editions of their programs. It's much more convenient for consumers too because they can just download and install the programs right to their hard drive.

You can also use Web sites offered by software companies to download "patches" or additional features. A **patch** is actually software code that fixes bugs in programs. An excellent example of how convenient this process is demonstrated by the Melissa virus mentioned earlier. Within 48 hours after the virus was discovered, many companies had patches to detect the virus or protect their system from it available through their Web sites. If we were doing business the old-fashioned way, these patches wouldn't have been available for weeks. But then some of you will say that if we had continued to do business the old-fashioned way, we wouldn't have needed the patch in the first place!

When you purchase software now, either through a regular retail outlet or on a Web site, make sure you register with the company, because this will allow it to send you email messages regarding new products, improved products, or patches to existing products. You'll also be able to access its Web site for free technical support. Yes, you do give up information when you send the registration in electronically, but the advantages associated with the notifications and other services may be worth it.

Many computer companies have established Web sites that offer free and quick support for problems you may be having with their products - either hardware or software. You don't have to spend hours on the phone waiting for a person to answer. Most of the problems you have are probably common to other users, and the Web sites are a better way for you to get help.

17.3 The World Wide Web

The **World Wide Web** is a vast repository of data and information connected through hyperlinks. When you think about the fact that it didn't even exist ten years ago, it's amazing to realize how much it has permeated everything we do in our personal and business lives.

We discussed protocols before: these are the rules by which data are transmitted over networks. The Hypertext Transfer Protocol (http) is what allows the Web to operate. When you see a Universal Resource Locator (URL) address on a Web site it will always start with http://www. Most software browser programs now automatically insert the http for you so you can simply enter the URL address of the Web site you want to access, beginning with the www.

Hypertext Markup Language (HTML) is the common language with which you create Web documents. It is very easy to use and is now included in most common software applications such as Word, WordPerfect, Excel, etc. As the technology improves to include audio, video, animated graphics, and movies on Web sites, derivative languages such as Dynamic HTML, Java, and ActiveX are becoming more common.

There is a difference between a Web***site*** and a Web ***page***. A Web site has the short domain address such as www.prenhall.com. It is the central repository for many, many Web pages that will be included at the end of the address after the domain name and a slash. For example, www.prenhall.com/index.html is a Web page within the Web site for Prentice Hall. A Web page is a single document stored within the Web site and probably linked to other pages on the site.

Webmasters, people who create and maintain Web sites, are in hot demand because of the limited knowledge and experience most companies have with Web sites. Software application programs such as FrontPage 98 or Macromedia Dreamweaver can help you set up and manage a Web site. You can also use these programs to create single pages and store them on a Web host computer. Many Internet service providers such as America Online and Web sites such as Geocities also give you the ability to create and store your own Web page on their servers.

Which brings us to the matter of managing a Web site once you've created it? You should never create a page or a site and then forget about it. You must constantly manage the information resource and make sure that not only is the content current, but so are any hyperlinks you have with other pages on your site or other outside sites. Many Web site managers make it a habit to change the site or at least some pages on it monthly, weekly, or even daily, in order to keep it fresh. It's one way you can keep people coming back to your site; they will know that something new has been added.

Searching for Information on the Web

The lesson gives you the basic information for using **search engines** and directories. You need to understand and remember that the various search engines use different methods of helping you find information on the Web. You shouldn't restrict yourself to just one or two search engines but should try many different ones. You may be surprised at the different results you'll get using the same topic.

Search engines use special software programs to monitor the Web for new or updated sites or pages. When they reach a new site or page they analyze the contents and determine the category in which it will be listed. They then add it to their database so that it will appear on the search result list when someone enters the appropriate subject. You can also search for FTP sites, Usenet, newswires, business news, stock quotes, and weather using these search engine capabilities.

If you develop a site or page you can add your URL to the search engine so it will know your site is available. Many search engines don't require you to do this since their software

programs will eventually find your site, but you can speed up the process by registering with the search engines.

Some innovative entrepreneurs have established businesses that will register your site with all the search engines - over 400 of them - for a price. You can do it yourself with your time as your cost.

When you are searching for information, try using a search site which submits your inquiry to 25 different search engines and returns a complete list of the results. Dogpile.com is the most popular of these services. If you type in a topic such as "horse breeding" on the Dogpile.com Web site, it will submit the topic to popular search directories and engines such as Yahoo, Excite, Lycos, Infoseek, and HotBot. You tell the search service how you want the contents listed and in what priority. It's much easier and faster than visiting each search engine site yourself.

You also should be aware of the individual and business directories on the Web. You could call them the "Yellow Pages of the World." They act just like the Yellow Pages of your telephone book. In fact, most of the information listed in them is gathered from telephone directories. They are easy to use and are cheaper than calling your phone company information service; they are free!

Web Portals

Portals are Web sites which serve as a starting point for you whenever you first enter the Web. Portals can be set as the "home page" on your browser, the first page that appears when you open your browser program. The most popular portal at the present time is Netscape Netcenter. This site receives millions of hits per day. You can personalize a portal according to your preferences and get individualized information about the weather, news, stock quotes, and even your daily horoscope. Many also offer you free email accounts.

The Yahoo! portal site reports that it has 35 million registered users. Excite has 20 million. Lycos reports 28 million. At its official launch on Jan. 12, Go Network claimed 9 million registered users.

So what's in it for the portal Web sites? If it's all free, how do they make any money and stay in business? Well, it's free to you, but they make their money by selling advertising space for other companies and by gathering information about you and selling it to other companies. Some portals get a certain amount of money, maybe 10 cents, for every person who clicks from the portal site to an advertiser's site. If that happens a few tens of thousands of times a day, every day, they can make a tidy sum of money. They also give the services away hoping that you'll buy their other products. Some of them simply operate in the red hoping to eventually make a profit.

17.4 Intranets and Extranets

Net this, Net that, it's almost enough to drive you crazy! **Intranets** and **Extranets** are basically the same thing as the Internet and use the same operating methods. Intranets are restricted to the internal members of an organization and Extranets are limited to certain users outside of an organization who are given special access to the Web site. Access to Intranets and Extranets is controlled through the use of usernames, and passwords, plus **firewalls**, security software programs that keep unauthorized users out of the network.

The beauty of Intranets and Extranets is that they don't require any special software or hardware other than what you would use for the Internet. The easy-to-use software programs to create Web sites and pages give more people in an organization the ability to use these Nets for very creative purposes. Using these 'Nets can drastically reduce the costs of disseminating information to employees, customers, and suppliers.

Suppose you are the Human Resources Manager of a mid-size company and you are establishing a new employee plan. Of course you need to get the information out to the employees as soon as possible so they can sign up for the plan. Many of them will have questions and will want some help computing the benefits of their enrollment. You can quickly and easily set up a Web page that explains how to enroll and gives them an enrollment form right on the Web. You can have a Frequently Asked Questions (FAQ) page employees can use to read what other people are asking and also post their questions.

You can answer their questions on the FAQ page, which gives other employees the opportunity to see the information. An especially useful tool would be to include an online calculator to compute contributions and the rate of return on investments. Think of the time you and the other Human Resource Office members will save if employees can do all that on their own and don't have to visit your office.

Extranets are becoming very popular as a way for companies to get information to customers and suppliers quickly and efficiently. It's much less costly to put the information on the Extranet and it's faster to update the information than to have to print and send out paper updates. Some companies are using Extranets to replace EDI systems. Smaller companies that couldn't afford the cost of EDI are using Extranets as a way to allow online product ordering and shipment tracking.

17.5 Internet Benefits to Organizations

More and more individuals, organizations, and companies are turning to the Internet as an integral company resource for information because of the widespread use and acceptance of the technology, and because of the ease of use and relatively low cost. We can list down the benefits of using the Internet as below.

- Connectivity and global reach
- Reduced communication costs
- Lower transaction costs
- Reduced agency costs
- Interactivity, flexibility, and customization
- Accelerated distribution of knowledge **.2**

To be sure, there are costs associated with using Net technologies. But can you imagine setting up your own private network, which would have to be installed in all the other organizations you do business with? You simply couldn't do it. But you can establish a network that is connected to the Internet, which in turn is connected to the other networks.

The use of Intranets, Extranets, and the Internet is also proving to be the answer to many "road warrior" prayers. They

can quickly and easily connect to the home office to receive up-to-date information about products, services, or internal company information. And they can do it from airports, hotel rooms, their own homes, or the ski lifts at Vail. No other technology has ever given companies and individuals so many options.

What started out to be the kingdom of the nerds is now used by millions of people for such things as ordering prescriptions, garden plants, and even Tupperware. Your company or organization can now reach millions of people in ways that were never before possible with reduced transaction costs.

The many uses of Intranet, Extranets, and the Internet, are limited only by your imagination! The Nets are open 24 hours a day, seven days a week. The benefits of using these new technologies are a blessing to many companies.

17.6 What Is an Internet Strategist?

An Internet Strategist is an underused yet much-needed part of any contemporary business. Novell says an Internet Strategist "sets an organization's Internet direction through a thorough understanding of Internet technology and its possible use in increasing productivity, expanding an organization's marketing reach, and reducing customer support costs." The American Electronics Association calls an Internet Strategist a "marketing expert who can figure out how to handle marketing in a still-evolving new medium." I define an Internet Strategist as a Management Information Systems specialist who can solve business problems using new information technology. No matter how you slice it, any company hoping to survive in the new economy needs someone who can best utilize technology. An Internet Strategist fills that role.

What an Internet Strategist Provides to Today's Businesses

Changes in today's technology present more of a challenge than figuring out how to share the office calendar online. Clients, partners, and employees expect that a business will use technology as a tool to its fullest extent in every situation. Doing so is possible in most environments, but it requires two important components. First is an understanding of the extent of the technology's reach. Second is the talent to implement needed changes.

The Internet provides unlimited potential as a communication medium and as an application platform. Some businesses enjoy the breadth of the Internet at their virtual doorstep, but most struggle–spending far too much capital for far too little return. The presence of a strategic plan for using the Internet as a business tool greatly enhances the return on investment. This plan is an Internet Strategist's domain.

Many IS managers read about the newest technology and then try to find a place in their organization to implement it. An Internet Strategist starts with business problems and uses his or her knowledge of existing technology to create timely and cost-effective solutions.

An educational research organization I know of that needed a remote application failed to hire the services of an Internet Strategist. This organization's "internet Application" ended up a VB 5 client server application with a database that replicated itself in six locations via expensive phone lines. Only after it experienced a 22% failure rate and spent tens of thousands of rupees did the organization engage an Internet Strategist.

Such failures are all too common in the Internet industry. The proliferation of tools like Adobe Pagemill and Microsoft Frontpage lull business owners into a false sense of security about the Internet's perceived simplicity. Engaging a specialist who can translate business needs into Internet languages often makes the difference between a successful project and a tremendous waste of capital and manpower.

Complementary Roles of an Internet Strategist

An Internet Strategist interacts with the Marketing team, the Development staff, and the Operations department. An Internet Strategist usually works with the decision makers in each division, such as the Directors of Marketing, IS, and Operations. These positions aren't titled the same in every organization, but all organizations contain them. An Internet Strategist enjoys a different relationship with each position.

The Director of Marketing is usually most interested in using the Internet to advertise, market, or sell. Advertising shows potential new customers the product; marketing convinces prospects that the product is what they want; selling consummates the deal with a customer. An Internet Strategist's place in these processes is to best utilize the company's technology and the Internet's opportunities to build a system that will maximize profit potential. To do so, an Internet Strategist is primarily tasked with reviewing marketing strategy while remaining mindful of both the possibilities and limitations of the Internet medium. An Internet Strategist must be able to say, "You can't do that," but also must be able to say, "You can do it this way, and it's much cooler."

Any Internet-related role is often associated heavily with a company's Information Systems division. In fact, the IS Director often fills the Internet Strategist role. When he or she does not, however, the two players must communicate closely. Developing internal systems and using the Internet in those systems are two remarkably similar tasks that require remarkably similar tactics. Planning is at the core of this close relationship. Both positions require the ability to look out two or even five years to create network strategies.

In general, an Internet Strategist does not own many processes within a company–with the occasional exception of the corporate web presence and intranet–but he or she acts as a forum for interaction between several business units. This function requires an unusual set of skills.

Skills Expected of an Internet Strategist

When working with Marketing, Operations, and Development, an Internet Strategist's greatest challenge is to translate between the specific languages each division of the business uses. This is like having a communications graduate, an engineering graduate, and an MBA all rolled into one employee. Marketing, Operations, and IS experience is mandatory, but the skills that complement this experience are even more varied and unusual.

Business skills learned in school will include conceptual accounting, statistics and high math, and technical writing and communication. Technical skills should focus on system and

data design and object-based methodology. Language doesn't matter. Languages come and go on the Internet, but good design lasts forever.

Practical skills vary even more. Real experience building web applications is a must. The Internet Strategist is not a froo-froo management position. Hands-on, up-to-date knowledge of how this all is done is an absolute requirement in order to best translate the needs of the business-side units for the technology builders. This falls into one of two categories: Microsoft builders (InterDev, Visual Basic, IIS, SQL Server, Windows NT) or Java builders (Java, JSP, OAS, Oracle, Solaris). The ability to use the Internet in daily business–e-mail, web, file transfer tools, instant messaging, streaming media–is another requirement of the same depth. Knowledge of the network layer also is expected.

On the business side, writing is most important, followed by an understanding of the sales and marketing processes. Other skills many have found helpful include statistical analysis, business experience in several industries, PC skills (such as with Office), traveling experience, reading comprehension, a firm grasp of several sales processes, and creative graphic arts.

An Internet Strategist uses management, engineering, and marketing skills and knowledge to produce vital advice about the use of a tool that is growing so fast that Inc. Magazine says that four months are like a year. Part of any vital company, not just technology companies, an Internet Strategist provides the glue to hold together the IS, Marketing, and Operations sides of a business in this rapidly changing world. An Internet Strategist can save your business. Don't enter cyberspace without one.

Note -

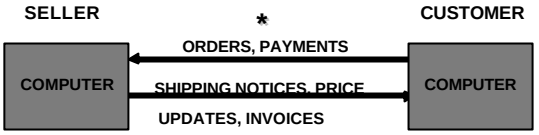
Points to Ponder

ELECTRONIC DATA INTERCHANGE (EDI)

COMPUTER - TO - COMPUTER

EXCHANGE BETWEEN TWO ORGANIZATIONS

OF STANDARD BUSINESS TRANSACTION DOCUMENTS



INTERNET CAPABILITIES

- **E -MAIL: person -to-person messaging; document sharing**
- **USERNET NEWSGROUPS: electronic bulletin boards for discussion groups**
- **LISTSERVs: e-mail list servers for discussion groups**
- **CHATTING: interactive conversations**
- **TELNET: log on one computer, work on another**
- **FTP: transfer files from computer to computer**
- **GOPHERS: use menus to locate text material**

WORLD WIDE WEB (WWW)

- STANDARDS TO STORE, RETRIEVE, FORMAT, DISPLAY INFORMATION
- CLIENT-SERVER ARCHITECTURE
- GRAPHICAL USER INTERFACE
- DYNAMIC LINKS TO OTHER DOCUMENTS ("hot links")
- EXPLOSION IN BUSINESS USE

*

EXTRANET

ALLOWS SELECT USERS OUTSIDE ORGANIZATION TO USE ITS INTRANET:

- CUSTOMERS
- BUSINESS PARTNERS
- VENDORS

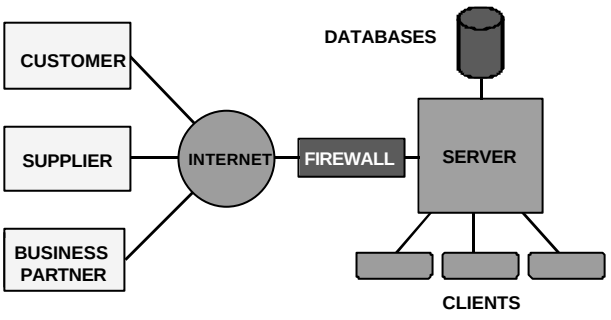
*

INTRANET

- INTERNAL NETWORK
- WWW TECHNOLOGY
- FIREWALL: Security System to Prevent Invasion of Private Networks
- OVERCOMES COMPUTER PLATFORM DIFFERENCES
- OFTEN INSTALLED ON EXISTING NETWORK INFRASTRUCTURE

*

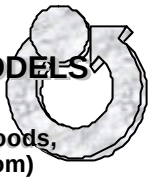
EXTRANET



INTERNET, INTRANET, EXTRANET

	Internet	Intranet	Extranet
Access	Public	Private	Semi-private
Users	Everyone	Members of a specific firm	Group of closely related firms
Infor-mation	Fragmented	Proprietary	Shared in closely trusted held circles

INTERNET BUSINESS MODELS



- **VIRTUAL STOREFRONT: sells goods, services on-line (e.g., Amazon.com)**
- **MARKETPLACE CONCENTRATOR: concentrates information from several providers (e.g., Internet Mall)**
- **INFORMATION BROKER: provides product, pricing, availability information (e.g., Travelocity, Auto-by-Tel)**

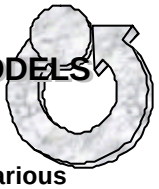
*

INTERNET BENEFITS

- **GLOBAL CONNECTIVITY**
- **REDUCED COMMUNICATIONS COST**
- **LOWER TRANSACTION COSTS**
- **REDUCED AGENCY COSTS**
- **INTERACTIVITY, FLEXIBILITY, CUSTOMIZATION**
- **ACCELERATED KNOWLEDGE**

*

INTERNET BUSINESS MODELS



- **TRANSACTION BROKER:**
  buyers view rates, terms from various sources (e.g., E*Trade, Ameritrade)
- **ELECTRONIC CLEARINGHOUSE:**
  auction-like setting, products, prices, change in response to demand (e.g., Bid.com)
- **REVERSE AUCTION:**
  buyer sets price, submits to multiple sellers (e.g., Priceline.com)

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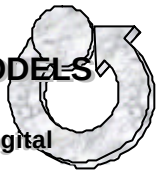
INTERNET BUSINESS MODELS



- DIGITAL PRODUCT DELIVERY: sell, download software, other digital products (e.g., SonicNet)
- CONTENT PROVIDER: creates revenue through providing client for a fee, and advertising (e.g., wsj.com (Wall Street Journal), tripod.com)
- ON-LINE SERVICE PROVIDER: provides service, support for hardware, software products (e.g., Tuneup.com)

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BENEFITS OF INTRANETS:

- EASY TO USE BROWSER INTERFACE
- LOW START-UP COSTS
- RICH, RESPONSIVE INFORMATION ENVIRONMENT
- REDUCED INFORMATION DISTRIBUTION COSTS

*

BENEFITS OF INTRANETS:

- CONNECTIVITY
- CAN BE TIED TO LEGACY SYSTEM & TRANSACTION PROCESSING
- INTERACTIVE APPLICATIONS WITH TEXT, AUDIO, VIDEO
- SCALABLE TO LARGER OR SMALLER SYSTEMS AS REQUIRED

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CHALLENGES & OPPORTUNITIES

- UNPROVEN BUSINESS MODELS
- BUSINESS PROCESS CHANGE REQUIREMENTS
- CHANNEL CONFLICTS
- TECHNOLOGY HURDLES
- LEGAL ISSUES
- SECURITY & PRIVACY

*

Review Questions

1. Explain the benefits we are getting through Internet and WWW?
2. Explain the following Concepts
   a. Internet
   b. WWW
   c. Intranet
   d. Extranet
3. Explain the Role of Internet Strategist in any organisation? Give your opinions on that.

Discussion Questions

1. Discuss the success of any company which has brought its business success through Internet.
2. Try to find out the requisites for making your business on-line
3. Discuss the components of a web page for an on-line university.

Application Exercises

1. You are working for a small firm that wishes to sell products (B2C) on the Internet. Find three firms that could be used to host your website. Identify the features, tools, and costs of each firm. Which one would you recommend?
2. Choose one common product available for purchase on the Internet and from local retailers (for example, a specific book, CD, or toy). Find at least five sites and two retail stores that sell the product. Compare the price of the item, including shipping and taxes. Would you expect the prices to be the same? Explain any differences?

Research the current standards for Internet ads (in terms of size). Check a few sites to see which size is the most common. Find a major site (newspapers are always good places to look) and identify how much it will cost to run a common ad.

Note -

LESSON 18: E-BUSINESS

Learning Objectives

1. To know about the role played by Internet and Intranets in E-commerce
2. To understand the supporting activities available for E-commerce
3. To study the concept and framework of E-business
4. To know the considerations in doing business through Internet.
5. To analyse the trends and future of E-business

18.1 Introduction

We have seen a lot about the benefits of networking and Internet in the earlier lessons. We may conclude the real benefit of Internet as a resource being utilised for doing business globally. Let us recall some of our understandings on Internet as follows. The Internet is a worldwide network of computers joined together by telecommunication lines. It is a communications medium that allows us to send electronic information between computers linked to this network. When we discuss the Internet we are generally talking about applications on the Internet that let us send electronic messages like e-mail or publish documents with images and text like the World Wide Web. Increasingly the Internet has become a sales channel for many different types of goods and services. It has been estimated that transactions worth $7.29 trillion will take place over the Internet by the year 2041.

E-Business refers to all business processes that take place across electronic networks. This includes everything from buying and selling of goods and services through the World Wide Web, to interactive television and a whole host of other emerging technologies. E-Business integrates Information and Communication Technologies (ICT) with traditional business processes, introducing efficiencies that cut costs and increase profits. Andrew Grove, the Intel Chairman, has predicted that:

"In a few years' time, there will be no Internet companies - there will just be companies - and all companies that will operate in the future, will be Internet companies."

The key to successful E-Business is not to concentrate on the technology itself but to decide the way forward for your business within this new environment. When you have decided how you want to move your business forward then start to look at the technology solutions.

Let us see the role played by Internet in E-commerce in the following sections which will help us to understand E-Business better.

18.2 The Internet and Electronic Commerce

Internet Business Models

The last thing you want to do is throw up a Web site or a Web page, include an email address, and call it done! Regardless of the type of business, you have to determine what you're going to do behind the scenes and how your electronic commerce efforts will fit in with your regular business processes.

There is no simple step-by-step list of things you need to do to establish an E-commerce process, no "one size fits all" method. But remember these facts:

- It's not cheap.
- It's not easy.
- It's not fast.

Some companies have spent millions of dollars only to fold up their E-commerce operations because they just weren't working. Some companies have built a Web site without thinking through the entire process; only to find out they have seriously hurt their normal operations. Some companies have realized that E-commerce was simply not the Holy Grail it was made out to be.

You need to analyze what you want the mission of the Web site to be. Are you going to have a Web site that simply offers information about your company and its products? Are you going to sell only to consumers? What impact will that have on your current retail outlets? How are you going to get people to your Web site in the first place? How are you going to keep them coming back? If you sell business-to-business, do you have the back-end processes in place to handle the increased sales? Who will host the Web site: your company internally? a Web host service? Who's going to create the Web site, what services will you offer on it, and how are you going to keep your information secure?

We don't mean to discourage you from electronic commerce; just the opposite. Thousands of businesses are finding new opportunities to connect to customers, suppliers, and employees.

Internet Business Models

Category	Example
Virtual Storefront	Amazon.com
Marketplace Concentrator	ShopNow.com
Information Broker	Travelocity.com
Transaction Broker	Ameritrade.com
Auction Clearinghouse	eBay.com
Digital Product Delivery	Bluemountain.com
Content Provider	WSJ.com
On-line Service Provider	Tuneup.com

The above table shows some ways companies use the Internet to conduct business. Even more intriguing is the disruption new, upstart companies are causing in traditional industries. MP3.com introduced the Rio music appliance, which uses music

downloaded for free from Web sites. Recording companies are jumping through hoops trying to respond to this threat to their business. The real lesson you should learn is that no business can afford to rest on its laurels and assume its business or industry is safe from changes caused by the Internet.

Customer-Centered Retailing

Some of the most successful consumer E-commerce companies have found that it isn't enough to set up a Web site to sell products: consumers want information about the products themselves and how to integrate the products into their lives.

Amazon.com, probably the most talked-about consumer retail Web site, doesn't just sell books and CDs. It also offers book reviews from other customers, links to other books related to the one they're purchasing and the opportunity to purchase gifts for friends and relatives which are then gift-wrapped and sent out. Amazon.com is moving into other markets such as online auctions and now owns part of an online grocery shopping service.

Disintermediation, removing the middleman, has allowed many companies to improve profits while reducing prices. Now we're starting to see a phenomenon called **reintermediation,** the process of creating new middlemen. Many people are concerned about selling products online because of the possibility of fraud.

Let's say you want to sell an antique car through your Web site. A stranger in Ohio emails you with an offer of $10,000. You hesitate to seal the deal because you don't know anything about this individual. You can use an electronic escrow service that will hold the buyer's funds to ensure he receives the merchandise while you make sure you get paid. Online auction services such as eBay.com offer a form of reintermediation through their Web sites to get buyers and sellers connected. That's the great thing about the Internet: One door closes and another door opens!

Business-to-Business E-Commerce

When you think of Internet-based business, you probably think of businesses selling to individual customers. It may surprise you to learn that business-to-business is the fastest growing area of E-commerce and outpaces consumer retailing by millions of dollars.

The Internet allows many smaller companies to participate in government and private bids they otherwise would be locked out of by bigger competitors. Governments and companies that let out the bids are finding that they get lower bids through the Internet because of the increased number of bidders.

Other companies are able to reduce costs by getting more competitive prices from a wider range of suppliers. But you still have to make sure you know all the costs associated with this new process. Let's say you've always gotten your office supplies from the store down the street. Suddenly you discover a Web site that offers lower prices. So you fill up your shopping cart and purchase your supplies from the Web site. But then you add in the shipping and handling costs. Did you really come out ahead?

If you're the one selling the product, you should make sure your prices and extra costs are in line with your competitor's. You also must make sure your company can handle the possible increase in sales. All parts of your organization should be involved in supporting the E-commerce effort, not just one or two departments.

One company, Asian Sources Online, has combined the two into Asia's largest electronic commerce venture. "Asian Sources established a Web site to connect thousands of mostly small and medium-size Asian exporters of everything from hardware, fashion and giftware to computers and electronic components with big importers such as Kmart, Toys "R" us, Home Depot, Tandy Radio Shack and Texas Instruments. A buyer sitting in, say, Chicago can pay virtual visits to factories all over Asia and see products without leaving his office.

A buyer connects to the Asian Sources Web site, views products from over 4,000 manufacturers, orders the products, and arranges for shipment and payment. Of course the buyers don't like the idea that they can't take a two-week business trip to the Orient any more, but that's another story.

18.3 Electronic Commerce Support Systems

You don't have to go it alone. Many businesses use companies that supply all of the Web support from designing and developing the Web site to actually storing the Web site pages **(Web hosting)** on their servers. Some commercial companies also offer backend services such as credit card transaction processing **(electronic payment systems).**

Product	Description	Vendor
Icat Electronic Commerce Suite	Provides on-line catalog shopping and order placement for sophisticated Web sites; Icat Commerce on-line version available for small business storefronts	Icat
Net.Commerce	Lower priced START version has a store creation wizard for catalog pricing, shipping, taxing, and secure payment processing with business-to-consumer and business-to-business capability; high-end PRO version for more advanced Web site with intelligent catalog capability and tools to integrate the Web site with legacy systems and middleware	IBM
Netscape MerchantXpert	Supports high-end business-to-consumer site with catalog search tools, order management, tax, payment, and logistics modules and tools to integrate the site with legacy systems	Netscape
Open Market Transact	Commerce services include on-line customer authentication, order and payment processing, tax calculations, and customer service with multiple language capabilities.	Open Market
Oracle Internet Commerce Server	Business-to-consumer commerce application that integrates with other Oracle applications for orders, inventory, customer service, call centers, and payment authorizations via third-party payment technology vendors	Oracle

Larger corporations can hire companies such as IBM to help them establish a Web presence. One of the benefits of having your Web E-commerce outsourced is that you don't have to hire the expertise in-house and you gain from the supplier's experience with other E-commerce endeavors. There are many considerations and decisions to make when you're developing E-commerce. It's not easy, it's not cheap, and it's not quick. But done right, it can give you opportunities you never had before.

18.4 Intranets and Electronic Business

Rather than create your own networking software from scratch, you can use Internet protocols with their easy to use interfaces to put a front on your existing systems. You'll have to create a software connection between the two, but often it's cheaper to do it this way than to start from scratch to build a whole new Information System.

For instance, you use a database software system as your main information system to support production and manufacturing. You have a second separate database software system that you use in advertising and marketing. You can spend a lot of money to create one big database system that combines the two, or you can build an interface that makes it *appear* as though the two are one.

How Intranets Support Electronic Business

- Connectivity: Accessible from most computing platforms
- Can be tied to legacy systems and core transaction databases
- Can create interactivity applications with text, audio, and video
- Scalable to larger or smaller computing platforms as requirements change
- Easy to use, universal Web browser interface
- Low start-up costs
- Richer, more responsive information environment
- Reduced information distribution costs

The two advantages that stand out are the low start-up costs, and the easy to use, universal Web browser interface. Businesses can defray lots of the cost of establishing an Intranet because they don't have to create the interface programs for users. The content can be created using simple, off-the-shelf software programs. The company isn't limited to text; it can include audio and video files which employees can use for training or communicating with distant colleagues and customers. Simply put, the possibilities are endless.

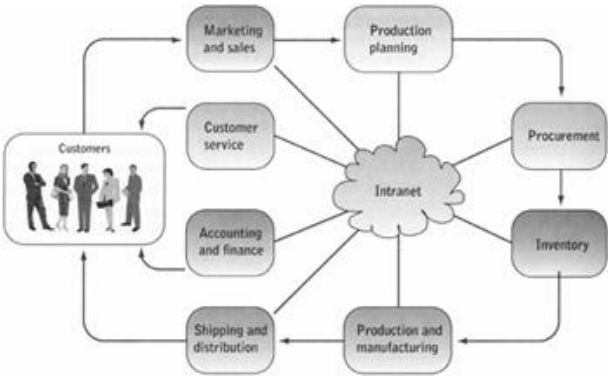
Intranets are especially useful for allowing geographically separated collaborative teams to work together. As long as you're careful to use firewalls to secure your Intranet from outside interference, they are a cheaper, quicker method of sharing data and files among many workers. To be sure, you still need face-to-face interaction, but you can get more work done cheaper this way.

A very nice feature of Intranets in organizations is their ability to connect different types of computers with different operating systems. Let's say that one department has a base of Apple computers and just loves the way they work. Another department has PCs that it refuses to give up. Yet another department uses a closed mainframe system for its computing needs. It's virtually impossible to get all the different platforms talking to one another except through the use of Intranets. Now it doesn't matter what type of computer hardware or operating system is being used: they can all communicate through Web sites. The company doesn't have to buy new hardware, and the software cost is restricted to a browser application.

Intranet Applications for Electronic Business

This figure gives you an idea of how your business can incorporate an Intranet to improve your functional applications.

Coordination and Supply Chain Management



An Intranet can drastically reduce an organization's **supply chain costs** and management through improved coordination between various departments. It's possible that the production and shipping departments are located in one building, and the engineering department is located across town. The engineers can waste a lot of time traveling back and forth across town or simply fail to coordinate with production altogether. An Intranet offers much improved coordination between these departments.

Outside suppliers have an advantage if they have access to the company's Intranet because they stay up-to-date on the latest design changes. They can also process deliveries easier and faster by having access to information that communicates the company's needs.

There are so many innovative uses of Intranets in business today it's hard to say just how far we're going with this technology. As user expertise grows and the technology becomes more common, Intranets will replace many traditional processes at lower cost and increased ease of use.

18.5 Defining E-Business

Electronic-business or **e-business** can be defined as the organized effort of individuals to produce and sell, for a profit, the products and services that satisfy society's needs through the facilities available on the Internet. *E-commerce* is a part of e-

business and is the term used to refer only to the buying and selling activities online including when a firm uses the Internet to identify suppliers, select products or services, make purchase commitments, complete financial transactions, and obtain service.

Organizing e-Business Resources

Besides the conventional organization of human, material, informational, and financial resources needed to conduct business, e-business requires several specialized resources in order for a firm to participate on the Internet.

1. **Human resources**, in the form of people who can design, create, and maintain web sites, are only a fraction of the specialized talents required by businesses considering an Internet presence.
2. **Material resources** must also include specialized computers, equipment, software, and high-speed Internet connection lines.
3. **Informational resources**, generally in the form of reporting software that focuses on tracking the efficiency of the web site operations and offers insight into how satisfied customers are interacting with the firm's web site, are needed.
4. **Financial resources,** the money required to start, maintain, and allow the firm to grow, usually reflect greater participation by individual entrepreneurs and venture capitalists, instead of conventional financial sources such as banks

Satisfying Needs Online

Customer needs that are satisfied by Internet firms are often unique to the Internet environment or are an improvement over conventional business practices. For example, AOL provides Internet access, browser services, chat rooms, data-bases, and exclusive Time Warner entertainment content among other services to its customers. The Internet provides the opportunity for interaction. Communication is now an active two-way street between the online program and the viewer. The Internet allows customers to specify the content they are offered. Knowing what is of interest to an individual customer allows an Internet firm to direct appropriate advertising to that customer.

Creating e-Business Profit

Firms can increase their profits by either increasing sales revenue or reducing expenses through a variety of e-business activities.

- **Revenue Growth.** A fundamental concern for online firms is how to select, develop, and nurture sources of revenues. Each source of revenue flowing into the firm is referred to metaphorically as a *revenue stream*.
- **Expense Reduction.** Expense reduction is the other major way in which e-business can help increase profitability. Providing online access to information customers can reduce the cost of dealing with customers.

18.6 A Framework For Understanding E-Business

A. The Internet was originally conceived as an elaborate military communications network that would allow vital messages to be transmitted in the event of war.

- New technology emerged that simplified use of the Internet and allowed the addition of multimedia content. This multimedia environment of audio, visual, and text data came to be known as the *World Wide Web* or *the web*.
- The Internet can be envisioned as a large network of computers connected by cables and satellites, which pass small, standardized packets of electronic data along from one station to another until they are delivered to their final destination.
- To transfer a variety of multimedia data around the world, data need to be *digitized*, which means converted to a type of signal that the computers and telecommunications equipment that make up the Internet can understand.
- Most firms involved in e-business fall more or less into one of the three primary groups as defined by their e-business activities: telecommunications and computer hardware manufacturers and Internet service providers; Internet software producers; and online sellers and content providers.

B. Telecommunications and Computer Hardware Manufacturers and Internet Service Providers.

- The telecommunications and computer hardware manufacturers that helped build the Internet, together with Internet service providers, supply the physical infrastructure of the industry today.
- Internet service providers (ISPs), which buy their technological capability from the makers of telecommunications hardware, provide customers with the necessary technology to connect to the Internet.
- AOL is the largest and best-known ISP, but hundreds of smaller ISPs in both urban and rural areas also provide access to the Internet.

C. Internet Software Producers

The second primary group of e-business firms that have emerged since the beginning of commercial activity on the Internet comprise the software producers who provide the functional capability to do things on the Internet. Activities such as searching the Internet, browsing web sites, sending e-mail messages, shopping online, and viewing multimedia content all require specialized software programs that allow computers to function the way they do on the Internet.

D. Online Sellers and Content Providers

The third primary group of e-business firms is made up of all the firms that customers actually interact with on web sites. The Internet would still be limited to communication between individuals and special interest groups of researchers if it was not for the activity of sellers and content producers of products and services that populate the Internet.

E. Global e-Business

All three primary groups of e-business firms are in a race to capture global business revenues that are only now just emerging.

F. Small e-Business

Although global-scale firms dominate e-business, the remarkable thing about the Internet is how accessible it is to small businesses. The relatively low barrier cost of entry to the Internet means that the door is open to thousands of small businesses seeking opportunities for growth internationally In some cases, small firms have found a niche service or product to sell online.

Social and Legal Concerns

The social and legal environmental concerns for an e-business extend beyond those shared by all businesses. Businesspeople must deal with the special circumstances of operating in a new frontier without borders or much in the way of government or other organizational control or regulation. For better or worse, the world of e-business is an emerging industry with great opportunities for customers and businesses but with equally great concerns about behaviors.

Ethics and Social Responsibility: Socially responsible and ethical behavior by both individuals and businesses on the Internet is a major concern, which has simply extended from the general social environment to the special virtual environment of cyberspace. The opportunity to commit unethical or even illegal behavior is a primary factor in determining whether that behavior will be committed. Unfortunately, the Internet provides a shelter of anonymity and detachment for both individuals as well as firms, which might suggest why certain behaviors have surfaced.

Security Concerns: For all intents and purposes, the Internet is an unregulated frontier in business. As such, both individuals and business users must be aware of the risks and dangers as well as the benefits and opportunities to be found online such as viruses and breech of privacy.

Government Regulation: For the most part, government regulators view the Internet as just an extension of regular business activity of firms operating in their jurisdiction. The rules and regulations apply to all businesses whether they exist entirely or only partially online. Taxes must be charged and sales of controlled products like pharmaceuticals must follow the law.

18.7 The Future of E-Business: Growth, Opportunities and Challenges

Since the advent of commercial activity on the Internet, developments in e-business have been rapid and formidable. Forrester Research, Inc., a Cambridge, Massachusetts, research firm, predicts that global Internet commerce will soar to $6.8 trillion of trade by the year 2004, up substantially from earlier attempts to estimate growth. Although most of this activity will remain a North American phenomenon, growth is expected to explode in some Asian-Pacific and Western European countries.

Measurements of Growth

Measurements of e-business growth not only illustrate the magnitude and scope of how much has happened in just a few short years but also indicate trends for the future.

- More than 61 percent of U.S. home Internet users go online every day often several times a day–compared with 57 percent in 1998 and 46 percent in 1997.
- Home users spent an average of 7.2 hours a week online, about the same as 1998, indicating home users have found a stable amount of time to allocate to Internet activities.
- Men still outnumber women slightly, but the growth in the number of women users has risen steadily. In 1997 only 16.5 percent of women were online and, by late 1999, that figure was up to 49 percent.
- The average Internet user's age has risen steadily as well, to 40 years, up from 38.6 years in 1997.
- The number of Internet users making purchases online nearly doubled between 1998 and 1999, going from 27 million to 52 million.
- According to a Neilsen / NetRatings survey, 130 million people can access the Internet from home, and some 80 million did in April 2000.
- In comparison to the home market, 35 million users had access to the Internet at their places of work, and nearly 31 million of them actively used the Internet. Both groups of users spent about thirty minutes per session and viewed an average of thirty-five pages. The primary difference between these groups was in the number of sessions per month, where those at work connected an average of thirty-eight times per month, twice the number of those at home.
- Global Internet users spent an average of 7.6 hours online in March 2000, up from 7.17 average hours per month in January 2000. The most time was spent by Internet users from the United States and Canada with a combined average of nearly thirteen hours per visitor per month, while users in Europe spent on average just over five hours on the Internet in March.

Convergence of Technologies

The phenomenon of overlapping capabilities and the merging of products and services into one fully integrated interactive system is referred to as the *convergence of technologies*. We can expect to see this tendency to help develop interactive television programs, which will allow viewers to pause, or even select, a preferred direction for a program.

Online Communities

Online communities, which are made up of groups of individuals as well as firms who in some way wish to exchange information, products, or services over the Internet are likely to grow.

Partnering Online

Although opportunities will continue to exist for independent e-business effort, much success will continue to come from firms that can cooperate and partner with others. By playing a partial role within a larger entity, smaller firms can enjoy competitive advantage, access to marketable items, and thereby increase their rate of market penetration.

18.8 Summary

You are a part of the most revolutionary time in business. Many companies are struggling with all the changes and trying desperately to comprehend their role in the new world. You can help yourself and your organization tremendously by understanding the issues involved and developing innovative strategies to resolve the problems.

Points to Ponder

Where does e-commerce begin…

- E-commerce, whether indirect or direct, is a layer (or several) above the actual infrastructure. It can consist of any range of activities unique to the needs or demands of specific consumer or user groups.
  - E.g., On-line business activities
  - E.g., On-line information sources

Why care?....

- Local policy and regulatory issues impact operations on the Internet
  - Each country or distinct economy has unique issues, distinct to respective laws, cultures, perspectives.
- Legal frameworks impact current and future use and functionality of the Internet and and the benefits of e-commerce
  - That is, the laws in tangible world apply on-line, and often new ones for on-line are created.

legal and regulatory frameworks?

- There is an expression that arose from old western movies – "where the pavement ends and the West begins"
  - The Internet and emerging e-commerce has created new and emerging business and legal challenges
  - Dot 'com' companies challenged traditional business models
  - E-commerce, whether direct or indirect challenges legal and regulatory frameworks in which they're developing
  - Have seen much activity in Europe, and beginning to see more in other regions of the world.

Interest by industry and legislators

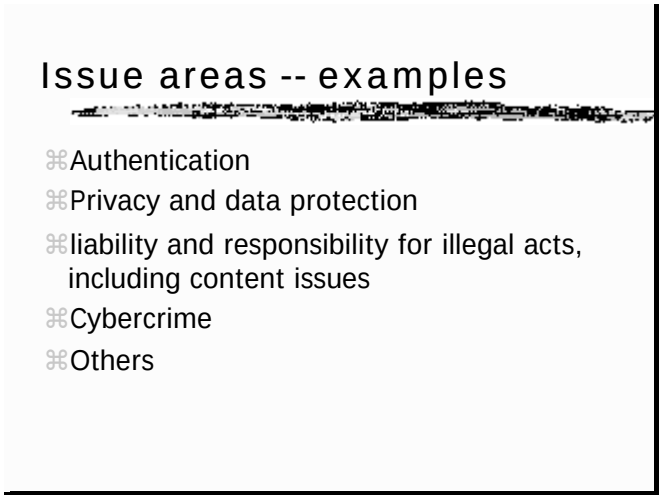
Impact is on all aspects relating to e-commerce, that is conducting some for of business on-line.
  Impacts consumers, and operational costs.

Perpetuated by Internet explosion

Social awareness

Consumer demands

Solutions to challenges – some technical, much private sector, and some legislative
  National, international, regional.
  The recipe to allow continued development and use



Review Questions

1. Use your imagination and come up with an idea of how your organization or company can use an Intranet or Extranet.
2. What current processes will you have to change to incorporate your idea?
3. Describe the different considerations when deciding whether you should establish a consumer E-commerce Web site or a Business-to-Business E-commerce Web site.
4. Why would your organization want to develop an Intranet?
5. What are some of the management issues involved with E-commerce and how would you resolve them?

Discussion Questions

1. Discuss the questions to be answered by a manager in suggesting the company to do business through Internet. (Assume your own company).
2. Discuss the various security measures involved in E-commerce

Application Exercise

1. Find data on at least one B2B auction site. How long has the site been operational? What percentage of total industry sales are carried on the auction site? Do firms use the site for regular purchases, or only for special items? Who pays for the operating costs of the site?
2. Find at least five companies that are offering business Web services. What services do they provide? What do they charge? How long have they been in business? What technologies do they use (for example, SOAP or XML)?

LESSON 19 : TUTORIAL ON E-BUSINESS

In this lecture, let us discuss cases out of which we will get thorough understanding of the benefits of Internet and the other Technologies used by the firms in their business.

Cases

Package Delivery

The secret to being a successful package delivery company is timeliness, efficiency, and affordability. In the last 30 years, guaranteed two-day and overnight delivery has made drastic changes in businesses' perceptions of *timely*. Pony Express delivered messages for several years, until the telegraph rendered it obsolete. Many thought that fax machines and e-mail would do the same thing to the overnight market. So far this has not been the case. The industry has continued to change nonethe-less, hastened by the march of technology, a new set of cus-tomer needs, and a change in the way business is conducted:

Manufacturers and sellers had previously focused on reduc-ing shipping costs and time to customers in a more competitive marketplace. The current marketplace now demands speed to market in order to reduce product cycle times. Many high-tech products are becoming obsolete in record times and the there is a need to provide fast-cycle logistics. Doing so adds enormous value to customers by compressing production and delivery cycles, particularly for time-sensitive products such as IT components, biotechnology and pharmaceutical products, or med-ical devices. Furthermore, it allows companies to reduce the carrying costs and lower their inventories levels

Efficiency is also a critical element in the delivery industry. Companies in other industries are increasingly relying on UPS and FedEx to handle many common delivery tasks. Through efficiency, these companies can provide delivery services follower costs than the other companies can match.

Financial Analysis

While moderate to high market growth continues in the industry, prices have declined because of fierce competition. Technologi-cal advances and efficiencies have enabled the industry to contin-ually cut costs. United Parcel Service (UPS) and Federal Express (FedEx), the two most technologically advanced companies, have reported profit increases greater than yearly sales increases

Stock/Investment Outlook

The stock projection for the package delivery industry is positive for the next few years. Most of the large delivery companies are rated a *buy* or *outperform* for the next three to four years

Growth Potential

The package industry has shifted from providing delivery services to becoming integrators of customers' supply chain sys-tems. FedEx and UPS have assisted companies with supply chain management by offering tools and consulting, and handling international shipment from end to end. One of the major areas for improvement that the package delivery must meet, particularly for express carriers, is that of free movement of packages through customs in order to meet global business demands for overnight delivery. Julian Oliver, the director general of the International Express Carriers Conference had the fol-lowing figures to offer on the express carrier industry [Oliver]

- 200 countries being serviced
- 650,000 people employed
- 1,200 aircraft
- 1,350 daily flights 175,000 trucks and vehicles
- 20 million daily shipments $50 billion in duties and taxes

In his presentation Oliver also points out that outside indus-try sources such as Boeing and Airbus predict prolonged growth in the industry. Both airline manufacturers predict double-digit growth rates for next 15 years for airfreight. Ac-cording to estimates from the Colography Group, the global value of air-shipped goods approached $2.2 trillion in 2000, in-creasing by almost 7 percent over 1999. As in the United States, the express segment of international shipping is also growing twice as fast as the broad market in terms of tonnage, Globalization, just-in-time logistics, customized mass produc-tion, rapid customer response, and e-commerce, along with other trends, all point to greater use of parcel service in the future.

Market Share Competitive Structure

The U.S. market is made up of seven large companies, dozens of smaller entities, and the U.S. post office. The biggest shake-up in the package delivery industry occurred when UPS, the sleeping giant, awoke. For years, UPS was the industry cash cow. It owned the package delivery market and was a very staid company trying to do one thing well-mass-produced de-livery. After the upstart FedEx began the new overnight mar-ket, UPS slowly began to transform itself to expand into that and other markets. One of the ways UPS transformed itself was to increase the marketing department from 7 to 600 peo-ple, in order to attract and keep corporate customers

Given the high cost of entry, the oligopoly in the market-place will continue. Billions are needed to develop facilities in trucking, delivery, computer, and air networks. These costs keep new companies from entering or becoming a dominant force in the marketplace. As time goes on, more buyouts, merg-ers, and alliances may further restrict the number of players.

Role of Research/Development

The role of research and development in the package delivery industry is to develop new technologies that will cut the cost of shipping, shorten delivery times, provide better services to customers, and integrate the supply chain between supplier and customer in order to reduce product cycle times. Wireless technologies and robust, Web-based applications that are accessible

to customers, are key technologies and services that are being offered to customers today. Most of the focus lies in improving efficiency through distribution and planning. The use of mobile computers and transponders, as well as satellites, to monitor packages and vehicles is also increasing shipping efficiency. Other high-tech applications are on the horizon. One is an IT tool that allows shippers and intermodal operators to simulate flows of cargo, detect inefficiencies in combined transport operations, and search for alternative transportation scenarios.

Technological Investment and Analysis

FedEx and UPS are leading the industry in technological spending. They are attempting to integrate all facets of the delivery process so companies can eventually outsource their supply chain management to them. Eventually these delivery companies want to become the supply chain managers for corporations. Once FedEx and UPS have introduced their services into customers' routines, it is more difficult and troublesome for customers to switch to other delivery services

Assets that provide the means to move goods physically are undifferentiated and generically available to all players. Technology has emerged as the method to distinguish a company's products, improve its service quality, and lower costs. As such, it has become increasingly important to manufacturers and sellers to be able to access real-time information about the sta-tus of parts, materials, and finished goods in a world of just-in-time inventory management. Furthermore, integration with suppliers' networks would provide a more accurate picture for managers to decide on production issues

Recommendation for the Future

New economy dynamics have transformed the supply chain. Forced by the reality of competition, firms can no longer manage production, inventory control, transport, and sell and ser-vice as functions independent of one another. The new economy supply chain is an entirely different animal, defined by its organic nature, whereby operational impacts of any part of the organism are keenly felt throughout the entire supply chain. Firms that want to compete and excel in the new econ-omy need to integrate demand, management, inventory management, distribution, and customer fulfillment with seamless information flows from the supplier level to the production level, and on to the customer level in real time. Each of the supply chain components must be supported by sophisticated information systems that provide the highest degree of visibility, precision, and efficiency. This is particularly true for com-panies engaged in electronic commerce

Case: Federal Express

There was no such industry as express delivery of packages until FedEx started it in 1973. Not only did it create an indus-try, but it has also set the standard against which competitors are measured. With annual revenues of $20 billion, FedEx Corp. is the premier global provider of transportation, e-commerce, and supply-chain management services. In order to gain a greater market, FedEx has expanded from its express delivery services to complete integrated business solutions through a network of subsidiaries operating independently, in-cluding FedEx Express, the world's largest express transporta-tion company; FedEx Ground, North America's second largest provider of small-package ground delivery service; FedEx Freight, a leading provider of regional less-than-truckload freight services; FedEx Custom Critical, the world's largest provider of expedited, time-critical shipments; and FedEx Trade Networks, a provider of customs brokerage, consulting, information technology, and trade facilitation solutions. FedEx has grown from being a solely overnight express package -delivery service to a complete supply-chain management provider for any type of business need.

Technological Investment and Analysis

Despite the economic slowdown, FedEx has continued to invest in its IT infrastructure with a proposed $1.5 billion IT budget for 2002, unchanged from its 200 I IT budget. There are approximately 2.2 million unique visitors to the website each month. Approximately 69 million packages delivered by FedEx Express every month are either processed or prepared for delivery online. [Chen 2001] FedEx's website was the first to allow customers to track their shipments online and to also ship them.

While customer-interfacing technologies keep customers coming back, it is in back-end systems where the Internet has made the most impact at FedEx. FedEx offers multiple methods for customers to connect to its shipping, tracking, and lo-gistics systems over leased lines, direct connections, private networks, and ED! (Electronic data interchange). Now the company is actively pushing large and small customers alike onto the Internet through the use of XML. Today, the majorities of large corporate customers continue to use private networks and leased lines to connect to FedEx's systems. But Robert Carter, executive vice president and CIO at FedEx, said he is optimistic that more and more blue-chip companies will begin to transact with FedEx using the Web and XML.

Technological Innovations

In 2002, FedEx launched online document completion to its customers that need to ship internationally. FedEx wants to enable its customers to complete documents online, therefore al-lowing them to export to more than 20 countries by completing the forms online and sending them directly to the appropriate customs officers over the Internet. The company currently pro-vides customs forms that must be printed, filled out, and sent to customs by the customer

Additionally FedEx's IT department began testing a num-ber of additional wireless technologies, including Bluetooth on courier devices, which allow carriers to communicate in short -range with their offices. The technology upgrade provides FedEx Ground customers with the fastest signature proof of delivery and adds to the most detailed package-tracking information in the ground shipping market [Transport News 2001] The company has also begun to wire its offices with WiFi wireless LANs that enable development groups to collaborate wirelessly in conference room~ All of this is an effort to provide the latest technology to customers and help them become even more efficient

Recommendation for the Future

FedEx should integrate as many tools to allow their customers to run their shipping departments if they wish to do so. How-

ever, FedEx has also recognized that there is a greater value to the customer in becoming involved in the many areas of supply-chain management in order to reduce product cycle times. This will allow major -customers to concentrate on their core business and outsource the supply chain management as-pect to FedEx. Furthermore, this move will allow FedEx to di-versify and become a long-term partner of the company there-fore ensuring future cash flows.

Questions

1. What has been the catalyst for change at Federal Express?
2. Upon which technologies has Federal Express relied?
3. How successful has technological change been at Federal Express?
4. What does the corporation say about its financial ability to embark on a major technological program of advancement?
5. What does Federal Express's Web page present about its business directives?
6. What challenges and opportunities is the package delivery industry facing?
7. How important is the collection and evaluation of data to the future of Federal Express?

Case: United Parcel Service

United Parcel Service (UPS), the world's largest package-delivery company, provides specialized transportation services through the pick-up and delivery of packages, primarily by air and ground transportation in the United States, as well as various logistics services. UPS is the leader in its industry for deliver-ing 55 percent of merchandise sold online compared with FedEx's 10 percent, according to consultancy the Sageza Group Inc. The company, founded in 1907, now handles over 3 billion packages and documents per year and delivers to every address in the United States and in more than 200 coun-tries and territories. Sales in FY 2000 totaled $29.771 billion, up 10.1 percent year-over-year.

New facilities in Georgia and New Jersey house what UPS claims is the largest database in the world, the DB2 database. The DB2 database has more than 7,000 gigabytes of records, the tracking information regarding all UPS packages shipped in an 18-month period. This kind of computing power trans-lates into information regarding senders, receivers, billing, bar codes, time sent, estimated destinations, a:i1d other information for more than 4 billion packages.

The new Atlanta site is primarily backup for the New Jer-sey operations in case of disaster or expansion needs. Input into these new centralized computing facilities is through DIADs, or delivery information acquisition devices specially developed for UPS by Motorola. These devices are handheld by the delivery person and feature 1.5 MB of RAM; digital sig-nature capability, and an optical coupler. The optical 'coupler is used to transfer information and signatures into the DVA or DIAD Vehicle Adapter, where data is then transferred via cel-lular phone or modem. UPSnet makes the transfer of data to the data facilities in New Jersey and Atlanta. UPSnet does this via a network of 500,000 miles of dedicated cables, more than 200 switching nodes, and a UPS satellite

Outsourcings of certain functions needing expert advice and creating partnerships that support the needs of information sys-tems are also underway. For example, to send all the information from the delivery trucks through the DV A using UPS To-talTrack, UPS has alliances with more than 90 local and regional cellular carriers including AT&T Wireless Communi-cations, AirTouch Cellular, Southwestern Bell Mobile Sys-tems, Pacific Telesis, GTE Mobilnet, and others. Northern Telecom switches provision UPSnet's dedicated cables di-rectly linked to the central computing facilities. Several types of products from several companies result in a I 00 percent up- time for the network.

Users of UPS MaxiTrac dial through lines provided by AT&T and Sprint. For data warehousing, UPS has chosen EMC Corp. and a system developed by Hewlett-Packard Co. and Oracle Corp. UPS's existing mainframes were not meeting the speed and availability needs required to service the vast amounts of data, but with the help of EMC, data warehousing will now be state of the art. These cooperative agreements have helped lessen UPS's technology-related-responsibilities and have focused UPS's energies on more core issues

The final implementation of UPS's technological initiative is the development and upgrading of software application products. One of the results of this initiative is UPS Online. This service is a Windows-based system that lets customers manage finances related to the package, track the status of their package, and print out shipping summaries. This system will integrate UPS into the customers' daily operations while providing more valuable information, allowing the customer to react situations in real time.

Another new product is the UPS website. On the site, a browser can find information about the company, what is new in the company, employment information, news releases, and a host of other information related to UPS. The customer can also find on the site a service that will, using bar codes, locate where the package is in the delivery process. In this way, even the casual, non company-related customer could have access to most of the information that users of UPS Online would have. If all goes as planned, the Internet and the UPS website will also serve as a center where transactions will occur without the security hazards still present on the Web. The Internet poten-tial is great and UPS wants to be one of the first companies capitalizing on its potential

Another new product is the improved help desk that will service both internal users as well as external users in an at-tempt to "empower our [employees and customers] to become as Independent as possible in using technology." The help desk function was not a formal organization five years ago, but as the volume and the sophistication of UPS and its software grew, and as the need for support for these new technologies grew, an operation was launched to service the need.

With the internal and external operations combined, the help desk receives approximately 70,000 calls a month, a dra-matic increase compared to approximately 14,000 calls a month in 1991. The external operation is run by 130 front-line experts and the internal group is run by 65 first-line consult-ants in the Mahwah, New Jersey, campus

The intimidating task of supporting all the software at UPS is, in turn, supported by Windows-based Expert Advi-sor from the Software Artistry Company. Previously, the help desk function was supported by IBM's mainframe based Infoman, but its limitations became too apparent as the move to PC-based operations from mainframe operations came about

Expert Advisor allows UPS to store more data online to assist helpers solve problems in a standardized manner quickly and efficiently. The help desk technicians no longer have to flip through binders full of information to solve an issue. Rather, they just have to type it into Expert Advisor. With its dynamic ability to constantly update and incorpo-rate new diagnostic tools and solutions into the system, Ex-pert Advisor has developed the help desk function into a real value-adding arm at UPS

UPS has therefore taken steps to initiate and seek new technolo-gies as well as react to industry forces. These tech-nologies all have an element of risk involved as significant funds have been allocated for the acquisition of new equipment, new software, and new employees. However, it is clear that UPS is trying to innovate to keep its market share and profitability

In an interesting twist, UPS acquired Mail Boxes Etc (MBE) in April 2001. MBE is the world's largest franchiser of local shipping centers. The transaction essentially gives UPS several thousand new customer counters, along with revenue from mail box rentals. More important, UPS ex-tended its operations in the international area by purchasing Fritz Companies, which specializes in logistics, freight for-warding, and customs brokerage. In 2001, UPS also acquired First International Bancorp, which specializes in structuring international transac-tions. [Quarterly report]

Technological Innovations

Telecommunications

In 1998, UPS launched an Internet-based delivery service that the company says could make life a lot easier for firms want-ing to send sensitive documents on tight deadlines. The service is called UPS Document Exchange. It is a suite of delivery and information management services that provides a choice of two Internet delivery services: UPS OnLine Courier and UPS OnLine Dossier

UPS OnLine Courier uses either the UPS website or a separate software package and allows customers to send doc-uments to anyone, regardless of the e-mail software package, operating system, or hardware being used on either side of the delivery process. UPS OnLine Courier is built on an open environment.

"It has a PDF (portable document format) and Adobe PDF built into it, so if the recipient doesn't have the same software as you do, it won't hinder their ability to read it. That's a bene-fit of the' Courier," said Joan Schnorbus, a UPS spokesperson. [Press release]

UPS OnLine Dossier takes UPS OnLine Courier a step fur-ther by using a double-encryption process and offering insur-ance. The document will self-destruct if tampered with. UPS OnLine Dossier authenticates identities using digital certifi-cates, which are required by both sender and receiver

UPS is developing another service for corporate customers. This service integrates UPS package-tracking capabilities directly with the customers' websites. The move allows consumers to ob-tain tracking information for their orders from the site where they ordered rather than by jumping to UPS

The Internet

Increasingly, UPS (and FedEx) are relying on the Internet to provide additional service to customers. For example, track-ing packages through the company website is faster and sub-stantially cheaper than the 800-number service using opera-tors. For the 2001 holiday season, UPS extended the use of the Internet by offering a Web-based return service. Cus-tomers wishing to return a product simply click on a link to print a return shipping label. The service costs only. 75 cents per transaction plus the shipping cost-making it substan-tially cheaper than other methods that require the help of a real person

Questions

1. What has been the catalyst for change at United ParcelService?
2. What are the critical success factors and core competencies for UPS?
3. Upon what technologies has UPS relied?
4. What caused a change in the way UPS used technology to meet the business needs of its customers?
5. How does the corporation's Web page support its business directives?
6 How important is the analysis of data to the corporation's continued success?
7. How will the capture and maintenance of customer data impact the corporation's future?

Note -

LESSON 20 :
TRANSACTION PROCESSING SYSTEM (TPS)

Learning Objectives

1. To understand the various types of Transactions and concepts of TPS
2. To study the characteristics and features of TPS
3. To learn the process of Transaction Processing
4. To know the applications of TPS.

20.1 Introduction

Whenever two people make an exchange, it is called a transaction. Transactions are important events for a company, and collecting data about them is called transaction processing. Examples of transactions include making a purchase at a store, withdrawing money from a checking account, making a payment to creditor, or paying an employee.

Because transactions generally involve an exchange of money, it is critical that the data be protected during transmission and stored carefully so that it cannot be altered. It is also critical that the data be saved so that managers can verify the data if any conflicts arise. Also, the sales and purchase data from the foundation of the accounting and financial systems of every company, so the system must be able to produce the standard reports.

Let us look at an **example** of real-world TPS. CareNet, the TPS of Travelers Insurance Company, is an advanced system that records and processes insurance-related transactions. Filing and process-ing insurance claims is a highly information-intensive process in which every step generates new data or modifies existing data. CareNet allows the company to accurately capture this data and disseminate it at the right time to its 7 million clients. The information generated by CareNet is useful both to employees of Travelers Insurance and to its clients. A Travelers employee can access the system and look at the latest transaction; an authorized client can also access CareNet to study the status of his or her insurance claim. This system, therefore, spans organizational boundaries and provides information to both internal external entities.

So when we are talking about the transactions of an organization in computerized manner, we talk about Transaction Processing System, popularly known as TPS

20.2 Transaction processing systems: Meaning

Transaction processing systems were among the earliest computerized systems. Their primary pur-pose is to record, process, validate, and store transactions that take place in the various functional areas/of a business for future retrieval and use. A transaction processing system (TPS) is an infor-mation system that records company transactions (a transaction is defined as an exchange between two or more business entities).

Transaction processing systems (TPS) are cross-functional information systems that process data resulting from the occurrence of business transactions.

Transactions are events that occur as part of doing business, such as sales, purchases, deposits, withdrawals, refunds, and payments. Transaction processing activities are needed to capture and process data, or the operations of a business would grind to a halt.

Let us look at a simple **example** of a business transaction. McDonald's, which sells a large number of hamburgers every day, orders raw materials from its suppliers. Each time the company places an order with a supplier, a transaction occurs and a transaction system records relevant information, such as the supplier's name, address, and credit rating, the kind and quantity of items purchased, and the invoice amount.

20.3 Types of Transactions

Note that the transactions can be internal or external.

When a department orders office supplies from the purchasing department, an **internal transaction** occurs, when a customer places an order for a product, an **external transaction** occurs.

- **Internal Transactions:** Those transactions, which are internal to the company and are related with the internal working of any organization. For example Recruitment Policy, Promotion Policy, Pro-duction policy etc
- **External Transactions:** Those transactions, which are external to the organization and are related with the external sources, are regarded as External Transaction. For example sales, purchase etc.

20.4 Characteristics of Transaction Processing Systems

1. A TPS records internal and external transactions for a company. It is a repository of data that is frequently accessed by other systems
2. A TPS performs routine, repetitive tasks. It is mostly used by lower-level managers to make operational decisions
3. Transactions can be recorded in batch mode or online. In batch mode, the files are updated periodically; in online mode, each transaction is recorded as it occurs.
4. There are six steps in processing a transaction. They are data entry, data validation, data pro-cessing and revalidation, storage, - output generation, and query support.

20.5 Features of TPS

1. A TPS supports different tasks by imposing a set of rules and guidelines that specify how to record, process, and store a given transaction. There are many uses of transaction processing systems in our everyday lives, such as when we make a purchase at retail store, deposit or withdraw money at a bank, or register for classes at a university. Almost all organizations, re-gardless of the industry in which they operate, have a manual or automated TPS

2. A TPS is the data life-line for a company because it is the source of data for other information systems, such as MIS and DSS (Decision Support Systems). Hence, if the TPS shuts down, the consequences can be serious for the organization
3. A TPS is also the main link between the organization and external entities, such as customers suppliers, distributors, and regulatory agencies
4. TPS exist for the various functional areas in an organization, such as finance, accounting, manu-facturing, production, human resources, marketing quality control, engineering, and research and development. Until a few years ago, many companies viewed the TPS for each business func-tion as separate entity with little or no connection to other systems in the company. Today, however, many companies are trying to build cross-functional TPS to promote the free exchange of information among different business units. This is a desirable goal, but is still very difficult to achieve

20.6 Process of Transaction Processing System

The six steps in processing a transaction are:

a. Data entry
b. Data Capture
c. Data validation
d. Processing and revalidation
e. Storage
f. Output generation
g. Query support

To be processed, transaction data must first be entered into the system. There are a number of input devices *for* entering data, including the keyboard and the mouse. Documents generated at the point where a transaction occurs are called source documents and become input data for the system

For **example,** when a customer returns an item at a store, the sales receipt becomes the source document *for* the transaction "return item *for* refund". An ATM receipt *for* a bank transaction be-comes.

a. Data Entry

To be processed, transaction data must first be entered into the system. There are a number of input devices *for* entering data, including the keyboard and the mouse. Documents generated at the point where a transaction occurs are called source documents and become input data *for* the system. For example, when a customer returns an item at a store, the sales receipt becomes the source document *for* the transaction "return item *for* refund". An ATM receipt for a bank transaction becomes

The use of automated methods of data entry is known as source data automation. Several methods have been developed to accomplish this automation, though very few completely automate the data entry process. They are all based *on* trying to reduce *or* eliminate many *of* the activities, people and data media required by traditional data entry methods

Methods for Data Entry:

- Keyboard/video display terminals
- Optical character recognition (OCR) devices, such as optical scanning wands and grocery check--*out* scanners.
- Magnetic ink character recognition (MICR) devices, such as MICR reader/sorters used in banking *for* check
- Other technologies, including electronic mice, light pens, magnetic stripe cards, voice input, and tactile. Input also be used as input device depending upon the application requirement

b. Data Capture

We could capture transaction data as close as possible to the source that generates the data. Salespersons capture data that rarely changes by prerecording it on machine-readable media, or by storing it on the computer system.

Tips for Data Capturing

- Capture data by using machine-readable media initially (bar-coded and magnetic stripe credit cards), instead of preparing written source documents
- Captures data directly without the use of data media by optical scanning of bar codes printed on product packaging. It ensures the accuracy and reliability of data by comparing

c. Data Validation

There are two steps in validation: **error detection and error correction,** Error detection is per-formed by one set of control mechanisms, error correction is performed by another

Some commonly used error detection procedures are checking the data for appropriate font (text, numbers, etc), checking for aberrations (values that are too low or too high), and checking for miss-ing data, invalid data, and inconsistent data. Missing data refers to fields that are missing a mandated data value.

For example, if the number of hours worked by a part-time employee is missing on a payroll form; that is a missing-data error.

Invalid data is data that is outside the range

For example, if the number of hours worked by a part-time employee is 72 hours per week instead of the 1120 hours, then we have invalid data

Inconsistent data means that the same data item assumes different values in different places with-out a valid reason.

For example, if payroll records show that an employee worked 25 hours per day.

d. Processing and Revalidation

One the accuracy and reliability of the data are validated, the data are ready for processing. There are two ways to process the transactions: online and bath mode

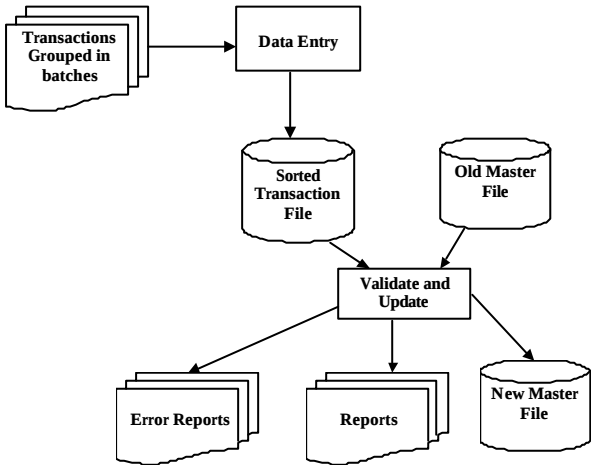
Following methods are available for Data Processing:

- **Online transaction processing (OLTP)** is the almost instantaneous processing of data. The term *online* means that the input device is directly linked to the TPS and therefore the data are processed as soon as. it is entered into the system. Input device may be at a remote location and be linked to the system by networks or by telecommu-nications systems. Some examples of online transaction processing are ATM transactions, student registration for classes. The

processing of flight reservations is another good example of an online system in which data are processed

A travel agent checks for seat availability, using the data in a central computer system, and lately notifies the customer as to the status of his or her ticket. Once the reservation is made, the airline system updates its files and sends a confirmation to the travel agent. Online 'processing is possible because of storage, such as disks, that process data in a random order.

- **Batch Processing**, in which transactions are accumulated over time and processed identically. Batch processing may be done on a daily, weekly, or monthly basis or any other time period appropriate to the application. For example, a company may process the travel expenses of its employees on a monthly basis, whereas Bath processing usually involves. Gathering source documents originated by business transactions, such as sales orders and in-voices, into groups called batches. Recording transaction data on an input medium, such as magnetic disks or magnetic tape. Sorting the transactions in a transaction file in the same sequence as the records in a sequential master file.



A transaction file contains information about a group of transactions that occurred in a given period of time. It is processed using techniques such as sorting, merging, and so on. Once the transaction file has been processed, the next step is to update the master file, which is permanent record of all transactions that have occurred. Each time the master file is updated with information from the transaction file, a new master file, including most current transaction data, is generated.

Although until the early 1960s batch processing was the only method for processing data, today there are other methods, However, batch processing continues to be a popular method because it is often the most sensible and practical approach, For example, batch processing lends itself well to payroll operations, since paychecks are generated periodically. Processing jobs in batches also results in more efficient use of computer resources. Finally, quality control is sometimes easier in batch pro-cessing, since errors detected at the end of a batch can be rectified before the next batch is pro-cessed.

e. Data Storage

Processed data must be carefully and properly stored for future use. Data storage is a critical consid-eration-for many organizations because the value and usefulness of data diminish if data are not properly stored. The kind of processing and the type o(storage medium are, to some extent, related issues. For example, magnetic tape is often used to store data that is Batch-processed. However, online transaction processing cannot be done. on magnetic tape; it relies on other types of storage media, such as magnetic disks

The next step in the processing of a transaction is to output the results of the transaction to the decision maker. Note that storage and output may not always occur in the same order. We can output the results 0f the transaction to the decision maker and then store them, or store the result and then output them to the decision maker.

f. Output Generation

Once data has been input, validated, processed, revalidated and stored, the output can be communi-cated to decision makers in two ways:

- Documents and reports
- Forms: screens or panels.

Documents are a popular output method. They can be processed further, either to generate additional information or to present the same information in a different format. Some examples of documents are invoices, paychecks, purchase, invoices., sales receipts, and job orders

What is the difference between documents and reports? A document is usually a record of one transaction, whereas a report is a summary of two or more transactions. For example, the manager of a retail store may receive an invoice (i.e., a document) from a supplier indicating the quantity and type of each item ordered and the total cost of the ore:;;'. A report, on the other hand, may summarize all the invoices from a given supplier. (Nevertheless, these terms are often used interchange-ably)

Computer output need not always be presented in hard-copy form (such as reports, documents, and printouts), but can also appear on computer screens and panels. Such soft-copy presentations are known as forms

g. Query Support

The last step in processing a transaction is querying (asking questions of) the system. Query facilities allow users to process data and information that may otherwise not be readily available. For example, a sales manager may query the system 'f the number of damaged items in a given store

Many transaction processing systems allow you to use the Internet, intranets, extranets, and web browsers or database management query languages to make inquiries and receive responses concerning the results of transaction processing activity. Typically, responses are displayed in a variety of pre-specified formats or screens. Examples of queries include:

- Checking on the status of a sales order
- Checking on the balance in an account
- Checking on the amount of stock in inventory

20.7 Summary

Every organisation must perform certain basic operations: pay employees, pay bills, monitor revenue, and file government reports. Operations are relatively structured, short-term, and easy to computerize. They form the foundation of the company. TPS support operations by collecting data and helping to control the underlying processes.

Transaction processing systems are responsible for capturing, storing, and providing access to the basic data of the organisation. The goal is to capture the transaction data as soon as possible. Common collection methods include point-of sale services, process control, electronic data interchange, and electronic commerce websites. Because data is the foundation for all other decisions, TPS must maintain data integrity and minimise the threats to the data.

Points to Ponder

Transactions Are In ...

Finance:

Each time you purchase gas using a credit card, the point-of-sale terminal connects to the credit card company's computer. In case that fails, it may alternatively try to debit the amount to your account by connecting to your bank.

This generalizes to all kinds of point-of-sale terminals such as cash registers, ATMs, etc.

When banks balance their accounts with each other (electronic fund transfer), they use transactions for reliability and recoverability.

Transactions Are In ...

Communications:

Each time you make a phone call, there is a call setup transaction that allocates some resources to your conversation; the call teardown is a second transaction, freeing those resources. The call setup increasingly involves complex algorithms to find the callee (800 numbers could be anywhere in the world) and to decide who is to be billed (800 and 900 numbers have complex billing). The system must deal with features like call forwarding, call waiting, and voice mail. After the call teardown, billing may involve many phone companies.

Transactions Are In ...

Travel:

Making reservations for a trip requires many related bookings and ticket purchases from airlines, hotels, rental car companies, and so on.

From the perspective of the customer, the whole trip package is one purchase. From the perspective of the multiple systems involved, many transactions are executed: One per airline reservation (at least), one for each hotel reservation, one for each car rental, one for each ticket to be printed, on for setting up the bill, etc.

Along the way, each inquiry that may not have resulted in a reservation is a transaction, too.

Transactions Are In ...

Manufacturing:

Order entry, job and inventory planning and scheduling, accounting, and so on are classical application areas of transaction processing. Computer integrated manufacturing (CIM) is a key technique for improving industrial productivity and efficiency. Just-in-time inventory control, automated warehouses, and robotic assembly lines each require a reliable data storage system to represent the factory state.

Transactions Are In ...

Real-Time Systems:

This application area includes all kinds of physical machinery that needs to interact with the real world, either as a sensor, or as an actor. Traditionally, such systems were custom made for each individual plant, starting from the hardware. The usual reason for that was that 20 years ago off-the-shelf systems could not guarantee real-time behavior that is critical in these applications. This has changed, and so has the feasibility of building entire systems from scratch. Standard software is now used to ensure that the application will be portable.

Review Questions

1. Define transaction and explain the different types of transactions in any business.
2. Explain the concept of Transaction Processing System and its importance.
3. List down the characteristics and features of TPS.
4. Explain in detail about the Transaction Processing Cycle / Stages.

Discussion Questions

Because of the importance of transactions, there is a large number of cases involving fraud and other legal problems with sales and other transactions. Pick an industry and find articles in business and trade journals that identify problems of this nature. How will computerisation of the transactions affect fraudulent transactions? Why would the computerisation make it easier or harder to detect these problems?

Application Exercise

Visit at least three retail stores in your area and determine how they handle transaction processing for sales. How many checkout counters are available at each store? By counting the number of customers in a 10 to 15 minutes time interval, estimate the total number of sales transaction occurring for a given day.

Note -

LESSON 21 : OPERATIONAL LEVEL INFORMATION SYSTEMS

Learning Objectives

- To have a better understanding about the various Information Systems at the operational level of any organisation
- To know about the various functional information systems at operational level.
- To identify the components and the benefits of operational level systems.

21.1 Introduction

So far, you have learned about information systems, the role of systems within organizations, the strategic uses of information systems, and the basic com-puter resources available to the manager. What you learned generally emphasized the organiza-tion as a whole, rather than the major areas of decision making com-monly found in organizations. Unit 4 focuses on these areas. You will apply what you have learned about information systems and computer system resources to problems in managerial decision making, accounting and finance, marketing, pro-duction, and human resources. You will also learn about information tools such as artificial intelligence and expert systems that are used to solve managerial problems.

These are just a few of many information tasks that must be completed accurately, swiftly, and repeatedly on a regular basis in many organizations. In large organizations, thousands of these tasks are completed daily. The information systems that perform or support the completion of these tasks are often referred to as operational information systems, or transaction processing systems. In fact financial transactions typically come to mind when you think of op-erational information systems because many operational information systems focus on the routine, repetitive financial transactions that are an important part of the basic activities of most business enterprises. However, operational information systems in-clude more than the financial transactions of an organization. Operational informa-tion systems record, process, and report all routine and repetitive activities or organi-zations. These activities occur not only in accounting and finance but also in human resources, production, and marketing. Just go through the following table.

Accounting / Finance	Marketing	Production	Human Resources
Fixed assets	Prospect leads	Purchasing	Position control
Sales Order Processing	Contact information	Receiving	Employee profiles
Accounts receivable	Micromarketing and Data Warehousing	Quality control	Employee skills
Accounts payable	Telemarketing	Shipping	Performance management
Inventory control	Direct mail	Automated materials handling	Government reporting
Payroll	Delivery tracking and routing	Image management	Training
Billing/Invoicing	Electronic shopping	Material selection	
	Electronic advertising	Shop-floor scheduling	
		Mass customization	
		Shop-floor control	

21.2 The Nature of Operational Information Systems

Operational information systems primarily produce routine, repetitive, descriptive, ex-pected, and objective data that describe past activities. The information they produce is usually detailed, highly structured, accurate, derived from internal sources, and pro-duced regularly. To some, these systems may appear to represent pure drudgery for employees who must complete them. However, the application of information sys-tems technology to operational information systems has reduced this drudgery to a great extent and provided managers with a number of major advantages

Management Advantages

Automating operational information systems usually increases the efficiency of these systems; they typically run faster and require fewer personnel and other business re-sources than manual systems. Organizations that automate operational information systems usually receive several benefits for their efforts

- Reduced Cost
- Increased Speed
- Increased Accuracy
- Increased Customer Service
- Increased Data for Decision Making

21.3 Operational Accounting and Financial Information Systems

Typically, the first applications that organizations computerize are operational-level fi-nancial accounting systems. Operational financial accounting information sys-tems are typically task oriented. They focus on processing financial transactions to produce the routine, repetitive information outputs that every organization finds nec-essary. These outputs include paychecks, checks to vendors, customer invoices, pur-chase orders, stock reports, and other regular forms and reports.

Financial Accounting Systems

The heart of an organization's operational financial information system is its financial accounting system. A computerized financial accounting system is composed of a series of software modules or subsystems that may be used separately or in an inte-grated fashion. The system modules typically include

- General ledger
- Fixed assets
- Sales order processing
- Accounts receivable
- Accounts payable
- Inventory control
- Purchase order processing
- Pay roll

When these computerized financial accounting systems are integrated, each sys-tem receives data as input from some systems and provides information as output to other systems.

Importance to Decision Making

The fact that operational financial accounting systems are predominantly routine and repetitive in nature does not mean that they do not contribute to decisions that are important to the organization. For example, the accounts receivable system may routinely process credit information about customers, which may include comparing the balance of customer accounts to customer credit limits. Though this comparison might seem trivial, it is essential to a common decision faced by the sales force: Should the customer be allowed to make this purchase on credit? Organizations that can provide on line credit information to salespeople reduce the risk of incurring bad debts, which lowers their cost of operations.

Let's briefly examine some of the important components of Operational Finance and Accounting Systems and their benefits in the following paragraphs.

General Ledger System provides managers with periodic accounting reports and statements such as the income statement and balance sheet.

Fixed Assets System maintains records of equipment, property, and other long--term assets that an organization owns. The records include the original cost of the as-sets, their depreciation rates, the accumulated depreciation to date, and the book value of the assets, or the original cost less accumulated depreciation.

Sales Order Processing System or order-entry system, routinely records sales orders and also provides data to other systems that fill those orders, maintain inventory levels, and bill the customer. This system provides sales tax data to the general ledger system for posting to taxing agency accounts, stock data to the inventory sys-tem for updating inventory balances, and sales data to the accounts receivable system for posting to customer accounts.

Accounts Receivables System allows you to enter, update, and delete customer information such as sales made on account, credit terms, cash payments received, credit memorandums, and account balances. Inputs to the accounts receivab1e system include sales invoices, credit memoran-dums, and cash received from customers. Typical outputs of this system are monthly customer statements of account and a schedule of accounts receivable listing each ac-count and its balance.

Accounts Payable System processes much the same routine, repetitive infor-mation as the accounts receivable system, except that in this case the information is about the organization's creditors rather than about its customers.

Inventory Control System provides input to the general ledger system and re-ceives input from the purchase order and the sales order systems. The basic purpose of the system is to keep track of inventory levels and inventory costs. The system maintains information about each stock item, such as stock numbers and stock de-scriptions, receipts and issues of stock, stock damage, and stock balances.

Purchase Order Processing System processes purchase orders and tracks which purchase orders have been filled, which stock items ordered are on backorder, which stock items have been damaged or do not meet the specifications of the origi-nal order, and which orders are still on order and when those orders are expected to arrive. The purchase order system provides information to the accounts payable and in-ventory systems. The system produces a variety of reports, including a list of all stock on backorder and an open-order report that lists all purchase orders not yet received and their expected arrival dates.

Payroll System processes wage and salary information such as payments to em-ployees; deductions from employee paychecks; and payments to federal, state, and other taxing agencies for taxes used. The payroll system produces such repoft4 as the weekly payroll summary report, overtime reports, forms for taxing agencies such as wage and tax statements (Forms W-2), payroll checks, and checks for payroll taxes owed to taxing agencies

21.4 Operational Marketing Information Systems

The marketing function occurs in all organizations, including profit and not-for-profit, manufacturing, agricultural, financial, educational, and service organizations. The basic goal of the marketing function in any organization is to satisfy the needs and wants of its customers. To achieve that goal, marketing personnel engage in activities such as planning and developing new products; advertising, promoting, selling, stor-ing, and distributing goods and services; providing financing and credit to customers' and conducting market research.

Operational marketing information systems include systems such as sales systems, advertising systems, sales promotion systems, warehousing systems, and pric-ing systems. The systems collect data that describe marketing operations, process those data, and make marketing information available to marketing managers to help them make decisions. To be effective, marketing information systems must be coordi-nated with other organizational information systems, such as purchasing systems, pro-duction systems, inventory systems, accounts receivable systems, credit systems, and order-entry systems.

Computer information systems have been widely applied to operational-level marketing tasks. Information technology has increased the productivity of salespeo-ple; helped firms manage customers better, locate prospective customers, customize marketing efforts to specific groups and individuals, and reduce costs; and vastly widened the reach of many organizations in terms of the geographic territory they serve. Computer technology applied to operational-level marketing systems also cap-tures data useful for tactical and strategic decisions.

Let's briefly examine some of the important components of Operational Marketing Systems and their benefits in the following paragraphs

Sales Force Automation Systems are designed to increase the productivity of sales-people. Bread-and-butter sales activities usually include identifying potential or prospective customers,

contacting customers, calling on customers, making sales pitches, closing the sale, and following up on sales. Typically, automating a sales force involves equipping salespeople with notebook computers and software to support their activities

Prospect information systems: Locating potential customers are often a time- consuming and frustrating part of the salesperson's work. The sources of information used to obtain sales leads are diverse and may include other customers, other vendors who sell supporting or ancillary products, newspaper notices, telephone directories, and customer inquiries. Searching directories and other customer lists may take a lot of time and yield few actual customers

Contact management systems: Provide information to the sales force pertaining to customers, their product or service preferences, sales history data, and a historical record of sales calls and/or visits. One output of these systems may be a call report showing the number of sales calls made by a salesperson categorized by size of organization, previous sales, or some other characteristic, and the number or amount of sales made per customer, per visit, and/or per category.

Other sales force automation systems: May also provide support for many other routine, repetitive salesperson activities, for example, travel expense reports, appointment calendars, telephone and address rolodexes, sales letter creation and distribution, e-mail, and fax. Internet access may also be provided so that salespeople can keep current on business news at any hour, especially news about the industry, competitors, and customers.

Micromarketing and Data Warehouse Systems: Pitching sales or advertising campaigns to very narrowly defined customer targets is called **micromarketing.** Computer systems have made micromarketing possible. They can be used to identify and target specific customers or prospects from large databases. For example, advertisements can be inserted into magazines targeted to each person who has purchased a product before and might be willing to QUY an up-grade. You might receive your favorite news magazine one week and find it contains an insert with your name on it, asking you how you are enjoying a product you had bought previously, and wondering if you might be interested in an accessory to that product. You might also receive a catalog from a mail-order firm that contains only data about products you have purchased before or products related to your pur-chases. Micromarketing avoids the waste of resources that occurs when marketing ef-forts cannot be so narrowly focused. It also can dramatically raise the probability of a successful marketing effort mined, to discover customer preferences and trends, sorted by geographic region, in-come level, sex, age, and occupation. The purpose of **data mining** a customer data-base is to identify new marketing opportunities and to allow marketing departments to focus sales, advertising, and promotional campaigns on tightly drawn market niches. Firms may use their customer records as their data warehouse. Many firms, however, augment their own customer database with customer data purchased from other companies. Some companies with large data ware-houses, such as polling and survey companies, credit rating firms, and credit card companies, sell their data warehouses. For example, one major credit card company, which has data on millions of credit card customers, sells its customer transaction in-formation to thousands of its business partners

Telemarketing systems: Usually include support for the automatic dialing of parties and/or delivering voice messages to the answering party under the control of a computer system. Some systems allow you to make notes about the calls, to gener-ate follow-up letters, and to view a customer file while a call to that customer is in progress.

Direct Mail Advertising Systems: Many organizations generate sales by mailing sales brochures and catalogs directly to customers using direct mail advertising systems. To distribute sales documents rapidly to large numbers of potential customers, most marketing departments main-tain customer mailing lists that are used for mass mailings. The 'lists may be drawn from customer files; accounts receivable records; prospect files; commercial databases of households, businesses, and organizations; or they can be purchased from other firms.

Point of Sale System: Systems provide immediate updates to sales and inventory systems and allow firms to monitor sales trends minute by minute. They also allow firms to capture customer data and preferences and add the information to their data warehouses.

Delivery Tracking and Routine Systems: Customers like to receive their merchandise on time. In a manual system, customers called in to a customer representative to check on the delivery of their merchandise. The customer rep would then have to call the delivery vehicle driver who uses a cell phone to tell the rep where he or she is and how soon the merchandise might be delivered. That process took time, frequently frustrated the customer, and cost the firm money to support.

Electronic Shopping and Advertising: Firms have been able to advertise and customers to shop via TV; radio, and the telephone for many years. The computer age, however, has made other avenues for shop-ping and advertising available, the most dramatic of which is clearly the Internet

Virtual shopping: When people view, select, and purchase products and services from a store in another location using electronic means, they are virtually shopping at that store. Virtual shopping, or electronic shopping, allows organizations to present information about goods and services to potential customers who are connected to their electronic "store." Selecting and buying goods using an electronic kiosk (de-scribed in the next section), from an organization's Internet site, and from a "virtual mall" of Internet Web "stores" are all examples of virtual or electronic shopping.

21.5 Operational Production Information Systems

Operational production systems are diverse; they include continuous flow pro-duction, mass production, job order production, and project production. In addition, operational production systems include the production of services as well as hard goods. The purpose of the production system is to acquire the raw materials and pur-chased parts; test the materials for quality; acquire the appropriate human resources, work space, and equipment; schedule the materials, human resources,

space, and equipment; fabricate the products or services; test the product or service outputs; and monitor and control the use and costs of the resources involved.

Numerous operational information systems support the production function. Some are part of the financial accounting system of an organization. For example, the purchasing, accounts payable, inventory, order entry, accounts receivable, and payroll subsystems of the accounting system provide information to support production ac-tivities. This section briefly describes some of the major operational information sys-tems used in production. The systems described are listed in Figure 10- I.

Let's briefly examine some of the important components of Operational Production Systems and their benefits in the following paragraphs

Purchasing Systems: To produce goods and services, you must have the right quantity of raw materials and production supplies on hand. Furthermore, you will want to procure these materials and supplies at the lowest cost and have them delivered at the right time. To assist in this function, the purchasing system has to maintain data on all phases of the acquisition of raw materials and purchased parts used in production.

Receiving Systems: When shipments of purchased goods and supplies are received, they must usually be opened, inspected, and verified against purchase orders, and the information about their status passed to the accounts payable, inventory, and production departments Delivery dates should also be noted for several reasons, including collecting data on the delivery-time reliability of suppliers. This type of information is supplied by receiving systems

Quality Control Systems provide information about the status of production goods as they move from the raw materials state, through goods in process, to finished goods. Quality control systems ensure that raw materials or parts purchased for use in the production processes meet the standards set for those materials. The systems also monitor quality during the production cycle.

Quality control data may be collected using shop-floor data collection sys-tems, which can include rich input devices-counters, assembly-line data entry terminals, process control sensors, and so on. Workers may use assembly -line data entry terminals to enter data regarding the status of goods in process and the amount of worker time devoted to each phase of the production process.

When inspection, testing, or monitoring identifies items that fail to meet the stan-dards that have been set, a variance occurs. If the variance occurs in raw materials or purchased parts, it may be reported on the receiving report. If it occurs during the production processes, the quality control system may shut down the production sys-tem or report the variance in some way to employees or supervisory personnel. If the variance occurs in finished goods, the goods must not be placed in inventory and the nature of the variance must be reported to the production manager. For ex-ample, the standards for sheets of copper rolling off a mill may demand that the sheet thickness never vary more than 0.01 mm positively or negatively. If, at any time during the production process, failures occur in equipment, raw materials, or human procedures that result in the sheets exceeding this tolerance, the quality control mechanisms in place may activate a warning light or bell, print a report, or shut down the production equipment entirely

Shipping Systems: At the other end of the production process, finished goods are placed in inventory and/or shipped to customers. Many records and documents are used to assist and monitor in the inventorying and shipping processes-for example, shipping reports and packing slips. The information from the shipping system affects the inventory and accounts receivable systems.

Cost Accounting Systems: Many operational-level financial accounting systems collect and report information about the resources that are used in the production processes so that managers can obtain accurate costs of production on products and services. Cost accounting sys-tems monitor the three major resources used in production: human resources, mate-rials, and equipment and facilities.

Materials management systems provide information on current inventory levels of production materials, use of these materials in the production processes and their locations, and specifications of how these materials are employed in products. The lat-ter system is usually called a bill-of-materials (BOM) system. A bill-of-materials system produces a list of the raw materials, subassemblies, and com-ponent parts needed to complete each product. It provides, in essence, a list of ingredients for the end product

Inventory Control System: Maintaining inventories at their proper levels eliminates production shutdowns from lack of raw materials and lost sales from lack of finished goods. However, main-taining inventories also represents a number of costs to the organization, including the costs of procuring and carrying the inventory, and stock out costs, or those costs that result when the right amount of the right item is not on hand at the right time.

Automated Material Handling Systems track, control, and otherwise support the movement of raw materials, work-in-process and finished goods from the receiving docks to the shipping docks.

Computer Aided Design and Manufacturing Systems are aiding product engineers design new products and improve old products.

Image Management Systems are designed to manage the storage and retrieval of engineering and architectural drawings using optical disk storage media.

Material Selection Systems aid in choosing the materials for the product under design.

Shop-Floor Scheduling Systems help in scheduling production jobs. The tasks include scheduling the time, building and rooms, tools and equipment, inventory, and personnel to complete factory orders.

21.6 Operational Human Resource Information Systems

Human resource departments are responsible for many facets to human resource management, including recruiting, assessment, selection, placement, training, performance appraisal, compensation and benefit management, promotion, termination, occupational health and safety, employee services, complaints with legal constraints, helping managers with human resource problems, and providing top management with information for strategic planning.

Operational Human Resource Information Systems provide managers with data to support the routine, repetitive human resource decisions that occur regularly in the management of organisation's human resources. There are many operational level human resource information systems including systems that help managers keep track of the organisation's positions and employees, conduct performance evaluation, provide alternative or flexible scheduling, recruit new employees, place employees, train employees, relocate employees, terminate employees, provide employment benefits and provide reports to governmental agencies.

Let us see some of the important sub systems of operational human resource information systems and their benefits as follows:

Position Control Systems is to identify each position in the organisation, the job title in which the position is classified, and the employee currently assigned to the position. Reference to the position control systems allows a human resource manager to identify the details about unfilled positions.

Employee Information Systems is a set of employee profile records, or employee inventory. An employee profile usually contains personal and organisation-related information, such as name, address, sex, minority status, marital status, citizenship, years of service or seniority data, education and training, previous experience, employment history within the organisation, salary rate, salary or wage grade, and recruitment and health plan choices.

Employee Skills Inventory contains information about every employee's work experience, work preferences, test scores, interests, and special skills or proficiencies.

Performance Management Systems: Many organisations review the work of employees on a regular basis to make decisions regarding merit pay, pay increases, transfer or promotion. Typically, a new employee is evaluated at the end of the first six months of employment, and other employees are evaluated annually. These reviews are often called performance appraisals. The data for performance appraisals are frequently collected by asking each employee's immediate superior to complete an employee appraisal form. The form may be also given to peers, the employees themselves, and even customers or clients.

Government Reporting Systems: Data Secures from the payroll, position control, employee profiles, performance management, and other human resource information systems can be used to produce reports required by myriad governmental laws and regulations, including affirmative action and equal employment opportunity laws and regulations.

Applicant Selection and Placement Systems After jobs and the employee requirements for those jobs have been identified and after a pool of suitable job candidates has been recruited, candidates must be screened, evaluated, selected, and placed in the positions that are open. The primary purpose of the application selection and placement system is to assist the human resources staff in these tasks.

Training Systems: A great deal of software available today providing on-line training for employees, including management training software, sale training software, microcomputer training software, and word processing software.

21.7 Summary

Operational information systems are diverse and are used in all phases of an organisation, including each functional business area. The systems record, process, and report the routine, repetitive transactions and other activities of the entire organisation, including accounting and finance, marketing, production and human resource management. These data help supervisory staff and operational level managers to perform their tasks and provide a foundation to tactical and strategic information systems. Computerizing these information systems usually reduces the drudgery associated with their development and maintenance, reduces operational costs, increases the speed and accuracy with which they are performed, and improves customer service.

Operational information systems are necessary precursors to the development of tactical and strategic information systems. Operational information systems provide much of the data used by tactical information systems and some of the data for strategic information systems. And the tactical and strategic information systems provide the support for managerial decision making in accounting / finance, marketing, production, and human resource management that you will learn about it in the next lesson.

Review Questions

1. What are two ways in which the accounts receivable system of a computerised accounting system might be useful to the manager?
2. In what ways might a computerised inventory system provide a competitive advantage to the organisation?
3. What is sales force automation? What types of support can sales force automation systems provide to salespeople?
4. What is a prospect information system?
5. What is micromarketing? What advantages does it provide to marketing?
6. Describe a telemarketing system.
7. What is an automated materials handling information system? With what kinds of equipment might this information systems work?
8. What is HRIS? What are all the components of operational HRIS?
9. What type of information does an employee information system typically contain?

Discussion Questions

1. Find out the ways through which operational information systems benefit organisations.
2. Discuss the nature of operational information systems and try to identify the activities happening inside the various components of operational information systems.

Application Exercise

1. Select a company you know and try to identify the operational information systems existing in various functional areas. Try to know the benefits they are offering to the company in getting the competitive advantage.

Note -

LESSON 22 :
TACTICAL AND STRATEGIC LEVEL INFORMATION SYSTEMS

Learning Objectives

- To have a better understanding about the various Information Systems at the managerial and strategic level of any organisation
- To know about the various functional information systems at managerial level.
- To identify the components and the benefits of operational level systems.
- To know about the support extended by these systems in Management Decisions

22.1 Introduction

As you move up the organizational ladder from supervisory positions to middle- and upper-management positions, you will make decisions that have an in-creasingly greater impact on the organization. The decisions you may face along the way are diverse and could include decisions similar to these:

1. Should you purchase a new piece of equipment or lease the equipment for a three-year period?
2. Is the idle cash of your firm being invested wisely?
3. Should you invest money in new computer equipment or in additional merchandise for resale? -
4. What criteria will you use to create territories for your salespeople and how large of a territory should each salesperson cover?
5. What products should be emphasized through advertising or promotion to reach the firm's sales goals?
6. What are the best potential sites for a new retail store location?
7. How many and what types of workers will be needed to staff a new plant in another state?

This lesson examines the types of tactical and strategic decisions that you may make as you move up the ranks of middle and upper management. Specifically, we examine the application of information technology to some of the tactical and strategic information systems frequently used by middle and upper management in four organizational functions: accounting/ finance, marketing, production, and human resource management.

22.2 The Nature of Tactical and Strategic Information Systems

Tactical information systems support management decision making by providing managers with regular summary reports, regular exception reports, ad hoc reports, and other information that helps them (1) control their areas of responsibility and (2) allocate their resources to pursue organization goals. While the focus of opera-tional information systems is on the completion of tasks, the focus of tactical information systems is on resource allocation; that is, how do you allocate the resources available to you to reach organizational goals.

In contrast, strategic-level information systems are goal oriented. That is, these systems are designed to support organizational goal and direction setting.

Examples of tactical and strategic information systems in four business functions

Accounting/Finance	Marketing	Production	Human Resources
Tactical Systems			
Budgeting	Sales management	Materials requirement planning	Job analysis and design
Cash management	Advertising and promotion	Just in time	Recruiting
Capital budgeting	Pricing	Capacity planning	Recruiting
Investment management	Distribution channel	Production scheduling	Succession planning
	Competitive tacking	Product design and development	
		Manufacturing resource planning	
		Computer integrated manufacturing	
Strategic Systems			
Financial condition analysis	Sales forecasting	Site planning and selection	Workforce planning
Long-term forecasting	Market research	Technology planning and assessment	Labor negotiations
	Product planning and development	Process positioning	
		Plant design	

It is difficult at times to categorize some information systems as dearly tactical or dearly strategic. For example, some marketing information systems, such as market-ing research systems and competitor tracking information systems, dearly could sup-port both tactical and strategic planning decision-making. Sometimes the decision to categorize a decision as tactical or strategic comes down to the length of time the de-cision is likely to impact an organization. That is, decisions that will impact an orga-nization for a year or less are often viewed as tactical, while decisions that will impact an organization for more than a year are often viewed as strategic.

The computerization of financial accounting systems changed the way managers viewed accounting information. A large database of information became available in computerized form, and it could be viewed or manipulated much more easily than data in traditional hard copy form. So managers began to view this information as a re-source for tactical planning. Suddenly managers could obtain important summaries and comparisons of financial accounting data easily and swiftly. In the past this infor-mation would have taken a great deal of time to extract from a manual financial ac-counting system. The result was that managers began to view the financial account-ing system as more than merely a transaction-processing system, a producer of checks, invoices, and statements. It became a repository of important data that assists management in tactical decision-making and long-range strategic planning.

22.3 Tactical Accounting and Financial Information Systems

Budgeting Systems permits managers to track actual revenues and expenses and compare these amounts to expected revenues and expenses. It also allows managers to compare current budget amounts to those of prior fiscal periods, other divi-sions, other departments-even to industry-wide data. Comparisons of budget data against such standards allow managers to assess how they use their resources to achieve their goals. For example, a manager may view the budget to find the amount of money ac-tually spent in the purchasing department on supervisory versus clerical staff. The manager may then compare those amounts to the amounts spent by other purchasing departments in the organization or in the industry.

For example, the general ledger system of a financial accounting system may pro-vide these reports:

1. Current budget allocations, expenditures, and variances by budget line item.
2. Current budget allocations compared to the previous year's allocations.
3. Current revenues and expenditures compared to the previous year's revenues and expenditures.
4. Current revenues and expenditures compared to the average of the other units or divisions of the organization.
5. Projected expenditures and variances for each budget line item for the entire year based on the expenditures incurred to date.

Regularly produced tactical-level reports, such as budget variance reports, often generate managerial questions and concerns. These in turn may lead managers to query the financial account-ing database for answers or solutions. Suppose, for exam-ple, that you are an accounting manager and supervise several departments, including the billing department. Suppose further that the regular budget report shows that the wages line of the billing department report is much higher than in prior years. To find out why, you might query the financial accounting database for answers. If the data-base stores the number of statements produced each month, the number of employ-ees in the billing department, and the costs associated with the billing depart-ment, you might obtain various measures of the productivity of that department, such as the average number of statements produced per billing department employee and the av-erage cost per statement. If you found poor productivity results, you might then ex-amine the productivity of each billing supervisor compared to the average for the or-ganization or the productiv-ity of each billing clerk compared to the average for the department. This information might lead you to decisions about changing supervi-sory personnel, providing training for specific billing clerks, acquiring new equipment to produce customer statements, or other possible remedies. Notice that the system does not make the decisions for you; it provides information to help you identify and remedy problems. It is a decision-support system, not a decision system.

Cash Management Systems

A **cash flow report** shows the estimated amount of cash that will be received and spent each month. The report shows which months will have ex-cess funds that might be put to use and which months will have insufficient funds, which may require the organization to borrow cash to meet its working capital or fixed asset acquisition needs.

Cash management systems are more difficult 'to sustain for smaller organiza-tions that may not be able to afford the resources necessary to track cash balances on a day-to-day basis and invest the excess to maximize organization income. Recogniz-ing that difficulty, Merrill Lynch, a brokerage house, created a product in the 1970s that offered business customers an account combining the attributes of a money mar-ket account, a brokerage account, a margin credit account, and a checking account. The product, called the cash management account (CMA) provided business cus-tomers with automatic deposits of cash and dividends from other accounts into a money market account. This option gave organization high interest rates on idle cash resulting from sales of stock, receipts of dividends, or deposits made for the purchase of stock. Organizations could also use a debit card and checks to withdraw money from the money market account. The result was that a small organization could use the service to maximize its income from idle cash sometimes available in its normal cash flow.

Capital Budgeting Systems

A capital budget contains information about the planned acquisition or disposal of major plant assets during the current year. The manager may compare the various capital spending plans using three commonly used evaluation tools: net present value, internal rate of return, and payback period. Before the plant asset is acquired, the man-ager should compare and evaluate various plans for its acquisition using some finan-cial software tool, such as an electronic spreadsheet.

For example, suppose a manager is considering acquiring a large electronic printer and estimates that her firm will keep the machine for five years. The printer may be purchased or leased. Each method requires the manager to spend different amounts of money over different periods of time. The manager can improve the deci-sion to buy or lease by evaluating the present value of the funds each method requires.

Investment Management Systems

Investment management-overseeing the organization's investments in stocks, bonds, and other securities-is an important part of cash management. Managing investments is also an important part of managing the organization's pension plan. Whatever their source of investment funds, most organizations invest money in secu-rities of one kind or another. Careful management of these investments is necessary to ensure the achievement of organization goals.

22.4 Strategic Accounting and Financial Information Systems

Strategic accounting and financial information systems typically include several type of information flows:

1. Internally generated financial condition analysis data, describing the status of the organization.

2. Externally generated economic, demographic, and social data describing the present and future environments for the organization.
3. Forecasts of the future of that organization in those environments.

Two major outcomes of financial strategic planning are the setting of financial goals and directions of the organization. The former may include setting goals for investments and return on investments. The latter may involve deciding on new investment opportunities or on the mix of capital sources used to fund the organization.

A major source of computerized information about the current and future Status of the organization is the organization's own financial accounting database. A major source of computerized information on the present and future environments in which the organization must operate are on-line databases that contain economic, special, demographic, technological, and political information. Projecting likely scenario for the organization using these two categories of data is the art of forecasting. Its' major purpose of strategic decision making is to use long-range forecasts to reduce the risk involved in major organizational decisions.

Financial Condition Analysis Systems

Computerized accounting systems provide the user with many reports to which conditions and analysis tools may be applied. For example, the manager may use a variety, analysis tools, on the data reported on the income statement and balance sheet. Many computerized accounting systems supp reports that automatically calculate and present the results of these tools and ratio Along with the data and reports, these tools and ratios make up the organization **financial condition analysis system.** This system provides management with variety of measures of the soundness of the organization and makes it possible to explore ways of improving the organizations financial condition.

Commonly used financial ratios

RATIO NAME	RATIO FORMULA
Current ratio	Current assets ÷ current liabilities
Working Capital	Current assets - current liabilities
Inventory turnover	Cost of goods sold ÷ average inventory
Debt-to-equity ratio	Stockholder equity ÷ total liabilities
Rate earned on stockholder's equity	Net income ÷ average stockholder's equity
Earnings per share	Net income ÷ number of shares

Long-Range Forecasting Systems

Strategic planners demand forecasts on a variety of factors that will affect organiza-tion performance in the future. Some forecasts may involve the use of internally gen-erated data. For example, past sales data may be used to project future sales. Other forecasts may use only external data or both internal and external data. For example, forecasting economic indicators helps planners understand the likely economic envi-ronment in which the organization must operate in the future. Forecasting the finan-cial health of the organization through long-range budget estimates-including a vari-ety of possible wage negotia-tion settlements, actions by competitors, interest rate fluctuations, fuel cost changes, and different inflation rates-provides planners with opportunities to consider actions that will help the organization survive bad times or take advantage of a future environment.

Information used in forecasting the future environment includes descriptions of the past activities of an organization, data on the present economy and forecasts of the future economy, information on the present demographic structure of the region or country and forecasts of the future demographic structure, and descriptions of the current social structure and social mores and predictions of the future structure of so-ciety and societal mores.

22.5 Tactical Marketing Information Systems

As you learned, the marketing function is the satisfaction of the needs and wants of customers-current and potential. Marketing managers engage in many planning activities in the pursuit of the marketing function. These planning activities result in a combination of products, services, advertising, promotion, price, and product delivery methods ultimately offered to the organiza-tion's customers, which is referred to as the marketing mix.

Tactical marketing information systems differ from operational marketing in-formation systems because in addition to producing information on a regular basis, they also generate ad hoc reports, create unexpected as well as expected output, pro-duce comparative as well as descriptive information, provide summary information as opposed to detailed data, include both internal and external data sources, and process subjective as well as objective data.

A great deal of the data that tactical marketing information systems utilize is col-lected by operational financial information systems. Tactical marketing information systems often combine operational-level financial data with other data to support tactical decision making by marketing managers. Tactical decisions are often made by managers when they prepare and implement marketing plans through which they hope to reach top management's sales and profit

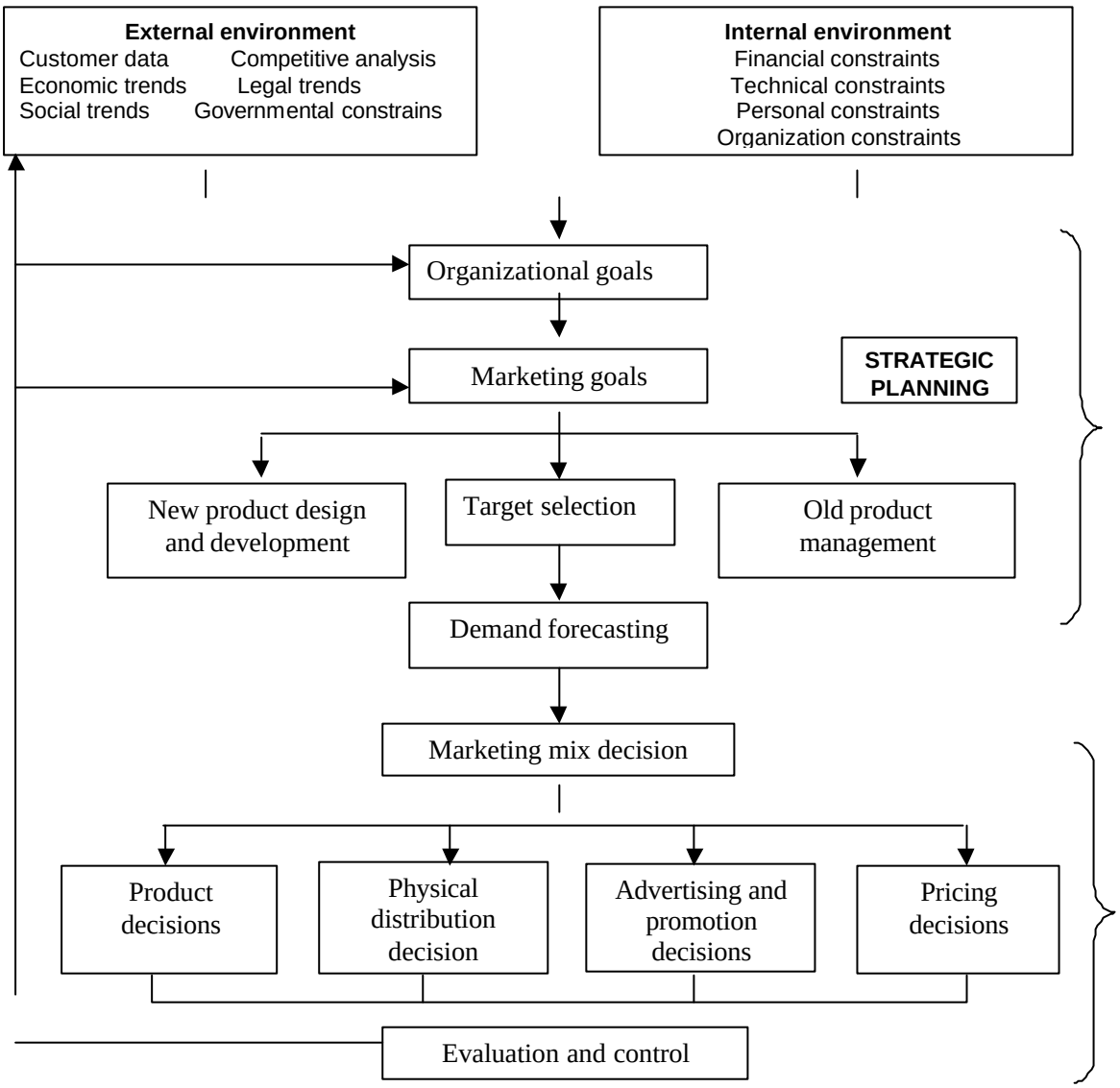
A major objective of marketing managers is to reach the sales goals set by top management. To accomplish this objective, marketing managers must make many tactical decisions, such as how sales territories should be shaped, how the sales force should be allocated within those territories, and what emphasis should be placed in the products offered and customers served. Marketing managers must decide ho to reward salespeople to encourage increased sales efforts, which market segment should be emphasized to best reach sales goals, and which products and service will best appeal to each segment. They also must monitor the progress of the sales effort to determine if their decisions were correct or if they need to change the tactical plans.

A planning model for marketing management

Tactical Planning

Sales Management Systems

Sales management systems enable marketing managers to assess the productivity of the sales force; the fertileness of sales territories; and the success of products by salesperson, territory, and customer type. Sales management systems keep track of salesperson call activities, sales orders, and customer activity. The



systems allow the manager to identify weak territories or weak products in a territory; to compare sales-person performance by product and customer type; to compare salesperson performance against salesperson goals; to analyze salesperson calls within territories or by customer type; to identify trends in customer purchases; to identify potential short-ages or excess stock in inventory; and to perform other planning, controlling, and or-ganizing tasks with ease and speed.

Advertising and Promotion Systems

Marketing managers also need to develop advertising and promotional tactics to implement strategic sales goals set by top management. Managers must decide which advertising media and promotional devices to use to reach the selected market segments, when to use these media and devices, and what overall mix of promotional activities to deploy to achieve sales goals. Advertising and promotion systems assist managers in these tasks.

Pricing Systems

Pricing systems provide information to managers that helps them set prices for their products and services. These information systems are important because the price of a product or service affects the sales volume and profitability of the organization. The marketing manager usually selects a price that will recover production costs and provide a profit, but the price chosen in constrained by the prices of com-petitors for similar products or services and for alternative products or services. To make pricing decisions, the marketing manager should know the expected demand for the product or similar products, the desired profit margin for the organization, the costs of producing the product or providing the service, and the prices of competing as well as substitute products. Substitute products refer to products that might be used instead of the original product, particularly when that product is viewed as too expensive by the customer. For example, a person might drive to a destination if the price of an airline ticket is viewed as too expensive.

Distribution Channel Systems

To support the marketing manager, the marketing information system should provide distribution channel decision-support systems. These systems should provide information on the costs of using the various distribution channels, the time lags caused by the various channels, the reliability of the various

channels in delivering the products and services, and the market segment situation provided by the channels. The systems should also track the demand and inventory at all levels of the distribution channels so that the manager may anticipate excess inventories and shortfalls.

Competitive Tracking Systems

To ensure that your organisation's marketing mix will continue to satisfy customers, you must keep abreast of major competitors and their activities. In the end, market share is likely to be greatest for the organisation that provides the marketing mix most closely matching a given market segment's needs and wants. Competitive Intelligence, or knowledge of the competitor prices, products, sales, advertising, and promotions, must be gathered if the organisation is to avoid falling behind the competition in the eyes of the customers. Gathering competitive intelligence is carried out through competitive tracking systems. It should be noted that data about competitors can be used both tactically and strategically by managers.

22. 6 Strategic Marketing Information Systems

To develop an overall marketing plan, an organization may engage in a variety of tactical and strategic planning activities (see Figure 11-8). The strategic activities may include segmenting the market into target groups of potential customers based on common characteristics, needs, or wants; selecting those market segments the or-ganization wishes to reach; planning products and services to meet those. cus-tomers' needs; and forecasting sales for the market segments and products. The tac-tical activities have already been described and include planning the marketing mix-the best combination of product, price, advertising, promotion, financing, and distribution channels to reach the chosen target groups. The strategic activities re-volving around sales forecasting and product planning decision making will now be discussed.

Sales Forecasting Systems

Strategic sales forecasting systems usually include several varieties of forecasts: forecasts of sales for the industry as a whole, forecasts of sales for the entire organiza-tion, forecasts of sales for each product or service, forecasts of sales for a new product or service, and forecasts for market segments. The results of these .sales forecasts are often further categorized by sales territory and sales division. Regardless of type, sales forecasts are usually based on more than historical data; they are not merely projec-tions of past trends. Sales forecasts are also based on assumptions about the activities of the competition, governmental action, shifting customer demand, economic trends, demographic trends, and a variety of other pertinent factors, including even the weather.

Marketing Research Systems

In large organizations, research departments conduct and manage marketing re-search. In smaller companies, marketing research may be completed by outside con-sultants or by personnel who must wear several hats. Regardless of how the function is completed, the results of marketing research provide important input to both tactical and strategic decision making.

These following activities are typical of a marketing research department.

1. Conducting trend analyses of industry sales of products and services identical or similar to those offered by the organization to identify products or services that are on the ascent or descent.
2. Analyzing population and target group characteristics, especially for trends or changes in data that could affect the organization.
3. Analyzing and identifying consumer preferences, including testing products and services.
4. Determining and analyzing customer satisfaction with the organization's existing products and services.
5. Estimating market share for all of each product and service offered.

Product planning and development systems

The major objective of **product planning and development systems** is to make information about consumer preferences obtained from the marketing research system and from customer inquiries available for the development of new products. The primary output of planning and development activities is a set of product specifications. In a manufacturing organization, these specifications would be given to the engineering department, which would try to design a product to. meet them. Similar activities occur in service organizations. For example, a survey Of bank .cus-tomers may indicate that customers would like a checking account that also acts like a savings account-an account in which they could place all their money, maximize the amount of cash earning interest, avoid multiple statements, and avoid the need to shift funds between savings and checking accounts. Bank personnel charged with product development may then identify specifications for such a product that meet current banking laws and regulations. These specifications may require the new ac-count to carry the same rate of interest as a passbook savings account, earn interest on the average balance on deposit during a month, not limit the number of deposits or withdrawals during a month, maintain a minimum balance of $500, and pay interest monthly. The specifications can be tested and refined through additional consumer surveys and focus groups or through testing the product in a subset of the mar-ket, such as one branch of the bank.

22.7 Tactical Production Information Systems

Production systems encompass all the activities necessary to ensure the manufac-ture of products or services. To perform its functions, the production system must lo-cate production sites, plan the layout of those sites, and produce a production plan. '{he production system has to acquire the raw materials, parts, and subassemblies needed to produce the products or services described in the plan and to identify how many workers of each type are required. The system must then allocate or acquire workers with the appropriate skills, make certain that sufficient work space and pro-duction equipment are available, and schedule an integrated use of these resources to produce the correct quantity of goods at \he correct time to meet the marketing sys-tem's forecasted needs. While production is under way, the system also must monitor the use and cost of those resources.

Materials Requirements Planning Systems

Inventory management can be taken a step further so that the system automatic produces purchases orders for stock that needs to be reordered. Materials requirement planning (MRP) software is basically a set of programs that use data from master production schedule, inventory files, and bill-of-materials systems-or list raw materials and components needed to create each product-to help manage production and inventory.

MRP systems perform a great deal of calculation and record keeping. When (quantities of raw materials and parts are large, the calculations and record keeping become too time-consuming to complete manually, except at high costs. The computer, however, has made such calculations and purchase-order preparation possible for all of organizations, and in recent years, software to implement materials requires planning has become abundant.

Just-in-Time Systems

The just-In-time (JIT) system is not tactical information system, but a tactical approach to production. The just-in-time approach was created by the Toyota Motor Company of Japan and has generated many advantages to organizations, especially those that do repetitive production. The purpose of the approach is to eliminate waste in the use of equipment, parts, space, workers' time, and materials, including the resources devoted to inventories. The basic philosophy of JIT is that operations should occur just when they are required to maintain the production schedule. To assure a smooth flow of operations in that environment, sources of problems must be eradicated. That means that quality must be emphasized because quality prob-lems interfere with the even flow of work. For inventory management, JIT translates into having just as much inventory on hand as is absolutely needed, which is achieved by developing efficient and effective production controls.

Capacity Planning Systems

In addition to ensuring that enough raw materials will be on hand for planned production, the' production manager must also see to it that enough production capacity will be available to meet production' goals. The purpose of capacity planning is to make certain that sufficient personnel, space, machines, and other production facili-ties are available at the right time to meet the organization's planned production. Managers also utilize capacity planning to minimize excess production capacity.

Capacity planning decisions are tactical production decisions and include allo-cating personnel and production facilities. Selecting sites for constructing plant facil-ities, acquiring plant facilities, and planning those facilities to meet long-term produc-tion goals are usually categorized as strategic planning production decisions.

Production Scheduling Systems

The purpose of the production schedule is to allocate the use of specific produc-tion facilities for the production of finished goods to meet the master production schedule. To manage the scheduling process, a number of scheduling tools have been developed. Two of these tools are Gantt and PERT (Program Evaluation and Report-ing Technique) charts.

These tools allow managers to control projects and project completion times and also to determine the impact problems will have on project completion dates. For ex-ample, top management may ask a manager to complete a project sooner than origi-nally planned. The manager may then consider ways to shorten the duration of the project by completing two tasks at once. However, to complete two tasks concur-rently may raise production costs substantially, because two production teams and two production facilities may be needed. To solve the problem, the manager may cre-ate what-if scenarios with the project conditions using the PERT chart tool. However, Product Design and development Systems completing multiple PERT charts manually requires extensive calculations and may prove frustrating to the manager. Computer-generated PERT charts let the manager simulate many scenarios with speed and ease. The use of 'project management software for this purpose is discussed later in this chapter.

Product Design and Development Systems

Many tactical decisions must be made to design and develop a product, especially a new product. The design engineering team usually depends on product specification information derived from customer surveys, target population analysis, or other mar-keting research systems.

The primary objective of the design .engineering team is to develop a product that meets perceived needs of customer. However, the team's tactical task is to achieve that objective with the least demand on company resources. Designing prod-ucts to contain or reduce costs often results in ingenious uses of raw materials, labor, and machinery. Through careful design, an engineering team can often design a prod-uct that can be produced at lower costs than competitors can produce it. Careful de-sign may also lead to a simpler product, which leads in turn to fewer maintenance problems, better customer acceptance, fewer product returns, and increased product repeat sales. Through the use of product design and development systems, the . engineering team may provide the company with important competitive advantages.

Manufacturing Resource Planning Systems

More recently, software that provides for manufacturing resource planning (MRP-II) has become available. MRP-II software extends the production information system to finance, marketing, human resource management, and other organizational functions. A fully developed MRP-II system includes modules that provide material re-quirements planning, shop-floor control, inventory management, and capacity plan-ning. The system also accesses cost accounting data through integration with the fi-nancial accounting system. MRP-II systems usually accept data from a wide range of shop-floor data collection equipment, including voice recognition equipment, factory robots, production-line sensors, process control systems, bar code readers, and CAD workstations.

Computer-Integrated Manufacturing Systems

Many production professionals envision a day when factory and product planning control, design, and operation will be totally integrated and almost totally computerized. Some software and hardware firms that provide MSP, MRP, MRP-II, CAD, CAM, CAI CAT, CAPp, CAl, robotics, and related information

systems are joining forces through mergers, acquisitions, and joint projects to integrate current production hardware an software products into systems that provide computer-integrated manufacturing (CIM), A growing number of manufacturers are utilizing CIM -or at least a great mar components of CIM-to run their factories. Implementing CIM can lead to considerable cost savings, improvement in quality, and more flexible responses to customer.

22.8 Strategic Production Information Systems

Strategic production information systems provide support for top-management-Ie1 production decisions such as:

- Selecting a plant site.
- Constructing a plant addition.
- Building a new plant.
- Designing and laying out a production facility.
- Choosing the technologies that will be used in the production processes.
- Choosing responsibility for production processes-deciding basic policies on vertical integration and outsourcing.

Decisions of this magnitude require the commitment of a large amount of capital and other resources over a long period of time and thus are strategic in nature. Clearly, such decisions must not be made lightly.

Site Planning and Selection Systems

Site planning systems usually rely on a variety of internal and external sources. Some of the external information needed is relatively objective and quantitative, such as the availability and cost of trained or experienced labor and the degree to which it is unionized, the availability and cost of transportation for raw materials and finished goods, the availability of suitable sites, the cost of land, the proximity of raw materials suppliers and finished goods customers, the availability and costs of power, and the rate of property and income taxation.

Technology Planning and Assessment Systems

Having access to information on new; production technologies allows top manage-ment to make better and more informed decisions about which production tech-nologies to use for a product or service. **Technology assessment systems,** which identify new technologies and assess them for their strategic advantage, can help top management in many areas, not merely production. Like site planning, technology in-formation systems may include CD-ROM databases, traditional library resources, Internet sites, and on-line databases maintained by government agencies, industry groups, private research groups, and consulting organizations. They may also include technology assessment groups within the production or engineering arms of the organization.

Process Positioning Systems

An important part of any organization's strategic production plan is the span of pro-duction processes it decides to perform for any given product or product line. Deci-sions of this nature are called **process positioning,** or vertical integration. An or-ganization might purchase raw materials, fabricate parts, assemble; parts into subassemblies, and then assemble and test the complete product. It may, on the other hand, decide to purchase already constructed subassemblies and parts from others and limit its internal span of production processes to assembling and testing the plant Design Systems completed product. Outsourcing subassemblies, for example, to production facilities in third world countries, may allow the organization to gain a competitive advantage by being a low-cost leader for its products.

Plant Design Systems

Designing and laying out a manufacturing plant requires large amounts of diverse in-formation about the proposed plant, including engineering data on the proposed site, proposed production technologies, the number and duties of plant personnel, the ex-pected schedule for the use of the facility, the area transportation system, choices of water and power systems and their costs, the cost and availability of construction materials, the plans for shop-floor information systems, and the need for physical secu-rity. Much of this information is available to the **plant design system** from the site planning, technology assessment, and process positioning decision processes.

22.9 Tactical Human Resource Information Systems

To assist managers in managing human resources, a number of information sys-tems, called **human resource information systems (HRIS),** have been developed (see Figure 11-1). Human resource information systems contain personal information about the employees of an organization, and securing this information against un-wanted or unwarranted access, use, or distribution is terribly important to the individuals involved. Unwarranted access, use, or distribution is also likely to be illegal under current legislation and can subject the organization to serious legal liability. Se-curity issues surrounding databases, such as the human resource information database and the computer systems that house these databases, are discussed in greater detail in Chapter 17. Human resource information systems include a number of tactical and strategic information systems. Tactical HRIS include job analysis and design, recruitment, train-ing and development, and employee compensation. Strategic HRIS include informa-tion systems that support workforce planning and labor negotiation.

Jon Analysis and Design Systems

Job analysis and design includes describing the jobs needed in an organization and the qualities of the workers needed to fill those jobs. These tasks involve the devel-opment of job descriptions for every type of position in an organization. Each job description specifies the purposes, tasks, duties, and responsibilities of each job and the conditions and performance standards under which those duties and respon-sibilities must be carried out. Job analysis and design also includes the development of job specifi-cations for each type of job. A job specification describes the skills, knowledge, expe-rience, and other personal characteristics required to perform the jobs that are listed in job descriptions. In short, job descriptions describe the jobs, and job specifications describe the workers needed to fill those jobs.

Recruiting Systems

A recruiting system should provide the organization with a bank of qualified appli-cants from which it may fill vacant positions identified through the position control system and described by the job analysis and design information system. The recruit-ing function should also ensure that the organization is in compliance with various federal, state, and local statutes and contract regulations for affirmative action and equal employment opportunity.

Compensation and Benefits Systems

To help human resource managers control their compensation and benefit plans, organizations must keep and maintain information describing the various pay plans and fringe benefits as well as the choices of each employee. The **compensation and benefits system** may support a variety of tactical human resource decisions, especially when compensation and benefits information is related to information from internal and external sources. For example, you may wish to relate the pay received by employees with the same job duties or job titles to identify employees who are paid more or less than they should be for the skills they have and the duties they must complete.

Succession Planning Systems

An important role of human resource departments is to make certain that replacements for key organizational personnel are available when the positions key personnel occupy become vacant because of death, injury, retirement, or other reasons. Planning for the succession of these key people means identifying replacement employee.

22.10 Strategic Human Resource Information Systems

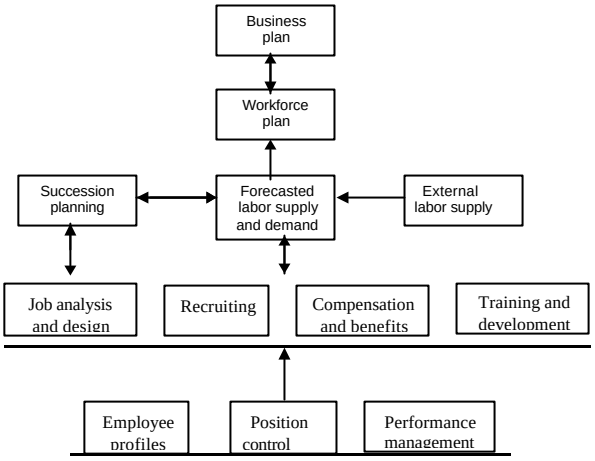
Human resource planning ensures that the organization has the right kinds and the right numbers of people at the right places at the right time to achieve its objectives Several types of human resource planning are strategic in nature, including workforce planning and labor negotiations.

Workforce Planning Systems

Organizations involved in long-term strategic planning, such as those planning to ex-pand into new market areas, construct factories or offices in new locations, or add new products, will need information about the quantity and quality of the available workforce to achieve their goals. Information systems that support workforce plan-ning serve this purpose. This type of planning involves identifying the human re-sources needed to meet the organizational objectives specified in the strategic plan and that means forecasting the supply and demand of the required workforce. These forecasts are estimates of the characteristics, quantity, and pricing of the labor force needed to achieve the long-term plans of the organization.. Forecasting human re-source needs requires information to answer a number of planning questions, includ-ing the following:

1. What should be the labor force of the organisation look like to meet the strategic plan? What skills, experiences, knowledge, and other qualities should be organisation's human resource process? In other words, what job descriptions and specializations does the strategic plan require?
2. What quantities of human resources with the qualities already identified are needed to carry out the strategic plan? In other words, how many positions for each job title does the strategic plan need?
3. What are the current human resources of the organization and how well do they satisfy the organization's strategic needs for human resources?
4. 4. What other human resources are available to achieve the strategic plan?

A model showing HRIS support for a workforce plan



Information Systems Supporting Labor Negotiations

Negotiating with craft, maintenance, office, and factory unions requires information gathered from many of the human resource information systems already discussed. In addition, negotiators need information from the financial accounting system and from external sources, including competitor wage agreements and appropriate economic data for the industry, employee group, and geographical region. Much of the external information required by a negotiating team can be obtained from the on-line data-bases discussed in Chapter 7. The human resource team completing the negotiating needs to be able to obtain numerous ad hoc reports that analyze the organization's and union's positions within the framework of both the industry and the current eco-nomic situation. The negotiating team must receive these ad hoc reports on a very timely basis because additional questions and tactics will occur to the team while they are negotiating.

22.11 Summary

Tactical information systems support managers in the allocation of resources to meet top managements goals. Strategic planning information systems, support the setting of organization goals. There are many applications of information becomes to tactical and strategic planning decisions in business and organizations. This chapter briefly de-fines applications to panning decisions in finance, marketing, production & human resources.

Financial information systems include tactical terms such as budgeting, cash management, capital budgeting, and investment management, and strategic systems, such as financial conditions analysis and long term forecasting. .A wealth of internal sources of information exists for these information systems, and many general purpose and software tools are also available.

Marketing information systems support managers in the management and control of the sales force, sales campaigns, advertising promotion campaigns, and the distribution and delivery of goods and services, as well as in tracking competitors. Strategic marketing informa-tion systems include sales forecasting, market re-search, and product planning and development.

Many tools are available to assist marketing managers in tactical and strategic decision making, including data warehouses, geographic information systems, on-line and Internet databases, and CD--ROM Databases

Tactical and strategic production information systems support decision making for the allocation and planning of manufacturing and production re-sources. Many information systems have been de-veloped to assist in controlling inventories: estimat-ing, assigning, and monitoring production capacity; designing products and services; scheduling pro-duction facilities; allocating human resources; con-trolling production projects; assessing production technologies; planning for the development of new plants; deciding on the level of vertical integration; and designing plant facilities. These information sys-tems use data from the organization's financial ac-counting and human resource databases. In addi-tion, many external sources of information, such as on-line government, scientific, and industry data-bases and Internet sites, provide support for strate-gic planning.

The continued use and refinement of computer support for manufacturing am' production opera-tions and decisions is leading organizations to an in-tegrated approach to the management of manufac-turing and production systems.

Human resource departments are responsible for many facets of human resource management, including tactical decision making in the areas of recruiting, training, compensation, benefit manage-ment, and job analysis and design. HR managers also provide top management with information for strategic planning, including providing workforce plans and support for labor negotiations.

Review Questions

1. What are the outcomes of Financial Strategic Planning?
2. What kinds of information, internal to an organisation, might be found in a data warehouse that would be useful to marketing personnel?
3. What major types of decisions do advertising and promotion systems support?
4. How might be the Internet be used to obtain information about competitors and competitive products?
5. Describe five activities performed by Marketing Research Department. How might computer information systems support each of these activities?
6. What is a Materials requirements planning system? How can an MRP system help an organisation?
7. What is JIT?
8. What is the purpose of capacity planning?
9. How a compensation and benefits information system might be used tactically?
10. What is a succession planning system?
11. What are the outputs of workforce planning forecast? What may be the types and sources of inputs to a workforce forecast?

Discussion Questions

1. Discuss and find out one summary report and one exception report that might be useful for these types of managers:
   a. Accounting Manager
   b. Budget Officer
   c. Investment Manager
2. Discuss the information requirements for strategic planners concerned about the environment in which the organisation may find itself 5 to 10 years from now.
3. Discuss and present how a marketing manager might use the Internet to monitor competitors.

Application Exercise

1. Interview three managers who are in three different levels of the organisation and discuss about the systems they are following.

LESSON 23 :
MANAGING KNOWLEDGE IN THE ORGANISATION

Learning Objectives

- To explain organizational knowledge management
- To study about the useful applications for distributing, creating, sharing knowledge
- To demonstrate how the various techniques improve knowledge base

23.1 Introduction

In many cases, decisions are too subjective or too large. Yet, decision makers can still use some help. Many organisations make the same difficult decisions every month or every year. Difficult decisions can require the participation of dozens of employees and analysis of gigabytes of data. It would be nice if the organisation could keep the knowledge gained from every decision and apply it to similar problems in the future. In the past, maintaining organisational knowledge was a key management factor in retaining and promoting key employees. But in medium and large organisations, turnover, distance, and the challenge of finding the experts can make it difficult to maintain and share the knowledge. So, some companies have attempted to create Knowledge Management (KM) Systems.

A KM system is designed to store any type of data needed to convey the context of the decision and the discussion involved in making the decision. While the system might contain rules, it is primarily a giant database of easily accessible data for experts. As we've mentioned in other chapters, information is becoming an important corporate resource that must be captured, protected, preserved, and grown. How you do that is the focus of this chapter.

23.2 Knowledge Management in the Organization

Creating and using knowledge is not limited to information-based companies: it is necessary for all organizations, regardless of industry sector. It's not enough to make good products; companies must make products that are better, less expensive to produce, and more desirable than those of competitors. Using corporate and individual knowledge wisely will help companies do that.

In the last few years, companies have downsized and flattened their organizations. Many of the employees who were laid off had been with the company for years. When they walked out the door, they took experience, education, contacts, and information with them. The companies are finding out how important that human resource is to their success.

And as companies continue to expand on a global basis and increase their use of technology to connect workers, they have to devise methods of disseminating information quickly to as many people as possible. If an employee in Chicago has experience with a certain production method, it would be silly not to share that information with employees in Singapore so that they don't "reinvent the wheel."

So as knowledge becomes a central productive and strategic asset, the success of the organization increasingly depends on its ability to gather, produce, maintain, and disseminate knowledge. To understand the concept of **knowledge management**, think of knowledge as a resource just like buildings, production equipment, product designs, and money. All these resources need to be systematically and actively managed.

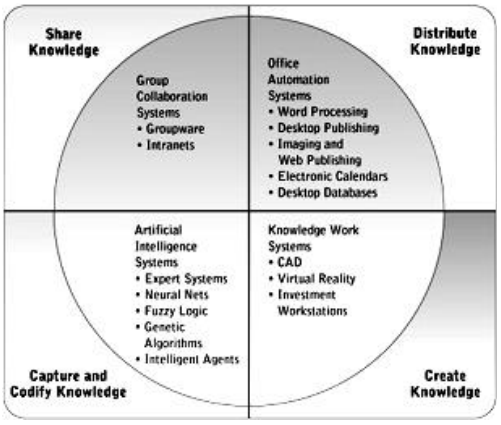
Information Systems and Knowledge Management

There are two main components to a Knowledge Management system: Office Automation Systems (OAS) and Knowledge Work Systems (KWS).

We're all pretty familiar with OAS systems that secretaries, clerical workers, and some professionals use. In fact, you've probably used some of the same applications contained in an OAS. The most popular is the Microsoft Office suite, which includes word processing (Word), personal information management systems (Outlook), spreadsheets (Excel), and database software (Access). OAS systems help disseminate and coordinate the flow of information created by someone other than themselves, BOTH internally and externally to the organization.

KWS, on the other hand, support the creation and integration of new knowledge that is beneficial to the organization. One could argue that the most important element of a KWS is the **tacit knowledge** that resides in the minds of the employees. Most other types of knowledge you can learn from books. Tacit knowledge usually comes from experience.

The following figure shows the types of systems an organization would use to create knowledge, capture and codify it, share the knowledge among people, and distribute it with various Office Automation Systems.



How contemporary information systems support workers

Knowledge Work and Productivity

We could have a good discussion of productivity gains as a result of the increased use of Information Systems of all kinds.

The latest figures say that "productivity growth - which languished at 1% during the 1970s and '80s - has taken a long-term leap to 2% or more as companies use information technology to become more efficient."

To add another dimension, it has long been known that our government does not adequately measure the dollar value associated with the export of information to foreign countries and the products created in the Information Services sector. It's not as easy to count the products from Information Services, such as software or financial advice, as it is to count the number of cars loaded onto a ship bound for Europe.

One of the more interesting aspects of the discussion here is the statement "Évalue created by computers may primarily flow to customers rather than to the company making the investments." The customer is happier; but is the company more productive? And although the company may not necessarily be able to count the productivity gains, it can realize gains from satisfied customers who return for more products or more information or more services.

Simply throwing a computer on an employee's desk does not make him or her instantly more productive or instantly smarter. You have to train people on the best use of the system. The company as a whole also has to rethink processes, workflows, and goals. If you had a problem or an inefficient process before, new hardware and software won't automatically fix it: think business process redesign and paradigm shifts. Information and knowledge are key business assets that must be nurtured, protected, grown, and managed for the benefit of the entire organization.

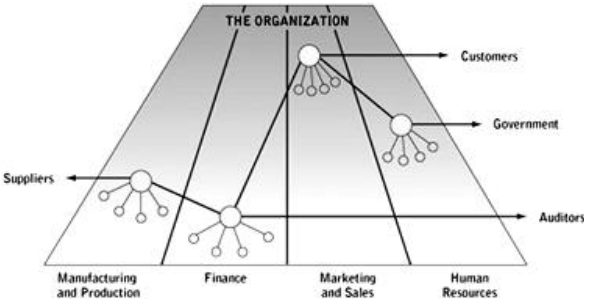
23.3 Information and Knowledge Work Systems

Information work is the art of creating and processing information. We use the term "art" because some companies do a very good job of creating, processing, and managing their information; others do such a poor job that these tasks become a detriment to the success of the organization. Which kind of company do you want to work for or own?

The two groups of employees primarily concerned with KWS are the data workers who process and distribute information and the knowledge workers who create knowledge and information. There are several ways to distinguish these two groups. You can also distinguish the two by the type of work they perform and how they create and use information. Here are some questions to help you:

- Do they create original ideas, or do they process, record, and store someone else's?
- Do they make their own original decisions regarding the information?
- Do they establish procedures to create and process the information, or do they follow someone else's procedures?

Distributing Knowledge: Office and Document Management Systems



The office, as we know it in the traditional sense, is the setting for the generation and processing of information. As the above figure shows, it's where different roles mesh into a smooth "machine" of producing information, knowledge, and ideas instead of a product that you can touch, feel, or smell.

Office Activity	Technology
Managing documents	Word processing; desktop publishing, document imaging; Web publishing; work flow managers
Scheduling	Electronic calendars; groupware, intranets
Communicating	E-mail; voice mail; digital answering systems; groupware; intranets
Managing data	Desktop databases; spreadsheets; user-friendly interfaces to mainframe databases

The table describes typical Office Automation Systems and the activities they support, all of which are vital to the success of the organization. While some OAS still rely on stacks and stacks of paper, modern technology emphasizes digital sourcing, storage, and distribution. As computers and associated technology become more embedded into the normal workflow of offices, more is being done without paper. For instance, a clerical worker can create a document, send it to co-workers or supervisors for their input via email, have it returned electronically, correct it, and distribute it online.

But no matter how much we talk about a paperless society, we are actually generating more paper than ever. One of the emerging technologies that is enhancing the productivity and ease-of-use of Office Automation Systems and reducing paper problems is the document imaging system, which converts documents and images into digital form so they can be stored and accessed by computer.

Documents not in use are stored on-line on an optical disk system called a jukebox. The index server maintains the information the system will use to locate, access, and retrieve a document.

A wonderful example of document imaging systems is bank checks. Most banks don't return canceled checks any more. They make a digital image of the check, store it electronically, and then destroy the piece of paper. If you ever need a copy of one of your old checks, you have to request it. While the initial use of paper isn't reduced, the cost of processing and mailing the checks to the customer is gone altogether.

The advantages of using document imaging systems lie in the chance to redesign workflows. If companies aren't willing to do

this, then they are laying out a lot of money to buy and install a system that they'll never fully use.

Creating Knowledge: Knowledge Work Systems

In this section we'll review many different Knowledge Work Systems (KWS) so that you have a clear understanding of how they differ from OAS and other Information Systems. These systems help create new products or improve old ones, and they're also used to integrate new data into the flow of information that is so vital to an organization.

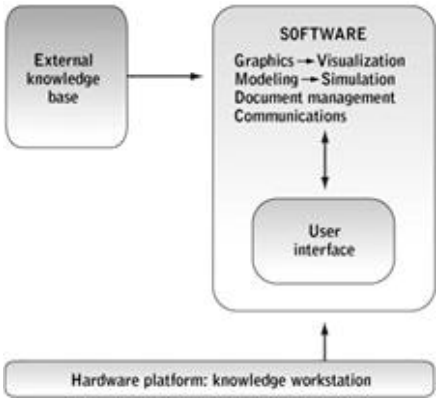
It's important that you understand the functions KWS perform. They:

- Keep the organization up-to-date in knowledge
- Serve as internal consultants
- Act as change agents

Requirements of Knowledge Work Systems

The first requirement of a KWS is that it provides knowledge workers with the necessary tools:

- Graphics tools
- Analytical tools
- Communication tools
- Document management tools



The above figure also shows how the elements of a KWS work together. Note that this kind of system requires links to external knowledge bases.

Most KWS require powerful workstations that can process the huge graphics files some professionals need or perform the massive calculations other types of professionals require. We're not talking clip art or simple adding or subtracting. We are talking huge amounts of data that must be processed quickly and the necessary storage for large files. The workstations must also have the necessary equipment and telecommunication connections that enable the knowledge workers to connect to external sources of information via Extranets, Intranets, or the Internet. These systems must have system and application software that is easy to use and manipulate, and intuitive to learn.

Examples of Knowledge Work Systems

Pick up any business or technology magazine, or watch the news channels and you'll find numerous examples of how companies are using Knowledge Work Systems to re-create their core processes, create new products or services, or improve old ones. The text gives some excellent examples:

Computer-aided design (CAD) applications are used by design engineers to build new products or improve old ones. It used to take 3-4 years and millions of dollars to design a new car. With improved CAD systems, automobile manufacturers have reduced the time to 18-24 months and cut the cost by millions of dollars. Boeing Company has seen the same startling results in their design process for airplanes.

Virtual reality systems have sophisticated imagery that makes you feel like you're "right there!" You may have seen this system on TV shows or in the movies. You're usually required to wear special equipment that feeds your reactions back to the computer so that it can plan its responses to your input. The U.S. Air Force uses virtual reality systems to help train pilots.

VRML (Virtual Reality Modeling Language) is a set of specifications for interactive 3-D modeling on the Web. Many companies are putting their training systems right on the Internet so that people can have access to the latest information and can use it when they need it. Some Web sites use Java applets to help process the programs on the local workstation.

How would you like to make investment decisions based on information that is 90 days old or older? Would you have very much faith in a system that told you only how the company did financially last year, or would you also like to know how the company performed last quarter? That's the idea behind investment workstations. They combine information about companies that is internal and external, new and old, in order to advise clients on the best use of their investment dollars. Massive amounts of data must be processed quickly in order to keep up with changing market conditions and the changing nature of the industries themselves.

Sharing Knowledge: Group Collaboration Systems and Intranet Knowledge Environments

It's no surprise that the workplace is changing rapidly. In fact, you'd have a hard time defining "workplace" in today's world. Group Collaboration Systems' role, along with Intranets, is to support all the new and different ways we work.

Groupware

Lotus Notes is the best-known groupware application, with Microsoft Exchange following closely in second place. The three Cs of groupware (communication, collaboration, and coordination), allow people to work together from virtually anyplace on earth. Telecommuters, and people assigned to geographically separated functions, can zip documents from one place to another, or even better, work on the same document at the same time. According to an article in Business Week magazine, Mar. 29, 1999, the most popular feature of groupware is email.

The newest version of Lotus Notes also allows users to hold online chat sessions. Users know when their colleagues are online and can then discuss current projects with them in real time. The use of groupware can reduce the costs of travel significantly and allow more communication between people than ever before. This kind of software support gives global companies tremendous advantages in merging their organiza-

tions and enhancing collaboration between offices around the world.

The Lotus Web site, **http://super.lotus.com**, has an excellent online demonstration of how you can use groupware and other features to enhance the three Cs of groupware, including a new feature that allows mobile access to Intranets, Extranets, and Web sites.

Knowledge Management Capabilities of Groupware

Capability	Description
Publishing	Posting documents as well as simultaneous work on the same documents by multiple users along with a mechanism to track changes to these documents
Replication	Maintaining and updating identical data on multiple PCs and servers
Discussion tracking	Organizing discussions by many users on different topics
Document management	Storing information from various types of software in a database
Work-flow management	Moving and tracking documents created by groups
Security	Preventing unauthorized access to data
Portability	Availability of the software for mobile use to access the corporate network from the road
Application development	Developing custom software applications with the software

This table gives you more ideas about how groupware can help companies organize and manage knowledge.

Intranet Knowledge Environments

Joe, a mechanic in Mumbai, needs to fix a radiator in a car he hasn't seen in five years (it's an old car). He can't remember exactly how the gasket fits on the top of the radiator or what bolts he needs. He walks over to his computer, accesses the Intranet the automobile manufacturer has established, clicks on the type of car, the type of repair, and downloads the latest information about fixing the part. He can view a video file showing him how the gasket fits, listen to an audio file that explains which bolts he needs along with acceptable substitutes, and read a warning about the dangers he might face when he removes the radiator.

Instead of the hours it might have taken Joe before to look through a manual, fiddle with the part, and try various methods of fixing the radiator, he can have the job done in less than half a day. Joe saves time and money, the customer is happy to get his car back so quickly, and the auto company saved hundreds of rupees training Joe.

Think about the other advantages of using Intranets to manage and disseminate this knowledge. The auto company didn't have to process very much paper to get the latest training manuals to Joe. Joe didn't have to sort through the new manuals, toss out the old, or ignore both the old and the new while he tried to fix the part on his own. No one wasted time organizing the most current information, and yet it was available whenever it was needed by whoever needed it.

Joe didn't need any special hardware or software or even any unique telecommunications transmission media. All he needed was a regular cheap computer hooked to a regular cheap telephone line. The company didn't have to install any special hardware or software other than what it normally would have to access an ordinary Internet or Intranet site. If he had any special questions, Joe could have sent an email to the technical support staff at the Repair Headquarters, who would have answered his question via a return email.

The technical support staff at the Repair Headquarters would track Joe's question and if it was unique, they would update their database with his question and answer so that it would be available to other mechanics or other support staff. The question and answer, ultimately filed in the database, would be available to the company's engineers for input in the next design review.

Amazing what we can do with today's technology! But what happens if Joe chooses not to use the technology? What happens if the technical support staff decides not to share information with the design engineers for fear they'll lose their jobs? What if the design staff ignores the data available to them? We're right back to the triangle of hardware, software, and persware. You've got to get the people to support the system and make it their friend so they will use it to the benefit of the company.

You can distinguish between OAS and KWS systems by the way they manage knowledge and information, and by the type of worker using them. OAS systems are comprised of information processors, while KWS systems create and manage knowledge using Computer Aided Design systems, virtual reality systems, and VRML. Knowledge is shared through the groupware and Intranet components of a KWS.

23.4 Implementation of Knowledge Management in Organisation

I have become convinced that the question is no longer whether to implement knowledge management (KM) in our organization, but how to implement it.

The real issue is how we use knowledge to better equip our employees to deliver quality services. It is no longer a question of knowledge management (KM) versus information management (IM) either, but rather a question of how best to implement both KM and IM as associated business disciplines to improve the way we make decisions and provide service to our customers, as individuals and as an organization. We are just embarking on a department-wide KM/IM initiative with the objective to achieve a knowledge-empowered workforce. This experience has afforded us several insights into the process of establishing KM, as well as the practical outcomes.

If it isn't practical, it isn't tactical!

Recent departmental re-organization has provided us with a great opportunity to evaluate our business processes and to start planning for some better corporate KM/IM principles and practices. We have realized if we want to be deliverers of world-class services, we need to adopt common KM/IM guidelines, procedures, and methodologies in order to maximize our return on the huge intellectual assets we hold as an organization. We must define a set of management principles that bind KM/IM to our business goals.

Without some stability in the organization, it will be impossible to get anyone's attention for long enough to start looking

at how KM and IM can help us work better and more effectively. However, I also believe that as our new organization evolves it will become evident that KM/IM holds the key to improved delivery of our services.

Step one: ask crucial questions

To change your organization's culture, you have to first get people onside by making it relevant to them personally. If you want to help people to get comfortable with KM as a business management tool there are three crucial questions you will need to address on behalf of your employees:

- How is KM relevant to what I do?
- What specifically am I expected to do?
- What's in it for me?

Knowledge management and to a lesser extent information management are neither well understood nor properly valued by the leaders of most organizations. I believe we haven't yet made the connection between what people intuitively know and what organizations intuitively do. We need to do a much better job of de-mystifying these two disciplines, and find a way to show that they are neither elitist nor impractical.

Step two: adopt a set of guiding principles

In order to keep things simple, and to ensure that everyone can understand what you are trying to do, you need guidelines. We are adopting a set of guiding principles to help us towards implementing our KM/IM initiative:

- **Corporate alignment** - Align KM with business drivers and strategic goals in order to ensure success
- **Credible targets** - Set an appropriate level of expectation around KM concepts so that senior managers will buy in
- **Clear language** - Avoid jargon, and find an appropriate level of language that is clear and consistent
- **Constant communications** - Keep talking about KM — the average individual needs to receive a message three times before they fully comprehend and digest it
- **Consultation and collaboration** - Provide tools and techniques for KM, and then let the communities become sharing, yet self-sustaining, entities. Develop a model of central alignment and de-centralized implementation.

Step three: find practical ways to move forward

You also need to find ways of moving these knowledge and information management principles forward. While we have been going through these major changes, the department's KM/IM office has been starting to work on practical ways to move the KM/IM yardsticks forward, laying the foundations for future growth. In order to address the questions of fit and relevance we can conduct a KM maturity survey, aimed at assessing the state of KM practices and skills. The intention was to take a snapshot in time of how we operate, assess gaps and impacts, and then start to address areas of concern. We can survey six knowledge dimensions: Planning, Retention, Tools, Culture, Processes, and Sharing and Re-use. The overall rating will show us just moving out of level one (chaotic) into level two (aware) for most dimensions. Overall we can find that strategic areas where we have long-term competencies, such as business analysis and planning, showed up better than tactical areas where KM has not had any real impact yet, such as processes and practices.

Step four: develop the right tools and processes

In order to facilitate the tasks of our knowledge workers and communities, we have a tool called the Knowledge Manager. It can be used by employees for KM analysis, planning and decision-making, and connects departmental knowledge and information repositories through a context-aware navigation tool. If we can start to imbed KM and IM attributes into our work processes through the use of this tool, then we will be laying a solid foundation for future KM/IM progress.

Step five: set realistic expectations

As we start to work in these areas, my most fundamental concern is that of setting a realistic expectation level within the organization. It is vital that everyone understands that KM is not a silver bullet, and that it is just another business management discipline that succeeds or fails depending on how much attention we give it. The message is simple: KM is about making better decisions together, nothing more.

At the same time we will start to address the issue of change management, the people factor. While culture is a crucial factor, it is also evident that cultures are infinitely adaptable given the right set of circumstances. I believe that it is the other "c-word," — communications — that we should be more concerned with. Current KM survey data highlights lack of communications as the single biggest reason that KM initiatives fail.

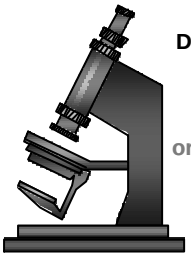
23.5 Summary

A winning strategy for any KM initiative needs to be one that addresses many different organizational requirements: fiscal, cultural and operational, and yet has the virtue of simplicity. A strategic plan needs to set realistic yet attainable goals, and should be able to resonate with any audience at any level within the department. If people understand what you are trying to do, and can see clear benefits to their participation, you stand a good chance of succeeding.

However, while KM is arguably an evolutionary rather than a revolutionary development, there are several aspects of this current phenomenon which taken together represent a significant change in the way organisations manage people, processes and information. KM involves taking a more holistic view of information, not only combining internal and external information - previously practised in some corporate libraries, relatively rarely in other sectors - but also co-ordinating planning and control (monitoring) information, and consolidating informal ('soft') and formal ('hard') information. KM also requires a *strategic* focus on valuable knowledge, concentrating on knowledge that will contribute to the improvement of organisational performance.

Points to Ponder

INFORMATION AND KNOWLEDGE WORK SYSTEMS



INFORMATION WORK: Work consists primarily of creating, processing information

DATA WORKERS: People who process & disseminate organization's paperwork

KNOWLEDGE WORKERS: People who design products or services or create new knowledge for organization

*

CREATE KNOWLEDGE
KNOWLEDGE WORK SYSTEMS:

INFORMATION SYSTEMS THAT AID KNOWLEDGE WORKERS TO CREATE, INTEGRATE NEW KNOWLEDGE IN ORGANIZATION

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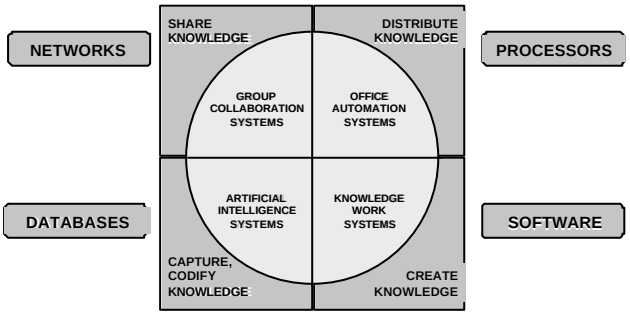
KNOWLEDGE MANAGEMENT & INFORMATION TECHNOLOGY



CREATE KNOWLEDGE
KNOWLEDGE WORKERS:

- **KEEP ORGANIZATION UP-TO-DATE IN KNOWLEDGE:** Technology; science; thought; the arts
- **INTERNAL CONSULTANTS IN THEIR AREAS**
- **CHANGE AGENTS:** Evaluating; initiating; promoting change projects

*

CREATE KNOWLEDGE
KNOWLEDGE SYSTEMS:

- **CAD/CAM (Computer Aided Design/Computer Aided Manufacturing):** Provides precise control over industrial design, manufacturing
- **VIRTUAL REALITY:** Interactive software creates photorealistic simulations of real world objects (Virtual Reality Modeling Language: **VRML**)

*

SHARE KNOWLEDGE
GROUP COLLABORATION SYSTEMS:

- **GROUPWARE:** Allows interactive collaboration, approval of documents
- **INTRANETS:** Good for relatively stable information in central repository
- **TEAMWARE:** Group collaborative software to customize team efforts

*

CREATE KNOWLEDGE
KNOWLEDGE SYSTEMS:

- **INVESTMENT WORKSTATIONS:** High-end PCs used in finance to analyze trading situations, facilitate portfolio management

*

Review Questions

1. Explain the role played by the Knowledge Management in Organisations.
2. Identify the Capabilities of Office Automation Systems and Groupware
3. Explain the various steps in the attempt to implement Knowledge Management in a company.

Discussion Questions

1. Discuss the difference between Office Automation Systems and Knowledge Work Systems in the way they create and use knowledge and information.
2. Describe how an organization can use groupware and Intranets to enhance the three Cs: communication, collaboration, and coordination.

Application Exercise

Interview a local manager and discuss the applications of OAS in his organisation. Try to gather information about the attempts made to create Knowledge Base in the company.

LESSON 24 :
ENTERPRISE INFORMATION SYSTEMS I

Learning Objectives

1. To understand the use of Information Systems in various business processes
2. To study the role of IS in Cross-functional systems and Enterprise Information Systems
3. To learn about Marketing Information Systems and Production Information Systems

24.1 Introduction

In the previous two lessons we have discussed the information systems at various levels of the organisation. The classification of Information Systems can be done on the basis of business functions also. This classification is done to achieve the maximum efficiency in business functions. There are lot many considerations we have to bother while we do business. The role played by the Internet and Information Technologies to support electronic commerce, enterprise communications and collaboration, and Web-enabled business processes both within a networked enterprise, and with its customers and business partners will definitely require specialised Information Systems for Business functions.

Information systems can be grouped into business function categories; however, in the real world information systems are typically integrated combinations of functional information systems. **Functional business systems** are composed of a variety of types of information systems (transaction processing, management information, decision support, etc) that support the business functions of:

- Accounting
- Finance
- Marketing
- Productions/operations management
- Human resource management

There is a strong emphasis in many organizations to develop such composite or cross-functional information systems that cross the boundaries of traditional business functions in order to reengineer and improve vital business processes. These organizations view cross-functional information systems as a strategic way to share information resources and improve the efficiency and effectiveness of a business, thus helping it attain its strategic objectives.

Business firms are turning to Internet technologies to integrate the flow of information among their internal business functions and their customers and suppliers. Companies are using the World Wide Web and their intranets and extranets as the technology platform for their cross-functional and Interorganizational information systems.

Let us review some foundation concepts which will help us to understand the detailed explanation of these systems.

E-Business Systems describes how information systems integrate and support enterprise-wide business processes and the business functions of marketing, manufacturing, human resource management, accounting, and finance.

Functional Business Systems: Functional business information systems support the business functions of marketing, production/operations, accounting, finance, and human resource management through a variety of e-business operational and management information systems.

Marketing: Marketing information systems support traditional and e-commerce processes and management of the marketing function. Major types of marketing information systems include interactive marketing at e-commerce websites, sales force automation, customer relationship management, sales management, product management, targeted marketing, advertising and promotion, and market research. Thus, marketing information systems assist marketing managers in electronic commerce product development and customer relationship decisions, as well as in planning advertising and sales promotion strategies and developing the e-commerce potential of new and present products, and new channels of distribution.

Manufacturing: Computer-based manufacturing information systems help a company achieve computer-integrated manufacturing (CIM), and thus simplify, automate, and integrate many of the activities needed to quickly produce high-quality products to meet changing customer demands. For example, computer-aided design using collaborative manufacturing networks helps engineers collaborate on the design of new products and processes. Then manufacturing resource planning systems help plan the types of resources needed in the production process. Finally, manufacturing execution systems monitor and control the manufacture of products on the factory floor through shop floor scheduling and control systems, controlling a physical process (process control), a machine tool (numerical control), or machines with some humanlike work capabilities (robots).

Human Resources Management: Human resource information systems support human resource management in organizations. They include information systems for staffing the organization, training and development, and compensation administration. HRM websites on the Internet or corporate intranets have become important tools for providing HR services to present and prospective employees.

Accounting and Finance: Accounting information systems record, report, and analyze business transactions and events for the management of the business enterprise. Examples

of common accounting information systems include order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger systems. Information systems in finance support financial manager in decisions regarding the financing of a business and the allocation of financial resources within a business. Financial information systems include cash management, online investment management, capital budgeting, and financial forecasting and planning.

Cross-Functional Enterprise Systems: Many e-business applications are integrated cross-functional enterprise applications like enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM), which also reengineers the business processes involved. Enterprise collaboration systems (ECS) support and enhance communication and collaboration among the teams and workgroups in an organization.

These systems themselves are being interconnected with enterprise application integration (EAI) software so that the business users of these applications can more easily access the information resources they need to support the needs of customers, suppliers, and business partners.

Transaction Processing Systems - Online transaction processing systems play a vital role in e-commerce. Transaction processing involves the basic activities of (1) data entry, (2) transaction processing, (3) database maintenance, (4) document and report generation, and (5) inquiry processing. Many firms are using the Internet, intranets, extranets, and other networks for online transaction processing to provide superior service to their customers and suppliers.

24.2 Sales and Marketing Information Systems

The business function of marketing is concerned with the planning, promotion, and sale of existing products in existing markets, and the development of new products and new markets to better serve present and potential customers.

As part of planning process, in order to produce superior value and satisfaction for customers, marketing managers need information at almost every turn. They need information about:

- customers
- end-users
- resellers
- competitors,
- government regulations
- other forces in the marketplace

A **marketing information system (MkIS)** consists of people, equipment, and procedures to gather, sort, analyse, evaluate, and distribute needed, timely and accurate information to marketing decision makers. MkIS distributes information to managers in the right form and at the right time to help them make better marketing decisions MkIS consists of people, equipment, and procedures to gather, sort, analyse, evaluate, and distribute needed, timely and accurate information to marketing decision makers. It distributes information to managers in the right form and at the right time to help them make better marketing decisions.

Activities or Functions of Marketing Information Systems

- Assessing Information Needs
- Developing Information
- Internal records
  - Marketing Research is consisting of Procedures to gather and analyse information for marketing decision making. The focus is on new information not already available in the MIS or in other secondary data sources. MR may be handled inside the firm or by outside specialists.
- Information Analysis
- Distributing Information

Marketing information systems integrate the information flow required by many marketing activities. Marketing information systems provide information for:

- Internet/intranet web sites and services make an interactive marketing process possible where customers can become partners in creating, marketing, purchasing, and improving products and services.
- Sales force automation systems use mobile computing and Internet technologies to automate many information processing activities for sales support and management.
- Other marketing systems assist marketing managers in product planning, pricing, and other product management decisions, advertising and sales promotion strategies, and market research and forecasting.

Interactive Marketing

The explosive growth of Internet technologies has had a major impact on the marketing function. The term **interactive marketing** has been coined to describe a type of marketing that is based on using the Internet, intranets, and extranets to establish two-way interaction between a business and its customers or potential customers. The goal of interactive marketing is to enable a company to profitably use those networks to attract and keep customers who will become partners with the business in creating, purchasing, and improving products and services.

- Customers are not passive participants, but are actively engaged in a network-enabled proactive and interactive process.
- Encourages customers to become involved in product development, delivery, and service issues.
- Enabled by various Internet technologies, including chat and discussion groups, web forms and questionnaires, and e-mail correspondence.
- Expected outcomes are a rich mixture of vital marketing data, new product ideas, volume sales and strong customer relationships.

Targeted Marketing

Targeted marketing has become an important tool in developing advertising and promotion strategies for a company's

electronic commerce websites. Target marketing is an advertising and promotion management concept that includes five targeting components:

- **Community**: companies can customize their web advertising messages and promotion methods to appeal to people in specific communities. These can be communities of interest, such as virtual communities of online sporting enthusiasts or arts and crafts hobbyists, or geographic communities formed by the websites of a city or local newspaper.
- **Content:** advertising such as electronic billboards or banners can be placed on various website pages, in addition to a company's home page. These messages reach the targeted audience.
- **Context**: advertising appears only in web pages that are relevant to the content of a product or service. So advertising is targeted only at people who are already looking for information about a subject matter that is related to a company's products.
- **Demographic/Psychographic:** marketing efforts can be aimed only at specific types or classes of people: unmarried, twenty-something, middle income, and male college graduates.
- **Online Behavior**: advertising and promotion efforts can be tailored to each visit to a site by an individual. This strategy is based on "web cookie" files recorded on the visitor's disk drive from previous visits. Cookie files enable a company to track a person's online behavior at a website so marketing efforts can be instantly developed and targeted to that individual at each visit to their website.

Sales Force Automation

Increasingly, computers and networks are providing the basis for **sales force automation**. In many companies, the sales force is being outfitted with notebook computers that connect them to Web browsers, and sales contact management software that connect them to marketing websites on the Internet, extranets, and their company intranets. Characteristics of sales force automation include:

- Increases the personal productivity of salespeople.
- Dramatically speeds up the capture and analysis of sales data from the field to marketing managers at company headquarters.
- Allows marketing and sales management to improve the delivery of information and the support they provide to their salespeople.
- Many companies view sales force automation as a way to gain a strategic advantage in sales productivity and marketing responsiveness.

Customer Relationship Management (CRM)

By keeping the customer in the center of all the processes, a state of the art CRM will fulfill several goals. First, it should enhance customer experience by delivering a personalized service no matter which interaction channel is chosen. Second, it will assist the employees to bring a better service, providing them with a broad and consolidated view on customer profile and relationship. Third, it helps the management to capture and analyze customer behavior, to provide metrics for customer segmentation and further supplies input for Decision Support Systems. Customer care and handling processes are systematized and marketing budgets can be optimally allocated to target specific groups. On the long term CRM will allow to maximize the customer life time value of each relationship where relationship is not the sum of punctual sales of poorly related products anymore but turns to the delivery of a consistent value proposition accompanying the customer in every stage of his life.

24.3 Manufacturing Information Systems

Manufacturing information systems support the production/operations function, which includes all activities concerned with the planning and control of the processes that produce goods or services. The production/operations function is concerned with the management of the operational systems of all business firms. Information systems used for operations management and transaction processing support all firms that must plan, monitor, and control inventories, purchases, and the flow of goods and services.

Information system helps in these manufacturing activities:

- Plant activity scheduling
- Material requirement assessment
- Material reallocation between orders
- Dynamic inventory management
- Grouping work orders by "characteristics"
- Resource qualification for task completion

Computer-Integrated Manufacturing (CIM)

Computer-based manufacturing information systems use several major techniques to support **computer-integrated manufacturing** (CIM). CIM is an overall concept that stresses that the goals of computer use in factory automation must be to:

- **Simplify:** (reengineer) production processes, product designs, and factory organization as a vital foundation to automation and integration.
- **Automate:** Production processes and the business functions that support them with computers, machines, and robots.
- **Integrate:** All production and support processes using computers, telecommunications networks, and other information technologies.

Overall goal of CIM: Is to create flexible, agile, manufacturing processes that efficiently produce products of the highest quality. Thus, CIM supports the concepts of:

- Flexible manufacturing systems
- Agile manufacturing
- Total quality management

Results of CIM: Implementing such manufacturing concepts enables a company to quickly respond to and fulfil customer requirements with high-quality products and services.

Uses of computers in manufacturing include:

- Computer-aided engineering (CAE)

- Computer-aided design (CAD)
- Computer-aided process planning (CAPP)
- Material requirements planning (MRP)
- Manufacturing resource planning (MRP-II)
- Computer-aided manufacturing (CAM)

Computer-aided manufacturing: (CAM) systems are those that automate the production process. For example, this could be accomplished by monitoring and controlling the production process in a factory (manufacturing execution systems) or by directly controlling a physical process (process control), a machine tool (machine control), or machines with some humanlike work capabilities (robots).

Manufacturing execution systems: (MES) are performance monitoring information systems for factory floor operations. They monitor, track, and control the five essential components involved in a production process:

- Materials
- Equipment
- Personnel
- Instructions and specifications
- Production facilities.

MES includes:

- Shop floor scheduling and control systems
- Machine control systems
- Robotics control systems
- Process control systems

Some of the benefits of CIM are:

- Increased efficiency through:
  - work simplification and automation,
  - better production schedule planning
  - better balancing of production workloads in production capacity
- Improved utilization of facilities, higher productivity, better quality control through:
  - continuous monitoring
  - feedback and control of factory operations, equipment and robots.
- Reduced investments in production inventories and facilities
  - work simplification
  - just-in-time inventory policies
  - better planning and control of production
  - better planning and control of finished goods requirements
- Improved customer service
- reducing out-of-stock situations
- producing high-quality products that better meet customer requirements

Process Control: the use of computers to control an ongoing physical process. Process control computers are used to control physical processes in such areas as:

- Petroleum refineries
- Food product manufacturing plants
- Cement plants
- Pulp and paper mills
- Steel mills
- Electrical power plants
- Chemical plants

Machine Control: the use of a computer to control the actions of a machine. This is also popularly called numerical control. The control of machine tools in factories is a typical numerical control application, though it also refers to the control of typesetting machines, weaving machines, and other industrial machinery.

Machine control computers are used in such areas as:

- Factories
- Industrial shops
- Machine tooling shops

Let us see some of the important subsystems of Manufacturing Information Systems and its functions.

Materials Requirement Planning (MRP)

- Take customer demand as initial input
- Number of product units needed and when they are needed
- Use long-range forecasts to put long-lead material on order
- Help reduce inventory cost while ensuring availability

Manufacturing Resource Planning (MRP II)

- MRP - Forecast and purchase of raw materials
- Assignment of jobs to personnel
- Assignment of manufacturing and assembly machinery

Combines MRP with other manufacturing-related activities to plan the manufacturing process such as

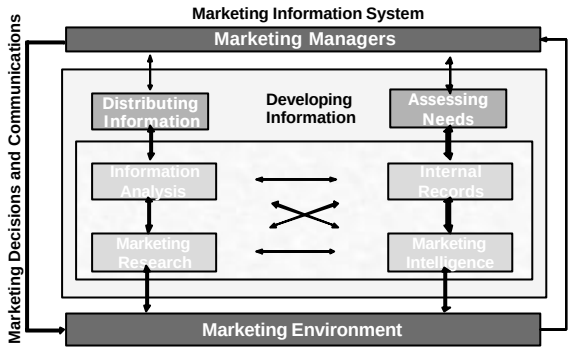
- Shop activity control and purchasing
- Source of demand
- Customer order entry and forecasting
- Support functions such as financial management, sales analysis, and data collection

In brief, Computer Integrated Manufacturing (CIM) is a technology, tool or method used to improve entirely the design and manufacturing process and increase productivity which use computers to help people and machines to communicate. It involves a series of integrated activities and operations involving the design, materials selection, planning, production, quality assurance, management and marketing of discrete consumer and durable goods. It is the integration of computer aided design, automatic material handling, robotics, process technologies, manufacturing planning & control, computer aided test, computer aided manufacturing. It focuses on the computer as the center of control of the entire factory, starting from the computerization of the fabrication and assembly processes to the information flow for production control, quality, maintenance, material handling, and inventory control in a totally integrated system.

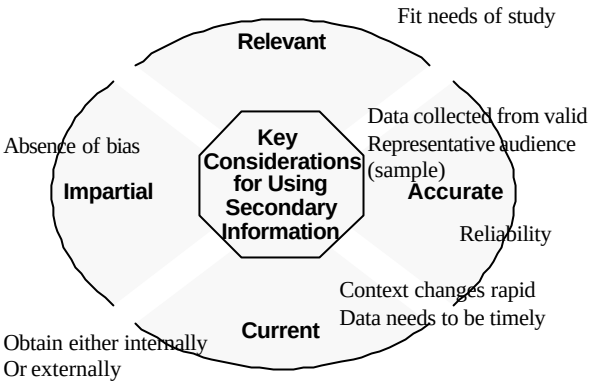
We will see the other Functional Information Systems in the next session as the continuum of these discussions.

Points to Ponder

The Marketing Information System

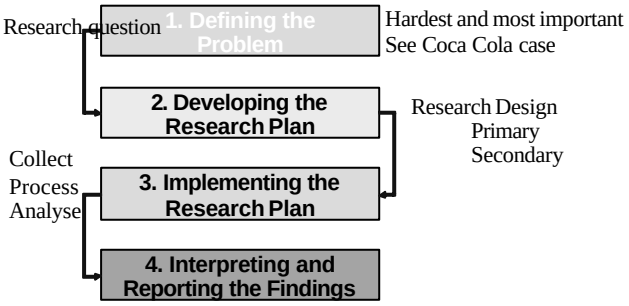


Secondary Information

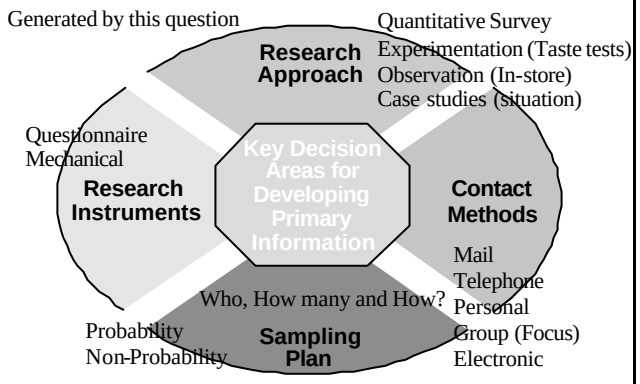


The Marketing Research Process

Exploratory, Descriptive, Causal



Primary Information



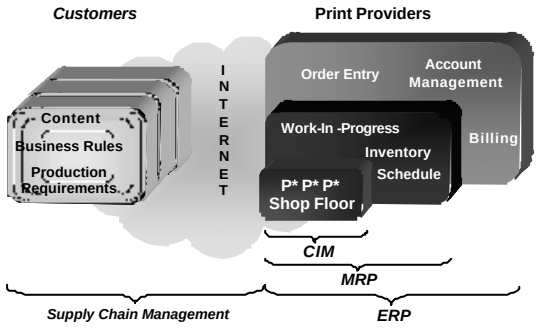
What to expect from CIM?

- Improved quality
  - Reduce errors, opportunities for error
  - Faster turnaround time
- Reduced manufacturing costs
  - Automation
  - Repeatable activities
  - Better coordination of resources
- Reduced transaction costs
  - Print runs shrinking
  - Transactions costs starting to dominate

Where are we headed?

- Automation
  - Expand digital workflow to all areas
  - Best of breed tools for specific functions
  - Global monitoring and control systems
- Integration
  - Production and business workflows
  - CIM ⇨ MRP ⇨ ERP ⇨ Supply Chain
  - Buyer ⇨ Provider ⇨ Production
- Moving from eCommerce to eProduction
  Printing will be on the leading edge

IS Environment



Review Questions

1. Explain the need of Functional Information Systems in Business Enterprises.
2. Briefly explain the functions and activities of Marketing Information Systems
3. Describe the Manufacturing Information Systems

Discussion Questions

1. Identify the importance of Sales Force Automation in Marketing Systems and suggest the activities it could perform.
2. Find out the benefits of Materials Resource Planning in Manufacturing System.
3. How does the use of Internet technologies to support the marketing function at any company improve business and customer value?
4. Why do IT-based targeted marketing programs sometimes product negative business results? How can such results be avoided?

Application Exercise

Try to know the Information Systems in any one of the companies existing in Marketing or Manufacturing. Find out their advantages and Disadvantages.

LESSON 25 :
ENTERPRISE INFORMATION SYSTEMS II

Learning Objectives

1. To understand the use of Information Systems in various business processes
2. To learn about Human Resource Information Systems and Financial Information Systems
3. To study the role of IS in Cross-functional systems and Enterprise Information Systems

25.1 Human Resource Information Systems (HRIS)

For years, human resources were dependent upon paper documentation and administrative record-keeping. Human resources retained their traditional duties with little significant change in how those duties were performed. Recently, a preponderance of new processes and technologies has revolutionized how human resource practitioners perform their jobs. The emergence of information and management systems has been integral to this revolution.

A human resources information system (HRIS) is a system of software and supporting computer hardware specifically designed to store and process all HR information. Also known as HRMS, human resources management systems or less commonly, HRIMS, these systems are the mainstay of modern HR departments. Traditionally, human resources departments relied on multiple programs in each department. An HRIS integrates all of these programs through a common database and single-user interface. An HRIS combines separate HR systems into a centralized database that performs the majority of HR transactions. HRIS are particularly useful for payroll and benefits administration.

A sophisticated HRIS will simplify transactions, automate administrative tasks, and minimize paperwork. It provides a consolidated database to coordinate self-service technologies. Employee self-services such as intranets, kiosks, and voice response systems (VRUs) are dependent upon an HRIS to be effective. Through system integration, an HRIS will reduce duplication and error while improving access to employee information.

HRIS are increasingly considered a necessary component of HR because of the increasingly global perspective of businesses. The combination of new technology and the subsequent loss of physical boundaries requires comprehensive HR systems that can maintain one database while incorporating a diversity of additional systems and capabilities.

The **human resource management** (HRM) function involves the recruitment, placement, evaluation, compensation, and development of the employees of an organization. The goal of HRM is the effective and efficient use of the human resources of a company. Thus, **human resource information systems** are designed to support:

- Planning to meet the personnel needs of the business.
- Development of employees to their full potential.
- Control of all personnel policies and programs.

Traditionally, businesses used computer-based information systems to:

- Produce pay checks and payroll reports
- Maintain personnel records
- Analyze the use of personnel in business operations.

Many firms have gone beyond these traditional personnel management functions and have developed human resource information systems (HRIS) that also support:

- Recruitment, selection and hiring
- Job placement
- Performance appraisals
- Employee benefit analysis
- Training and development
- Health, safety, and security

HRM and the Internet: The Internet has become a major force for change in human resource management. For example, companies are:

- Recruiting for employees through recruitment sections of their corporate web sites.
- Using commercial recruiting services and databases on the World Wide Web, posting messages in selected Internet newsgroups, and communicating with job applicants by Internet e-mail.

HRM and the Corporate Intranet: Intranet technologies allow companies to process most common HRM applications over their corporate intranets. For example:

- Intranets allow the HRM department to provide around-the-clock services to their customers – the employees.
- Intranets allow for the dissemination of valuable information faster than through previous company channels.
- Intranets can collect information online from employees for input to their HRM files
- Intranets enable employees to perform HRM tasks with little intervention by the HRM department.
- Intranets can serve as a superior training tool.
- Intranets enable employees to produce automated pay checks, the online alternative to timecards.

Staffing the Organization: The staffing function must be supported by information systems that record and track human resources within a company to maximize their use. These systems are used in personnel record keeping systems, employee skills inventory systems, and personnel requirements forecasting systems. Examples:

- Personnel record keeping system keeps track of additions, deletions, and other changes to the records in a personnel database.
- Changes in job assignments and compensation, or hiring and terminations
- Employee skills inventory system that uses the employee skill data from a personnel database to locate employees within a company who have the skills required for specific assignments and projects.
- Forecasting personnel requirements to assure a business an adequate supply of high-quality human resources.

Training and Development:
Information systems help human resource managers:

- Plan and monitor employee recruitment, training, performance appraisals, and career development by analyzing the success history of present programs.
- Analyze the career development status of each employee to determine whether development methods such as training programs and periodic performance appraisals should be recommended.

The potential for efficiency presented by an HRIS can be significant. Because an HRIS automates the bulk of transactional work, HR staff have increased time to perform strategic functions.

25.2 Accounting Information Systems

Accounting information systems are the oldest and most widely used information systems in business. Computer-based accounting information systems:

- Record and report the flow of funds through an organization on a historical basis and produce important financial statements such as balance sheets and income statements.
- Produce forecasts of future conditions such as projected financial statements and financial budgets.
- Operational accounting systems focus on transaction processing systems. They emphasize legal and historical record-keeping and the production of accurate financial statements. Typically, operational accounting systems include:
  - Order processing
  - Inventory control
  - Accounts receivable
  - Accounts payable
  - Accounts payroll
  - General ledger systems.
- Management accounting systems focus on the planning and control of business operations. They emphasize:
  - Cost accounting reports
  - Development of financial budgets and projected financial statements
  - Analytical reports comparing actual to forecasted performance.

You will have heard the term “double entry book keeping”. This is an old established system of bookkeeping which forms the basis of all accounting systems. Today, of course, companies of all sizes usually use computerised accounting systems. Nevertheless, it is useful to learn a little about the double entry system as this will help you understand how a trial balance is drawn up.

Every “transaction” is supported by a business document. What do you understand by the term “transaction”, and which documents are we talking about? I have listed some of the most common transactions below. Most transactions are related to the sale or purchase of goods, services, capital items and consumables.

If you are a seller and make a sale:

- You produce an invoice.
- You send the top copy of the invoice to the buyer.
- You retain the second copy of the invoice

If you are a buyer and make a purchase

- The seller produces an invoice
- You receive the top copy of the invoice
- The seller retains the second copy of the invoice.

If you are a seller who has goods returned:

- You produce a credit note.
- You send the top copy of the credit note to the buyer.
- You retain the second copy of the credit note.

If you are a buyer who returns some goods

- The seller produces a credit note.
- You receive the top copy of the credit note.
- The seller retains the second copy of the credit note.

In this way everybody receives a document as a record of the transaction.

When purchasing capital items you will receive the top copy of the seller’s invoice. In addition, you may also receive a deed (for premises) or a formal hire purchase agreement. When purchasing small quantities of consumables or other small items the document you will receive could be the till receipt. Alternatively, the proprietor may make out and sign an internal petty cash voucher to release the money from the petty cash account.

Let us see some of the important subsystems of Accounting Information Systems as follows.

Online Accounting Systems: Accounting information systems are being affected by Internet and client/server technologies. Using the Internet, intranets, extranets, and other network changes how accounting information systems monitor and track business activity. The online, interactive nature of such networks calls for new forms of transaction documents, procedures, and controls. Many companies are using or developing network links to their trading partners through the use of the Internet or other networks for applications such as order processing inventory control, accounts receivable, and accounts payable.

Order Processing: Order processing, or sales order processing, is an important transaction processing system that captures and processes customer orders and produces data needed for sales analysis and inventory control. In many firms, it also keeps track of the status of customer orders until goods are delivered. Computer-based sales order processing systems:

- Provide a fast, accurate, and efficient method of recording and screening customer orders and sales transactions.
- Provide inventory control systems with information on accepted orders so they can be filled as quickly as possible.

Inventory Control: Inventory control systems process data reflecting changes to items in inventory. A computer-based inventory control system:

- Record changes to inventory levels and prepares appropriate shipping documents.
- May notify managers about items that need reordering and provide them with a variety of inventory status reports.
- Helps a business provide high-quality service to customers while minimizing investment in inventory and inventory carrying costs.

Accounts Receivable: Accounts receivable systems keep records of amounts owed by customers from data generated by customer purchases and payments. Accounts receivable systems:

- Produce invoices to customers, monthly customer statements and credit management reports.
- Stimulate prompt customer payments by preparing accurate and timely invoices and monthly statements to credit customers.
- Provide managers with reports to help them control the amount of credit extended and the collection of money owed.

  Help to maximize profitable credit sales while minimizing losses from bad debts.

Accounts Payable: Accounts payable systems keep track of data concerning purchases from and payments to suppliers. Accounts payable systems:

- Prepare checks in payment of outstanding invoices and produce cash management reports.
- Help ensure prompt and accurate payment of suppliers to maintain good relationships, ensure a good credit standing, and secure any discounts offered for prompt payment.
- Provide tight financial control over all cash disbursements of the business.
- Provide management with information needed for the analysis of payments, expenses, purchases, employee expense accounts, and cash requirements.

Payroll: Payroll systems receive and maintain data from employee time cards and other work records. Accounts payable systems:

- Produce paychecks and other documents such as earning statements, payroll reports, and labor analysis reports
- Product reports for management and government agencies.
- Help businesses make prompt and accurate payments to their employees, as well as reports to management, employees, and government agencies concerning earnings, taxes, and other deductions.
- Provide management with reports analyzing labor costs and productivity.

General Ledger: General ledger systems consolidate data from accounts receivable, accounts payable, payroll, and other accounting information systems. General ledger systems:

- At the end of each accounting period, these systems produce the general ledger trial balance, the income statement and balance sheet of the firm, and various income and expense reports for management.
- Help businesses accomplish accounting tasks in an accurate and timely manner.
- Typically provide better financial controls and management reports and involves fewer personnel and lower costs than manual accounting methods.

Newer technologies play an important role in improving the effectiveness of internal financial information. For example, the cost-volume-profit (CVP) analysis technique and other methods of analyzing costs and margins give management the subtle information it needs to make short- to medium-term financial decisions. Activity-based costing (ABC) opens up a whole new approach to matching costs and resources to their true causes. A state-of-the-art financial information system lays the foundation for consistent and reliable reporting, regardless of the way the company analyzes the information.

25.3 Financial Management Systems

Computer-based **financial management syste**ms support financial managers in decisions concerning:

- The financing of a business.
- The allocation and control of financial resources within a business.

Major financial information system categories include:

- Cash and investment management.
- Capital budgeting
- Financial forecasting
- Financial planning

Cash Management: **Cash management** systems collect information on all cash receipts and disbursements within a company on a real-time or periodic basis. Cash management systems:

- Allow businesses to deposit or invest excess funds more quickly, and thus increase the income generated by deposited or invested funds.
- Produce daily, weekly, or monthly forecasts of cash receipts or disbursements (cash flow forecast) that are used to spot future cash deficits or surpluses.
- Mathematical models frequently can determine optimal cash collection programs and determine alternative financing or investment strategies for dealing with forecasted cash deficits or surpluses.

Online Investment Management: Many businesses invest their excess cash in short-term low-risk marketable securities or in higher return/higher risk alternatives, so that investment income may be earned until the funds are required. Portfolio of securities can be managed with the help of portfolio management software packages. Online investment management services:

- Are available from hundreds of online sources on the Internet and other networks.
- Help a financial manager make buying, selling, or holding decisions for each type of security so that an optimum mix of securities is developed that minimizes risk and maximizes investment income for the business.

Capital Budgeting: The **capital budgeting** process involves evaluating the profitability and financial impact of proposed capital expenditures.

- Long term expenditure proposals for plants and equipment can be analyzed suing a variety of techniques. This application makes heavy use of spreadsheet models that incorporate present value analysis of expected cash flows and probability analysis of risk to determine the optimum mix of capital projects for a business.

Financial Forecasting and Planning: A variety of financial forecasting packages provide analytical techniques that result in economic or financial forecasts of national and local economic conditions, wage levels, price levels, and interest rates.

Financial Planning systems use financial planning models to evaluate the present and projected financial performance of a business or of one of its divisions or subsidiaries. Financial planning systems:

- Help determine the financial needs of a business and analyze alternative methods of financing the business.
- Use financial forecasts concerning the economic situation, business operations, types of financing available, interest rates, and stock and bond prices to develop an optimal financing plan for the business.
- Frequently use electronic spreadsheet packages and DSS generators to build and manipulate models.
- Are used to answer what-if and goal-seeking questions in order to evaluate financial and investment alternatives.

Internal financial reporting traditionally means compiling and distributing generic reports that show a company's past, short-term financial performance. The financial reports at one company look the same as they would at any other company. And the information leaves management without insight, unable to link what happened yesterday with how the company will meets its financial targets of tomorrow.

Best Practices

Best practices in the area of providing financial information can be quite technical and complex. For example, the best practices address the fundamental assumptions and structure of internal financial reporting, the selection of performance measures at the company, approaches to financial analysis, and choices in the financial information system. As daunting as these best practices may appear, companies should keep in mind that they have complete control and flexibility in the area of internal financial reporting. After all, it is internal reporting, so it is completely up to the company to decide what serves it best. In as much as these best practices are intricate and complex, a company in the end should select the approaches and technologies that support its own decision-making process. A list of the best practices is given below.

- **Identify and understand the information needed by internal customers to execute the business strategy, satisfy customers, and evaluate business process performance.**

  Once the finance group understands management's financial information needs, the next step is to design, or redesign, the financial information systems to meet those needs. At this point, most companies shift from the traditional focus on historical financial data, which provides after-the-fact record keeping, to a new emphasis on information for decision making. For example, reports that include activity-based costing, target costing, and life cycle costing link financial performance with factors that affect revenues and expenses. These costing methods also uncover trends in financial performance and indicate the effects of the current trends on the company's attainment of strategic objectives.

- **Measure and report profit contributed by appropriate segments, such as product line, customer, channel, division, and geographic location.**

  Meaningful internal financial information differentiates profitable customers and business segments from those that are not. To achieve this all-important goal, the company needs to structure financial reports appropriately, so that recipients of the reports can plainly grasp the profitability analysis. To collect the appropriate information to analyze, a company first needs to identify how to segment its business to reflect the flow of profits, such as by market segment, by distribution channel, by customer, or by division. Then the company assigns to each segment the appropriate revenues, variable costs, and fixed costs. For example, for a channel profitability analysis, costs would include channel management costs; channel maintenance costs; advertising, promotion, and marketing costs; trade show costs; and marketing staff costs. Through assigning the relevant revenues and costs to the business segments, the company may identify high-profit and high-loss segments, and then set objectives for avoiding costs relevant to high-loss segments.

- **Integrate financial analysis with operational and industry analyses to identify opportunities for improving business performance.**

  Many companies could use more sophistication in their financial reporting, with techniques such as analysis of ratios and comparisons to industry and peer performance. These techniques give management insight into where the business may be vulnerable and where it might enjoy unique strengths. However, it's easy to go overboard with sophisticated financial analysis techniques; keeping the measures simple and relevant to strategic business issues is a reliable, powerful course of action.

Companies that apply best practices select a small number of key financial statistics and ratios to watch closely, keeping in mind the company's circumstances and objectives. Ratios and statistics are more meaningful if evaluated in terms of their trends over time. To broaden the focus of financial analysis, high-performance companies compare their numbers to those of competitors and best-of-class performers.

The balanced scorecard approach to financial reporting is particularly powerful. For a balanced scorecard, the company selects a short list of measures that not only indicates the operational and financial health of the business, but also its level of customer satisfaction and the creative health of the business. An example of a balanced scorecard is one that chooses measures that focus on four critical issues:

- **The customer perspective:** how do customers see the company?
- **The internal business perspective:** what must the company excel at?
- **The innovation and learning perspective:** can the company continue to improve and create value?
- **The financial perspective:** how does the company look to shareholders?

Taking a balanced scorecard approach, a company creates performance measures to track all levels of the company that reflect these four critical issues. For example, on periodic internal reports, customer satisfaction metrics and statistics on the number of employees participating in coursework are reported right alongside finance and operations numbers. To create meaningful report content, employees from finance, operations, and other functional areas need to collaborate with one another.

- **Use cost-volume-profit analysis, contribution margins, and relevant costs and qualitative factors to evaluate business opportunities.**

  Methods such as cost-volume-profit analysis, contribution margin calculation, and relevant cost calculation help a company to evaluate the impact of expected changes in the volume of sales on resulting costs and profits.

  Special business opportunities require a company to look at short-term financial issues — such as revenues, expenses, and cash flow — as opposed to long-term financial issues such as equity distribution and indebtedness. Also, when evaluating special opportunities, in addition to looking at the numbers, companies need to consider qualitative factors. Market expectations and customer expectations should always play a role in a company's decision to accept a one-time special order or to outsource its core business. Will existing customer schedules be affected? Will the company lose expertise in a key skill area? Are there hidden costs, like training and supervising time, that do not appear in the original analysis?

- **Use the attributes of world-class financial information systems to evaluate and improve the company's existing financial information systems.**

  At the foundation of effective internal financial reporting is a robust information system that collects and disseminates information flexibly and reliably. Best practices companies study the attributes of a world-class information system and look for computer hardware, software, and systems design for their business that deliver these attributes:

  - Standardized: the system captures and processes information consistently throughout the company
  - Complete: the system handles the information requirements of diverse groups of users
  - Appropriate: the information is relevant, predictive, exception oriented, and at the right level of detail
  - Unified: the system has information links to customers and suppliers, and changes to data in one area move through the whole system
  - Flexible: applications may be tailored to the company's needs
  - Cost-effective: the system makes efficient use of hardware and software licenses
  - Easy to use: all types of users are comfortable with the system
  - Timely: the system provides information when it's needed

- **Ensure that key decision makers understand the strengths and weaknesses of internal financial information.**

  Internal information has its limitations. The information is more meaningful and relevant when decision makers understand its limits, how it is produced, and how it can help them.

  The finance group can assist management in understanding internal financial information by explaining the processes that underlie it. For example, the finance group can explain how the financial system measures, records, and classifies transactions; how the finance group periodically summarizes and reports financial information; and the meaning and limitations on interpreting the information. One limitation of internal information is its bias toward analyzing the past and focusing on short-term profitability. Another is its tendency to focus on issues important only to the company, opposed to issues of concern to customers as well.

- **Provide accurate and reliable activity-based cost information for resource allocation decision making.**

  Activity-based costing (ABC) is a powerful tool that companies use to determine which activities contribute to profitability. The concept of ABC is to distill a company's production process into a set of activities and then attribute and analyze costs by activity. With ABC, a company sees which activities cause its costs.

  Implementing ABC lets a company allocate resources based on critical activities; eliminate redundant activities and costs; eliminate activities that do not add value to the customer; set budget levels in accordance with activities that cause costs; and place more reliable information on activities and processes into the hands of management.

24.4 Cross-Functional Enterprise Systems

Cross-functional enterprise applications are integrated combinations of information subsystems that share information resources and support business processes across the functional units of the business enterprise and extend beyond to customers, suppliers, and other business partners.

Many organizations are using information technology to develop integrated **cross-functional enterprise systems** that cross the boundaries of traditional **business functions** in order to reengineer and improve vital business processes all across the enterprise. These organizations view cross-functional enterprise systems as a strategic way to use IT to share information resources and improve the efficiency and effectiveness of business processes, thus helping an e-business attain its strategic objectives.

Information systems typically are integrated combinations of cross-functional business systems. Such systems support **business processes**, such as:

- Product development
- Production
- Distribution
- Order management
- Customer support Etc.

Enterprise Application Architecture

Enterprise Application architecture translates the logical design into a physical structure that includes hardware, software, network support, and processing methods. The end product of the systems design phase is the preparation of the system design specification document

Design Checklist

- Enterprise resource planning
- Initial cost and TCO
- Scalability
- Web integration
- Legacy interface requirements
- Security
- Processing options

Enterprise Application Integration

Many companies have moved from functional mainframe legacy systems to integrated cross-functional enterprise applications. This typically has involved installing:

- Enterprise resource planning (ERP) software
- Supply chain management (SCM) software
- Customer relationship management (CRM) software

These cross-functional enterprise software applications focus on supporting integrated clusters of business processes involved in the operations of a business.

Enterprise application integration (EAI) software is becoming available, which interconnects these enterprise application clusters. EAI software:

- Enables users to model the business processes involved in the interactions that should occur between business applications.
- Provides middleware that performs data conversion and coordination, application communication and messaging services, and access to the application interfaces involved.
- Integrate a variety of enterprise application clusters by letting them exchange data according to rules derived from the business process models developed by users.
- Integrate the front-office and back-office applications of an e-business, so they work together in a seamless, integrated way. This is a vital capability that provides real business value to an e-business enterprise that must respond quickly and effectively to business events and customer demands.

Enterprise Collaboration Systems

Enterprise collaboration systems provide tools to help us collaborate - to communicate ideas, share resources, and coordinate our cooperative work efforts as members of the many formal and informal process and project teams and workgroups that make up many of today's organisations.

The goal of enterprise collaboration systems is to enable us to work together more easily and effectively by helping us to:

- **Communicate** - sharing information with each other
- **Coordinate** - coordinating our individual work efforts and use of resources with each other
- **Collaborate** - working together cooperatively on joint projects and assignments

Tools for Enterprise Collaboration

Electronic communication tools include electronic mail, voice mail, bulletin board systems, and faxing. They enable you to electronically send documents and files in data, text, voice, or multimedia form over computer networks. This helps you share everything from short voice and text messages to copies of project documents and data files with your team members.

Electronic Conferencing Tools helps people communicate and collaborate while working together. A variety of conferencing methods enable the members of teams and workgroups at different locations to exchange ideas interactively at the same time, or at different times at their convenience. Electronic conferencing options also include electronic meeting systems, where team members can meet at the same time and place in a decision room setting.

Collaborative Work Management Tools help people accomplish or manage group work activities. This category of groupware includes:

- Calendaring and scheduling tools
- Task and project management
- Workflow systems
- Knowledge repositories

25.5 Summary

- **Accounting Systems:** Information systems that record and report business transactions, the flow of funds through an organization, and produce financial statements. This

provides information for the planning and control of business operations, as well as for legal and historical record-keeping.

- **Accounts Payable**: A record of purchases from suppliers.
- **Accounts Receivable:** A record of amounts owed by customers.
- **Batch Processing:** A category of data processing in which data is accumulated into "batches" and processed periodically.
- **Computer-Aided Manufacturing:** The use of computers to automate the production process and operations of a manufacturing plant. Also called factory automation.
- **Computer-Integrated Manufacturing:** An overall concept that stresses that the goals of computer use in factory automation should be to simplify, automate, and integrate production processes and other aspects of manufacturing.
- **Cross-Functional Integrated Systems:** Information systems that are integrated combinations of business information resources across the functional units of an organization.
- **e-Business:** e-business is the use of the Internet and other networks and information technologies to support electronic commerce, enterprise communications and collaboration, and web-enabled business processes both within an internetworked enterprise, and with its customers and business partners.
- **Enterprise Application Architecture** Using the Internet and other networks for e-commerce, collaboration, and business process. Businesses use these technologies to establish interrelationships to each other and to customers, employees, business partners, and other stakeholders of an internetworked e-business enterprise.
- **Enterprise Application Integration:** A cross-functional e-business application that integrates front-office applications like customer relationship management with back-office applications like enterprise resource management.
- **Enterprise Collaboration Systems:** The use of groupware tools and the Internet, intranets, extranets, and other computer networks to support and enhance communication, coordination, collaboration, and resource sharing among teams and workgroups in an internetworked enterprise.
- **Financial Management Systems:** Information systems that support financial managers in the financing of a business and the allocation and control of financial resources. Includes cash and securities management, capital budgeting, financial forecasting, and financial planning.
- **Functional Business Systems:** Information systems within a business organization that support one of the traditional functions of business such as marketing, finance, or production. Functional business systems can be either operations or management information systems.
- **General Ledger:** A collection of financial records of a firm.
- **Human Resource Systems:** Information systems that support human resource management activities such as recruitment, selection and hiring, job placement and performance appraisals, and training and development.
- **Interactive Marketing:** A dynamic collaborative process of creating, purchasing, and improving products and services that builds close relationships between a business and its customers, using a variety of services on the Internet, intranets, and extranets.
- **Inventory Control:** The activity of monitoring and controlling the inventory.
- **Machine Control:** The technology of controlling machine tools by computers.
- **Manufacturing Execution Systems:** MES are performance monitoring information systems for factory floor operations. They monitor, track, and control the five essential components involved in a production process: materials, equipment, personnel, instructions and specifications, and production facilities.
- **Manufacturing Systems:** Information systems that support the planning, control, and accomplishment of manufacturing processes. This includes concepts such as computer-integrated manufacturing (CIM) and technologies such as computer-aided manufacturing (CAM) or computer-aided design (CAD).
- **Marketing Systems:** Information systems that support the planning, control, and transaction processing required for the accomplishment of marketing activities, such as sales management, advertising and promotion.
- **Online Accounting Systems:** Online accounting information systems are using the Internet, intranets, extranets, and other networks to be directly involved in the processing of transactions between a business and its customers and suppliers.
- **Online HRM Systems:** Online HRM systems are using the Internet to actively recruit for employees through recruitment sections of their corporate web sites and commercial recruitment services and databases on the World Wide Web.
- **Online Investment Systems:** Online investment systems are using the Internet and other networks in order to make buying, selling, or holding decisions for each type of security so that an optimum mix is developed that minimizes risk and maximizes investment income for the business.
- **Online Transaction Processing Systems:** A real-time transaction processing system.
- **Order Processing:** The activities involved in processing orders from customers.
- **Payroll:** A record of the employees to be paid and the amount due to each.
- **Process Control:** The use of a computer to control an ongoing physical process such as petrochemical production.
- **Real-time Processing:** Data processing in which data is processed immediately rather than periodically. Also called online processing.
- **Sales Force Automation:** The use of computers to automate sales recording and reporting by sales people, as well as communications and sales support.
- **Targeted Marketing:** Targeted marketing has become an important tool in developing advertising and promotion

strategies for a company's electronic commerce web sites. Targeted marketing includes five targeting components: community, content, context, demographic/psychographic, and online behavior.

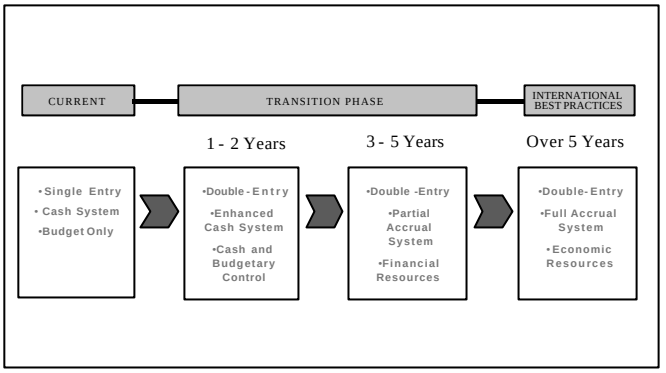
- **Transaction Processing Cycle:** A cycle of basic transaction processing activities including data entry, transaction processing, database maintenance, document and report generation, and inquiry processing.

Points to Ponder

Human Resources Information System (HRIS)

Conditions for successful HRIS

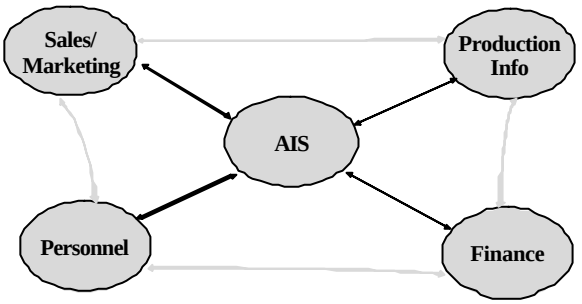
1. Organizational Conditions
   - Availability of Internal User Support
   - Size of organization
2. System Conditions
   - Documentation
   - Ease of use
   - Usefulness



Greatest Impact on HRM systems

- The Internet
- Users access resources easily
- Customization of HR portals
- Greatest mobility
- Examples: Employee self-service functionality, Web-based payroll System and Email
- SAP and PeopleSoft are leading brands

AIS as an MIS Subsystem



Roles of Accountants With Respect to an AIS

- **Financial accountants** prepare financial information for external decision-making in accordance with GAAP
- **Managerial accountants** prepare financial information for internal decision-making

Review Questions

a. Explain briefly how computer-based information systems can enhance Accounting function in a firm.

b. Explain briefly how computer-based information systems can enhance HR function in a firm.

c. Explain briefly how computer-based information systems can enhance Finance function in a firm.

d. Briefly describe the cross-functions Information Systems and its integration in Enterprises

Discussion Questions

1. Discuss the various trends in HRIS?
2. Find out the competitive advantages companies can make out of AIS and FMS?

Application Exercise

Try to write one page report on "**Mobile Computing**". Choose either one of the two options:

a. In an area of business (Accounting, Management / HR, Marketing, Production / Operations, Finance) you are interested in.

b. If you have not decided which area of business for your career, choose your favorite industry (Automobile, Food / Restaurant, Healthcare / Hospital, Hospitality / Hotel, Leisure / Tourism, etc.), and write the report on emerging (new) technology in that particular industry.

Roles of Accountants With Respect to an AIS

- **Auditors** - evaluate controls and attest to the fairness of the financial statements.
- **Accounting managers** - control all accounting activities of a firm.
- **Tax specialists** - develop information that reflects tax obligations of the firm.
- **Consultants** - devise specifications for the AIS.

LESSON 25 :
TUTORIAL ON ENTERPRISE INFORMATION SYSTEMS

Dear Students, after understanding about the various level information systems in the organisation and the functional information systems, let us check and verify our knowledge by analyzing the following case.

Case: Crystalline Entities

According to the sign on the building, *Crystalline Entities (CE)* (a fictional company) was founded in 1895 by Hugo Salazar. In reality, the company was started in 1957 by Denise Luzon to import crystal glass figurines and china plates for sale in the United States. Hardly anyone who works at the company today remembers that Denise was really responsible for the creation and initial success of the company, and that irritates John Balrun, the current CEO. Denise retired years ago and the firm is now a publicly traded company with annual sales of about $20 million. John has been CEO for seven years. All but one of the vice-presidents have been hired within the last five years. The VP of finance, Martha Vaniche, has been with the company almost as long as John. Because of turnover, most of the 342 employees at the corporate offices are younger and have worked there an average of about three years.

The company is organized in a traditional hierarchy by business function (marketing, accounting and finance, production and purchasing, distribution, and human re-sources). About 15 years ago, *CE* bought several small manufacturers in Ireland and Spain. These firms make up about 15 percent of current production. They are located in small towns with low labor costs and are run independently by local managers. The local managers know their employees personally and emphasize quality production. Items that don't pass the quality inspections are either destroyed or sold to local buyers. The other 85 percent of the production is purchased from a variety of companies around the world. Quality is maintained by inspecting all shipments and by dropping suppliers who cause problems.

Although there are many products, there are three basic types of sales. First, many of the products are given as gifts (especially for weddings and anniversaries). These purchases are typically made through department and specialty stores. The second type of sale consists of add-on and replacement pieces that complement or complete a set. Many of these items are sold as special orders that are placed by customers through the department stores. Occasionally customers will order pieces directly from *CE*. The third type of sale is through various factory outlet stores. These stores are scattered across the country and typically offer out-of-date items for 20 to 30 percent discounts. The stores are independently owned, and *CE* offers them substantial discounts whenever they wish to drop certain pat-terns and clear their warehouse.

Core Products

The core products are crucial to Crystalline Entities. By keeping costs down, and by offering lower prices and special packages, CE uses the core products to capture market share. As a result, the core products represent about 60 percent of the total sales, but only 15 percent of the profits. The special orders are considerably more profitable and make up about 70 percent of the total profits. Miscellaneous products and impulse purchases make up the rest of the sales. When CE experienced decreasing sales growth 15 years ago, the decline not only hurt current profits but also sales for the next three years because of lost sales of specialty items for matching sets.

Going back to the early days of the company, Denise decided that it was best to focus on a few core products. To compete against the established companies she wanted to offer good-quality crystal and porcelain products at a lower price than the competitors. Her deception about the age of the company was deliberately used to build an image of an established, high-quality company without spending much money. To keep management costs down, the company was organized to emphasize decentralized decisions. Products were ordered in bulk from overseas producers with low labor costs. The core items were stocked in inexpensive warehouses. Marketing consisted of making regular visits to department and specialty stores and convincing managers to carry the *CE* products. When buyers became convinced of the quality and compared prices to existing brands, sales increased. As sales increased it became easier to convince additional stores to carry the products. Corporate profits increased and the company expanded. About 15 years ago, the company ran out of new markets and experienced major growing pains. Budgets were cut, staffing was slashed, and the company searched for new ways to increase profits.

At some point, *CE* began experimenting with new designs and items that were aimed at impulse purchases. The goal was to increase sales by capitalizing on the *CE* reputation for good-quality products at reasonable prices. Today, there are two basic categories of products: a core group of styles and patterns that is always in stock, and temporary or experimental items and china or crystal patterns. *CE* guarantees that the core items will always be available so that customers can expand their sets or replace broken items.

When the company experienced the decline in sales, management decided to recommit the company to providing high-quality products at lower costs than the competition. As part of that strategy, they decided the best way to hold costs down was to keep management operations as simple as possible. Hence, the various operations were delegated to decentralized departments. Marketing consists mainly of contacting department store buyers and processing orders that are sent to the distribution department. Marketing also produces rough sales forecasts for the next quarter. These reports are based on comments by salespeople and focus on categories of products (crystal, core products, experimental,

special orders, and miscellaneous products). The reports are sent to production and senior management. New designs are sent to production and purchasing for final approval and to estimate the production costs. Every month, basic accounting numbers on costs are sent to the ac-counting department.

Business Function Responsibilities

Purchasing and production focus on quality and are responsible for finding low-cost production facilities that can produce large quantities of standardized products. Production reports and schedules are sent to the marketing department every month, with quarterly summaries sent to management. Quarterly production cost and profit numbers are sent to the accounting department for the quarterly financial reports. On the purchasing side, purchase orders are sent to accounting, with monthly summaries sent to marketing. When the manufacturer ships products, the company includes an invoice and also sends a separate shipping list to the distribution warehouses.

The distribution department is responsible for transporting the products, storing them in warehouses, and delivering the appropriate items to each store. Costs are kept under control by billing retail stores for freight charges. Each warehouse manager has control over which products are sold at a discount to factory outlet stores. When products have been around too long, they are offered to outlet stores at whatever price they can get. Each warehouse produces a quarterly inventory report and a monthly list of sales to outlet stores. Both reports are sent to marketing, which sends them on to accounting. When products arrive at the warehouse, a receiving list is created that is sent to purchasing which cross checks the list with the supplier shipping lists. Weekly reports of items shipped from the warehouse to stores is sent to accounting which handles the billing.

Finance and accounting create traditional quarterly statements that are distributed to the other departments and to management. Accounts receivable send bills to customers and records payments. All of the financial records are stored on the IBM AS/400. Analysis of some of the reports and taxes are processed on the personal computers.

Existing Computer Facilities

As a result of the decision to simplify management of the firm, each department tends to operate independently of the others. Basic financial and personnel data is collected by accounting and finance to produce quarterly and annual reports. The MIS department consists of three people who work in the accounting department. The midsize IBM AS/400 computer records orders from the department stores, basic payroll data, inventory, and standard financial data. It produces traditional accounting statements and other basic re-ports for the government. Accounting and human resources use the computer most often.

All of the VPs and most of the managers have personal computers on their desks that are attached via a LAN to the AS/400, giving them access to the basic reports. The personal computers are also used to write memos and perform simple calculations using spreadsheets. The LAN is used by some employees for e-mail messages.

Currently, around 1400 stores are regular customers of *CE*. They typically place one or two orders a week for core products and miscellaneous new items. On average, *CE* receives about 800 orders a day for specialty items. Most orders are filled and shipped within three working days. Orders are generally shipped from the nearest warehouse. There are five warehouses scattered across the United States—all in low-wage and low-rent areas. Occasionally, when a warehouse does not have enough items, the warehouse manager will call the other warehouses and have them ship the product. Orders, shipment invoices, and billing are handled by the computer. The accounting department uses the data to track ac-counts receivable. Because of the volume of data, the orders and shipping invoices are moved to tape backup every month and removed from the online system. Only the basic order data (date, buyer, totals, etc.) are kept on the system. The design department in marketing has a small network of computers to help the group with art designs. Many of the patterns and colors are created with graphics packages. Some people do initial designs on paper and scan them into the computer to experiment with variations and different colors. Members of the design department actively use their network to share ideas and pieces of designs. Although their smaller LAN is also connected to the central computer, there has been little reason for them to use the central computer.

Choosing Core Products

The issue of core products causes considerable friction within the company. Every year, the designers introduce new patterns, and they want to place them in the core group. It is a personal status symbol for the workers to have their designs placed in the permanent collection. Yet, the company cannot afford to have thousands of different patterns in the core group, because it would require a huge inventory. On the other hand, some items the core group has not sold very well for many years. Every year, there is a meeting among all the VPs and departmental managers to decide which products should be included in the core group. These meetings often degenerate into arguments and shouting matches. Lately, John Balrun has noticed that the younger staff members and VPs seem to be join together and yelling at him and Martha. The accountants have supported the decision to hold the core products stable and to hold costs down. The marketing department suggests it would be better to increase sales by offering more products.

It seems that the arguments and political negotiations have started early this year. Several managers have been circulating a memo complaining that the finance and accounting departments refuse to cooperate with the designers. Jan Dover, the head of the design department, is complaining that the group can't get sales figures for each of the new patterns. They want also want to track sales of the core patterns during the last few years to see which ones could be dropped. The designers are claiming that the accounting department refuses to furnish the data.

John Balrun initially dismissed Jan's complaint, because there has been consider-able antagonism between her and Martha. John suspects that Jan's memo is just a political ploy to gain attention before the annual design meeting. However, it seems that Jan went to the MIS department with her request for additional information. The MIS department complained to John saying the staff are already overworked. They say *CE* will

need a new faster computer, a massive increase in disk space, and at least two new programmer analysts to do the initial work requested by Jan. John called a meeting with Jan, Martha, the head of accounting, and the MIS members. At the meeting, the MIS group stated that it was impossible to provide the data requested by the design team. The only data that was kept for more than a year were the basic financial and accounting statements. These statements provide summary values for sales by category, but not for each design pattern. In fact, the only detail records that might be available on backup tapes were production data and some inventory figures for the last couple of years. After considerable discussion of the experimental patterns, it was decided that it was impossible to obtain accurate sales figures. At best, the only numbers available were orders and shipments to the retail stores. Occasionally, the *CE* sales people submit informal reports on which items they believe are selling well, and which ones are sitting the shelves. Someone at the meeting suggested using final inventory levels at the warehouse as an indicator of how well products were selling. However, the distribution managers have control over the size of the warehouse inventories. Sometimes a product sells well when it is introduced and the managers load the warehouses, but then have a high inventory at the end of the year. In other cases, the warehouse manager might have already unloaded weak-selling items to a factory outlet at a discount price. To keep costs under control, the warehouse managers record outlet sales only by category, which is not itemized by pattern and color.

The designers now accept that the data they want is not available to make design decisions this year. However, they have stated that they want to change the current system so that they can make better decisions next year. John Balrun does not know where to start. It appears that most of the data does not exist. Plus, it looks as if any attempt to change the current system will go against the fundamental goals of *Crystalline Entities* provide quality crystal, porcelain, and china at prices below those of the competition.

Case Questions

1. Can MIS help *Crystalline Entities*? In particular, is it possible to get the data requested by the designers?
2. What system problems exist?
3. What level (operations, tactical, strategic) is the primary source of problems?
4. Diagram the flow of data through the organization.
5. Devise improvements that will solve the basic problems of *Crystalline Entities.* Include an implementation plan.
6. What resistance do you expect to encounter? How can it be minimized or overcome?
7. Is it possible to satisfy the designers and keep the essential goals of the company?

LESSON 27 :
INFORMATION, MANAGEMENT AND DECISION MAKING

Learning Outcomes

1. To learn the various decisional roles managers play.
2. To know about the levels and types of management decisions
3. To learn about the models of decision making
4. To understand the influence of Information Technology in the management process

27.1 Introduction

Managers help keep chaos to a minimum. We've all worked for the person who proves this theory wrong, but when all is said and done, minimizing chaos is the manager's number one job.

An organization's success is built around its managers, but also relies on technical competence, adaptability to its environments, and a thorough knowledge of its product and production processes. Some companies seem to "get it," while others companies just seem to get lost! Why? Management is the answer: management of the employees, management of the product, and management of information.

Three Schools of Management

Let's take a close look at the three schools of management (technical-rational perspective, behavioral, and cognitive), and see how they fit into different organizations. As we discuss the management theories you should concentrate on how they would use various information system configurations to enhance their characteristics.

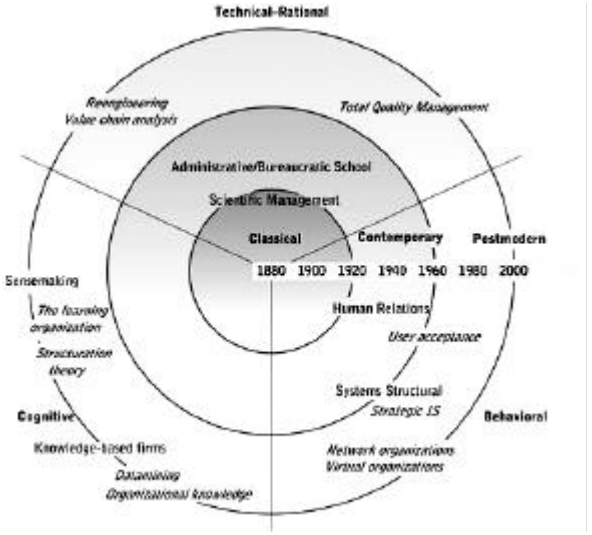
The Technical-Rational Perspective

The **technical-rational** or **classical** perspective basically views people as machines. The manager's job is to keep the machine running smoothly and in concert with all the other machines. The manager is also responsible for creating an administration that keeps the machine well-oiled and fixes any broken parts.

Henri Fayol's classic theory of management says managers perform five distinct functions:

- Planning
- Organizing
- Coordinating
- Deciding
- Controlling

In order to fulfill each of these functions, a manager must communicate. Think about it. If a manager devises a plan, doesn't she have to tell someone what that plan is? If the manager coordinates a new plan, doesn't he have to communicate with someone about the new plan? If the manager makes ?e have to know what that decision is?



The evolution of management theory

The people a manager communicates with, regardless of the action, are all around him/her. They could be at a lower or higher management level. They could be inside or outside the organization. It doesn't matter.

The role of information systems, using the technical-rational perspective, is to improve the mechanical operation of the organization.

Behavioral Perspective

We all know that humans aren't machines. They don't work in isolation from other humans, and there are many more factors to take into consideration when managing humans rather than machines. The **behavioral perspective** takes these important characteristics into account. Just as humans are living, breathing, ever-changing beings, so too are organizations.

The manager's role is to assist the organization in continually changing and adapting to its environment.

This management theory gives you insight into the use of information systems to enhance the effectiveness of the organization. It has had a powerful influence on the field of information systems:

- User acceptance literature emphasizes the sociological and psychological aspects of the system success.
- Strategic IS literature emphasizes the importance of responding to and dominating the environment.
- Network organization and virtual organization literature emphasizes organizing labor without traditional hierarchies.

Managerial Roles: Mintzberg

In his research, Mintzberg found that **managerial roles** fell into three categories:

- **Interpersonal**. Managers act as representatives of the organization to internal and external audiences.
- **Informational**. Managers pass information up and down and around the organization.
- **Decisional**. Once managers make a decision, they must pass it on to someone else. But before they can make that decision, they have to gather information from internal/external sources.

How Managers Get Things Done: Kotter

Kotter argues that managers are always looking out for themselves. They establish agendas and goals, build interpersonal networks, and then execute their own personal agendas.

What Managers Decide: Wrapp

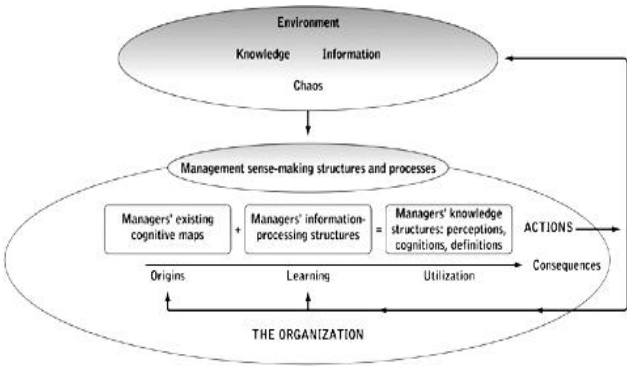
Wrapp's theory of management describes managers not as dictators but as guides. They guide the people and the organization as a whole toward consensus goals. They understand that no part of the organization can work in isolation from other parts and that it takes the whole team to win the game.

The Cognitive Perspective and Postmodern Era

To be successful, the **cognitive perspective** says an organization must create and use information to its utmost advantage. The organization must gather, create, store, disseminate, and use information and knowledge. The effective manager will make sense of the situation, help the organization act in its best interest, and create the proper infrastructure for information- and knowledge-processing to the advantage of the organization.

This management theory has evolved in and from the computer revolution of the last few decades as information systems proliferated and improved. The organization can now get a better sense of its environment, internal and external, and how to create and use information through and from the Internet.

Managerial Sense-making



Managerial sense-making

Managerial sense-making is the philosophy of managers properly defining a situation for both the employees and the organization. The old adage "Let's make sense of it all" is the operative words. Some managers are more successful at this than others. As depicted in the above figure, the successful manager:

- Creates knowledge structures by filtering information from the environment. Not every tidbit of information is worthwhile.
- Solves problems and makes decisions. If the manager is successful, then the organization triumphs.
- Processes information. The information may be internal or external.
- Creates information-processing structures, programs, and routines. The manager decides what information is needed based on his/her definition of the situation.

The Knowledge-Based View of the Firm

Managerial sense-making focuses on the individual manager. The knowledge-based view focuses on the organization's ability to gather, produce, maintain, and disseminate knowledge. Some organizations require more intense information and knowledge gathering in order to produce their products and services than others. For instance, the Research and Development department of a candy manufacturer has more need for knowledge-based information systems than would the Production Department. That's not to say the Production Department has no need for knowledge or for information, but its tasks are less dependent on knowledge-based systems and more dependent on transaction processing systems.

Regardless of the management model followed, managers spend most of their time communicating: listening, talking, reading, and writing. The use of email technology allows managers to complete more communications than ever before. They can also employ other methods of technology that increase the amount of communicating they do. Remember the Human Resources Department policy on dress codes that the HR manager posted to the Intranet? Communication at its finest!

27.2 Introduction to Decision Making

Everybody makes decisions. It's a natural part of life, and most of the time we don't even think about the process. In an organization, decisions are made at every level. The level at which the decision is made can also determine the complexity of the decision in relation to the input of data and output of information.

Levels of Decision Making

In the previous units, we discussed the various types of Information Systems and how they relate to the levels of an organization. We can also relate those Information Systems to the types of decisions managers make.

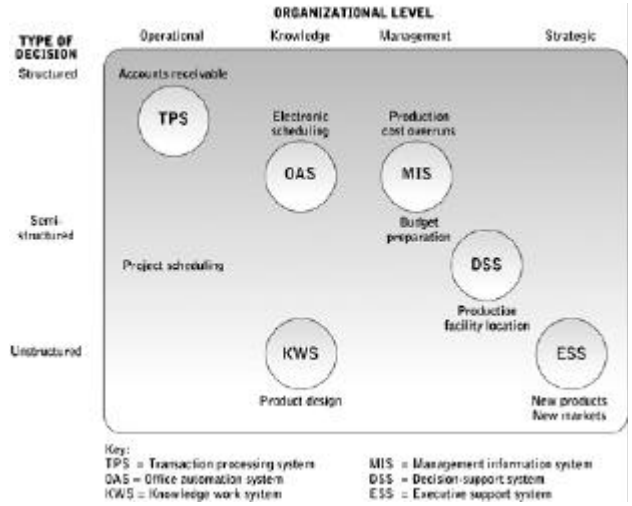
- **Strategic Decision Making**. These decisions are usually concerned with the major objectives of the organization, such as "Do we need to change the core business we are in?" They also concern policies of the organization, such as "Do we want to support affirmative action?"
- **Management Control.** These decisions affect the use of resources, such as "Do we need to find a different supplier of packaging materials?" Management-level decisions also determine the performance of the operational units, such as "How much is the bottleneck in Production affecting the overall profit and loss of the organization, and what can we do about it?"

- **Knowledge-Level Decision Making.** These decisions determine new ideas or improvements to current products or services. A decision made at this level could be "Do we need to find a new chocolate recipe that results in a radically different taste for our candy bar?"
- **Operational control**. These decisions determine specific tasks that support decisions made at the strategic or managerial levels. An example is "How many candy bars do we produce today?"

Types of Decisions: Structured versus Unstructured

Some decisions are very structured while others are very unstructured. You may wake up in the morning and make the structured, routine decision to get out of bed. Then you have to make the unstructured decision of what clothes to wear that day (for some of us this may be a very routine decision!). Structured decisions involve definite procedures and are not necessarily very complex. The more unstructured a decision becomes, the more complex it becomes.

Types of Decisions and Types of Systems



Information systems support different decisions at different organization levels

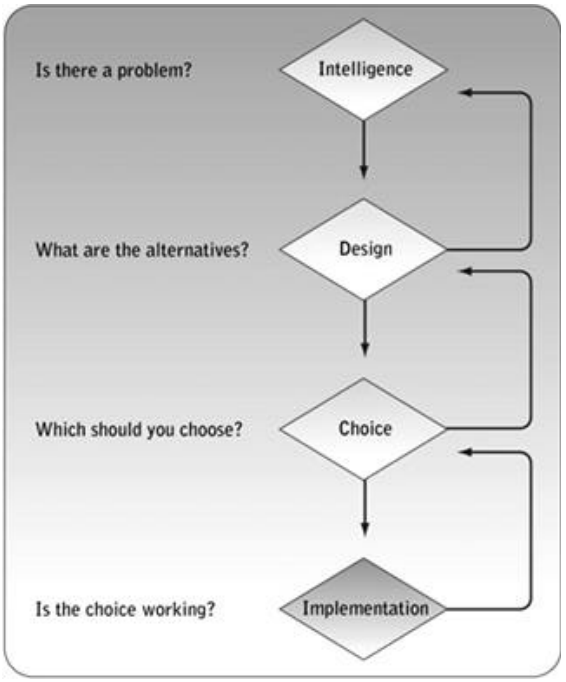
One size does not fit all when it comes to pairing the types of systems to the types of decisions. Every level of the organization makes different types of decisions, so the system used should fit the organizational level, as shown in the above figure.

It's easy to develop an information system to support structured decision making. Do you increase production on the day shift or hold it to the swing shift; do you purchase another piece of equipment or repair the old one? What hasn't been so easy to develop is a system that supports the unstructured decision making that takes place in the upper echelons of a company. Do we expand into foreign markets or stay within the confines of our own country; do we build a new plant in Arizona or Alabama; do we stop production of a long-time product due to falling demand or boost our marketing? The ability to create information systems to support the latter decisions is long overdue.

Stages of Decision Making

Some people seem to make sudden or impulsive decisions. Other people seem to make very slow, deliberate decisions. But regardless of appearances, the decision-making process follows the same stages of development and implementation. Let's use the example of purchasing a new television, using the following figure.

The decision-making process



- **Intelligence.** You identify the facts: You don't have a television or the one that you do have isn't any good. You intuitively understand what the problem is and the effect it's having on you. You missed your favorite show last night.
- **Design.** You design possible solutions: You could watch the television in your neighbor's apartment or you could purchase a new one for yourself. Your neighbor will get annoyed if you keep coming over. On the other hand, you won't be able to go on vacation if you use your money to buy a new television.
- **Choice.** You gather data that helps you make a better decision: Your neighbor doesn't like the same shows you like or she's getting rather tired of you being there. You also determine that televisions cost a lot of money so you figure out how you can afford one. You choose to purchase a new television instead of watching your neighbor's.
- **Implementation.** You implement the decision: You stop at the appliance store on your way home from work and carry out your decision to purchase a new television.

- **Feedback.** You gather feedback: You're broke but you can watch anything you want!

Of course this is a simplified example of the decision-making process. But the same process is used for almost every decision made by almost every person.

Information Systems help improve the decision-making process by

- providing more information about the problem
- presenting a greater variety of possible alternatives
- showing consequences and effects of choices
- measuring the outcome of different possible solutions
- providing feedback on the decision that is made

Different types of decisions require different types of systems. All decisions follow the same pattern although some may be more complex and require several iterations of the decision-making stages.

27.3 Individual Models of Decision Making

No matter how much you know, you can't possibly know everything. No one can possibly know all the input to a decision, process all the possible outcomes, and know every output from the final decision. Neither can an Information System. However, it can gather more input, process it faster, and output more alternatives than a human can.

What a machine can't do is make decisions in context. That could be a positive aspect or a drawback. Humans make decisions based on experience and in very distinct ways based on their frame of reference. For instance, some people won't buy a certain type of television because they haven't had "good luck" with that brand before. Based on their experience, they choose a different alternative than another person would. Some people will do careful, extensive research into all the possible models of televisions and make a decision based on that data. Some people will purchase the same brand as the one they already have. Others simply walk into the store and point to the model they want.

The Rational Model

The **rational model** of human behavior says that people will evaluate the situation and determine what they want the result to be. They will determine the alternative courses of action, know the consequences of each course, and then pick the course with the biggest payoff. If it were only that easy! Think about some of the decisions you've made recently. Did you have an absolutely clear understanding of the situation and know exactly what you wanted the end result to be? Probably not if you did not evaluate the decision closely and thoroughly. Did you examine every possible solution? Probably not. Did you fully comprehend the consequences of every possible solution? Not likely. Was there only one possible outcome to your decision or were there several?

Bounded Rationality and Satisficing

Sometimes people will follow the rational model to a certain extent, with a lot of compromising throughout the decision-making process, by using **bounded rationality**. That is, they will look at several alternatives, briefly evaluate the consequences of the alternatives, and then pick the solution that will get them closest to where they want to be **(satisficing)**. If they've experienced a similar situation, they'll probably go with the decision most like the previous decision.

Muddling Through

Compromise is a very common occurrence in decision-making. Your club needs to raise dues to pay for a new piece of equipment. Some of your members don't want to purchase the equipment and others want the best brand on the market. A spirited discussion takes place with each side presenting conflicting opinions. After a while, you agree to purchase a used piece costing only half of the original price. You **muddled through** the decision-making process until everyone agreed on the solution. As it turns out, the decision was similar to one made several years before. By following the previous decision, your group practiced **incremental decision making**.

Psychological Types and Frames of Reference

The **cognitive style** theory supports the idea that people make decisions based on their experiences and values. Why are there so many different types and styles of automobiles and trucks? After all, isn't the basic idea of owning a vehicle simply a matter of how you get from one location to another? Why do you choose a red car over a blue car? Why do some people own a pickup truck in the heart of a major metropolitan area? Isn't the reason for owning a truck simply to haul things? Major studies have confirmed that people decide the color of their vehicles based on personality type. People choose the type of vehicle, car or truck or minivan, based on their experiences and psychological needs more than for the absolute need for a particular type of transportation.

People are people. Sounds simplified and silly, but it's one of the best explanations for why people make decisions the way they do. This lesson points that some people use a **systematic decision-making** process, while others use an **intuitive** process. You could argue that one method is better than the other, but it's an argument you could carry on forever.

27.4 Organizational Models of Decision Making

If it's tough for an individual to make a decision, think how hard it is in an organization with many people all used to making decisions their way! The organizational decision-making process must take into account the various wants and needs of the people who make up that organization. Let's look at various models of **organizational decision-making**.

Bureaucratic Models

According to the **bureaucratic model**, the main goal of an organization is the preservation of the organization itself. Change is very slow and difficult because the structure isn't designed for change. Change causes uncertainty, and this type of organization isn't strong on changing anything.

Change is difficult in the bureaucratic organization because most use Standard Operating Procedures to determine how tasks will be accomplished. These SOPs have developed over a long period of time and are usually based on previous decisions and work habits. To some members of the bureaucratic organiza-

tion, changing the SOPs is to say that the previous methods were inferior or wrong. That's not necessarily the case, since changing environments can bring the need for changing the organization. Nonetheless, changing the bureaucratic organization is a slow and sometimes painful process.

A word of caution: Everyone automatically associates "bureaucratic" with government organizations. Private organizations can be just as interested in preserving their structure. Many private companies could use some drastic changes and improvements, but they don't make them because they are more interested in keeping the status quo.

Political Models of Organizational Choice

The decision-making process in the **political model** is based not necessarily on what's good for the organization, but on what's good for the players involved. Compromise is more the norm than clear-cut decisions. The goal of this type of organization is to blend the interests of the players into a decision that satisfies as many people or entities as possible.

"Garbage Can" Model

Garbage can model sounds like a funny label, but it's very apt. "Oops" is the operative word in this organization. Too often the people involved in this type of decision making process develop the wrong answer to the wrong question. Any success is purely accidental.

27.5 How Information Technology Has Changed the Management Process

Times have changed and so have the methods by which managers make decisions. Information technology has helped speed the change in methods.

Traditional and Contemporary Management

Technology has enabled companies to flatten their hierarchies. The last few years has seen an exodus of middle managers. Companies simply didn't need the extra layers because of technological advances that allow lower levels of employees to communicate and collaborate easier and faster than ever before. Managers in these newly flattened organizations are now responsible for making sure employees know the environmental influences on the organization, know the goals of the organization, and adjust the organization to meet the new influences. Managers then free their employees to meet not only the organization's goals, but also their personal goals.

Information systems can help managers and employees work more efficiently and effectively in this new environment by increasing the amount of information available to all employees. Communications are faster and more widespread with new technologies that enable employees and managers to collaborate more closely and work better in teams. New information systems also enable virtual organizations and geographically dispersed teams and groups to work together to meet personal and organizational goals.

Implications for System Design

The decision-making process is much different in today's organization than it was just a few years ago. The danger of building a system to accommodate today's process is that it will not take these changes into account. Understanding how people and organizations make decisions will help build a system that can accommodate the organization and the employees.

Information systems should be created not only to help mangers and employees make decisions, but also help them better communicate between all levels and units of the organization. Remember, decisions are not made in isolation.. More important, decisions affect a wide range of people, and the system should accommodate this fact.

The real danger in using information systems to help make decisions is that the decision-making process will be based on the wrong information. Because managers may assume that the situation is similar to one they experienced before, they may not be as careful as they would be if it were an entirely new situation. For instance, management may decide that the new packaging materials are as good as the old ones because they are the same color.

Therefore managers won't be as careful in studying all the data, all the possible outcomes and the alternatives when making the decision to change suppliers. They make the decision based on the first available alternative that moves them toward their ultimate goal. They find out too late that the packaging materials are not as good as the old ones and they end up with more damaged goods and irate customers.

Information systems should have these characteristics:

- They are flexible and provide many options for handling data and evaluating information.
- They are capable of supporting a variety of styles, skills, and knowledge.
- They are powerful in the sense of having multiple analytical and intuitive models for the evaluation of data and the ability to keep track of many alternatives and consequences.
- They reflect the bureaucratic and political requirements of systems.
- They reflect an appreciation of the limits of organizational change and an awareness of what information systems can and cannot do.

27.6 Summary

An organization must examine the theory it most closely follows and then design the information system to fit. Above all, managers communicate. Make that process easier, cheaper, faster, and more efficient and you've increased the worth of that manager tremendously. Increase the number of people and entities the manager can communicate with, and you reduce the number of managers required.

You should remember that every decision causes change and that people react to change in many different ways. Some people embrace change; others abhor it. But you can't make a decision without causing a change somewhere.

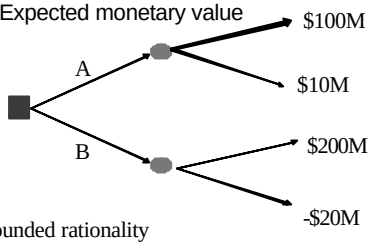
Understanding how an organization makes decisions can help increase the success of the decisions made.

Using information systems in the decision-making process should be a positive exercise. That is, the system should help managers at all levels make better decisions, more efficiently, to the benefit of a greater number of people, and to improve the organization.

Point to Ponder

Models of Decision Making

- Rational model
  - Economic rational actor - obtains all the facts, weighs likelihood of all the alternative outcomes, and chooses the one with the highest probable value.(expected value)
  - Expected monetary value



* Bounded rationality

Decision Making Process

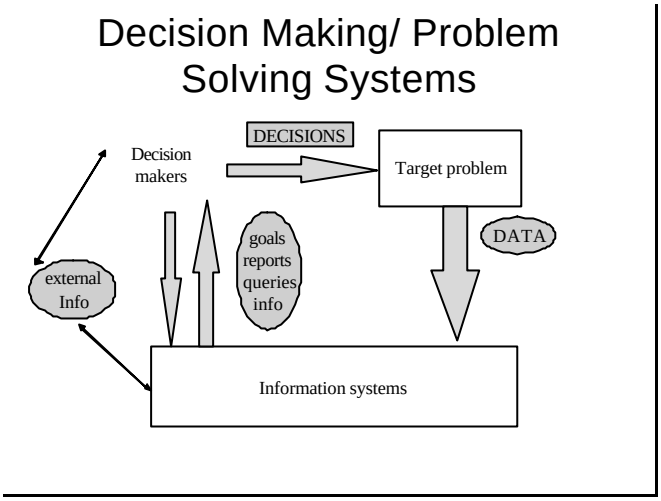
- Decision making process
  - Intelligence
    - Sensing, finding, identifying, and defining problem/opportunity
  - Design
    - Diagnosing the problem/opportunity
    - Generating alternatives
  - Choice
    - Choosing the best alternative

Models of Decision Making

- Satisfying
  - Less than optimization
  - More realistic
  - Limited number of alternatives
- Organizational and Political
  - Sub-units or members with own "goals" and "resources"
  - Power struggle
  - Bargaining and negotiation

Information Characteristics for Different Types of Decisions

Characteristics	Operational	Managerial	Strategic
Accuracy	High	⟷	Low
Level of detail	Detailed	⟷	Aggregate
Time horizon	Present	⟷	Future
Use	Frequent	⟷	Infrequent
Source	Internal	⟷	External
Scope	Narrow	⟷	Wide
Nature	Quantitative	⟷	Qualitative
Age	Current	⟷	Current/old



Review Questions

1. Explain the management perspective and roles of managers in the modern business scenario.
2. Describe the various levels and types of decision making.
3. Explain the models of decision making
4. Explain the impact of Information Technology in making decisions better.

Discussion Questions:

1. Describe how your organization can or cannot use the knowledge-based view of management.
2. Following the stages of decision making as described in the above text, make a decision. Write down each stage of the decision.

Application Exercise

1. Analyze organization according to the three models of organizational decision making. Which one comes closest to describing how your organization makes decisions?

LESSON 28 :
DECISION SUPPORT SYSTEMS (DSS)

Learning Objectives

1. To learn how managers can enhance their decision making
2. To know about the concept – DSS and its components
3. To study the various types of DSS and its functions

28.1 Introduction

The more information you have, based on internal experiences or from external sources, the better your decisions. Business executives are faced with the same dilemmas when they make decisions. They need the best tools available to help them.

Decision makers to make quality decisions should, to the best of their abilities:

1. thoroughly check a wide range of alternatives
2. gather full range of goals and implications of choices
3. weigh costs and risks of both positive and negative consequences
4. intensively search for new information for evaluating alternatives
5. take all new information into account, even when it doesn't support initial course of action
6. re-examine positive and negative consequences of all alternatives, including initially rejected ones
7. make detailed provisions for implementation, including contingency plans for known risks

When we discussed Transaction Processing Systems and Management Information Systems, the decisions were clear-cut: "Should we order more raw materials to support the increased production of our product?" Most decisions facing executives are unstructured or semi-structured: "What will happen to our sales if we increase our candy bar prices by 5%?"

Decision Support Systems (DSS) help executives make better decisions by using historical and current data from internal Information Systems and external sources. By combining massive amounts of data with sophisticated analytical models and tools, and by making the system easy to use, they provide a much better source of information to use in the decision-making process.

Decision Support Systems (DSS) are a class of computerized information systems that support decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to successfully complete decision process tasks.

DSS and MIS

In order to better understand a decision support system, let's compare the characteristics of an MIS system with those of a DSS system:

MIS	DSS
Structured decisions	Semistructured, unstuctured decisions
Reports based on routine flows of data	Focused on specific decisions / classes of decisions
General control of organization	End-user control of data, tools, and sessions
Structured information flows	Emphasizes change, flexibility, quick responses
Presentation in form of reports	Presentation in form of graphics
	Greater emphasis on models, assumptions, ad hoc queries
Traditional systems development	Develop through prototyping; iterative process

You can also understand the differences between these two types of systems by understanding the differences in the types of decisions made at the two levels of management. Are your decisions routines, or are your decisions nonroutines? You might find it helpful to review the information about decision-making processes from the previous lesson.

28.2 Framework of Decisions Support Systems

A conceptual framework for Decision Support Systems (DSS) is developed based on the dominant technology component or driver of decision support, the targeted users, the specific purpose of the system and the primary deployment technology. Five generic categories based on the dominant technology component are proposed, including Communications-Driven, Data-Driven, Document-Driven, Knowledge-Driven, and Model-Driven Decision Support Systems. Each generic DSS can be targeted to internal or external stakeholders. DSS can have specific or very general purposes. Finally, the DSS deployment technology may be a mainframe computer, a client/server LAN, or a Web-Based architecture. The goal in proposing this expanded DSS framework is to help people understand how to integrate, evaluate and select appropriate means for supporting and informing decision-makers.

Because of the limitations of hardware and software, early DSS systems provided executives only limited help. With the increased power of computer hardware, and the sophisticated software available today, DSS can crunch lots more data, in less time, in greater detail, with easy to use interfaces. The more detailed data and information executives have to work with, the better their decisions can be.

Need for an Expanded Framework

Decision Support Systems should be defined as a broad category of information systems for informing and supporting decision-makers. DSS are intended to improve and speed-up the processes by which people make and communicate decisions. We need to improve how we define Decision Support Systems on both a conceptual level and on a concrete, technical

level. Both managers and DSS designers need to understand categories of decision support so they can better communicate about what needs to be accomplished in informing and supporting decision makers.

The DSS literature includes a number of frameworks for categorizing systems. Steven Alter (1980) developed the broadest and most comprehensive one more than 20 years ago. A new, broader typology or framework than Alter's (1980) is needed because Decision Support Systems are much more common and more diverse than when he conducted his research and proposed his framework.

Decision Support Systems do vary in many ways. Some DSS focus on data, some on models and some on communications. DSS also differ in scope, some DSS are intended for one "primary" user and used "stand-alone" for analysis and others are intended for many users in an organization. A Decision Support System could be categorized in terms of the generic operations it performs, independent of type of problem, functional area or decision perspective. His seven types included: file drawer systems, data analysis systems, analysis information systems, accounting and financial models, representational models, optimization models, and suggestion models.

An Expanded Framework

The following expanded DSS framework is still evolving. The author and others have used the framework to classify a large number of software packages and systems. Anecdotal reports indicate that people who have tried to use it in describing a proposed or existing DSS have found it comprehensive, useful and parsimonious. It seems to help one categorize the most common Decision Support Systems currently in use. The framework focuses on one major dimension with 5 generic types of DSS and 3 secondary dimensions. The primary dimension is the dominant technology component or driver of the decision support system; the secondary dimensions are the targeted users, the specific purpose of the system and the primary deployment technology. Some DSS are best classified as hybrid systems driven by more than one major DSS component.

28.3 Types of DSS

Data-Driven DSS

Data-Driven DSS take the massive amounts of data available through the company's TPS and MIS systems and cull from it useful information which executives can use to make more informed decisions. They don't have to have a theory or model but can "free-flow" the data.

The first generic type of Decision Support System is a **Data-Driven DSS.** These systems include file drawer and management reporting systems, data warehousing and analysis systems, Executive Information Systems (EIS) and Spatial Decision Support Systems. Business Intelligence Systems are also examples of Data-Driven DSS. Data- Driven DSS emphasize access to and manipulation of large databases of structured data and especially a time-series of internal company data and sometimes external data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. Data-Driven DSS with Online Analytical Processing (OLAP) provide the highest level of functionality and decision support that is linked to analysis of large collections of historical data.

Model-Driven DSS

A second category, **Model-Driven DSS,** includes systems that use accounting and financial models, representational models, and optimization models. Model-Driven DSS emphasize access to and manipulation of a model. Simple statistical and analytical tools provide the most elementary level of functionality. Some OLAP systems that allow complex analysis of data may be classified as hybrid DSS systems providing modeling, data retrieval and data summarization functionality. Model-Driven DSS use data and parameters provided by decision-makers to aid them in analyzing a situation, but they are not usually data intensive. Very large databases are usually not needed for Model-Driven DSS.

Model-Driven DSS were isolated from the main Information Systems of the organization and were primarily used for the typical "what-if" analysis. That is, "What if we increase production of our products and decrease the shipment time?" These systems rely heavily on models to help executives understand the impact of their decisions on the organization, its suppliers, and its customers.

Knowledge-Driven DSS

The terminology for this third generic type of DSS is still evolving. Currently, the best term seems to be **Knowledge-Driven DSS.** Adding the modifier "driven" to the word knowledge maintains a parallelism in the framework and focuses on the dominant knowledge base component. Knowledge-Driven DSS can suggest or recommend actions to managers. These DSS are personcomputer systems with specialized problem-solving expertise. The "expertise" consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving some of these problems. A related concept is Data Mining. It refers to a class of analytical applications that search for hidden patterns in a database. Data mining is the process of sifting through large amounts of data to produce data content relationships.

Document-Driven DSS

A new type of DSS, a **Document-Driven DSS** or Knowledge Management System, is evolving to help managers retrieve and manage unstructured documents and Web pages. A Document-Driven DSS integrates a variety of storage and processing technologies to provide complete document retrieval and analysis. The Web provides access to large document databases including databases of hypertext documents, images, sounds and video. Examples of documents that would be accessed by a Document-Based DSS are policies and procedures, product specifications, catalogs, and corporate historical documents, including minutes of meetings, corporate records, and important correspondence. A search engine is a powerful decisionaiding tool associated with a Document-Driven DSS.

Communications-Driven and Group DSS

Group Decision Support Systems (GDSS) came first**,** but now a broader category of **Communications-Driven DSS** or groupware can be identified. This fifth generic type of Decision Support System includes communication, collaboration and decision support technologies that do not fit within those DSS types identified. Therefore, we need to identify these systems as a specific category of DSS. A Group DSS is a hybrid Decision Support System that emphasizes both the use of communications and decision models. A Group Decision Support System is an interactive computer-based system intended to facilitate the solution of problems by decision-makers working together as a group. Groupware supports electronic communication, scheduling, document sharing, and other group productivity and decision support enhancing activities We have a number of technologies and capabilities in this category in the framework – Group DSS, two-way interactive video, White Boards, Bulletin Boards, and Email.

Inter-Organizational or Intra-Organizational DSS

A relatively new targeted user group for DSS made possible by new technologies and the rapid growth of the Internet is customers and suppliers. We can call DSS targeted for external users an **Inter-organizational DSS.** The public Internet is creating communication links for many types of inter-organizational systems, including DSS. An Inter-Organizational DSS provides stakeholders with access to a company's intranet and authority or privileges to use specific DSS capabilities. Companies can make a Data-Driven DSS available to suppliers or a Model-Driven DSS available to customers to design a product or choose a product. Most DSS are **Intra-Organizational DSS** that are designed for use by individuals in a company as "standalone DSS" or for use by a group of managers in a company as a Group or Enterprise-Wide DSS.

Function-Specific or General Purpose DSS

Many DSS are designed to support specific business functions or types of businesses and industries. We can call such a Decision Support System a function-specific or industry- specific DSS. A **Function-Specific DSS** like a budgeting system may be purchased from a vendor or customized in-house using a more general-purpose development package. Vendor developed or "off-the-shelf" DSS support functional areas of a business like marketing or finance; some DSS products are designed to support decision tasks in a specific industry like a crew scheduling DSS for an airline. A task-specific DSS has an important purpose in solving a routine or recurring decision task. Function or task-specific DSS can be further classified and understood in terms of the dominant DSS component, that is as a Model-Driven, Data-Driven or Suggestion DSS. A function or task-specific DSS holds and derives knowledge relevant for a decision about some function that an organization performs (e.g., a marketing function or a production function). This type of DSS is categorized by purpose; function-specific DSS help a person or group accomplish a specific decision task. General-purpose DSS software helps support broad tasks like project management, decision analysis, or business planning.

28.4 Components of DSS

Traditionally, academics and MIS staffs have discussed building Decision Support Systems in terms of four major components:

- The user interface
- The database
- The models and analytical tools and
- The DSS architecture and network

This traditional list of components remains useful because it identifies similarities and differences between categories or types of DSS. The DSS framework is primarily based on the different emphases placed on DSS components when systems are actually constructed.

Data-Driven, Document-Driven and Knowledge-Driven DSS need specialized database components.

A Model- Driven DSS may use a simple flat-file database with fewer than 1,000 records, but the model component is very important. Experience and some empirical evidence indicate that design and implementation issues vary for Data-Driven, Document-Driven, Model-Driven and Knowledge-Driven DSS.

Multi-participant systems like Group and Inter- Organizational DSS also create complex implementation issues. For instance, when implementing a Data-Driven DSS a designer should be especially concerned about the user's interest in applying the DSS in unanticipated or novel situations. Despite the significant differences created by the specific task and scope of a DSS, all Decision Support Systems have similar technical components and share a common purpose, supporting decision- making.

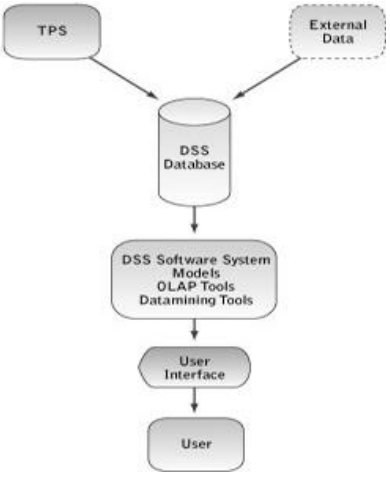
A Data-Driven DSS database is a collection of current and historical structured data from a number of sources that have been organized for easy access and analysis.

We are expanding the data component to include unstructured documents in Document-Driven DSS and "knowledge" in the form of rules or frames in Knowledge-Driven DSS. Supporting management decision-making means that computerized tools are used to make sense of the structured data or documents in a database.

Mathematical and analytical models are the major component of a Model-Driven DSS. Each Model-Driven DSS has a specific set of purposes and hence different models are needed and used. Choosing appropriate models is a key design issue. Also, the software used for creating specific models needs to manage needed data and the user interface. In Model-Driven DSS the values of key variables or parameters are changed, often repeatedly, to reflect potential changes in supply, production, the economy, sales, the marketplace, costs, and/or other environmental and internal factors. Information from the models is then analyzed and evaluated by the decision-maker.

Knowledge-Driven DSS use special models for processing rules or identifying relationships in data. The DSS architecture and networking design component refers to how hardware is organized, how software and data are distributed in the system, and how components of the system are integrated and connected. A major issue today is whether DSS should be available using a Web browser on a company intranet and also

available on the Global Internet. Networking is the key driver of Communications- Driven DSS.



Overview of a DSS

The **DSS software system** must be easy to use and adaptable to the needs of each executive. A well-built DSS uses the **models** that the text describes. You've probably used statistical models in other classes to determine the mean, median, or deviations of data. These statistical models are the basis of datamining.

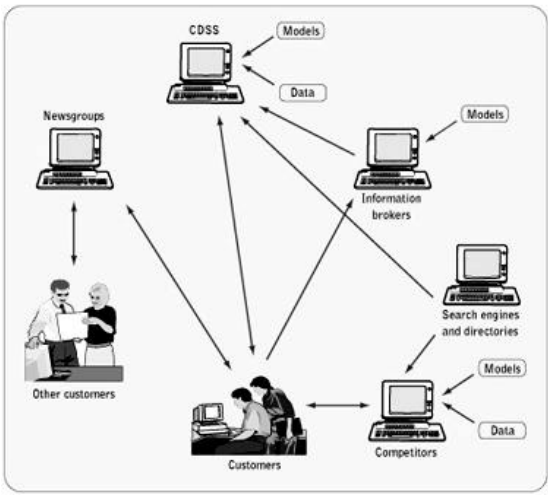
The What-If decisions most commonly made by executives use **sensitivity analysis** to help them predict what effect their decisions will have on the organization. Executives don't make decisions based solely on intuition. The more information they have, the more they experiment with different outcomes in a safe mode, the better their decisions. That's the benefit of the models used in the software tools.

28.5 Examples of DSS Applications

Organization	DSS Application
American Airlines Equico Capital Corporation	Price and route selection Investment evaluation
General Accident Insurance	Customer buying patterns and fraud detection
Bank of America Frito-Lay, Inc. Burlington Coat Factory National Gypsum	Customer profiles Price, advertising, and promotion selection Store location and inventory mix Corporate planning and forecasting
Southern Railway	Train dispatching and routing
Texas Oil and Gas Corporation	Evaluation of potential drilling sites
United Airlines	Flight scheduling
U.S. Department of Defense	Defense contract analysis

28.6 Web-Based DSS

Of course, no discussion would be complete without information about how companies are using the Internet and the Web in the customer DSS decision-making process. The following figure shows an Internet **CDSS (Customer Decision-Support System).**



Customer decision support on the Internet

Here's an example: You decide to purchase a new home and use the Web to search real estate sites. You find the perfect house in a good neighborhood but it seems a little pricey. You don't know the down payment you'll need. You also need to find out how much your monthly payments will be based on the interest rate you can get. Luckily the real estate Web site has several helpful calculators (customer decision support systems) you can use to determine the down payment, current interest rates available, and the monthly payment. Some customer decision support systems will even provide an amortization schedule. You can make your decision about the purchase of the home or know instantly that you need to find another house.

28.7 Summary

Executives make semi-structured and unstructured decisions based on historical and current data, from both internal and external sources. Well-built Decision-Support Systems help them make better decisions by making more of these kinds of data available in the decision-making process. Datamining is one of the most effective tools for gathering useful information provided it's used properly. In addition to data, the components of a DSS include effective software tools, and a user interface that is easy to use.

Decision-makers receive and analyze information using many different media, including traditional print, group and interpersonal information exchanges, and computer based tools. One set of computer-based tools has been termed Decision Support Systems. For more than 30 years, researchers and Information Systems specialists have built and studied a wide variety of systems for supporting and informing decision-makers that they have called Decision Support Systems or Management Decision Systems.

In the past few years, some additional terms like business intelligence, data mining, on-line analytical processing, groupware, knowledgeware, and knowledge management have been used for systems that are intended to inform and support decision-makers. The new terms are imprecisely defined and subject to marketing hyperbole. This proliferation of terms creates problems in conducting research and in communicating with decision-makers about decision support systems. The solution is developing an expanded and well-defined framework for categorizing decision support systems.

The terms framework, taxonomy, conceptual model and typology are often used interchangeably. Taxonomies classify objects and typologies show how mutually exclusive types of things are related. Frameworks provide an organizing approach and a conceptual model shows how ideas are related. The general desire is to create a set of labels that help people organize and categorize information.

Points to Ponder

Decision Support Systems

- an information system
- purpose to provide information for making informed decisions
- interactive (needed for experimenting and prospecting)

Definitions of DSS

- Management Decision Systems -- Interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems.
- Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semi-structured problems.

Basic Themes of DSS

- Information systems.
- Used by managers.
- Used in making decisions.
- Used to support, not to replace people.
- Used when the decision is "semistructured" or "unstructured."
- Incorporate a database of some sort.
- Incorporate models.

DSS as a System

◆ **Man-Machine System DSS is man-machine system for decision making purposes. Man part is more open and probabilistic while the machine part is more closed and deterministic.**
E.g. DSS for deciding PRICE and ADVERTISING levels

◆ **Closed-loop system with feedback external to system DSS uses feedback to adjust output. Feedback is not internal like an elevator. The user provides judgmental inputs to DSS.**

◆ **DSS components: Database, model base, knowledge base, interface which interact with each other and the user.**

DSS Benefits

- Improving Personal Efficiency
- Expediting Problem Solving
- Facilitating Interpersonal Communications
- Promoting Learning or Training
- Increasing Organizational Control

The DSS Hierarchy

- Suggestion systems
- Optimization systems
- Representational models
- Accounting models
- Analysis information systems
- Data analysis systems
- File drawer systems

File Drawer Systems

- They are the simplest type of DSS
- Can provide access to data items
- data is used to make a decision
- ATM Machine
- Use the balance to make transfer of funds decisions

Analysis Information Systems

- Provide access to multiple data sources
- Combines data from different sources
- Allows data analysis capabilities
- Compare growth in revenues to industry average- requires access to many sources
- The characteristic of the recent "datawarehouse" is similar

Data Analysis Systems

- Provide access to data
- Allows data manipulation capabilities
- Airline Reservation system
- No more seats available
- provide alternative flights you can use
- use the info to make flight plans

Accounting Models

- Use internal accounting data
- Provide accounting modeling capabilities
- Can not handle uncertainty
- Use s Bill of Material
- calculate production cost
- make pricing decisions

Representational Model

- Can incorporate uncertainty
- uses models to solve decision problem using forecasts
- Can be used to augment the capabilities of Accounting models
- Use the demand data to forecast next years demand
- Use the results to make inventory decisions.

Suggestion Systems

- A descriptive model used to suggest to the decision maker the best action
- May incorporate an Expert System
- Applicant applies for personal loan
- use the system to recommend a decision

Optimization Systems

- Used to estimate the effects of different decision alternative
- Based on optimization models
- Can incorporate uncertainty
- Assign sales force to territory
- Provide the best assignment schedule

Review Questions

1. What do you meant by DSS? Explain the framework of DSS?
2. Explain the components and benefits of DSS?
3. Briefly write a short note on various types of DSS with examples.
4. Explain Web Based DSS and its benefits.

Discussion Questions

1. Discuss the issues in designing the DSS for any organisation.
2. Which of the following are decision support Systems? Explain the reasons for your answers.
   a. A marketing system that provides a weekly sales report summarised by product line.
   b. A sales prospect database that managers can use to make queries, such as list the names of all prospects having the postal code 400614.
   c. A personnel information system that provides a listing of all new hires, changes, and terminations at the beginning of each week.
   d. A financial system that projects the cash flow impacts of two investment decisions.
3. Discuss the qualitative benefits of DSS and present it.

Application Exercise

1. A marketing manager has asked you to help design a DSS for the marketing department. Every month marketers need to evaluate the effectiveness of their advertising campaigns and decide how to allocate their budget for the next month. They advertise only in the local area and have four basic choices: radio, television, local newspapers, and direct mail. Each month, they conduct random phone interviews to find out who sees their advertisements. They can also purchase local scanner data to determine sales of related products. Each month, the media salespeople give them the Arbitron ratings that show the number of people (and demographics) who they believe saw each advertisement. They also receive a schedule of costs for the upcoming month. As a first step in creating the DSS, identify any relevant assumptions and input and output variables, along with any models that might be useful.
2. A government official recently noted that the government is having difficulty processing applications for assistance programs (welfare). Although most applications are legitimate, several facts they contain have to be checked. For instance, welfare workers have to check motor vehicle and real estate records to see whether the applicants own cars or property. The agency checks birth, death, and marriage records to verify the existence of dependents. They sometimes examine public health data and check criminal records. It takes time to check all of the records, plus the agency needs to keep track of the results of the searches. Additionally, a few applicants have applied multiple times—sometimes in different localities. The office needs to randomly check some applications to search for fraud. Every week, summary reports have to be sent to the state offices. A key feature of these reports is that they are used to convince politicians to increase funding for certain programs. Describe how a DSS could help this agency. Hint: Identify the decisions that need to be made.

Note -

LESSON 29 :
GROUP DECISION SUPPORT SYSTEMS

Learning Objectives

1. To know the concept of GDSS and its application in decision making
2. To understand the need of GDSS and its Goals in the organisation.
3. To study about the tools used in GDSS
4. To know how GDSS can help managerial decision making better.

29.1 Introduction

Many business decisions involve a group of people. Often one person might be responsible for the final decision, but meetings are used to enable everyone to have a say, analyse the potential effects on each area, and persuade others to accept a decision. Decisions that involve groups of people have additional complications. Someone has to organise and control the meeting. During the meeting, people compete to make comments and get their options heard. Someone has to take notes of the meeting and votes have to be counted.

Information systems can help with group decisions. Groupware tools can be used to share data and documents. Message systems can be used to share comments and early drafts of work. Bulletin boards can be used to let everyone express opinions and evaluations. In the late 1980's, an additional tool known as a group decision support systems (GDSS) was defined. A GDSS is designed to help managers reach a consensus during meetings.

29.2 What is a GDSS?

More and more, companies are turning to groups and teams to get work done. Hours upon hours are spent in meetings, in group collaboration, in communicating with many people. To help groups make decisions, a new category of systems was developed—the group decision-support system (GDSS).

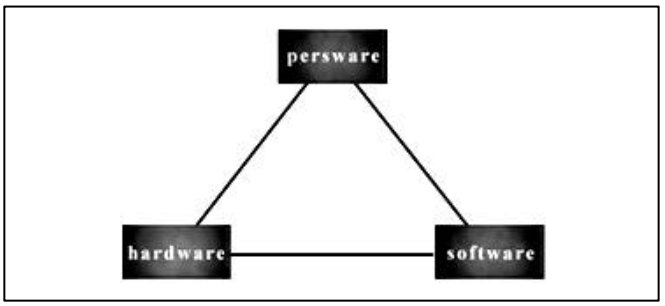
You've been there: a meeting where nothing seemed to get done, where some people dominated the agenda and others never said a word, which dragged on for hours with no clear agenda. When it was all over no one was sure what was accomplished, if anything. But the donuts and coffee were good!

Organizations have been struggling with this problem for years. They are now using GDSS as a way to increase the efficiency and effectiveness of meetings. The text includes a list of elements that GDSS use to help organizations. We'll highlight a few of them:

- **Preplanning:** A clear-cut agenda of the topics for the meeting.
- **Open, collaborative meeting atmosphere:** Free flow of ideas and communications without any of the attendees feeling shy about contributing
- **Evaluation objectivity**: Reduces "office politics" and the chance that ideas will be dismissed because of who presented them instead of what was presented
- **Documentation:** Clear communication about what took place and what decisions were made by the group
- **Preservation of "organizational memory"**: Even those unable to attend the meeting will know what took place; great for geographically separated team members.

29.3 GDSS Characteristics and Software Tools

We're back to our triangle of



In GDSS the hardware includes more than just computers and peripheral equipment. It also includes the conference facilities, audiovisual equipment, and networking equipment that connect everyone. The persware extends to the meeting facilitators and the staff that keeps the hardware operating correctly. As the hardware becomes more sophisticated and widely available, many companies are bypassing specially equipped rooms in favor of having the group participants "attend" the meeting through their individual desktop computers.

Many of the software tools and programs discussed, Groupware, can also be used to support GDSS. Some of these software tools are being reworked to allow people to attend meetings through Intranets or Extranets. Some highlights:

- **Electronic questionnaires:** Set an agenda and plan ahead for the meeting
- **Electronic brainstorming**: Allows all users to participate without fear of reprisal or criticism
- **Questionnaire tools:** Gather information even before the meeting begins, so facts and information are readily available
- **Stakeholder identification:** Determines the impact of the group's decision
- **Group dictionaries:** Reduce the problem of different interpretations

Now instead of wasting time in meetings, people will know ahead of time what is on the agenda. All of the information generated during the meeting is maintained for future use and

reference. Because input is anonymous, ideas are evaluated on their own merit. And for geographically separated attendees, travel time and dollars are saved. **Electronic meeting systems** make these efficiencies possible. The following figure shows the sequence of activities at a typical EMS meeting.

Group system tools

All is not perfect with EMS, however. Face-to-face communications is critical for managers and others to gain insight into how people feel about ideas and topics. Body language can often speak louder than words. Some people still may not contribute freely because they know that all input is stored on the file server, even though it is anonymous. And the system itself imposes disciplines on the group that members may not like.

29.4 Features of GDSS

Most versions of GDSS use special meeting rooms where each participant is seated at a networked computer. A facilitator operates the network and keeps the discussion moving in the right direction. Before the meeting, the primary decision maker meets with the facilitator to establish the objective of the meeting. They setup sample questions and design the overall strategy.

Typical meetings begin with a brainstorming session, where participants are asked to think of ideas, problems and potential solutions. They type each of these into categories on their computers. The basic ideas and suggestions are stored in a database and shared with the group through the networked computers.

In terms of discussions and comments, the facilitator can choose individual items and project them on the screen for the entire group to analyse. Participants can write comments or criticisms of any idea at any time. This system is particularly helpful if many participants come up with many ideas and comments at the same time. The computer enables everyone to enter comments at the same time, which is faster than waiting for each person to finish speaking.

Another feature of using the computer for the entry of ideas and comments is that they can be anonymous. Although each comment is numbered, they are not traced back to the original author, so people are free to criticize their supervisor's ideas. Anonymity reduces embarrassment and encourages people to submit riskier ideas.

At various points, the facilitator can call for participants to vote on some of the ideas and concepts. Depending on the software package, there can be several ways to vote. In addition to traditional one-vote methods, there are several schemes where you place weights on your choices. The votes are done on the computer and results appear immediately. Because it is so easy to vote, the GDSS encourages the group to take several votes. This approach makes it easier to drop undesirable alternatives early in the discussion.

One useful feature of conducting the meeting over a computer network is that all of the comments, criticisms, and votes are recorded. They can all be pointed at the end of the session. Managers can review all of the comments and add them to their reports.

In theory, a meeting could be conducted entirely on a computer network, saving costs and travel time if the participants are located in different cities. Also, if it is designed properly, a GDSS can give each participant access to the corporate data while he or she is in the meeting. If a question raises about various facts, the computer can find the answer without waiting for a second meeting.

29.5 Why do we need GDSS?

- Many organizations use group or team structures to organize the work effort.
- Complex decisions often require more co-ordinated efforts and input of multiple individuals.
- Decision making is diffused throughout the organization.
- Information technology is a powerful tool to support the group decision making processes of an organization.

29.6 Goals of GDSS

A. Mitigate the problems of group work.

- Social pressures of conformity may result in "groupthink".
- Lack of co-ordination of work and poor planning of meetings.
- Inappropriate influence of group dynamics.
- Tendency of group members to rely on others to do most of the work.
- Tendency toward compromised solutions of poor quality;
- Social "loafing"
- Tendency to repeat what was already said.
- Larger costs of making decisions.
- Tendency of group to take riskier decisions than they should.
- Incomplete or inappropriate use of information.
- Inappropriate representation in group.

B. Accentuate the Benefits of group work.

- Groups are better than individuals at understanding problems.
- Groups are better than individuals at catching errors.
- A group has more knowledge/information than any one member.
- Working in a group may stimulate the participants and the process.
- The participation of the members in a decision means less likelihood to resist implementation.
- People are accountable for the decisions that they participate in.

C. Support multiple group processes.

- Generate ideas and alternatives
- Provide methods that aid the decision and judgment process
- Provide access to rules that will aid the choice between alternatives
- Provide methods for reconciling conflict.

29.7 How GDSS Can Enhance Group Decision Making

Go back to the previous list of problems associated with meetings and you can determine how GDSS solve some of these problems.

1. Improved preplanning: Forces an agenda to keep the meeting on track.
2. Increased participation: Increases the number of people who can effectively contribute to the meeting.
3. Open, collaborative meeting atmosphere: Nonjudgmental input by all attendees.
4. Criticism-free idea generation: Anonymity can generate more input and better ideas.
5. Evaluation objectivity: The idea itself is evaluated and not the person contributing the idea.
6. Idea organization and evaluation: Organized input makes it easier to comprehend the results of the meeting.
7. Setting priorities and making decisions: All management levels are on equal footing.
8. Documentation of meetings: Results of meeting are available soon after for further use and discussion.
9. Access to external information: Reduces amount of disagreements by having the facts.
10. Preservation of "organizational memory:" Information is available to other groups within the organization.

You can see from this list that the potential for efficient and effective meetings is increased by using GDSS to promote open and organized decision making in groups.

More and more, decisions are being made by groups in today's business environment. Most meetings are inefficient. Using Group Decision Support Systems, comprised of hardware, software, and people, helps streamline group meetings and communications by removing obstacles and using technology to increase the effectiveness of the decisions.

29.8 Limitations of GDSS

Perhaps the greatest drawback to a GDSS is that it requires participants to type in their ideas, comments and criticisms. Most people are used to meetings based on oral discussions. Even if they have adequate typing skills, a GDSS can inhibit some managers.

Along the same lines, in a traditional meeting, only one person speaks at a time, and everyone concentrates on the same issue at the same time. With a GDSS your focus is continually drawn to the many different comments and discussions taking place at the same time. People who type rapidly and fit from topic to topic will find that they can dominate the discussions.

In terms of costs, maintaining a separate meeting room with networked computers can be expensive. Unless the facility is used on a regular basis, the computers will be idle a great deal of then time. When you factor in the costs for network software, the GDSS software, and other utilities, the costs multiply. One way to minimize this problem is to lease the facilities that have been established by a couple of universities and some companies.

The use of GDSS also requires a trained facilitator – someone who can lead discussions, help users, and control the GDSS software on the network. Hiring an in-house specialist can be very expensive of there are only a few meetings a year. Again, using facilities are scrupulously honest; there might be some topics that you do not want to discuss with non-employees.

One way to overcome these limitations is to alter the approach to the meetings. Instead of requiring everyone to get together at the same time in on room, meetings could be held via network discussion groups. Each participant could read the messages, add comments, and vote on issues electronically at any time from any location. Again, the internet offers possibilities to provide these facilities, but it could be a few years before organisations and managers can accept the changes required.

29.9 Summary

The GDSS started originally from the Management Information System at University of Arizona. Some kind of problems has always been observed that are associated more with large meetings than with small meetings. By large meetings we mean meetings with generally more than 15 participants, but can go much beyond that, e.g. 40 or even 50. Some of the identified problems are:

- Time consuming;
- Dominance over the meeting; and
- Honesty and participation.

However, it is important to realize that we are not therefore trying to say that small meetings do not have these above problems; these problems mentioned exist in any kind of meetings, but we are just trying to stress that they are more commonly found in large meetings. Small meetings tend to be more easily controlled than large meetings.

In a GDSS environment, there is usually a big room with something like 40 seats, which means that 40 people can be at the meeting at any one time. There are not only 40 seats but also 40 microcomputers. This enables every participant to have

the use of one microcomputer during the course of the meeting. The reason why each participant needs a microcomputer depends on how GDSS works.

In the GDSS, with special computer software, the facilitator of each meeting will first make the agenda of the meeting, which will be projected onto a big screen that everyone can see. Then the participants will type simultaneously in their ideas of the topic of discussion on the individual microcomputers next to them. Then the computer will sort the ideas, and then the participants will then vote or comment on which ideas they like or they dislike. In the course of the whole meeting, GDSS stores, categorizes and prints out all the ideas, comments and vote tallies, so that each of the meeting participants will get a summary of the meeting when it ends.

What so special about GDSS is that it enables meeting participants to simultaneously "talk", when the computer sorts and sends ideas to each of the terminal, all at the same time. That saves a tremendous amount of time, because all these are done electronically instead of manually, and the time saved will enable participants to spend more time manipulating and expressing their ideas. This can consequently increase the productivity and efficiency of the group. The time-consuming benefit also has an added bonus: when productivity and efficiency in meetings increase, it is likely that the team spirit can be consolidated, resulting in an increase of the strength of binding among team members.

Besides, under this GDSS, no one can dominate the meeting. This is because of another feature of GDSS. GDSS provides an anonymous scheme, so that whatever you type in the terminal (i.e. your opinion) will be protected. Under this circumstance, no one really knows who is typing what. Because of this, not a single person can dominate the meetings. In the worst case, we might say "some ideas" are dominating the meeting, but this is perfectly fine because this is as a matter of fact an aim of the GDSS: to help meeting participants voice their opinions from an idea-oriented mindset. For example, simply because you have a prejudice against person A does not mean that you are going to reject the idea being proposed in the meeting, because you do not know who is proposing that idea!!

Besides, this anonymity scheme will also help those team members who are shy to voice opinions. And with the anonymity, people are likely to be more honest, just as you'll say more, and more honestly on the professor's evaluation form if you know whatever you write will not affect your final grade on the course. This, of course, is because you know you don't have to worry about the consequences.

However, whether this anonymity is good or not can be very controversial. The success of meetings supported by GDSS depends largely on the conduct of the participants. If people are taking advantage of the anonymity system by typing obscene words or foul languages, this system may be banned for the good of the organization.

Points to Ponder

Characteristics of GDSS

- **Hardware: Conference facility, electronic hardware**
- **Software tools: Tools for organizing ideas, gathering information, and ranking and seeking priorities**
- **People: Participants, trained facilitator, staff supporting hardware and software**

GDSS Software Tools

- **Electronic questionnaires**
- **Electronic brainstorming tools**
- **Idea organizers**
- **Questionnaire tools**

GDSS Software Tools

- **Tools for voting or setting priorities**
- **Stakeholder identification and analysis tools**

GDSS ENHANCED DECISION MAKING

ALLOWS: Improved pre-planning

- Increased participation
- Open, collaborative atmosphere
- Idea generation free of criticism
- Evaluation objectivity
- Idea organization & evaluation

GDSS ENHANCED DECISION MAKING

ALLOWS: Setting priorities & decision making

- Documentation of meetings
- Access to external information
- Preservation of organizational memory

Review Questions

1. Explain the concept of GDSS and find out its need in organisations.
2. Briefly describe the features and components of GDSS.
3. Explain the goals and benefits of GDSS.
4. How GDSS can help better decision making?

Discussion Questions

1. Discuss and list down relevant design issues relating to the development of GDSS.
2. Discuss and find out a business situation that could benefit from the use of a groupware product. Describe the problems that exist and how they can be overcome with groupware tools.

Application Exercise

Visit a local company and find out the facilities they are having for making decisions in a group.

LESSON 30 :
EXECUTIVE SUPPORT SYSTEMS

Learning Objectives

1. To understand the role of Executive Support Systems in the organisation
2. To know the characteristics of the ESS
3. To study about the various interfaces available to ESS
4. To know the applications of ESS

30.1 Introduction

I think DSS was an interesting topic and you all still remembering a lot about DSS and it's working. If you remember then most of the DSS users are professionals and middle managers like financial analysts, loan officers, auditors, or production schedulers. However top executives use DSS very rarely. Could you answer so? If yes then you already know the need of Executive support system. But I feel that majority of people will have the answer no. So we need to know what the top execu-tives requirement is that is not provided by DSS. What top executives actually want their information and support system to provide them? These are the questions and answers to them will make a framework for executive support system.

Executive Support Systems (ESS) supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as "educated guesses." Executives rely as much, if not more so, on external data than they do on data internal to their organization. Decisions must be made in the context of the world outside the organization. The problems and situations senior executives face are very fluid, always changing, so the system must be flexible and easy to manipulate.

30.2 The Role of ESS in the Organization

Executives often face information overload and must be able to separate the chaff from the wheat in order to make the right decision. On the other hand, if the information they have is not detailed enough they may not be able to make the best decision. An ESS can supply the summarized information executives need and yet provide the opportunity to **drill down** to more detail if necessary.

As technology advances, ESS are able to link data from various sources both internal and external to provide the amount and kind of information executives find useful. As common software programs include more options and executives gain experience using these programs, they're turning to them as an easy way to manipulate information. Many executives are also turning to the Web to provide the flexibility they need.

The Nature of Executive's Work

We now know the basics of ESS. Now before continuing further I want to discuss the nature of an executives work. This means that which type of work executives normally do or perform for which they require not a DSS but ESS. This is highly required before building an ESS. Because without the knowledge of executives work we cannot decide about the system which is suitable for him.

Basically manager's role is divided into 3 categories

1. Interpersonal Role - Roles like figurehead, leader, and liaison
2. Informational roles - Roles of monitor, disseminator, spokesperson
3. Decisional roles - Entrepreneur, disturbance handler, resource alligator, negotiator.

Most of the ESS support all these roles for executive's successful working. If we pay attention then we can see that for interpersonal roles and informational roles with very few advances to DSS the executives can start using ESS. But executives mainly require the ESS for decisional roles. To determine the information needs of executives, it is necessary to specify the activities, which are per-formed in decisional role.

We divide the work of executives in relation to the decision roles into 2 phases. Phase 1 is the identification of problems or opportunities. Phase 2 is the decision of what to do about it. The figure below provides the flowchart that describes about the process of information flow in decisional roles.

Functional units like finance, production, accounting, and personnel etc. generate the internal information. The external information comes from the sources such as online databases, newspaper, industry newsletters, government reports, personal contacts etc. We know that the com-bined information is very important because that is the source needed for successful competition and survival. As the data is large the information is needed to be scanned further. The collected inform-ation is then checked and verified for its correction that is it is evaluated for the further use of the organization. Finally the evaluated information is sent for qualitative or quantitative analysis. Then the executive makes a decision whether an opportunity occurs or problem occurs. If there is a problem then information is given as an input for the next step else it is again scanned for further evaluation. Finally the executives take the decision.

30.3 Developing ESS

As with DSS, executive support systems are developed using the prototyping method. Prototyping allows iterative, quick changes to the system. Executives are busy people who don't want to spend a lot of time in the development process. They know what they want, they want it quickly, and they want it to work the first time. That's a tough goal for developers.

ESS must support many of the executive's informational requirements or she will find other ways to supplement her decision-making tasks. If the system doesn't provide the flexibility to scout out problems, new opportunities, or keep an eye on the competition, executives will ignore the system and seek other ways of getting the information they need—mainly other people.

30.4 Benefits of ESS

As more executives come up through the ranks, they are more familiar with and rely more on technology to assist them with their jobs. Executive Support Systems don't provide executives with ready-made decisions. They provide the information that helps them make their decisions. Executives use that information, along with their experience, knowledge, education, and understanding of the corporation and the business environment as a whole, to make their decisions.

Executives are more inclined to want summarized data rather than detailed data (even though the details must be available). ESS rely on graphic presentation of information because it's a much quicker way for busy executives to grasp summarized information.

Because of the trend toward flatter organizations with fewer layers of management, companies are employing ESS at lower levels of the organization. This trend will probably continue as more managers become knowledgeable about the power and flexibility of ESS.

Advantages

- Simple for high-level executives to use Operations do not require extensive computer experience
- Provides timely delivery of company summary information
- Provides better understanding of information
- Filters data for better time management
- Provides system for improvement in information tracking

Disadvantages

- Computer skills required to obtain results
- Requires preparation and analysis time to get desired information
- Detail oriented Provides detailed analysis of a situation
- Difficult to quantify benefits of DSS How do you quantify a better decision?
- Difficult to maintain database integrity
- Provides only moderate support of external data and graphics capabilities

30.5 Examples of ESS

The examples of ESS provided in the lesson offer interesting contrasts of how each organization uses its system to aid in the decision-making process.

The Sutter Home Winery uses mostly external data, including information from the Internet, in its ESS. It organizes the information in order to help executives make decisions based on trends in the marketplace. The information includes data on competitors and information from market research. Sutter uses its system output to determine sales forecasts, marketing campaigns, and investment plans.

Managers at the Royal Bank of Canada are able to choose their own criteria (from among 15 choices) to drill down and navigate data through easy-to-use interfaces. They don't have to accept data in formats chosen by someone else who may not understand individual manager's needs. Data analysis is more timely because the information is quicker to obtain and more convenient than before.

Virtually all of the information in the U.S. General Services Administration's ESS is internal data used to help executives manage the government's assets and inventory of buildings. The information is used for analysis of the efficient, or inefficient, use of buildings. The systems includes the ability to drill down to more specific detail if necessary. Output includes graphs and pictures of the inventory. Huge amounts of data are available quicker and are more specific to the user's needs.

I would like to explain more of ESS with the following industry problem which will give you a better understanding.

30.6 ESS: A Better Example

We know that car industry is characterized by tough competition and fast-shifting opportunities. One of such car industry was Hertz that needs to compete against dozens of competitors in hundreds of locations. Now the company's key to success is marketing. Several marketing decision must be made instantaneously. Some of such decisions can be

- Whether to give discount on product seeing other company's strategy. . Whether to give some attractive gift with the product or not
- Whether to give free servicing for one year, free accessories or not. Whether to give insurance policy or not

All these decisions are taken on daily basis based on the information about cities, climates, holidays, business cycles, and tourist activities, past promotions and competitor and customer's behavior. It is also necessary to know everyday the rental prices set by all competitors in all cities. This is a time - consuming data collection task as the amount of information required is quite large and also it should be very timely. This requires the use of large mainframe computers to process such huge quantity of data. The problem for this car industry was how to provide accessibility to this information and use it properly.

The initial solution, which was implemented in 1987, was the use of DSS to allow fast analysis by executives and managers. The DSS was good enough to analyze information but when the marketing manager has some question he or she needs to contact the assistant staff for this purpose. This process, which looks so simple, is quite complicated and problematic due to following reason

- The assistant staff is not always available
- There can be misunderstanding of concepts
- The process becomes quite lengthy in case of confusion a the information not timely accessed most of the time.

These limitations made Hertz Company to think of a better and efficient system. which can be used by Executives or senior managers. It was sure that this system is merely an extension to DSS so that senior executives do not need to contact staff assistant and can access the data of there need themselves. So the ESS was used as the front end to DSS. It was named as Executive information system or Executive support system because of the purpose for which it was made. The ESS serves as an executive tool to analyze the stored information and make real time decisions without the use of assistants or support staff. The system is extremely user-friendly and is maintained by

the marketing staff that continuously upgrades and improves the system for their executives.

Executives on the other hand can manipulate and refine data to be more meaningful and strategically more significant to them. Even the workload on the mainframe programming resources has been (educed because ESS allows executives to draw information from the mainframe, store the needed data on their own PC and take a decision. The most significant fact that executives were using ESS is because it does all these work in real time (instantly).

So I would now like to remind the definition of executive support system. As with other IS this also does not have any specific definition and is interpreted differently by different persons. So a general definition of ESS is as follows.

An ESS (Executive support system) is a computer-based system that serves the information needs to top executives. It provides rapid access to timely information and direct access to management reports. ESS is very user-friendly, supported by graphics, and provides exceptions reporting and" drill-down" capabilities. It is easily connected with online information services and electronic mail.

Some factors that contributed to the development of ESS are as follows. These are also the factors that tell us why to use ESS for higher management.

Internal External

Internal	External
Need for timely information	Increasingly competitive environment
Need for Improved communication	Rapidly changing environment
Need for access to operational data	Need to access external databases
Need for rapid updates from different business units	Need to proactively approach external environment
Need to access corporate databases	Increasing Government regulations

30.7 Characteristics of ESS

An ESS has many distinct characteristics that differentiate it from other applications software. A list of these features is presented in table below. A successful executive information system minimizes hard copy reports while keeping high-level executives up dated. With an ESS, qualitative information is obtained without producing volumes of paper.

Advanced internal control and communication are typical focuses of an ESS. The ability to view exception reporting on the computer screen is an example of an ESS-facilitated management control technique. Most Executive Support Systems highlight the areas of the business that are going astray. Color codes are used to display data that are in an acceptable or unacceptable range as defined by the executive. This technique allows the computet to track important project assignments within a company using the executive information system. An ESS allows access to external as well as company internal information.

Characteristics	Description
Degree of use	High, consistent, without need of technical assistance
Computer skills required	Very low -must be easy to learn and use
Flexibility	High - must fit executive decision making style
Principle use	Tracking, control
Decisions supported	Upper level management, unstructured
Data supported	Company internal and external
Output capabilities	Text, tabular, graphical, trend toward audio/video in future
Graphic concentration	High, presentation style
Data access speed	Must be high, fast response

30.8 Difference between ESS and DSS

Decision support systems, reflected to as DSS, are another type of computer information system designed support and improve the decision-making process. Many more computer users will be familiar with DSS because these systems were developed as a support tool for middle to lower level managers and system analysts. Like the ESS, DSS are made up of several distinct components. While both types contain a modeling capability and database component, the presentation components are typically not as sophisticated in a DSS. The reason is that DSS were developed to support decisions from the middle level up, while an ESS concentrates on supporting the very top level of management.

Although both ESS and DSS are designed to support and improve the decision-making process, the actual type of decision an executive makes differs from that of a middle manager. The ESS can be thought of as a system that provides information to help formulate intelligent queries, which can then be passed on to the DSS. An analyst can then perform a detailed analysis, not an executive. The intention of the ESS is to allow executives to familiarize themselves with the organization as a whole, and not just one particular area. The DSS usually provides very detailed information to assist analysis of problems in one section/department of a business. Another primary difference is the ability of an ESS to incorporate "what if' models in the program. With this ability, the user can perform impact analyses, such as "What is the effect on profits if we close Plant A." Another important difference is that external data retrieved from on-line databases as well as internal data will be examined when answering a query to the ESS. The DSS typically only places a moderate emphasis on incorporating external data into the decision process.

While each system tracks and reports the status of certain activities, the level of detail provided when a problem occurs is vastly different. An ESS delivers primarily summary information. It allows for details to be given by incorporating the "drilling down" capability. The DSS will attempt to provide all the details incorporated into the problem analysis the first time.

30.9 ESS Applications

As stated previously, studies have shown that about one third of the largest corporations in the United States have some kind of ESS installed or under installation. But just which companies are turning to Executive Support Systems to enlighten their top managers? The following examples of ESS implementations highlight some of the more popular applications for this software product.

30.9.1 Manufacturing

- ***Hiram-walker Of Windsor, Ontario, Canada***

  Hiram-Walker is a liquor distillery and distributor that uses an ESS to check rivals' performance. The company collects competitive shipment figures once a month to support company strategic decisions. Hiram-Walker uses an Information Resources, Inc., product for their ESS application.

- ***Valspar Corporation, Minneapolis, Minnesota***

  Valspar implemented Pilot Software's Lightship ESS as a prototype effort to investigate ESS and quickly build an ESS for one or two top executives. Valspar was looking for a low-cost, Windows based solution. Valspar is a manufacturer of paints and coatings. They currently use a {Unisys 1100 mainframe and most users access the mainframe via terminals. The Lightship ESS is operated from a 386-notebook computer. The program shells are setup in Lightship and files are downloaded onto a floppy every month. Valspar is using Lightship for three applications: profit-and-loss statements for the corporation and the profit centers, a manufacturing statement for each of the plants, and a business management report including all the company's divisions.

30.9.2 Medical

- ***Baylor University Medical Center, Dallas, Texas***

  The medical center uses Performance Advisor to supplement. its mainframe general-ledger pro-grams. The product helps create flexible budgets that allow various levels of customer activity.

- ***Merited Hospital, Madison, Wisconsin***

  Merited Hospital is using The Alternative View product from Gerber Alley as their £IS for clinical applications. As part of their total quality management (TQM) process over the last four years, they have concentrated establishing methods to obtain accurate information from the large quantity of data processed at the hospital daily.

30.9.3 Government

- **Correctional Services Of Canada (CSC)**

  CSC is one of Canada's largest government departments. In 1990, CSC was facing a serious infor-mation crisis. With responsibility for the care and safe control of more than 21,000 offenders, 10,500 employees, and a one billion dollar budget, executive and managers lacked the technological re-sources to transform mountains of transactional data into useful information to assist the decision-making process and to measure performance. Implementing an £IS allowed esc to turn their infor-mation problem around. The ESS was built around Coe's corporate values, especially access to information and management accountability. Also, the future corporate objectives were considered when developing the ESS.

  The system focuses managers and executives on key performance indicators, enhances their follow through and communication with others, and tracks early warning indicators of potential problems such as inmate population increases and budget deficits. CSC selected Comshare Inc's Commander ESS for implementation across ten provinces and two territories. CSC wanted to implement its new client-server system quickly and selected Commander because it provided a complete off-the-shelf solution. Using Commander, CSC had the system up and running in three months.

  The ESS is part of CSC's strategic information network (SIN) which includes a host of communica-tions and office automation applications. SIN 'consists of 41 local area networks (LANs) and 160 servers linked through a wide-area network (WAN). The £IS provides 288 CSC users access to six custom-designed executive applications that extract information from separate databases at the lo-cal, regional, and national level.

- ***Naval Computer & Telecommunications Command, US Navy, Washington DC***

  The Naval Computer and Telecommunications Command consist of 15,000 personnel performing activities at 30 sites worldwide. Their mission is to provide information, management capabilities to Navy and joint DOD communication programs. The Command must keep abreast of all the programs, data requirements, and new information technology. The commander and 35 executives within the organizations use an internal ESS to track program progress and the assist in decisions. NCTC is also implementing an £IS in the operations area for the first time outside the headquarters building. The Greatest present roadblock is the issue of multilevel security, being able to combine classified and unclassified data.

30.9.4 Financial

- ***Great-west Life Assurance Of Winnipeg (Canada)***

  This company uses preformatted screens in their ESS to display sales figures from the previous day. They are also using a package from Information Resources, Inc., to prototype a new system where nationwide sales figures can be monitored. Currently, the information systems department in Winnipeg prepares the information on a HP UNIX server, then pulls information from an IBM mainframe, and crunches the numbers for the reports. Data are distributed overnight to end-users' 386 and 486 DOS-based personal computers. Great-West Life would like to move to a client-server arrangement, so PC users could access data on the server, but communication costs are too high.

- ***Key Bank Of New York, Albany New York***

  Due to most computer users' comfort with spreadsheet applications, Lotus 1-2-3 was the natural choice as the key

component of the bank's new ESS. Titled; "Vision 2001," this ESS will completely reengineer the flow of data and will supply executives with a new level of customer data. The platform for this ESS will be chosen to allow Lotus 1-2-3 to maintain an important pal\., c III the corporation for the future.

30.10 ESS implementation: Success or Failure

The implementation of ESS is different from implementation of DSS or any other computer based information system since it involves executives. The following factors are critical for successful implementation of ESS

1. A committed and informed executive sponsor - There must be an executive who has both a realistic understanding of the capabilities of ESS, and who really wants the system so badly that he is willing to put considerable time and energy till the system gets developed. He should also be committed to the company and should have complete knowledge about the resources of the company.
2. An operating sponsor - As the executive sponsor usually lacks sufficient time to devote to the project, there should be an operating sponsor designated to manage the details of implementation from the user's side.
3. A clear link to business objectives - The ESS must help in solving business problems or meet the needs that are addressed most effectively with information systems technology. It should also provide very rapid access to external database, best graphical displays and data with textual annotations
4. Appropriate information system resources - The quality of ESS project manager is very critical. This person should not only have technical knowledge but also business knowledge and the ability to communicate effectively with senior management.
5. Appropriate technology - The choice of hardware and software has a major bearing on the acceptance and rejection of any system. The ESS system when implemented should be in such a way that it supports vast variety of hardware and software.
6. Management of data problems - The physical and technical ability to provide reliable access to data can be major issue in ESS development.
7. Management of organizational resistance - Political resistance to ESS is one of the most com-mon causes of implementation failure of ESS. An ESS alters information flows and this always has the potential to significantly shift power relationships in a company
8. Prototype Development - A small prototype of the system should be developed, tested and evaluated before making a new ESS.

30.11 Summary

Executive Support Systems meet the needs of corporate executives by providing them with vast amounts of information quickly and in graphical form to help them make effective decisions. ESS must be flexible, easy to use, and contain both internal and external sources of information.

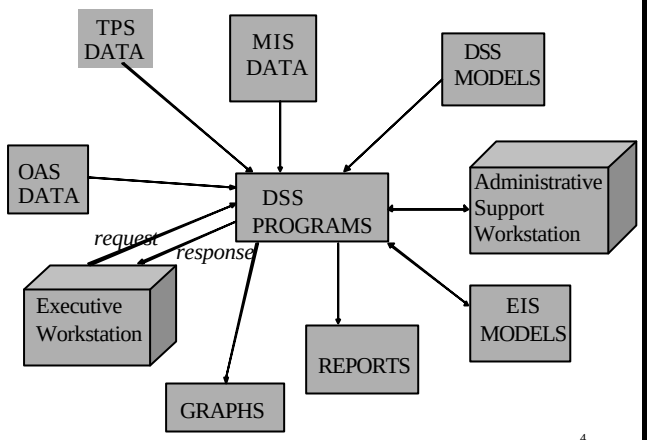
Points to Ponder

Executive Support Systems

- Information systems which support the information needs of very senior executives
- sometime called Executive Information Systems
- summarize and present data at the highest level (reports and graphics)
- accepts data from all other IS's
- primary goal is to obtain data from a variety of sources, integrate and aggregate that data and display the resulting information in an easy-to-use comprehensible format 2

Computerised ESS

- advantage of computerised system - data is available as and when required without relying on human intervention (timeliness and accuracy)



4

ESS features

- summary level data
- allows 'drill-down' from high levels of information to lower
- data manipulation facilities
- graphics (user-friendly) presentation
- template system

5

Advantages

- access information faster
- access broader range of information
- retrieve selected information in a focused way
- display output in a graphical form

6

8 critical success factors for ESS

- committed and informed executive sponsor
- operating sponsor
- clear link to business objectives
- use of appropriate resources from IS function
- use of appropriate technology
- recognising the existence of data problems and managing the solutions of those problems
- managing organisational resistance
- managing the spread and evolution of the system

7

Review Questions

1. Explain the role of ESS in organisation and how it supports to managers in decision making?
2. Explain the advantages and disadvantages of ESS?
3. Explain the various characteristics of ESS?
4. Briefly write the benefits of ESS with relevant examples
5. Identify the Implementation issues of ESS in any organisation

Discussion Questions

1. Discuss the types of decisions top level executives are making and try to identify the information requirements of them. Explain it with the discussed example

Application Exercise

Interview a Strategic Level Person regarding the types of decisions he/she is making and try to identify the process they are following.

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