UNIT 13: BUILDING INFORMATION SYSTEMS

Structure

13.1 INTRODUCTION

An Information system is a set of people, procedures, and resources that collects, transforms, and disseminates information in an organization. Today's end users rely on many types of Information Systems (IS). Some are simple manual information systems, where people use tools such as pencils and paper, or machines such as calculators and typewriters. Others are computer-based information systems. However, in this unit, we will concentrate on *computer-based information systems* that use hardware, software, telecommunications, and other forms of *Information Technology* (IT) to transform data resources into a variety of information products. Four kinds of organizational changes are enabled by Information systems. These are automation, rationalization, re-engineering, and paradigm shift. When an organization does not use its internal resources to build and operate information system it takes help of other organizations to provide these services. This is called outsourcing. There are advantages and disadvantages of using outsourcing. Quality programs differ greatly from company to company. Some are merely generalized "sales" campaigns intended to sensitize employees to the need to strive for more quality in their daily work. At the opposite extreme, quality programs can result in fundamental changes in the way a company does its business. Companies also follow different routes in achieving quality. Whatever route a company selects, the more it tries to achieve with its quality programs, the more information systems can contribute the success of those programs.

13.2 OBJECTIVES

After reading this unit, you should be able to:

- Identify different types of Information system;
- Explain the impact of Information System on doing business;
- Describe about planned organizational change;
- Understand the business values of Information System;
- Enumerate the advantages and disadvantages of outsourcing Information System; and
- Discuss how IS can be used to ensure quality.

13.3 COMPUTER BASED INFORMATION SYSTEMS AND ITS CLASSIFICATION

A computer based information system uses the resources of people (end users and IS specialists), hardware (machines and media), and software (programs and procedures), to perform input, processing, output, storage, and control activities that convert data resources into information products as shown in *Figure 13.1*.

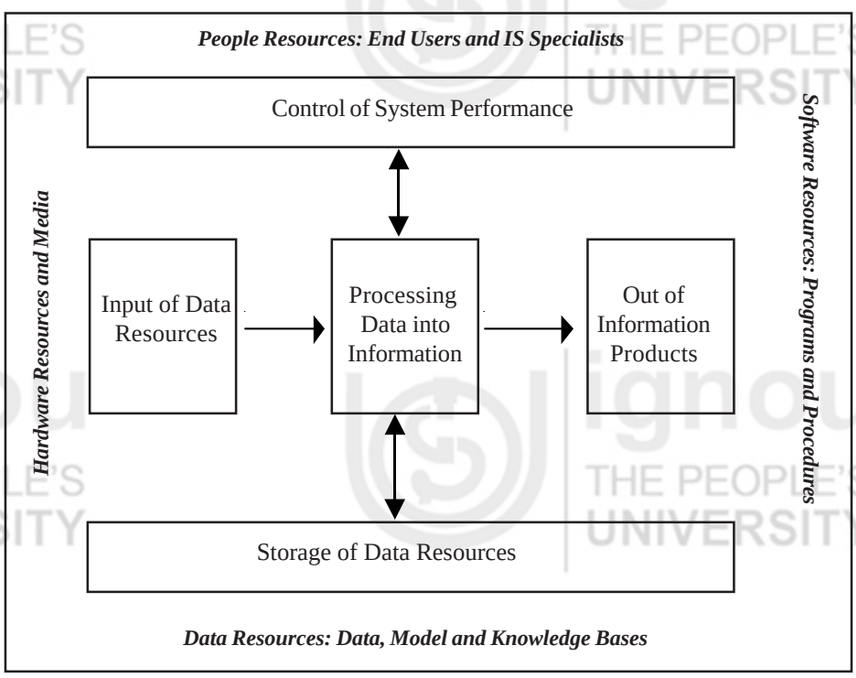

Fig. 13.1: The Components of an Information System

Source: *James A, O'Brien, Introduction to Information System, 1995*

Before going into the details of Computer based Information System. Let us first discuss about a system. A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs through an organized transformation process.

Such a system (sometimes called a dynamic system) has three basic interacting components or functions:

- Input involves capturing and assembling elements that enter the system to be processed. For example, raw materials, energy, data, and human effort must be secured and organized for processing.

- Processing involves transformation processes that convert input into output. Examples are a manufacturing process or mathematical calculations.
- Output involves transferring elements that have been produced by a transformation process to their ultimate destination. For example, finished products, human services, and management information must be transmitted to their human users.

The systems concept can be made even more useful by including two additional components: feedback and control. A system with feedback and control components is sometimes called a cybernetic system, that is, a self-monitoring, self-regulating system.

- Feedback is data about the performance of a system. For example, data about sales performance is feedback to a sales manager.
- Control involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal. The control function then makes necessary adjustments to a system's input and processing components to ensure that it produces proper output. For example, a sales manager exercises control when he or she reassigns salespersons to new territories after evaluating feedback about their sales performance.

This information system model highlights the relationships among the components and activities of information systems. It provides a framework that emphasizes four major concepts that can be applied to all types of information systems:

- People, hardware, software, and data are the four basic resources of information systems.
- People resources include end users and IS specialists, hardware resources consist of machines and media, software resources include both programs and procedures, and data resources can include data, model, and knowledge bases.
- Data resources are transformed by information processing activities into a variety of information products for end users.
- Information processing consists of input, processing, output, storage, and control activities.

Basic IS model shown in the given in *Table 13.1*. The table indicates that a computer based information system consists of four major resources: people, hardware, software, and data.

Table 13.1: Different Resources of Information Systems

People Resources:
Specialists – systems analysts, programmers, and computer operators.
End users – anyone else who uses information systems.
Hardware Resources:
Machines – computers, video monitors, magnetic disk drives, printers, and optical scanners.
Media – floppy disks, magnetic tape, optical disks, plastic cards, and paper forms.
Software Resources:
Programs – operating system programs, spreadsheet programs, word processing programs, and payroll programs.
Procedures – data entry procedures, error correction procedures, and paycheck distribution procedures.
Data Resources:
Product descriptions, customer records, employee files, and inventory databases.
Information Products:
Management reports and business documents using text and graphics displays, audio responses, and paper forms.

There are many kinds of information systems in the real world. All of them use hardware, software, and people resources to transform data resources into information products.

It is important not to confuse information systems with the concept of computer systems. A computer system is a group of interconnected hardware components that may take the form of a microcomputer, minicomputer, or large mainframe computer system. However, whether it sits on a desk or is one of many computers in a telecommunications network, a computer system still represents only the hardware resources component of a computer-based information system. As we have just seen, an information system also consists of people, software, and data resources.

Types of Information System

Although people often think of information systems as tools for decision-making, each type of information system supports both communication and decision-making in a number of ways.

Table 13.2: Typical Ways Each Type of Information System Supports Communication and Decision Making

System Type	Typical User	Impact on Communication	Impact on Decision Making
Office Automation system: provides individuals effective ways to process personal and organizational business data, to perform calculations, and to create documents	* Anyone who stores personal data, creates documents, or performs calculation.	* provide tools for creating documents and presentations, such as work processors and presentation systems.	* Provides spreadsheets and other tools for analyzing information * Communication tools also help in implementing decisions.
Communication System: Helps people work together by sharing information in many different forms	* Anyone who communicates with others, including office workers, managers, and professions	* Telephones and teleconferencing for communication * E-mail, v-mail, fax, for communicating using messages and documents * Access to memos and other shared information * Scheduling meetings * Controlling flow of work	* Telephones and teleconferencing for decision making * E-mail, v-mail, fax, other tools for obtaining information * Supports sharing information related to making joint decisions
Transaction Processing System (TPS): collects and stores information about transactions; controls some aspects of transactions	* People whose work involves performing transactions	* Creates a database that can be accessed directly, thereby making some person-to-person communication unnecessary	* Gives immediate feedback on decisions made while processing transactions * Provides information for planning and management decisions

Management information system (MIS) and executive information system (EIS): Converts TPS data into information for monitoring performance and managing an organization; provides executives information in a readily accessible interactive format	* Managers, executives, and people who receive feedback about their work	* Provides a basis of facts rather than opinions for explaining problems and their solutions * May incorporate e-mail and other communication methods with presentation of computerized data	* Provides summary information and measures of performance for monitoring results * May provide easy ways to analyze the types of information provided in less flexible form by older MIS
Decision support system (DSS): Helps people make decisions by providing information, models, or analysis tools	* Analysis managers and other professionals	* Analysis using DSS helps provide a clear rationale for explaining a decision	* Provides tools for analyzing data and building models * Analysis using a DSS helps define and evaluate alternatives
Execution system: Directly supports the organization's value added work (e.g., helps sales people	* People who do an organization's value added work, especially if that work involves special skills or knowledge	* May support communication or information sharing between people doing different parts of the task * May help explain the result of the task to customers	* May provide tools, information, or structured methods for making decisions * May store and provide expert knowledge to support decisions in specific areas

One of the reasons the various categories are mentioned frequently is that each is used in every functional area of business.

Table 13.3: Examples of Each Type of Information System in three Functional Areas of Business

System Type	Sales Examples	Manufacturing Examples	Finance Examples
Office automation systems	* Spreadsheet to analyze different possible prices * Word processor to create sales contract	* preadsheet to analyze a production schedule * Word processor to write a memo about how to fix a machine	* preadsheet to compare several loan arrangements. * Word processor to write a memo about new financial procedures
Communication Systems	* E-mail and fax used to contact customer * Video conference to present new sales materials to sales force * Work flow system to make sure all sales steps are completed * System to coordinate all work on a complex sales contract	* E-mail and v-mail to discuss a problem with a new machine * Video-conference to coordinate, manufacturing and sales efforts * Work flow system to make sure engineering changes are approved	* V-mail and fax to communicate with bank about loan arrangements * Video conference to explain effect of financing on factory investments * Work flow system to make sure invoice approval precedes payment * System for exchanging the latest information related to lawsuit
Transaction Processing System (TPS)	* Point of sale system for sales transactions * Keeping track of customer contacts during a sales cycle	* Tracking movement of work in process in a factory * Tracking receipts of materials from suppliers	* Processing credit card payments * Payment of stock dividends and bond interest
Management Information System (MIS) and Executive Information System (EIS)	* Weekly sales report by product and region * Consolidation of sales projections by product and region * Flexible access to sales data by product and region	* Weekly production report by production and operation * Determination of planned purchases based on a production schedule * Flexible access to production data by product and operation	* Receivables report showing invoices and payments * Monthly financial plan consolidation * Flexible access to corporate financial plan by line item
Decision Support System (DSS)	* System helping insurance salespeople test alternatives * Marketing data and models to analyze sales	* System displaying current priorities for machine operator * Production data and models to analyze production results * Use of a GDSS to identify production problems	* System analyzing characteristics of customers who pay bills promptly * Stock database and models to help in selecting stocks to buy or sell
Execution System	* System to generate competitive bids * System to help salespeople suggest the best choice for the customer	* System to diagnose machine failures * System to transfer customer requirements to an automated machine cell	* System to support a loan approval process * System to find price inconsistencies between different equity markets.

Activity A

List down the major business activities of your organization. Describe what kind of information systems are already being used for these activities. Also suggest some applications of information systems in the activities that are still done manually.

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13.3.1 Office Automation Systems

An office automation system (OAS) facilitates everyday information processing tasks in offices and business organizations. These systems include a wide range of tools such as spreadsheets, word processors, and presentation packages. Although telephones, e-mail, v-mail, and fax can be included in this category, we will treat communication systems as a separate category.

OASs help people perform personal recordkeeping, writing, and calculation chores efficiently. Of all the system types, OASs and communication systems are the most familiar to students. Tools generally grouped within the OAS category include:

Spreadsheets are an efficient method for performing calculations that can be visualized in terms of the cells of a spreadsheet. Although spreadsheet programs seem second nature today, the first spreadsheet program was VisiCalc, which helped create the demand for the first personal computers in the late 1970s.

Text and image processing systems store, revise, and print documents containing text or image data. These systems started with simple work processor but have evolved to include desktop publishing systems for creating complex documents ranging from brochures to book chapters.

Presentation packages help managers develop presentations independently, instead of working with typists and technical artists. These products automatically convert outlines into printed pages containing appropriately spaced titles and subtitles. These pages can be copied directly onto transparencies or slides used in presentations.

Personal database systems and note-taking systems help people keep track of their own personal data (rather than the organization's shared data.) Typical applications include an appointment book and calendar, a to do list, and a notepad.

When using these tools for personal productivity purposes, users can apply any approach they want because the work is unstructured. In these situations, some individuals use them extensively and enjoy major efficiency benefits, whereas others do not use them at all. The same tools can also be used for broader purposes; however, in which they are incorporated into larger systems that organizations use to structure and routinize tasks. For example, a corporate planning system may require each department manager to fill in and forward a pre-formatted spreadsheet whose uniformity will facilitate the corporations planning process.

13.3.2 Communication Systems

Electronic communication systems help people work together by exchanging or sharing information in many different forms. New communication capabilities have changed the way many businesses operate by making it possible to do many things at a distance that previously required being present in a specific location. This section groups these tools into four general categories. Teleconferencing systems make it possible to hold same-time, different-place meetings. Messaging systems make it possible to transmit specific messages to specific individuals or groups of individuals. Groupware systems start with messaging but go further by facilitating access to documents and controlling team-related workflow. Knowledge management systems facilitate the sharing of knowledge rather than just information.

Teleconferencing

The use of electronic transmission to permit same-time, different-place meetings is called teleconferencing. We can think of a traditional telephone call as a minimal teleconference, but the term is normally applied to other options including audio conferencing, audio graphic conferencing, and video conferencing.

The distinction between these approaches is related to the type of information that is shared. Audio conferencing is a single telephone call involving three or more people participating from at least two locations. If several people on the call are in the same office, they can all participate using a speakerphone, which includes a high-sensitivity microphone and a loudspeaker that can be heard by anyone in a room. Audio graphic conferencing is an extension of audio conferencing permitting dispersed participants to see pictures or graphical material at the same time. This is especially useful when the purpose of the meeting is to share information that is difficult to describe, organize, or visualize, such as a spreadsheet or model used to perform calculations under different assumptions. Video conferencing is an interactive meeting involving two or more groups of people who can see each other using television screens. The least expensive forms of video conferencing are tiny cameras and 4-inch screens add to telephones or separate video conferencing windows displayed on computer screens. In typical business video conferencing, remote participants appear on a television screen.

Video conferencing simulates a face-to-face meeting without requiring unnecessary travel, which absorbs time and energy, not to speak of the cost of airplane and hotel bills. However, the effectiveness of videoconferences decreases if the participants lack a prior social bond. For example, doing sales calls via videoconference might seem tempting but might not foster the personal relationship needed to succeed in many sales situations. On the other hand, Citibank and other banks have begun to experiment with stripped-down branch offices that have no tellers but permit customers to open accounts by video conferencing with multilingual staffers in another state.

Messaging Systems

Different-time, different-place communication has been used for centuries in the form of books and letters. Messaging system make it possible to transmit specific messages to specific individuals or groups of individuals. They use technologies such as electronic mail, voice mail, and fax to make different-time, different-place communication more effective.

The use of computers to send and retrieve text messages or document addressed to individual people or locations is called electronic mail (e-mail). Each user is identified by is usually based on the person's name and also serves as the person's e-mail

address. The sender uses a word processor to create a message and then addresses it to a distribution list. The distribution list might be an individual account name or a group of names, such as those for the sales department or everyone working on a particular project. The recipient can read the message immediately or can wait until it is convenient. The recipient e-mail message can save it, print it, erase it, or forward it to someone else. The recipient can also edit the message to extract parts to be saved, printed, or passed on.

E-mail is effective in many situations, such as permitting you to leave a message without going through an additional person who might garble it. With e-mail you can send a message to a person traveling away from the office who can log onto a network using a laptop computer. If you are working on a memo or other document and want to get feedback from someone before you distribute it, you can use e-mail to send it to the person for a quick response. E-mail also allows you to send the same message to many individuals without having to contact them individually. For example, a product designer can responds with a good idea, the minimal effort of distributing the request is worth it.

There have been many innovative uses of e-mail to improve communication. People in large organizations have used it to bypass bureaucratic structures. For example, top managers sometimes bypass intermediate management levels by obtaining specific information directly from people throughout the organization. Some organizations have replaced the majority of their formal memos with informal e-mail that gets to the pont directly. As happened at IBM's Europe headquarters in Paris, e-mail has also been used as a communication tool fro people who are not fluent in the language in which business is conducted. E-mail removes accents and permits non-fluent speakers to read a message several times that otherwise might be misunderstood in a phone conversation. It also helps them express their ideas more effectively than they might by using a telephone.

Groupware

A relatively new and still somewhat unshaped category, groupware helps teams work together by sharing information and by controlling internal workflows. Coined in the late 1980s the term groupware has attained wide recognition due to the increasing need for groups to work together more effectively at a distance as a result of downsizing and rapid organizational change. Products viewed as groupware are still new enough that their long-term direction is unclear even though the competitive need to work effectively in dispersed teams is greater than ever.

Groupware goes beyond messaging by facilitative access to documents and controlling team-related workflow. Many groupware products are related to specific group related tasks such as project management, scheduling meetings ("calendaring"), and retrieving data from shared databases. Lotus Notes, a prominent product in this category, is designed for sharing text and images and contains a data structure that is a cross between a table-oriented database and an outline. For example, a law firm in Seattle uses Lotus Notes to permit everyone working on a particular case to have access to the most current memos and other information about that case, even if they are traveling. Other companies use Lotus Notes to store and revise product information for salespeople selling industrial products, thereby replacing the massive three-ring binders they formerly lugged around.

Yet other groupware functions are performed through computer conferencing, the exchange of text messages typed into computers from various locations to discuss a particular issue. When done through the Internet this is sometimes called a newsgroup. A computer conference permits people in dispersed locations to combine their ideas in useful ways even though they cannot speak to each other face-to-face. Any conference participant may be able to add new ideas, attach comments to

existing messages, or direct comments to specific individuals or groups. Proponents of computer conferencing recognize some disadvantages or working through computers but emphasize major advantages, such as preventing a single forceful individual from dominating a meeting. Also, because everything is done through a computer, a record of how ideas developed is automatically generated.

A different type of groupware product focuses primarily on the flow of work in office settings. These products provide tools for structuring the process by which information for a particular multi-step task is managed, transferred, and routed. A typical example is the approval of travel expenditure. In this case, one person must propose the expenditure and someone else must approve it. The workflow application is set up to make the approval process simple and complete. In effect, groupware is being used as a small transaction processing system for multistep transaction.

Intranets and Extranets

The widespread use of the World Wide Web has led many firms to apply the information sharing concepts of groupware on a much larger scale by creating an additional type of communication system, intranets and extranets. Intranets are private communication networks that use the type of interface popularized by the Web but are accessible only by authorized employees, contractors, and customers. They are typically used to communicate nonsensitive but broadly useful information such as recent corporate news, general product information, employee manuals, corporate policies, telephone directories, details of health insurance and other employee benefits, and calendars. In some cases employees can use intranets to access and change their personal choices regarding health insurance and other benefits. Once security issues are addressed adequately, intranets for accessing general-purpose corporate data may lead to widespread use of intranets as a front end to transaction processing systems and management information systems described in the following sections.

Extranets are private networks that operate similarly to intranets but are directed at customers rather than at employees. Extranets provide information customers' need, such as detailed product descriptions, frequently asked questions about different products, maintenance information, warranties, and how to contact customer service and sales offices. Much of this information was formerly difficult for customers to access because paper versions of it at the customer site became scattered and outdated. By using extranets, companies are making this type of information increasingly available at a single interactive site that is easy to navigate.

Knowledge Management

A final type of communication system is very different from systems that support real time communication or provide access to information. Today's leading businesses are increasingly aware that their employees' knowledge is one of their primary assets. In consulting companies and other organizations that rely heavily on unique competencies and methods, knowledge has more competitive significance than physical assets because the physical assets can be replaced or replenished more easily.

Knowledge management systems are communication systems designed to facilitate the sharing of knowledge rather than just information. As with groupware, the idea of knowledge management is still emerging and is applied in many different ways in different firms. The computer applications underlying knowledge management systems are often built on technologies such as intranets, electronic mail, groupware, databases, and search engines. Functions supported by these technologies include

codifying knowledge (such as best practices), organizing it in repositories for later access, finding knowledge (using search engines and other schemes), and providing organized ways to find people who have needed knowledge.

The human element is paramount in knowledge management. The companies with the best results to date stitch technologies together into a system that operates effectively and that is genuinely supported by the culture. For example, employee reviews in many consulting companies give significant weight to demonstrated contribution to internal knowledge management systems. This type of recognition is especially important if the firm's culture otherwise encourages hoarding of knowledge for personal advancement. In many cases, the most effective use of knowledge requires involvement of the person who is the expert. When a British Petroleum drilling ship in the North Sea encountered an equipment failure, it put the equipment in front of a video camera and used a satellite link to contact a drilling expert in Scotland. His rapid diagnosis of the problem prevented delays and a possible shutdown.

13.3.3 Transaction Processing Systems

A transaction processing system (TPS) collects and stores data about transactions and sometimes controls decisions made as part of a transaction. A transaction is a business event that generates or modifies data stores in an information system. TPSs were the first computerized information systems. We encounter computerized TPSs frequently, including every time we write a cheque, use a credit card, or pay a bill sent by a company. A TPS used to record a sale and generate a receipt is primarily concerned with collecting and storing data. If the TPS validates a credit card or helps a clerk determine whether to accept a personal check, it also controls decisions made within the transaction.

TPSs are designed based on detailed specifications for how the transaction should be performed and how to control the collection of specific data in specific data formats and in accordance with rules, polices, and goals of the organization. Most contain enough structure to enforce rules and procedures for work done by clerks or customer service agents. Some TPSs bypass clerks and totally automate transactions; such as the way ATMs automate deposits and cash with drawls. A well-designed TPS checks each transaction for easily detectable errors such as missing data, data values that are obviously too high or too low, data values that are inconsistent with other data in the database and data in the wrong format. It may check for required authorizations for the transaction. Certain TPSs such as airline reservation systems may automate decision-making functions such as finding the flight that best meets the customer's needs. Finally, when all the information for the transaction has been collected and validated, the TPS stores it in a standard format for later access by others.

As anyone knows who has tried to make a reservation when a computerized reservation system is down, organizations rely heavily on their TPSs. Breakdowns disrupt operations and may even bring business to a complete halt. As a result, a well-designed TPS has backup and recovery procedures that minimize disruptions resulting from computer outages.

Batch versus Real Time Processing

The two types of transaction processing are batch and real time processing. With batch processing, information for individual transaction is gathered and stored but isn't processed immediately. Later, either on a schedule or when a sufficient number

of transactions have accumulated, the transactions are processed to update the database. With real time processing, each transaction is processed immediately. The person providing the information is typically available to he4lp with error correction and receives confirmation of transaction completion. Batch processing was the only feasible form of transaction processing when data were stored only on punched cards or tapes. Real time transaction processing requires immediate access to an online database.

Batch processing is currently used in some situation where the transaction data comes in on paper, such as in processing cheques and airline ticket stubs. A batch approach is also used for generating paychecks and other forms of paper output that will be distributed after a delay. Unfortunately time delays inherent in batch processing may cause significant disadvantages. The central database may never be completely current because of transactions received while the batch was being processed. Worse yet, batching the transactions creates built-in delays, with transactions not completed until the next day in some cases. Even systems with interactive user interfaces may include lengthy delays before transactions are completed. For example, weekend deposits into many ATMs are not posted to the depositor's account until Monday. Even though the ATM's user interface is interactive, the system in a larger sense doesn't perform real time processing.

Compared to batch processing, real time processing has more stringent requirements for computer response and computer uptime. As is obvious when a travel agent says "Sorry, the computer is down," the jobs and work methods of the people in the real time TPS are designed under the assumption that the system will be up and available.

13.3.4 Enterprise Information Systems

Many firms have tried to take transaction processing to a higher level by creating enterprise information systems that encompass the transaction processing done in the various functional silos. The idea of these efforts is to create unified databases that permit any authorized individual to obtain whatever information would be helpful in making decisions across the organization. In theory at least, having all this information in a unified database should improve decision-making. Enterprise information systems are quite controversial because the effort to create them is enormous. They involve much more than changing the format of databases. Often it is necessary to change business processes to suit the needs of the information system instead of *vice versa*. Nonetheless, many organizations have found that the integration resulting from this large investment seems to be worthwhile. The last part of this discussion explains why these information systems are usually called enterprise resource planning (ERP) systems even though planning is not their main focus.

Management and Executive Information Systems

A management information system (MIS) provides information for an organization's managers. The idea of MIS predates the computer age. For example, as long ago as the middle 1500s, the Fogger family in Augsberg, Germany, had business interests throughout Europe and even into China and Peru. To keep in touch, they set up a worldwide news reporting service through which their agents wrote letters about critical political and economic events in their areas of responsibility. These letters were collected, interpreted, analyzed, and summarized in Augsberg and answered through instructions sent to the family's agents. This paper-based system encompassing planning, execution, and control helped the family move more rapidly in the mercantile world than their rivals. Instructions went out to the agents; the agents executed their work' and the agents reported their results.

Computerized MIS generates information for monitoring performance, maintaining coordination, and providing background information about the organization's operation. Users include both managers and the employees who receive feedback about performance indicators such as productivity.

The concept of MIS emerged partly as a response to the shortcomings of the first computerized TPSs, which often improved transaction processing but provided little information for management. Computerized MISs typically extract and summarize data from TPSs to allow managers to monitor and direct the organization and to provide employees accurate feedback about easily measured aspects of their work. For example, a listing of every sale during a day or week would be extremely difficult to use in monitoring a hardware store's performance. However, the same data could be summarized in measures of performance, such as total sales for each type of item, for each salesperson, and for each hour of the day. The transaction data remains indispensable, and the MIS focuses it for management.

As part of an organization's formal control mechanisms, an MIS provides some structure for the comparatively unstructured task of management by identifying important measures of performance. The fact that everyone knows how performance is measured helps in making decisions and helps managers motivate workers.

From MIS to EIS

An executive information system (EIS) is a highly interactive system that provides managers and executives' flexible access to information for monitoring operating results and general business conditions. These systems are sometimes called executive support systems (ESS). EIS attempts to take over where the traditional MIS approach falls short. Although sometimes acceptable for monitoring the same indicators over time, the traditional MIS approach of providing prespecified reports on a scheduled basis is too inflexible for many questions executives really care about, such as understanding problems and new situations.

EISs provide executives with internal and competitive information through user-friendly interfaces that can be used by someone with little computer-related knowledge. EISs are designed to help executives find the information they need whenever they need it and in whatever form is most useful. Typically, users can choose among numerous tabilar or graphical formats. They can also control the level of detail, the triggers for exception conditions, and other aspects of the information displayed. Most EISs focus on providing executives with the background information they need, as well as help in understanding the causes of exceptions and surprises. This leaves executives better prepared to discuss issues with their subordinates.

13.3.5 Decision Support Systems

A decision support system (DSS) is an interactive information system that provides information, models and data manipulation tools to help make decisions in semi structured and unstructured situations where no one knows exactly how the decision should be made. The traditional DSS approach includes interactive problem solving direct use of models, and user-controllable methods for displaying and analyzing data and in formulating and evaluating alternative decisions. This approach grew out of dissatisfaction with the traditional limitations of TPS and MIS. TPS focused on record keeping and control of repetitive clerical processes. MIS provided reports for management but were often inflexible and unable to produce the information in a form in which managers could use it effectively. In contrast, DSSs were intended to support managers and professionals doing largely analytical work in less structured situation with unclear criteria for success. DSSs are typically designed to solve the structured parts of the problem and help isolate places where judgment and experience are required.

DSSs may report repetitive or non-repetitive decision-making. They support repetitive decision making by defining procedures and formats, but they still permit the users to decide how and when to use the system's capabilities. They support non-repetitive decision making by providing data, models and interface methods that can be used however the user wants. The broad spectrum of information systems with the DSS label range from general tools such as spreadsheets, data analysis, and graphics packages to highly customized simulation or optimization models focusing on a specific business situation.

OLAP and Data Mining

The use of online data analysis tools to explore large databases of transaction data is called online analytical processing (OLAP). The idea of OLAP grew out of difficulties analyzing the data in databases that were being updated continually by online transaction processing systems. When the analytical processes accessed large slices of the transaction database, they slowed down transaction processing critical to customer relationships. The salutation was periodic downloads of data from the active transaction processing database into a separate database designed specifically to support analysis work. The separate database often resides on a different computer, which together with its specialized software is called a data warehouse. Downloading data to a data warehouse makes it possible to perform both transaction processing and analytical processing efficiently without mutual interference.

Data mining is the use of data analysis tools to try to find the patterns in large transaction databases such as the customer receipts generated in a large sample of grocery stores across the United States. Careful analysis of this data might reveal patterns that could be used for marketing promotions, such as a correlation between diaper sales and beer sales during the evening hours.

13.3.6 Execution Systems

The information system categories discussed so far are primarily oriented toward planning and control activities or toward general office and communication activities. What about systems designed to directly support people doing the value added work that customers care about, such as practicing medicine, designing buildings, or selling investments? Some people call these systems "functional area systems". Because there is no generally accepted term form information systems that support value added work, we will call them execution systems. These systems have become much more important in the last decade as advances in computer speed, memory capacity, and portability made it increasingly possible to use computerized systems directly while doing value added work. Such systems help plastic surgeons design operation and show the likely results to their patients help lawyers find precedents relevant to lawsuits, and help maintenance engineers keep machines running.

Expert systems are a type of execution system that has received attention as an offshoot of artificial intelligence research. An expert system supports the intellectual work of professionals engaged in design, diagnosis, or evaluation of complex situations requiring expert knowledge in a well-defined area. Expert systems have been used to diagnose diseases, configure computers, analyze chemicals, interpret geological data, and support many other problem solving processes. This type of work requires expert knowledge of the process of performing particular tasks. Although these tasks may have some repetitive elements, many situations have unique characteristics that must be considered based on expert knowledge. Intellectual work even in narrowly defined areas is typically much less repetitive than transaction processing general office work.

13.3.7 Going Beyond the Information System Categories

The field of IT moves so rapidly that terminology often fails to keep pace with innovation. The same problem occurs with information system classification. People identify a new type of system, such as DSS or EIS, and describe its characteristics are no longer as important or have become commonplace. Eventually many information systems contain characteristics from several system categories. Furthermore a system that fits in a category today may not fit once new features are added. Information systems that contain characteristics of several different categories can be called hybrid information systems.

In the mid-1990s the widespread adoption of a form of hybrid information system called an enterprise resource planning (ERP) system became highly visible and somewhat controversial. Resource planning actually describes only a small part of why ERP systems exist. As with many IT terms, the term ERP evolved out of an early form of DSS called material requirements planning (MRP). These systems provide an integrated view necessary to coordinate purchasing and production scheduling activities.

ERP systems try to create an integrated database that spans the major activities in a company. Ideally, having production, sales, human resources, and finances data in the same database should make it easier to analyze the business and to coordinate decision-making. Software vendors such as SAP, Baan, People soft, and Oracle currently sell ERP software. These vendors analyzed basic business processes such as purchasing and of the process variations they found. This design strategy makes their products enormously complicated. Just figuring out which of the many options to use often takes several hundred person-months of time. In many situations, departments must give up existing customized systems that address their unique problems in order to use the more general software and its integrated database.

13.4 REDESIGNING THE ORGANIZATION WITH INFORMATION SYSTEMS

One of the most important things to know about building a new information system is that this process is one kind of planned organizational change. Frequently, new systems mean new ways of doing business and working together. The nature of tasks, the speed with which they must be completed, the nature of supervision (its frequency and intensity), and who has what information about whom will all be decided in the process of building an information system. This is especially true in contemporary systems, which deeply affect many parts of the organization. System builders must understand how a system will affect the organization as a whole, focusing particularly on organizational conflict and changes in the locus of decision-making. Builders must also consider how the nature of work groups will change under the impact of the new system. Builders determine how much change is needed.

New information systems can be powerful instruments for organizational change; Figure 13.3 shows that there are four kinds of structural organizational change which are enabled by information technology: automation, rationalization, re-engineering, and paradigm shifts. Each carries different rewards and risks.

The most common form of IT-enabled organizational change is automation. The first applications of information technology involved assisting employees perform their tasks more efficiently and effectively. Calculating paychecks and payroll registers, giving bank teller's instant access to customer deposit records, and developing a nationwide network of airline reservation terminals for airline reservation agents are all examples of early automation. Automation is akin to putting a larger motor in an existing automobile.

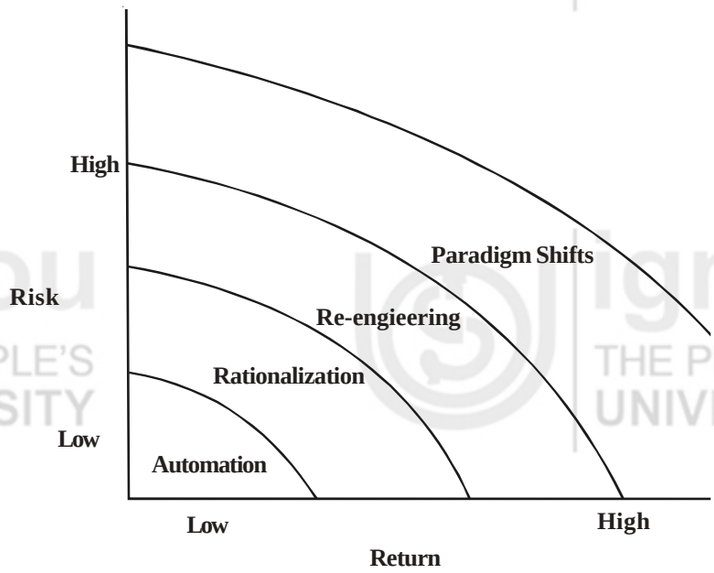

Fig. 13.2: Organizational Change carries Risk and Rewards

Source: *Kenneth C Laudon, Jane P Laudon, Prentice Hall India, 1996*

A deeper form of organizational change – one that follows quickly from early automation – is rationalization procedure. Automation frequently reveals new bottlenecks in production, and makes the existing arrangement of procedures and structures painfully cumbersome. Rationalization of procedures is the streamlining of standard operating procedures, eliminating obvious bottlenecks, so that automation can make operating procedures more efficient.

A more powerful type of organization change is business re-engineering, in which business processes are analyzed, simplified, and redesigned. Re-engineering involves radically rethinking the flow of work; the business procedures used to produce products and services with a mind of radically reduce the costs of business.
A business process is a set of logically related tasks performed to achieve a defined business outcome. Some examples of business processes are developing a new product, ordering goods from a supplier, or processing and paying an insurance claim. Using information technology, organizations can rethink and streamline their business processes to improve speed, service and quality. Business re-engineering reorganizes workflows, combining steps to cut waste and eliminating repetitive, paper-intensive tasks (sometimes the new design eliminates jobs as well). It is much more ambitious than rationalization of procedures, requiring a new vision of how the process is to be organized. Rationalizing procedures and redesigning business processes are limited to specific parts of a business. New information systems can ultimately affect the design of the entire organization by actually transforming how the organization carries out its business or even the nature of the business itself.

This still more radical form of business change is called a paradigm shift.
A paradigm shift involves rethinking the nature of the business and the nature of the organization itself. Banks, for instance, may decide not to automate, rationalize, or reengineering the jobs of tellers. Instead they may decide to eliminate branch banking altogether and seek less expensive source of funds, like international borrowing. Retail customers may be forced to use the Internet to conduct all their business, or a proprietary network. A paradigm shift is akin to rethinking not just the automobile, but transportation itself.

Of course nothing is free. Paradigm shifts and re-engineering often fail because extensive organization change is so difficult to orchestrate. Some experts believe that 70% of the time they fail. Why then do so many corporation entertain such radical change, because the rewards are equally high. In many instances firms seeking paradigm shifts and pursuing re-engineering strategies achieve stunning, order-of-magnitude increases in their returns on investment (or productivity).

13.5 BUSINESS VALUES OF INFORMATION SYSTEM

Another important fact about information systems is shown in Figure 13.3. No matter how they may be classified, information systems have following business values in an organization by supporting business operations, decision-making, and strategic management:

- Support of business operations.
- Support of managerial decision-making.
- Support of strategic competitive advantage.

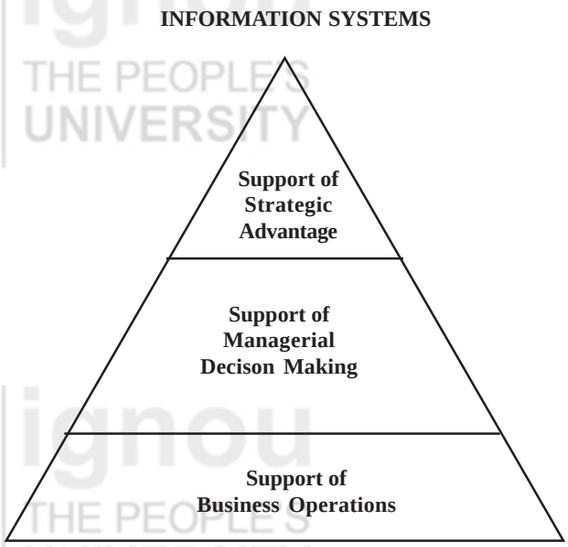

Fig. 13.3: Business Values of Information System

Let's take a retail store as an example to illustrate this important first point.
As a consumer, you have to deal regularly with information systems used to support business operations at the many retail stores where you shop. For example, most department stores use computer-based information systems to help them record customer purchases, keep track of inventory, pay employees, buy new merchandise, and evaluate sales trends. Store operations would grind to a halt without the support of such information systems.

Information systems also help store managers make better decisions and attempt to gain a strategic competitive advantage. For example, decisions on what lines of clothing or appliances need to be added or discontinued, or what kind of investments they require, are typically made after an analysis provided by computer-based information systems.

This not only supports the decision making of store managers but also helps them look for ways to gain an advantage over other retailers in the competition for customers. For example, store managers might make a decision to invest in a computerized touch-screen catalog ordering system as a strategic information system. This might lure customers away from other stores, based on the ease of ordering merchandise provided by such a computer-based information system. Thus, strategic information helps provide strategic products and services that given an organization a comparative advantage over its competitors.

13.6 OUTSOURCING INFORMATION SYSTEMS

If a firm does not want to use its own internal resources to build and operate information systems, it can hire an external organization that specializes in providing these services to do the work. The process of turning over an organization's computer central operations, telecommunications networks, or applications development to external vendors of these services is called outsourcing.

Outsourcing information system is not a new phenomenon. Outsourcing options have existed since the dawn of data processing. As early as 1963, Petrot's Electronic Data Systems (EDS) handled data processing services for Frito-Lay and Blue Cross. Activities such as software programming, operation of large computers, time-sharing and purchase of packaged software have to some extent been outsourced since the 1960s.

Because information systems play such a large role in contemporary organizations, information technology now accounts for about half of most large firms' capital expenditure. In firms where the cost of information systems function has risen rapidly, managers are seeking ways to control those costs and are treating information technology as a capital investment instead of an operating cost of the firm. One option for controlling these costs is to outsource.

13.6.1 Advantages and Disadvantages of Outsourcing

Outsourcing is becoming popular because some organization perceive it as being more cost effective than it would be to maintain their own computer center and information systems staff. The provider of outsourcing services can benefit from economies of scale (the same knowledge, skills, and capacity can be shared with many different customers) and is likely to charge competitive prices for information systems services. Outsourcing allows a company with fluctuating needs for computer processing to pay for only what it uses rather than to build its own computer center to stand underutilized when there is no peak load. Some firms outsource because their internal information systems staff cannot keep pace with technological change. But not all organizations benefit from outsourcing, and the disadvantages of outsourcing can create serious problems for organizations if they are not well understood and managed.

Advantages of Outsourcing:

The most popular explanations for outsourcing are the following:

Economy: Outsourcing vendors are specialists in the information systems services and technologies they provide. Through specialization and economies of scale, they can deliver the same service and value for less money than the cost of an internal organization.

Service Quality: Because outsourcing vendors will lose their clients if the service is unsatisfactory, companies often have more leverage over external vendors than over their own employees. The firm that out-sources may be able to obtain a higher level of service from vendors for the same or lower costs.

Predicatability: An outsourcing contract with a fixed price for a specified level of service reduces uncertainly of costs.

Flexibility: Business growth can be accommodated without making major changes in the organization's information systems infrastructure. As information technology permeates the entire value chain of a business, outsourcing may provide superior control of the business because its costs and capabilities can be adjusted to meet changing needs.

Making Fixed Costs Variable: Some outsourcing agreements, such as running payroll, are based on the price per unit of work done (such as the cost to process each cheque). Many out-sources will take into account variations in transaction processing volumes likely to occur during the year or over the course of the outsourcing agreement. Clients only need to pay for the amount of services they consume, as opposed to paying a fixed cost to maintain internal systems that are not fully utilized.

Freeing up Human Resources for other Projects and Financial Capital: Scarce and costly talent within an organization can refocus on activities with higher value and payback than they would find in running a technology factory. Some agreements with outsource include the sale for cash of the outsourced firm's technology capital assets to the vendor.

Disadvantages of Outsourcing

Not all organizations obtain these benefits from outsourcing. There are dangers in placing the information systems functions outside the organization. Outsourcing can create serious problems such as loss of control, vulnerability of strategic information, and dependence on the fortunes of an external firm.

Loss of Control: When a firm farms out the responsibility for developing and operating its information systems to another organization, it can lose control over its information systems function. Outsourcing places the vendor in an advantageous position where the client has to accept whatever the vendor does and whatever fees the vendor charges. If a vendor becomes the firm's only alternative for running and developing its information systems, the client must accept whatever technologies the vendor provides. This dependency could eventually result in higher costs or loss of control over technological direction.

Vulnerability of Strategic Information: Trade secrets or proprietary information may leak out to competitors because a firm's information systems are being run or developed by outsiders. This could be especially harmful if a firm allows an outsourcer to develop or to operate applications that give it some type of competitive advantage.

Dependency: The firm becomes dependent on the viability of the vendor. A vendor with financial problems or deteriorating services may create severe problems for its clients.

13.6.2 When to Use Outsourcing?

Since outsourcing has both benefits and liabilities and is not meant for all organizations or all situations, managers should assess the role of information systems in their organization before making an outsourcing decision. There are a number of circumstances under which outsourcing makes a great deal of sense:

- When there is limited opportunity for the firm to distinguish itself competitively through a particular information systems application or series of applications. For instance, both the development and operation of payroll systems are frequently outsourced to free the information systems staff to concentrate on activities with a higher potential payoff, such as customer service or manufacturing systems. Applications such as payroll or cafeteria accounting, for which the firm obtains little competitive advantage from excellence, are strong candidates for outsourcing. If carefully developed, applications such as airline reservations or plant scheduling could provide a firm with a distinct advantage over competitors. The firm could lose profits, customers, or market share if such systems have problems. Applications where the rewards for excellence are high and where the penalties for failure are high should probably be developed and operated internally.

Companies may also continue to develop applications internally while outsourcing their computer center operations when they do not need to distinguish themselves competitively by performing their computer processing onsite.

When the predictability of uninterrupted information systems service is not very important. For instance, airline reservations or catalog shopping systems are too "critical" to be trusted outside. If these systems failed to operate for a few days or even a few hours, they could close down the business. On the other hand, a system to process employee insurance claims could be more easily outsourced because uninterrupted processing of claims is not critical to the survival of the firm.

When outsourcing does not strip the company of the technical know-how required for future information systems innovation. If a firm outsource some of its system but maintains its own internal information systems staff, it should ensure that its staff remains technically up to date and has the expertise to develop future applications.

When the firm's existing information systems capabilities are limited, ineffective, or technically inferior. Some organizations use outsourcers as an easy way to revamp their information systems technology. For instance, they might use an outsourcer to help them make the transition from traditional mainframe-based computing to a new information architecture – distributed computing environment.

Despite the conventional wisdom on when to outsource, companies sometimes do outsource strategic functions. In any case, if systems development and the information systems function are well managed and productive, there may not be much immediate benefit that can be provided by an external vendor.

Managing Outsourcing

To obtain value from outsourcing, organizations need to make sure the process is properly managed. With sound business analysis and an understanding of outsourcing's strengths and limitations, managers can identify the most appropriate applications to outsource and develop a workable outsourcing plan.

Segmenting the firm's range of information systems activities into pieces that potentially can be outsourced makes the problem more manageable and also helps companies match an outsourcer with the appropriate job. Noncritical applications are usually the most appropriate candidates for outsourcing. Firms should identify

mission-critical applications and mission-critical human resources required to develop and manage these applications. This would allow the firm to retain its most highly skilled people and focus all of its efforts on the most mission-critical applications development. Setting technology strategy is one area that companies should not abdicate to outsourcers. This strategic task is best kept in-house. Ideally, the firm should have a working relationship of trust with an outsourcing vendor. The vendor should understand the client's business and work with client as a partner, adapting agreements to meet the client's changing needs.

Firms should clearly understand the advantages provided by the vendor and what they will have to give up to obtain these advantages. For lower operating costs, can the client live with a five-second-response time during peak hours or next-day repair of microcomputers in remote offices? Organizations should not abdicate management responsibility by outsourcing. They need to manage the outsourcer as they would manage their own internal information systems department by setting priorities, ensuring that the right people are brought in, and guaranteeing that information systems are running smoothly. They should establish criteria for evaluating the outsourcing vendor that include performance expectations and measurement methods for response time, transaction volumes, security, disaster recovery, backup in the event of a catastrophe, processing requirements of new applications and distributed processing on microcomputers, workstations, and LANs. Firms should design outsourcing contracts carefully so that the outsourcing services can be adjusted if the nature of the business changes.

Activity B

Take the case of a petrol pump, a bookstore, a software development company, and an electronic goods manufacturer. Is outsourcing information systems required for them? Describe what can be outsourced and the advantages.

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13.7 ENSURING QUALITY WITH INFORMATION SYSTEM

The emergence of a global economy has stimulated worldwide interest in achieving quality. Companies can no longer be satisfied with producing goods and services that compete only with goods produced within their own country – consumers can now select from a broad range of products and services produced anywhere in the world. Before examining how information systems can contribute to quality throughout the organization, we must first define the term quality.

Traditional definitions for quality have focused upon the conformance to specifications (or the absence of variation from those specifications). With this definition, a producer can easily measure the quality of its products. Achieving quality under this definition requires three steps from the manufacturer: First, establish product specifications. Second, measure products as they are produced to determine whether or not they achieve the standards established in the specifications. Third, alter the manufacturing process whenever necessary to bring the products up to standard.

However, achieving quality is not quite that simple and direct. The definition of quality has been changing and broadening in recent years. Defining quality as conformances to specifications view it from a producer's perspective only. Customers have a different perspective, being more concerned with value for their Rupees. They normally apply three criteria. First, customers are concerned with the quality of the physical product. They want to know if the product is durable, how safe it is, its reliability, its ease of use and installation, its stylishness, and how well the producer supports the product. Second, customers are concerned with the quality of service, by which they mean the accuracy and truthfulness of the advertising, the timeliness and accuracy of the billing process, responsiveness to warranties (implied as well as specified), and ongoing product support. Finally, customer concepts of quality include the psychological aspects: how well do the sales and support staff know their products, the courtesy and sensitivity of the staff, and even their neatness, the reputation of the product. For companies to compete globally, they need to include a customer perspective in any definition of quality.

Today more and more businesses are turning to an idea known as total quality management. Total quality management (TQM) is a concept that makes quality the responsibility of all people within an organization. TQM holds that the achievement of quality control is an end in itself. Everyone is expected to contribute to the overall improvement of quality – the engineer who avoids design errors, the production worker who spots defects, the sales representative who presents the product properly to potential customers, and even the secretary who avoids typing mistakes. Total quality management encompasses all of the functions within an organization. TQM is based on quality management concepts developed by American quality experts. Japanese management adopted the goal of zero defects, focusing on improving their products or services prior to shipment rather than correcting them after they have been delivered. Japanese companies often give the responsibility for quality consistency to the workers who actually make the product or service, as opposed to a quality control department. Studies have repeatedly shown that the earlier in the business cycle a problem is eliminated, the less it costs for the company to eliminate it. Thus the Japanese quality approach not only brought a shift in focus to the workers and an increased respect for product and service quality but also lowered costs.

How Information Systems Contribute to Total Quality Management?

Information systems can fill a special role in corporate quality programs for a number of reasons. First, IS is deeply involved with the daily work of other departments throughout the organizations. IS analysis usually have taken a leading role in designing, developing, and supporting such varied departmental systems as corporate payrolls, patent research systems, chemical process control systems, logistics systems, and sales support systems. IS professionals also maintain their knowledge of these departments through their participation in departmental information planning. In addition, IS personnel are usually key to the sharing of data between departments because they have unique knowledge of the relationships between various departments. Often, only IS personnel know where certain data originate, how other departments use and store them, and which other functions would benefit from having access to them. With this broad understanding of the functional integration of the corporation, IS personnel can be valuable members of any quality project team.

The IS staff in effective information systems departments have three skills that are critical to the success of a quality program. First, they are specialists in analyzing and redesigning business processes. Second, many IS technicians are experienced in quantifying and measuring procedures and critical activities in any process. Typically, IS departments have long been involved with measurements of their own manager

training has long been a staple of better IS departments; such training includes the use of project management, software. These skills can contribute a great deal to any serious quality program, which will normally be organized as a project and will usually be heavily task-oriented.

The information systems staff is the source of ideas on the application of technology to quality issues; often they are also the people who can make that technology available to the quality project. For example, with the help of IS departments, statistical analysis software is becoming more widely used in the drive for quality.

Benchmark: Many companies have been effective in achieving quality by setting strict standards for products, services and other activities, and then measuring performance against those standards. Companies may use external industry standards, standards set by other companies, internally developed high standards, or some combination of the three.

IS Contributes to these Efforts in Many Ways: IS staff participates in re-engineering projects and helps to design and build the systems that make the quality processes possible. Any study of quality programs shows that information is a top concern to those involved, and IS is often central to the collection of that information. To improve production or sales, for example, management needs data to determine both what is being done right and what is being done wrong. IS is usually the key to making that information available in a timely fashion and in a format useful to those who need it for quality purposes. For instance, manufacturing data have traditionally been supplied to management in summary form at the end of the manufacturing process. In effect it is historical data that at best can be used to reduce future problems. To provide better information for benchmarking, information systems specialists can work with business specialists either to design new systems or to analyze quality-related data found in existing systems.

Use Customer Demands as a Guide to Improving Products and Services: Improving customer service, making customer service the number one priority, will improve the quality of the product itself.

Reduce Cycle Time: Experience indicates that the single best way to address quality problems is to reduce the amount of time from the beginning of a process to its end (cycle time). Reducing cycle time usually results in fewer steps, an improvement right there. But reducing cycle time has other advantages. With less time passing between beginning and end, workers will be better aware of what came just before, and so are less likely to make mistakes.

Improve the Quality and Precision of the Design: Quality and precision in design will eliminate many production problems. Computer-aided design (CAD) software has made dramatic quality improvements possible in a wide range of businesses from aircraft manufacturing to production of razor blades.

Increase the Precision of Production: For many products, one key way to achieve quality is to tighten production tolerance. CAD software has also made this possible. Most CAD software packages include a facility to translate design specifications into specifications both for production tooling and for the production process itself. In this way, products with more precise designs can also be produced more efficiently.

Include Line Workers in any Quality Process: Experience has shown that involvement of the people who perform the function is critical to achieving quality in that function. Although the information systems are could potentially make many more contributions like these, its involvement in corporate quality programs has provoked a great deal of controversy. IS has been criticized for a reluctance to

become involved in organization-wide quality programs. Often IS focuses exclusively upon technological capabilities while not reaching out to aid the rest of the company in the ways described above. For example, many IS departments are criticized for failure to use customer demands as a guide to improving their products and services. On the other hand, non-IS departments often fail to consider contributions the IS staff might make to their quality project and so do not reach out to involve them. It is not uncommon for IS to be viewed only as technical support with little to contribute to the planning or content of the quality program.

13.8 SUMMARY

In this unit we discuss about computer based information system and their different types. Information systems have been used by organization as an effective way for decision-making and in supporting communication. The field of IT moves so rapidly that terminology often fails to keep pace with innovation. The same problem occurs with information system classification. People identify a new type of system, such as DSS or EIS, and describe its characteristics are no longer as important or have become commonplace. Eventually many information systems contain characteristics from several system categories. Furthermore a system that fits in a category today may not fit once new features are added. Information systems that contain characteristics of several different categories can be called hybrid information systems.

Organizations in the past few years have shown a tendency to focus on their core business. Functions that are not considered to be part of the core business are outsourced to external suppliers. Organizations face an increased need, flexibility as a consequence of a faster changing competitive environment and rapid developments in information technology. Management has been questioning the idea that quality costs more. Today many senior executives have come to the conclusion that the lack of quality is actually a significant expense. While we all understand that product returns and repairs result in added costs for repair (labor, parts replacement, and additional shipping), only recently has management focused on the many previously hidden costs that arise from producing products that are not high quality.

13.9 UNIT END EXERCISES

1. What types of resources are used in an information system?
2. What are the different types of computer based information system used in different functional areas business by organizations?
3. Who are the typical users of information system?
4. What is the most common form of IT enabled organizational change?
5. Which form of organizational change requires business processes to be analyzed simplified and redesign?
6. When outsourcing should be used by the organizations?
7. How Information systems can contribute for total quality management?

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