UNIT 1 INTRODUCTION TO INFORMATION TECHNOLOGY

Structure

1.0 OBJECTIVES

After reading this Unit, you will be able to:

- understand the concept of information technology;
- define information technology and describe its development;
- identify the different components of information technology and their applications; and
- appreciate the impact of information technology on information creation, storage, processing, retrieval and dissemination.

1.1 INTRODUCTION

Technology has been defined as "systematic knowledge and action, usually of industrial processes but applicable to any recurrent activity". In providing tools and techniques for action, technology at once adds to and draws from a knowledge base in which theory and practice interact and compact. At its most general level technology may be regarded as definable specifiable way of doing anything. In other words, we may say a technology is a codified, communicable procedure for solving problems.

Technology, Manfred Kochen observed, impacts in three stages. First, it enables us to do what we are now doing, but better, faster and cheaper; second, it enables us to do what we cannot do now; and third, it changes our life styles.

Information technology is a recent and comprehensive term, which describes the whole range of processes for generation, storage, transmission, retrieval and processing of information.

In this Unit, an attempt is made to discuss the components of information technology and to identify elements that really matter m the investigation and implementation of new information technologies in information systems and services.

1.2 DEVELOPMENT OF INFORMATION TECHNOLOGY

Despite the impression often given that information technology has suddenly burst on the scene, its roots could be traced well into the past.

1.2.1 Historical Perspective

The history of man-made information technology is one of slow evolution dating back to

5,000 years. It has followed the mechanical and later electronic rather than biochemical path, with primitive signs, hieroglyphics, the alphabet writing, the book printing, and computer type-setting - a more or less linear development. More recently, the telephone, radio, television, satellite transmission, transistor, the computer, and the microprocessor represent distinct qualitative changes in the information technology, with the fact that we now have to accept the composite term information technology to include a whole range of new developments. It has been said that information technology is the science of information handling, particularly by computers used to support the communication of knowledge in scientific technical, economic and social fields.

1.2.2 Definition of Information Technology (IT)

The term `Information Technology' (IT) has varying interpretations. Macmillan Dictionary of Information Technology defines IT as "the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro-electronics-based combination of computing and telecommunications". Two points are worth consideration about this definition:

1) The new information technology is seen as involving the formulating, recording and processing and **not just transmitting of information.** These are elements in the communication process which can be separated (both analytically and in practice) but in the context of human communication they tend to be intertwined.

2) Modem information technology deals with a wide variety of ways of representing information. It covers **not only the textual (i.e.,** cognitive, propositional and verbalised forms, we often think under the head information), but also **numerical, visual, and auditory representations.**

UNESCO defines Information Technology as "scientific, technological and engineering disciplines and the management techniques used in information handling and processing information, their applications; computers and their interaction with man and machine and associated social, economic and cultural matters". (Stokes)

This definition, while emphasising the significant role of computers, appears not to take into its purview the communication systems. It may, however, be stated that communication systems are as essential to information technology as computers. As a consequence, we have a convergence of **three strands** of technologies: **computers, micro-electronics and communications.** In other words, a mosaic of technologies, products and techniques have combined to provide new electronic dimensions to information management. This mosaic is known by the name new information technology. It is important to bear in mind that information technology is **not just concerned** with **new pieces of equipment** but with **much broader spectrum of information activities.** Information technology encompasses such different things as book, print; reprography, the telephone network, broadcasting and computers.

In the following sections let us briefly consider the major components of information technology namely: computer technology, communications technology and reprographic and micrographic technologies.

Self Check Exercise

l) Briefly explain the meaning of the term ‘Information Technology?

Note: i) Write your answer in the space given below

ii) Check your answer with the answers given at the end of this Unit.

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1.3 COMPUTER TECHNOLOGY

Computer technology may conveniently be grouped into: processor technology, storage technology and software aspects.

1.3.1 Processor Technology

Computers consist of electronic components assembled in a design or "architecture" that will perform necessary functions of input, output, computation and control (control of both the computer itself and of attached peripheral devices that perform input and output functions and store the files).

In the past, electronic components were expensive, so a minimum number were used in a single processor that alternately performs input, control, processing and output. Besides, the first generation of computers, operated by means of vacuum tubes or valves, were relatively bulky and energy consuming. The first major innovation, leading to micro-electronics was the discovery of transistor, a product of solid state physics, which used semiconductor materials. The most important development of these today is based on the non-metallic element `silicon'. Being much smaller than the vacuum tube, the transistor quickly replaced it in all electronic equipment. However, transistors and other equipment had to be wired together and a single piece of equipment might have thousands of such components. The wiring and assembly of such elements were a delicate and costly process. This naturally paved the way for research towards the concept of **integrated circuit (IC).** At first IC's were simple but, as the technology developed, they rapidly became smaller and more complex. This led to the miniaturisation and refinement.

The central feature of micro-electronics is the development of **micro-processor,** a special form of IC with functions of arithmetic, logic and control - similar to those of Central Processing Unit (CPU) of a computer and **contained in a single chip.** In addition, the microprocessor includes units to interpret instructions from the stored programme to supply the control memory the information necessary to retrieve instructions and send out data as required. The microprocessor is the **building** block from which modem computer systems are assembled. The microprocessor uses very, little energy and has few environmental requirements of older machinery. Air conditioning, for example, might not be necessary for a general purpose computer using microprocessor technology. The practical significance of this is that it is mow possible to bring the computer to the problem instead of bringing the problem to the computer. The aspects referred to above form a major hardware component of a computer.

13.2 Storage Technology

In the previous section, the, recent innovations relating to the processing aspects of computer technology were discussed briefly. In considering some of the advances in devices for digital information storage, it may be stated that most of the primary storage in computers is now supplied by semi-conductor circuits. There have been significant developments in memory technology affecting three areas of performance spectrum; the high speed, *high* performance; the midrange and the low speed bulk memory systems.

It is now possible that even a small computer system might have **cache** memory, a small associative memory retaining most recently referenced information and in a readily available place. In some cases, cache memory may be at the **top** of a **hierarchy of memories** having a wide variety of characteristics. Memory management, dynamic memory allocation, and virtual memory schemes, generally found in large computer systems, are now appearing on computers which are small and less costly.

The development of ***charge*** **coupled devices (CCDs) and bubble memories** has filled the gap which previously existed in the continuum of memory devices such as fixed-head magnetic disks and these are slower than other semi-conductor memories. These memories have advantage over magnetic disks in that they contain' no mechanical parts and could be used to store significant amount of information and can be treated as a structured file system.

There has been a continuous improvement in recording densities of magnetic media. Floppy disks and microfloppies provide a convenient media to store data. The development of video

disk has added a new dimension to the information storage technology. Video disks could' be used to store large volumes of information in digital form. This kind of mass storage devices are believed to be very useful in the development of information storage and retrieval systems. It May be stated that all these innovations in storage technology provide us a variety of alternatives depending on the requirements of speed of operation. These developments add more capabilities to the storage aspects and may be considered advances in the storage technology.

1.3.3 Software Aspects

Software is a generic term covering the concepts, procedures and instructions which enable computer systems to do useful things. Usually, software is conceived in terms of computer programs, discrete units of software which make the computer to carry out specific tasks, and or systems or packages.

The importance of software is obvious, since it is the software which applies the power of the computer to solve the users' problems. Many of the users need a clear understanding of the capabilities of software more than hardware aspects. It is known for some years now that the "rapid increase in the capabilities of computer systems has not been matched by corresponding increases in the development and quality of software. This situation has caused much disenchantment with computer systems.

The methods by which computer software is produced have changed considerably in recent years with the emergence of "software engineering", which enabled improvements in programming practice, such as structured, or modular programming.

As one of the solutions to the software problem increased production and availability of packaged software is encouraged. Another solution to the problem is the use of fourth generation languages and flexible integrated software to produce prototypes of programmes to meet the user needs. It is hoped that these solutions would be able to meet fairly standard requirements. For the average user they mean that there will be an increasing number of packages to meet most of his needs.

1.4 COMMUNICATIONS TECHNOLOGY

The development of communications technology is, in a sense, a symbol of man's effort to communicate rapidly over great distances. Communications technology is older than computer technology. It has grown as rapidly as the computer technology in recent times. These two technologies are now fusing into what Anthony Oettinger has called `compunications'. This newly emergent technology is changing our life styles as few technologies have before. This new technology has probable and important uses in the home, office, factory, community and in information exchange system and holds prospects of immediate relevance to information profession. Some of the significant aspects of information transmission technology are discussed briefly in the following paragraphs.

A communication system can establish paths over which messages can be sent between any two instruments in specified locations at desired times. This type of system is generally known as switched .network.' Communications technology has advanced to the extent that now it is possible to hire services from a commercially operated network. Hence, there is a steady growth of computer-to-computer data traffic. Also, computer manufactures are offering network architectures which together offer multiple operating systems running on families of similar computers. A terminal of a computer network may have access to any of the computers within the network, if it is authorised to do so. A computer serves as a terminal when connected for providing computation, information retrieval, etc., in accordance with the request of the terminal. A multi-lateral access capability allows the users of the terminal to share these resources. Such networks are characterised by a new technique known as packet switching in which the message is divided into a number of message blocks called packets and are transmitted between nodes in store and forward basis. Among the information resources to be shared are the data bases. A number of information systems have come into operation based on this concept.

Another advancement of great significance in telecommunications from the technological point of view is that of a fundamental and massive shift from analog to digital modes of transmission. This shift is underpinned by new transmission channels of enormous capacity. This shift is massive in that it involves the replacement or upgrading of costly equipment. It also involves types of communications namely voice, facsimile, computer transmissions and television communication, which will all be affected. For example, every manufacturer of semi-conductor circuits has started to produce a device called Codec-short for `Coder-decoder'. This circuit takes the human voice and transmits by the standard voice-grade telephone channel, samples the signal 8,000 times per second, and encodes it into a digital bit stream. Digitised signals from hundreds of telephone conversations are then bundled, transmitted over a high capacity communication links, decoded at the other end, and reconstituted into a very close approximation of the original voice. While this may appear to be an elaborate and excessively complicated procedure, the switch from analog to digital makes good sense from a number of points of view. Firstly, the cost performance of digital circuits continues to improve remarkably. Secondly, **noise problems** inherent in analog devices can be eliminated. This transformation from analog to digital mode has resulted in the intelligent communication channel and has reduced even the thin line of distinction between communications and computing.

As a result of rapid technological progress, a variety of services, which have traditionally been considered separate, are now becoming increasingly similar. This tendency is generally referred to as convergence of service modes. Telecommunications can now handle not only speech and data but also visual information in a unified manner. Broadcasting is now capable of providing two-way or selective dissemination of **audio** and **visual** information by way of a broad-band cables in addition to conventional one way dissemination. With the result, two traditionally separate 'services, telecommunications and broadcasting tend to merge together in their mode of operation and thereby provide users with diversified types of information more efficiently. This innovation could be utilised for the publication of journals through the extensive use of techniques like facsimile text processing and word processing. Library and information services may also be included into the integrated whole. To handle the economy of scale, the concept of Integrated Services Digital Network (ISDN) is evolving very rapidly.

1.5 REPROGRAPHIC AND MICROGRAPHIC TECHNOLOGIES

1.5.1 Reprography

Reprography, as a term, has gained international recognition in 1963. It includes "photocopying , microcopying, duplicating and in-plant printing and is characterised by the small scale of its operatives". Reprographic techniques include such processes as diffusion transfer, physical transfer, quick stabilisation, diazo, thermography, and electrostatography for copying documents. Reprographic technology has been playing a vital role in the dissemination of recorded information and has now come to stay as one of the means to provide access to document resources geographically located in different places. Document delivery service largely depends on the facilities afforded by reprography.

1.5.2 Micrography

Micrographic technology is an outgrowth of photographic technology. Since this technology is being increasingly used to supplement computer systems, strong electronic and photo-electronic influences make it multi-technology dependent. Micrographic technology finds its application not only as a publishing medium but also, as a communication medium, computer output medium, and storage medium. In the past, the use of microform as a publishing medium was limited because of inherent limitations. It may be stated that the widely known field of use for this technology was in connection with archivation and for file and library compaction, in which microforms replace traditional paper publications. Micropublishing for selective retrieval should be seen as user-oriented application in the context of changing information' transfer needs. It involves two separate, but interlinked distribution processes, (i) publication of full content on microforms, and (ii) distribution of retrieval support information (i.e., index, access to database, etc.). This support information is the key to the retrieval. It can be made available on any medium (such as paper, microfilm, magnetic tape or floppy disk) that provides ease of access to location codes for the full information on microforms.

These micro-publications are resources and often essential tools for certain information workers. Their value for the user depends primarily on the human engineering of the retrieval support hardware and software and relevance of information that can be obtained in response to a particular problem. The production process for a micro-publication reflects a dual information flow. The content is either microfilmed or if it is available in machine-readable form, converted directly into microfiche by a COM system. The primary information is inexpensively duplicated and distributed to all those who are in need of it. 1VIicroforms permit (as publication and storage media) compaction, organisation for ease of use and partial or full automation of retrieval. Most important, however, are the economic advantages and the potential for up-to-date complete information supply in a decentralised and user-oriented form. As information transfer medium, microforms exhibit many desirable features suitable for use in IRS Systems with automated retrieval and on-demand reproduction. These computer microforms (CMF) systems offer high on-line storage capacity and economic on-demand publishing capabilities, provided special microforms with high reduction ratios are used.

The new technologies are causing rapid changes. The factors which are having impact are computers, microprocessors, lasers, digitisation of information and screen based technology including television and telecommunications. Some of the aspects relevant to information profession are developments in keyboards, OCR, input to photosetting systems, electronic full page composition techniques, and graphic reproduction. Data capture in machine-readable form is becoming easier with the advances in word processing and direct entry photosetters. Increasing digitization of data makes printing a more systems oriented process.

Self Check Exercise

2) Explain in simple terms the significant features of computer technology.

3) What is the meaning of ‘compunication’?

3) Differentiate between reprography and micrography.

Note: i) Write your answer in the space given below

ii) Check your answer with the answers given at the end of this Unit.

1.6 SUMMARY

The main purpose of this Unit is to introduce to you the concept of Information Technology (IT) and explain its components or ram mitts. To achieve the above objective, an attempt has been made to provide to you, in as brief a mamma as possible, the basic knowledge which an information professional will heed in trying to understand what Information Technology is all about.

It has been mentioned in the text of this Unit that the expression Information Technology is a composite term conveying the convergence of computer, communications, reprographics and micrographics. A succinct description of these component technologies has been provided in this Unit. Since there are going to be separate Units discussing computers and communications basics, only a broad tine of these aspects is included in this Unit. It is hoped that the explanation provided in the Unit and the descriptive account would be helpful to the students of BLIS Programme in. the proper understanding of Information Technology and its relevance to information systems and services.

1.7 ANSWERS TO SELF CHECK EXERCISES

1) The term Information Technology (IT) has different interpretations. For example, Macmillan *Dictionary of* Information Technology defines Information Technology as "the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a micro-electronics-based combination of computing and telecommunications".

   On the other hand, UNESCO defines IT as "scientific, technological and engineering disciplines and the management techniques used **in** information *handling* and processing information; their applications; computers and their interaction with man and machine and associated social, economic *and* cultural matters (Stokes)

   From the first definition, IT is seen as involving the formulating, recording and processing and not just transmitting of information. These are elements in the communication process which can be separated but in the context of *human communication* tend to be intertwined. Secondly, IT deals with a wide variety of ways of representing information. It not only covers the textual (i.e., cognitive, **propositional** and verbalised forms, which we normally associate with information) but also numerical, visual and auditory representations.

   The UNESCO definition mostly emphasises the significant role of computers while not highlighting the importance of communication systems. However, it must be stated that communication systems are as essential to IT as computers. In other words, a mosaic of technologies, products **and** techniques have combined to provide new electronic dimensions to information management. ¸This mosaic is known by the name new Information Technology. It is important to bear **in** mind that Information Technology is not just concerned *with new* pieces of equipment but with mach broader spectrum of information activities.

2) Computers consist of electronic components assembled in a design or architecture that will perform necessary functions of input, outputs computation and control (control of both the computer itself and of attached peripheral devices that perform input and output functions *and* store the files),

   In the past, electronic components were expensive therefore, a minimum number were used in a single processor that alternately used to perform input, processing and output.

   The first major innovation leading to micro-electronics was the discovery of transistors, which used semiconductor materials. The most important development of these today is based on non-waffle element `Silicon'. The next innovation of significance was the development of Integrated Circuit (IC). In the beginning, the ICs were simple, but as the *technology* developed, they rapidly became smaller and more complex. This resulted in the miniaturisation and refinement of computers. A significant feature of micro-electronics is the development of micro-processor, a special form of IC with functions of arithmetic, logic and control, similar to *those of CPU of a computer and contained in a* single chip.

In addition, microprocessor includes units of stored programme to supply memory the information necessary to retrieve instructions and control to send out data as required. The microprocessor is the building block from which modern computer systems are assembled. The microprocessor uses less energy and few environmental requirements of old machinery. The practical significance of this is that it is now possible to bring the computer to the problem instead of bringing the problem to the computer.' The significant aspects discussed earlier form a major hardware component of a computer.

Similarly, there had been significant developments in memory technology. It is now possible that even a small computer system might have cache memory, a small associative memory retaining most recently referenced information and in a readily available place. Memory management, dynamic memory allocation and virtual memory schemes which are generally found in large computer systems, are now appearing on computers which are small and less costly.

There has been a continuous improvement in recording densities on magnetic media. Floppy disks and microfloppies provide a convenient media to store data. The development of videodisk has added a new dimension to the information storage technology. Videodisks could be used to store large volumes of information in digital form. It may be stated that the innovations in storage technology provide a variety of alternatives to choose depending on the speed of requirements.

The importance of software is obvious, since it is the software which applies the power of the computer to solve users problems. The methods by which computer software is produced have changed considerably in recent years with the emergence of `software engineering', which enabled improvements in programming practice, such as structured, or modular programming.

These developments in computer technology enable us to develop efficient information systems and services and help the users in a purposeful manner.

3) The development of communications technology is a symbol of man's effort to communicate rapidly over great distances. Communications technology is older than computer technology. In recent times, it has grown as rapidly as computer technology. These two technologies are now fusing into what Anthony Oettinger has called **`Compunications'.** This newly emergent technology is changing our life: styles as few technologies have before. This new technology has important uses in the home, office, factory, community and in information exchange system and holds prospects of immediate **relevance** to **information profession.** Hence, every information professional must make efforts to understand the nature and role of `Compunications'.,

4) Reprography includes 'Photocopying, microcopying, duplicating and in-plant printing and is characterised by the small scale of its operatives'. Reprography as a term gained ' international recognition in 1963. Reprographic techniques comprise such processes as diffusion transfer, quick stabilisation, diazo, thermography and electrostatography for copying documents. Reprographic technology has been playing a significant role in the dissemination of recorded information and is accepted as one of the means to provide access to document resources geographically located in different places. Document delivery service has largely became possible due to the facilities provided by reprography.

   On the other hand, micrographic technology is an outgrowth of; photographic technology. Since micrographic technology is used to supplement computer systems, strong electronic and photo electronic influences make micrography a multi-technology dependent.

   Micrography finds its application not only as a publishing medium, but also, as a communication medium, computer output medium and storage medium. However, the widely known field of use for micrographic technology is in connection with archivation and for file and library compaction, in which microforms replace traditional paper publications. As information transfer medium microforms exhibit many features suitable for use in ISR Systems, with automated retrieval and on-demand reproduction. Computer microform(CMF) system offer high online storage capacity and economic on-demand publishing capabilities.

1.8 KEY WORDS

Compunications : The fusion of computer and telecommunication technologies into one technology has been defined as compunication by Anthony Oettinger

Information Technology : The science of information handling, particularly by computers, used to support the communication of knowledge in scientific, technical, economic and social fields

Integrated Circuits : A chip on which a number of transistors and their interconnecting patterns on an extremely small scale, formed by photolithographic techniques

Large Seale Integration (LSI) : Generally applied to integrated circuits containing from 100 to 5000 logic gates or 1000 to 16,000 memory bits.

Microelectronics : A branch of electronics concerned with the design, production and application of electronic devices of a very small dimension characterised by very high component packing density

Microprocessor : The single chip equivalent of the central processing unit of a main computer. The microprocessor can be regarded a chip with fixed circuitry but capable of being adopted by any user to meet the needs of his particular application

Processing Technology : An aspect of computer technology which deals with the methods and techniques associated with the processing aspects in a computer.

Storage Technology : A part of computer technology which deals with different storage media used for information storage. The characteristics and attributes relating to different types of digital storage are *discussed* in this area of technology.

Transistor : It is basically a single semi-conductor device on a piece of silicon

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