USE AND IMPACT OF INFORMATION TECHNOLOGY AND COMMUNICATION ( ICT ) IN UNIVERSITY LIBRARIES OF RAJASTHAN STATE:

A STUDY

Submitted in partial fulfillment of the requirement for the award of the degree of DOCTOR OF PHILOSOPHY

IN

LIBRARY & INFORMATION SCIENCE

(2016-2019)

BY

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REF.NO.

UNDER THE SUPERVISION OF MR.

OPJS UNIVERSITY, CHURU

(RAJASTHAN)

2018

DECLARATION

I hereby declare that the thesis work titled “Use and Impact of Information Technology and Communication (ICT’S) in University Libraries of Rajasthan State : A Survey” submitted by me under the supervision of Mr. ………………………for the award of the degree of Doctor of Philosophy in Library & Information Science to OPJS University, Churu, Rajasthan is an original work carried out by me. I also declare that this work has neither been used for any other purpose nor submitted to any other university for the award of any degree.

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Acknowledgement

Any job accomplished in this world is wholly due to the consent of the Almighty, God the most merciful and the most benevolent.

With my grateful heart, I would like to thank my supervisor Dr. ……………..who gave me some drops of knowledge from his knowledge ocean. I thank him for all help and support he gave me throughout the study work.

I fall short of words to express the blessing of my parents and my wife Garima Sharma and my loving son Raghave Bhardwaj who have always been the source of strength and encouragement to me throughout my study.

VIKAS BHARDWAJ

INTRODUCTION

INFORMATION TECHNOLOGY AND COMMUNICATION

CONCEPT

Information Technology is electronic technologies used for collecting, storing, processing and communicating information. There are two main categproes-those which process information (such as computer systems) ; and those which disseminate information (such as telecommunication systems). IT has a wider connotation for librarians which include in addition technologies like, repro-micrographic technology, technical communication technologies; and database creation and use.

The term ‘Information Technology’ is widely used in UK, USA and India; ‘Telematics’ is used for the same in France and ‘Informatics’ is widely used in Russia and other socialist countries.

SCOPE

Dr. S.S. Murthy says that Information Technology is operative in the following environments:-

1. **Library management –** Classification, Cataloguing, Indexing, Database Creation, CAS, SDI, etc;
2. **Library Automation-** Organising databases and automating library housekeeping operations;
3. **Library Networking-** Resource sharing and information dissemination;
4. **Reprography**- Photography, Microfilms, Microfiche audio and video tapes, printing, optical discs, etc; and
5. **Technical Communication-** Technicalwriting, Editing, publishing, DTP systems, etc.

Jennifer Rowley outlined the following four areas of Information Technology:

1. Methods and tolls for recording of knowledge- Computer storage media (such as magnetic tapes, discs, etc.); optical storage media (such as CDs); and products like full-text databases, etc;
2. Methods of keeping records – Computer hardware software designing, creating and editing databases, etc;
3. Methods of indexing documents and information – Computerised indexes and index files; large machine readable catalogues, network of libraries; and
4. Methods of communicating knowledge – Electronic mail, facsimile transmission, electronic journals, teleconferencing. And data communication networks.

**IMPACT OF INFORMATION TECHNOLOGY AND COMMUNICATION**

The InformationTechnology has a wide ranging impact on library and information work.

**THE ELECTRONIC LIBRARY**

The Electronic Library is a store-house of information, documents, audio-visual and graphic materials stored in a variety of media ranging from printed books, periodicals, posters and reports, microforms, slides, films, videos, audio discs, audio tapes, optical discs, magnetic tapes, floppy discs, etc. Electronic Library of the future is likely to be part of a network, In theory, it is only necessary for one electronic copy of a document to be stored in the whole world. A world electronic library would be a possibility.

An electronic library deals with both house-keeping operations lime acquisitions, catalogue creation, circulation control, serial control. Online Public Access Catalogues (OPAC) and the generation of management information; and information retrieval systems like external databases and associated services and products and internal or local databases and their associated services and products. The associated services include Current Awareness Services (CAS), Selective Dissemination of Information (SDI), etc.

Online searching of external databases has been available since the early 1960s.

**THE ELECTRONIC OFFICE**

Offices are also concerned with information storage and retrieval. Hence, ITC is widely used in offices. An office is a place where people read, think, write and communicate. A number of devices were introduced in offices. For example, the word processor was seen as a substitute for the typewriter; and computers are used for filling of records. The new technology affected the organization and nature of work in offices. New technology has freed office work from its focus on the flow of paper between people and allowed the focus of activities to shift to the transaction recorded in the computers and the people making decisions and performing various tasks. It enabled faster decision making, elimination of redundant work and better utilization of human resources.

**COMPUTER TECHNOLOGY**

**BRIEF HISTORY**

The history of computers dates back to 5000 BC when the first calculating table called ‘abacus’ was designed by the Chinese to aid in calculations. Later it was also used by Greeks and Romans. This device is still used in some parts of middle East, far East, India and China in schools for teaching mathematical calculations.

In 1617, John Napier, a Scotish mathematician published a work describing methods of performing the fundamental operations of multiplication and division by means of ‘rods’. He derived a set of II rods, each having 4 faces. These rods have numbers marked on them in such a manner that the products and the quotients of large numbers can be obtained by simply placing them side by side. This technique is used with original data tables.

The French scientist-philosopher Blaise Pascal constructed a digital calculating machine in 1642. Which resembles a modern desk-calculator. This machine was limited to the computation of additions and subtractions. Multiplications and divisions were done as a series of additions and subtractions respectively.

A German mathematician Gottfried Von Leibniz invented a more advanced machine for purposes of additions I 1694. It was called ‘Stepped Reckoner’. This machine could be used to multiply, divide and calculate square-roots. Its working model was available in the market in 1694. But it proved unreliable. Amore reliable model came into market in 1820.

Charles Babbage of UK first conceived of the ‘Difference Engine’ and ‘Analytical Engine’ in the early 19th century, as automatic devices to perform a sequence of operations. He could not have visualized the phenomenal development that were to take place I the following century and a half. In fact, Babbage did not even succeed in completing his machine. But his ‘Analytical Engine’-a prototype computer which was 100 years ahead of time, is best known for two innovations-one was, the ‘conditional transfer’ which permitted the machine to compare quantities and depending upon the result of comparison, branch or jump to another instruction or sequence of instructions; and the second feature permitted the result of calculating to change other numbers and instructions previously set into the machine. This made possible for the machine to modify its own programme. It is worthy to note that even today’s computers are built around the same concepts.

The first successful punched card data processing equipment was developed by Herman Hollerith for the US Bureau of Census in 1880s. The same technique was used as basic data input medium till recently. He also developed a machine named ‘tabulator’ for processing data stored on punched cards. His intentions had significant impact on the future design of computers.

Howard Aiken of Harvard University in association with IBM engineers developed a fully automatic calculator called “Automatic Sequence Controlled Calculator (Harvard Mark-I) in 1944.’ Earlier to this, in Germany Konard Zuse is known to have developed the Zuse 23 computer in 1941. But little is known about this machine.

The first truly electronic computer was the “Electronic Numerical Integrator and Computer (ENIAC)” Designed by Mauchly and Eckert and completed at the University of Pennsylvania in 1946-1947. ENIAC employed electronic component, unlike the electro-mechanical components used by MARK-I, UNIVAC-I By the same designers became the first commercially available computer in 1951. Since then, there have been many developments in computer technology.

**GENERATIONS OF COMPUTERS**

The term ‘generation’ is used to distinguish computers by developments in hardware and to some extent in software. The various generations also represent the chronological developments in computer technology.

**Generation the Period Period Length of Technology**

1st generation 1946-60 about 15 years Vacuum Tube

2nd generation 1960-64 about 4 years Transistors

3rd generation 1965-70 about 6 years Integrated circuits

4th generation 1971-85 about 15 years Large scale integrated circuits and

very large scale integrated circuits

5th generation 1985- work in progress Artificial Intelligence

**CLASSIFICATION BY SIZE**

During 1960s computers were classified into two categories- Mini and Mainframe (including Super Computer). With the coming into market, the Personal Computers in 1975, we have the following 4 categories mostly by size:-

Personal Computers

Mini-Computers

Mainframe Computers

Super Computers

Personal Computers are of 4 kinds by the technology used in their manufacturing. These are:-

1. Personal Computers
2. Personal Computer- Extended intermediate technology (PC-XT)
3. Personal Computer- Advanced Technology (PC-AT)
4. Personal Computer- Super advanced Technology

Mini-Computers are smaller than Mainframes, but are larger enough to require and-alone components. They support several terminals and printers which can be located at different places.

Mainframes are the earliest electronic computers which were large and very expensive. They were very slow as well. In the early days of computing all were mainframes. Mainframes of the present day employ a new design philosophy known as parallel processing whereby operations are performed in parallel, i.e. simultaneously; rather than sequentially.

Super Computers today do not link the computer with one input or output system instead they support as many as hundred or more separate keyboards or screen stations.

**ADVANTAGES OF COMPUTERISTION**

Computers provide the following advantages to librarians and information specialists, like for any other:

1. Large data can be handled with ease and accuracy
2. Operates at a great speed and promptness
3. High rate and better quality in performance
4. Labor saving
5. Cost effective
6. Ease in functioning
7. Avoids/eliminates duplication of work
8. Greater manipulation possible

**COMPUTER KINDS BY PRINCIPLE OF WORKING**

1. Analog Computers accept information for processing in physical form in terms of weight volume, electric current, etc. Analog computers are usually built to satisfy a particular requirement. These computers are mostly used for scientific work. They are unsuitable for library requirements.
2. Digital computers accept information in a unitary form Letters, symbols and numbers. These may represent anything the computer user wishes. These are general purpose computers suitable for information processing.
3. Hybrid Computers are built using the good qualities of the both-the digital as well as analog computers. In such computers certain calculations are done in the analog portion and certain in the digital portion.

**MODE OF PROCESSING**

There are three ways of processing information by computers:

*Batch Processing* – This is a method in which the data are accumulated and processed on after another by the computer, so that, there is a linear flow through the system. There is no direct access to the computer.

*Real –Time Processing* – In this a user sits at a terminal and has a direct communication with the computer. A programme controls the processing of data already on file for transmission back to the terminal. This is also called as online processing.

*Remote Job Entry Processing –* This is a system in which online and batch processing are linked together. As online terminal is used to enter a job into the queue of jobs to be batch processed by the computer.

**HARDWARE**

The physical tangible component of the computer system is known as hardware. Broadly speaking, hardware has two main parts :

1. **Central Processing Unit (CPU)**
2. **Input/output Devices**
3. **CENTRAL PROCESSING UNIT**

Central Processing Unit (CPU) – Is a part of computer in which instructions are interpreted and executed.

1. Arithmetic Unit – The portion of the CPU that performs computations.
2. Control Unit – A device that serves as an interface between channel commands and secondary storage of peripheral devices.
3. Memory – Is a temporary storage. If the power is turned off, everything in it is lost. There are two types of memory : Random Access Memory (RAM); and Read Only Memory (ROM).
4. **INPUT / OUTPUT DEVICES**
5. Keyboard resembles a typewriter, which has many keys, used for inputting the data to the computer. The special keys of a computer keyboard includes Cursor movement keys, editing keys, numeric keypad, Esc (escape). Alt (alternative) and Ctrl. An alternative to keyboard is a pointer device called a mouse. There are other input /output systems like Touch – Sensitive – Displays and Voice Recognition Systems, etc.
6. Display devices include Visual Display (VDU) simply addressed as ‘screens’ or monitors. These are either cathode ray tubes (CRT) or liquid crystal display (LCD) systems which function like television sets.
7. Printers are used to produce a permanent visual record on paper. There are different kinds of printers like Dot-Matrix Printers (DMP), Laser printers, Daisywheel, Inkjet, Thermal, etc.
8. Other Peripheral devices have been introduced to reduce the human intervention to capture data from the source and store it in the computer memory for future use. These include Scanners, Bar-Code readers and Plotters.
9. Data Storage Devices – Main memory is not always large enough to store all the data necessary for a particular application. The auxiliary storage or secondary storage devices are used to store the additional data. These devices include Magnetic tape, Magnetic disks, Floppy diskettes, Hard Discs, Optical Discs (Video discs and compact discs – ROM (Read Only Memory); and WORM (Write Once and Read Many); and Rewritable).

**SOFTWARE**

Computers are to be instructed as to ‘What is to be done’. These instructions are to be given in a sequence, in a language understandable to the computer hardware. Such instructions are called “programmes’. The programs are also called as “Software”. Basically there are two types of softwares:

1. Systems Software; and
2. Application Software

**SYSTEMS SOFTWARE**

These are programmes which control the hardware and co-ordinate the running of various applications. There are 3types of systems software’s :

1. Operating Software
2. Utilities software; and
3. Language Translators

**OPERATING SOFTWARE**

OS is a software that manages the general operation of the computer resources, bringing programme into main memory, etc.

OS can be ‘System Specific’ or ‘Generic System’, i.e. Specific to a computer system (Which cannot be used on any other computer); or those that can be used on a variety of different computers. The former, thus, are those developed by computer manufacturers and are coustom-designed (e.g. , APPLE); and the later developed by software houses (e.g., CP/M; MS-DOS, UNIX, etc.).

CP/M for 8-bit computers

MS-DOS for 16-bit computers

UNIX for multi-user systems.

**UTILITIES SOFTWARE**

These are general purpose programmes for performing common data-processing tasks like sorting a file into alphabetical sequence, etc.

There are several types of utility programmes. Important of them are; disk utilities, text-editors, and device drivers.

**Language Translator (Compilers and Interpreters)**

Compiler is a software that translates a programme written in human oriented language into the machine language that the computer executes directly. Every programming language requires its own special compiler.

Interpreter reads, translates and executes some programmes one line at a time. Thus, the translation into the machine language is performed while the programme is running.

**Programming Languages**

These are the languages which we use for communicating with computers. There are four types of programming languages- Low Level Languages; Assembly Languages; High Level Languages; and Very High Level Languages.

**Low Level Languages**

These are also called as machine languages or machine codes. The machine is able to understand instructions or data only as a string of binary codes. Binary codes consist of Is 0s. Some programmes are written in decimal codes. The set of instructions written in binary or decimal codes is called low level Language.

**Assembly Languages**

Assembly code languages make some concessions to the programmer in that they are mnemonic literal sequences to designate machine codes and to reference storage locations. Generally, on machine language statement during the translation produced for each assembly language statement during the translation process.

A translator that accepts assembly language as input and produces machine language as output is called Assembler.

**High Level Languages**

A language closer to English than assembler language that, when translated, produces many machine language instructions for each input statement. They consist of symbols and word. Many of the languages have just slight variations.

Some of the prominent examples of high level languages are COBOL (=Common Business Oriented Language); FORTRAN(=Formula Translation); PL/L (=Programme Language 1); PASCAL, etc.

Instructions in high level languages are translated into machine code instructions by programmes called “Compilers” or “Interpreters”.

The original programme written in a high level language is called a ‘Source Programme’ and its translation in machine in machine language is called the ‘Object Programme’.

**Very High Level Languages**

The Very High Level Languages are also called as ‘Fourth Generation Languages’. These are earliest to use. There are 6 types of fourth generation languages : Report Generators; Retrieval and Update Languages; Decision Support System Tolls; Graphics Generators; Applications Packages; and Applications Generators.

**SOFTWARE PACKAGES**

In many instances, it is advantageous to choose a commercially available package, since it is too costly to write a local software package or to commission someone to do this. Following are some of the library software packages commercially available in India :

**S.No. Package**

01 Ultra Catalogue System

02 Bibliographic Retrieval

03 Computerized Library

04 Madras Management Soft. (CLMS)

05 Software for Automation of Uptron India Ltd.

06 Library Info. Mgmt. (SALIM)

07 Library Manager- Systems Data Controls Ltd,

08 Integrated Library Pragati Computers Pvt. Ltd.,

09 Ulysis Wipro Info. Tech. Ltd., Secunderabad

10 Libman Datapro Consultancy Services, Pune

11 Libsys- -Libsys Corporation, New Delhi

12 Library Management –U and I Soft. Pvt. Ltd.

13 Archives Minifax Elec. Systems P. Ltd, Mumbai

14 Soul – INFLIBNET, Ahmedabad

15 KOHA-Open Source Software, Katipo Communication, New Zeland

**APPLICATIONS SOFTWARE**

Application Software refers to the class of programme designed to make end users better at performing tasks that would otherwise have to be done manually. The common applications software available in the market for the most common uses are :

1. Word processors
2. Spreadsheets
3. Database Management Systems
4. Integrated Software Packages
5. Graphics Packages
6. Desktop Publishing Packages
7. Statistical Packages
8. CAD Software
9. Decision Support Systems
10. Games
11. Expert Systems, etc.

**TELECOMMUNICATION TECHNOLOGY**

**TELECOMMUICATIONS:**

**COMMUNICATION**

Telecommunication is the transmission of data over a network by means of an electrical or optical channel.

The fundamental objective of a communication system is the exchange of information between two points-a source and a destination. A simple communication model would therefore comprise- The Source; Message; Encoder (that transforms the information into signals); Transmitter; Medium (of transmission); Receiver; Decoder (that reconverts the signals into information); and the Recipient.

**SYSTEMS**

Communication through written symbols is known to have been in practice since 4000 BC . Invention of printing by movable types by Gutenberg in the 15th century was a revolution in communication.

**Telegraph**

The first serviceable telegraphic device was invented in 1792 by a French Engineer Claude Chappe. The first practical electric telegraph was produced in 1837, by Cooke and Wheatstone in England.

**Telephone**

Alexander Graham Beel invented tha telephone in 1876. The first telephone exchange was set up at Connecticut in 1878.

**Long Distance Communication**

In order to provide long distance communication various telephone exchanges were linked together. With the increase in distance, the voice was reduced to almost inaudible. To avoid this, the operators were to repeat the message. In 1920 electronic repeaters were introduced. In 1930, new equipment was introduced, which could transmit various messages simultaneously through a couple of wires running through various towns.

**Satellite Communication**

**1965** heralded a new era in communication with the orbiting of ‘Early Bird’ telecommunication satellite by the United States.

**MODE OF TRANSMISSION**

Computers handle data in the form of binary digits or bits. The data transmitted or received are also in the form of bits. These bits are to be translated or assembled, and this is achieved through what is called the ‘timign modes of transmission’. There are two modes namely, Asynchronous and Synchronous modes of transmission.

In asynchronous mode, each character of 8 bits is transmitted as small block or a logical unit, There will be an idle time between the transmissions of each block and therefore it is relatively slow.

In synchronous mode also, characters are set as blocks and there is a counting or timing mechanism which recognizes the first eight bits transmitted as the first character, the second eight bits as the second character and son on. The data is transmitted at a fixed rate. It is faster than the other mode. Any faulty bit would result in the complete distortion of data.

**SIGNALS**

The type of signals into which the information is to be transmitted is to be encoded depending upon the transmission medium used. For instance, it may be electrical impulses for transmission through a cable; microwave signals for microwave and satellite transmission; or light waves for transmission through an optical fiber.

**TRANSMISSION MEDIUM**

The media used for transmission can be broadly categorized into two; viz. bounded media and broadcast media. In bounded media, the source and recipient are to be physically attached in some permanent or semi permanent way. The major ones of this category are: Twisted wires/ cables, coaxial cables and optical fibers. Broadcast media rely on free space propagation of the transmitted signals. These include microwave and satellite systems.

**MEDIA MODE**

There are several techniques of data transmission. The cables connecting terminals to a computer can be categorized as simplex, half-duplex and full –duplex channels.

Simplex : Data transmission in one direction at a time .

Half-Duplex : Data transmission in either direction, but only one way at the same time.