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From Cave Paintings to Virtual Web-based Information Resources: Expedition of Library Collection Formats

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Abstract

The study confers the trends in information storage mediums offered by libraries i.e. collection formats to bring to light the development and advancement in the formats of collection from cave paintings to the virtual web-based information resources. In the beginning, information storage formats tend to be crude and rough in response to the available demand for information as well as the technique available, to store and preserve information that ultimately were most apt to the libraries rationale in that particular era. However, with the passage of time a progression of incessant transformations together with latest technology inputs transformed the formats of collection besides adding a range of features to the contemporary formats. Moreover, with the advent of information technology (IT), particularly web-based technologies revolutionized the idea of collection formats and paved way for novel format known as e-resources that require information and communication technology (ICT) based gadgets for access. Consequently, at present the e-resources particularly web-based resources have changed libraries from gateways of owned collections to casement on the global intellect and acquaintance for better communication of ideas and information among library uses. The haul-up of the simple collection formats was imperative to carry on with the resourceful information requirements of the extensively tech-savvy library users.

Keywords: *Library, library collection, formats of collection, cave paintings, clay tablets, print collection, e-resources, web-based resources, ICT*

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INTRODUCTION

Since the very inception of civilization humans by means of their great potential of intellect, wisdom and mind have been enough competence of mastering their situations. Through the times amid the development of thoughts, increase of the experiences and minuteness of observations, the knowledge has been emerging considerably beyond any limits [1–3]. All through the past, man has sought numerous different ways not only to acquire but also to preserve the knowledge [1]. Thus, since early period man has been very conscious about the importance of recording, storing as well as preserving information. In view of that, man had been constantly developing methods for recording his experiences and ideas through various means of information storage mediums according to the availability of materials and the requirements of society at a particular juncture of the human history [1–2]. In this context, the most significant landmark in man's cultural development is the invention of writing. Beginning with this landmark, various cultures began to advance from strictly oral customs to written ones [4].

Consequently, humans from beginning attempted many ways and means to record as well as preserve every piece of information, knowledge and ideas to be disseminated to future generations to come. In this endeavour, many evolutions took place in the forms or formats of the information storage medium from time to time in order to make information recording, storing, preserving as well as retrieving much easier. Based on the evolution of information storage mediums, the formats of the collection can be divided into following three eras:

1. Preprint era,
2. Print era,
3. Modern/Electronic era.

METHODOLOGY

A cavernous scrutiny of literature is done in an endeavour to highlight the trail of developments in collection formats. Various search terms like "library", "collection in libraries", "writing material", "printing", "ICT", "e-resources", etc. were used for recouping the literature from a realm of online scholarly databases, search engines and related web resources.

Preprint Era

This era is the landmark in the evolution of writing systems that includes both, writing (development of various scripts) as well as materials for writing information storage mediums). During this period for the aim of recording events and communicating ideas, man began to use naturally available materials, which were generally obtainable without many problems. A number of these materials were long lasting and durable. The factors that might be responsible for the changes and developments in writing materials may include preservation, easy accessibility and portability. The same is evident from the fact that even the crudest writing could be preserved on materials such as stone, on the other hand the classiest, writing on materials such as papyrus would deteriorate much easily [1]. As a result the writing materials developed as per needs and techniques during that period were natural and included bark, leaves of trees, skin of animals, wooden lintels, adobe, bricks, shells, semi-precious stones, silk, bone, ivory, murals, ceramics, clay, metals and paper were used. Hard stone was probably one of the best means of preserving message although some non-corrosive metals such as gold have also been valuable to this extent [5–6]. Consequently, the writing materials evolved during this era can be grouped under the following headings.

Cave Paintings

Since the point in time man became mindful about the need of communication, they started to discover ways for the same that led to the innovation of writing system. However, the earliest writing systems commence with miniature images used in place of words, literally illustrating the thing in question [7]. For the period of the upper Paleolithic, 30–40,000 years ago, humans started by drawing graffiti and paintings on rocks and walls of caves [8–9]. Cave painting is the most general and best-preserved form of Palaeolithic art [9]. The oldest ones were prepared about 35,000 years ago [10]. Because drawing paved the way for writing, the foremost remnants of writing materials are the stone walls of the caves on which the renowned images were drawn [11]. Consequently, it is apparent that the rocks were the earliest writing material used by the primitive races in order to explain some recognizable matter or to convey information to passerby [5]. Although, researchers don't have much confidence about the genuine intention of cave paintings, however, it is assumed that they could have been part of magical rites, hunting rituals, or an effort to mark the events during diverse seasons. Further, a dissimilar presupposition is that cave paintings (especially the more realistic ones) may fundamentally be demarcation of the surrounding world [8, 10].

Tally Sticks

Amid further development in civilization, human necessities keep on developing. Therefore, another predecessor was 'tally sticks' that are ancient mnemonic device (memory aid) to record and document numbers, quantities, or even messages for the period of 5000 BC. [6, 12]. These appeared initially as animal bones carved with notches, in the upper Paleolithic age [13]. Although the origin of this technique is vanished in prehistory, but archaeological evidence of the existence of such devices is sufficient [12]. One of the most notable example is the famous ancient artifacts is the Ishango bone [12–13]. Historical reference is given by Pliny the Elder (AD 23–79) about the best wood to use for tallies, and by Marco Polo (1254–1324) who mentions the use of the tally in China. They have been used for several purposes viz.; messaging and scheduling, and principally in financial and legal transactions [13].

Clay Tablets

As soon as men were enough capable of giving exhaustive expression to their ideas, they began to think of alternative writing system which possibly will be able to cater their newly developed needs; like easy to use and carry, convenient to write and ready

availability of material. At that point of time, instead of making inscriptions on rocks, they started writing on tablets of various kinds of materials viz.; soft stone, clay, wood, lead and some kinds of metals soft stone with a pointed tool, called a stylus, made of iron or other metal [1, 5]. However, among all materials clay brought in the useful combination of tremendous ease of making the inscription with the potential for rendering it permanent [6]. Since, it was the most readily obtainable and thus the cheapest material for writing purposes [14]. Based on the available literature this era began between 3100 and 3500 BC in Mesopotamia [15–16]. It is awfully well assumed that the Sumerians were the former people who developed the writing system known as "cuneiform", which is considered the oldest system of writing [3]. Because the historic records reveal that, the earliest, written documents are in Sumerian language [2–3, 17]. Since the first libraries of which there is any real proof are the clay-tablet repositories of Sumerians and clay-cylinders collections of Assyrians. The earliest was discovered in the ancient city of Urk or Eresh in lower valley near Euphrates River [18]. In about 3200 BC, temple officials in Sumer developed a reliable and lasting method of keeping track of the animals and other goods, which were the temple's wealth [19]. They used to write on wet clay tablets upon which they created impressions by means of an arrow shaped tool of metal [2, 5]. When allowed to dry hard in the sun or baked in ovens the clay tablet became a permanent document [5]. Thus, Sumerians used cuneiform alphabet, pressed in clay with a triangular stylus, which were dried and/or fired for longevity [5, 2]. Further Babylonians and Assyrian also adopted the similar idea of Sumerian writing system with difference in script/language [5, 2–3]. With the course of time the use of stone and clay tablets was pursued by the simpler and more opportune metal plates of different kinds viz.; lead, copper, brass and bronze. Among them lead was used in very early period. Pliny states that, "the public acts of the most remote nations were recorded in leaden books". On the other hand, brass and bronze were the materials that both Greeks and Romans used [20]. However, these materials were not much convenient for sending and storing messages because of some limitations viz., they were much costlier, rare and difficult to transport because of their weight. Moreover, it was not easy to inscribe on these surfaces.

Papyrus

The second civilization to develop writing, soon after the Sumerians, is Egypt [2, 21]. By the point in time as the ancient Egyptians moved from prehistory to history by developing a written language, they discovered the necessity for a medium other than stone to transcribe upon [2–3, 22]. Although the clay-tablets proved to be suitable material for writing, however it suffered from many limitations, as it could be easily broken or if it comes in close contact of water, the data would be lost forever, etc. So in order to overcome these limitations another writing material came into existence known as papyrus. Papyrus is an early form of paper made from the pith of the papyrus plant that was once abundant in the Nile Delta of Egypt. Around 3000 BC, in Egypt, people began making a flexible smooth surface, which will accept and retain ink without blur or smudge [21]. The dry atmosphere of Egypt had been particularly positive for the preservation of these documents; in many instances, they stayed unharmed by decay and are as original as when first written [5, 22]. Further, the general use of papyrus as an ancient writing surface is confirmed by early writers and by numerous documents and sculptures [5]. As papyrus was convenient to use and carry, it continued to be the most acknowledged writing surface for centuries, which was also used by Greeks and Romans [23]. Papyrus persisted to be used to some extent as a writing material in Europe until the tenth century but by the twelfth century it had completely disappeared [5].

Bamboo Books

An aboriginal plant in China, the bamboo, prove as a suitable writing material as papyrus in Egypt [21]. In China, early books were made from bamboo strips, which were bound together so that they could be rolled like a sushi mat or folded and stacked ("The Medium of Early Books," 2012, Bamboo Books) [23]. Therefore, bamboo and wooden slips were one of the main medium for literacy in early China

[24]. Literature reveals that bamboo books survived from as early as about 400 BC [21]. The most primitive surviving examples of wood or bamboo slips date from the 5th BC during the Warring States period. Yet, references in earlier texts existing on other media make it apparent that some precursor of these Warring States period bamboo slips was in use as early as the late Shang period (from about 1250 BC). Bamboo or wooden strips were the standard writing material during the Han dynasty and excavated examples have been found in abundance [24]. Since, bamboo books were often too weighty to carry effortlessly, the Chinese began painting ink on silk with a piece of horsehair. The silk was stored on a scroll, which made it easier to transport ("Medium of early books", 2012, Silk) [25].

Wax, Leaves and Wood

Subsequent in importance to papyrus in Greece and Rome was the wax tablet [26]. A form of writing material, which had a continuous existence from ancient times right through the Middle Ages ("The waxed tablet,"2007) [26]. Therefore, Greeks and Romans were the people who found at an early period that plain wood boards covered with wax (wax tablets), served excellently for writing purpose. Consequently, wax tablets were produced to make available a portable and reusable surface for writing. These were created by pouring wax into a wooden frame and written on with a stilus [5, 20, 28]. These tablets were habitually laced together in sets in the form of a book [5, 26]. The two outer leaves had wax only on the inside, while the interior leaves were double sided [26]. Accordingly, in ancient world these were considered as renewable notebooks [29]. Because when the writing was not needed to any further extent, the wax was heated and melted back to a smooth state so that it could be used again [26, 30].They were generally employed for memoranda, accounts, school exercises, correspondence, literary composition, and legal documents [5]. However, writing by engraving in wax required the application of much more heaviness and grip than would be required with ink on parchment or papyrus; moreover, the scribe had to lift the stilus in order to change the direction of the stroke [27]. Therefore, writing on this material became a cumbersome job, which lead to the invention of alternative writing materials. Wax tablets continued to be used to a limited extent in Europe until the fourteenth or fifteenth century [5].

Since, scribes in all civilizations, are proficient at making use of local materials [28]. So, among other materials used by ancient people for writing, the most general were the bark of trees, and leaves, predominantly those of the palm [5]. As, the flat surfaces of leaves emerge to be excellent base for writing, and the Egyptians are believed to have been the former who wrote on palm leaves [29, 30]. Further, some eastern people used the leaves of the banana and cocoa trees; in fact the type used largely depended by what grew in the locality [20]. In eastern civilizations such as India, the principal writing medium from the time of Christ was bark of trees most commonly birch bark or *bhurjapatra* (Sanskrit) [31]. In fact, the Latin word for bark, liber, came to mean also 'book' [5]. Although, at present their use is almost abandoned but still birch bark and palm leaf continue to be used even today on a limited scale in a rural milieu for the use of horoscopes, wedding invitations and other cultural uses [31].

Parchment and Vellum

Papyrus remained to be most valuable information storing medium yet, it too had several problematic qualities viz.; it not only did turn brittle with age, but it also hastily deteriorated under the humid environment that existed outside of the desert. Further, most papyrus only grew in the Nile region of Egypt, which gave Egyptians almost complete control over this resource [5, 32]. So, in order to overcome these difficulties, during the 2nd century BC people in the region of the Mediterranean, began using a much more expensive alternative to papyrus called parchment [33]. The word parchment is derived from Pergamum, the name of a city in Mysia, where it is said, the material was first used [5, 20, 33–34]. It is a fine writing material prepared from the skins of sheep or goats, which steadily superseded papyrus because of its various advantages [5, 31–32]. Although it is a form of leather yet ordinary

leather has been sporadically used for writing purposes since about 2500 BC, but only one side can be written on. With parchment both surfaces are treated and rubbed until smooth, to form a flexible double surface to write upon [33–34]. Another form of parchment known as vellum, a word that is used slackly to represent parchment and particularly to mean fine parchment [5]. However, more exactingly it refers to parchment prepared from calf's skin, or sometimes from kids and dead born lambs (although goat skin can be as fine in quality). The words *vellum* and veal come from Latin *vitulus*, meaning *calf*, or its diminutive *vitellus*. In the middle Ages, calfskin and split sheep skin were the most common materials for making parchment in England and France, while goat skin was more common in Italy (Parchment). Consequently, parchment replaced papyrus as the primary writing surface in the Western world by the 4th century CE [32, 35]. Because it was, the preeminent writing material known to the ancients, owed to its various advantages over papyrus and other writing materials. This could be endorsed to the facts, that it was exceptionally durable, could be written on both sides and had the advantage of being greaseproof, so ink could be erased and the parchment reused [32, 34]. An erased parchment, which is then reused, is called a palimpsest [32]. Thus, from the 4th until the 15th centuries it remained the standard writing surface of medieval European scribes. Further, as parchment is sturdy and flexible enough for separate pages of a manuscript to be sewn together down one side, to form the spine of a book, this lead to the development of codex form [33]. The term codex, which originally meant the trunk or stem of a tree, was applied to the wax lined wooden tablets but the name was given as well by the Romans to the folded parchment volume [5]. The codex was the early look of what we know as a book i.e., pages bound together. Papyrus codices date from the first century AD and by the fourth century AD codices (of papyrus or parchment) had superseded scrolls as the most preferred reading devices. As, codex users appreciated the format over scrolls, for the same qualities the books are valued today i.e.: portability, ease of finding your place, and the ability to write on both sides of the page [36]. However, despite of good qualities, parchment too suffered from certain limitations; like it is denser than papyrus, making a volume heavier than its papyrus equivalent. In addition, the pages have a tendency to curl. Moreover, it was always expensive [34].

Paper

Although humans have documented on various surfaces such as cave walls, tree bark, stone, clay, wood, wax, metal, papyrus, vellum, and parchment. However, scribes/printers were persistently searching for innovative materials since many of these surfaces were not sufficient. For example, cave paintings, in which pictures were drawn on cave walls, were not possible to transport and difficult to see without light. Papyrus (compressed sheets of Egyptian reed stalk), as well as vellum and parchment (the prepared skin of cow, lamb, goat, and sheep), were high in cost and deteriorated quickly. Clay, that dries fast, was difficult to use [37]. Thus, the breakthrough in the evolution of writing material was the invention of paper, which was evolved as result of many factors mentioned above, besides following viz.; non-availability or less abundance of raw materials, limitations suffered by other materials etc. Therefore, to overcome the difficulties people began to think of more appropriate writing material. The credit for invention of paper goes to China where it actually originated. In China, generally, bamboo was used as a writing material, however they were very heavy and uncomfortable to transport. Although silk was occasionally used, but was usually too expensive to consider [38]. Consequently, Chinese set out to make a new material, the product being paper which was developed around 150 AD [26, 39]. The invention of paper made of vegetable fibre is endorsed to the Chinese court official Ts 'aiLun, who illustrated the contemporary technique of papermaking in 105 A.D. He was the first person who brought up the method to make paper out of cotton rags, bark, hemp and old fishnets [5, 26, 38]. The Chinese made the art known to the Hindus, the Persians, and the Arabs [5]. The technology was first exported to Japan in 610. After mercantile trades, the innovation spread to the Middle East, where it was adopted by the Indians and subsequently

by the Italians in about the 13th century [38]. Eventually it became available to the rest of world. The innovative writing material paper has numerous advantages over former ones viz.; it is much thinner and more flexible than papyrus or parchment, much more adaptable to methods of large-scale production [39]. Further, besides a lot more convenient material for writing; it is cheaper as well as easy to store and transport.

Print Era

This era modernized the technique of information storage, preservation and dissemination.

Since, all through the history, record keeping has been a fundamental part of human civilization. Record keeping, which lets humans to store information physically for present as well as for future thought, has highly developed with technology. Accordingly, developments in material science improved the writing surface of records, advancements with ink improved the durability of records, and most imperatively printing technology increased the speed of recording beyond imagination as compared to early times [37]. Although before the invention of mechanical printing technology, people used to record and write documents manually. For that reason, books had to be copied by hand, which was a sluggish, painstaking process that could take more than a year for each book. Moreover, the scribes copying them often made errors. As a result, very few books were published, and that too were available only to monks and scholars [38–41]. However, with the passage of time knowledge tends to increase continuously without any bound, which further aggravated the situation. Therefore, people began to think of solution to tackle the situation efficiently. All this lead to the invention of printing technology and one such printing technology is the printing press, which is considered one of the most important inventions in history. Because for the first time mass production of text became possible; this in turn influenced human communication, religion, and psychology in numerous ways. Moreover, most significantly it played an important role in promoting literacy among the masses [37, 42]. It was developed based on early principles of printing, and it has undergone many modifications over the years to meet the needs of people in different eras [42]. The history of printing dates back from T'ang Dynasty when Chinese developed wood block printing. They began printing on paper in the 7th century, and created the earliest dated printed book known as "Diamond Sutra", printed in China in 868 CE [42–43]. This led to the printing of the first full-length book and a few other enhancements in the movable type printing which was invented by Pi Sheng in China around 1040 [42–44]. This printing machine used movable metal type pieces to generate prints, and it made the procedure of printing more proficient and flexible. However, since it was made of clay, it broke easily. Consequently, in the 13th century, the Koreans formed a metal type movable printing device, which applied the typecasting technique that was used in coin casting [42–43]. By the middle of the 15th century, quite a lot of print masters were on the threshold of perfecting the techniques of printing with movable metal type. However, the first man to make obvious the viability of movable type was Johannes Gutenberg (c.1398–1468) [45]. Thus, when German craftsman invented the first printing press in 1440, referred to as Guttenberg press after the name of its inventor, the printing world was modernized and certain industries were given the prospect to print a variety of media more effortlessly and promptly [44]. By 1450, the Gutenberg printing press was in full operation, printing German poems. With the financial support of Johann Fust, Gutenberg published his 1282 page Bible with 42 lines per page. This bible, more generally known as the Gutenberg Bible and was considered the first mass-produced book in history because 180 copies were printed [37]. Over the late 1400s and early 1500s, the technology diffused from Mainz to cities across Europe [46]. William Caxton first brought the printing press to England. In 1469, Caxton learned how to use the press in order to sell books to the English nobility [37].

Gutenberg's printing press led to a significant increase in the number of print shops all over the Europe. However, as the demand for printed materials increased over time, there was a need for a printing press that could

produce higher quality prints at a faster rate [42]. In America, printing technology was brought approximately two centuries later [37]. Subsequently printing technology slowly and steadily spread throughout the world with constant modification to meet the growing needs of user in a more enhanced and accurate way.

To sum up regarding the impact of printing technology, printing press brought global revolutionary changes in the literary field, which directly or indirectly led to improvement of society in one way or the other. Since with the invention of printing press, scholars and intellectuals are able to record their ideas more easily, conveniently and particularly with less errors. As a result, more and more information began to generate and disseminated at much quicker pace than ever before, which lead to new inventions and discoveries that ultimately facilitated the improvements in all aspects of life. Accordingly, it transformed the approach through which information was archived, preserved as well as disseminated by knowledge institutions like libraries. For instance over the manuscript era people used to follow chain system (closed system) because of paucity of reading material available. However, this innovative technology transformed the closed system into open system that helped more and more people to literate themselves. Consequently, with the possibility of mass production of information material available, more and more knowledge institutions tended to archive the material to meet the authentic information needs of their respective users. Accordingly, it led to the innovative development of libraries as they became capable to cater needs of more and more users irrespective of their caste, colour, creed, religion and class.

Modern/Electronic era

This epoch completely revolutionized the process of information storage, preservation, dissemination and more particularly information retrieval due to emergence and advancements in the field of information technology [47,48]. Although, printing technology modernized and enhanced methods of information storage, preservation and dissemination; yet it suffered from several limitations, viz.: since present era is the information era rather the knowledge based era, which has led to information explosion in every sphere. Consequently, the knowledge based institutions like those, that libraries need to acquire every bit of information to meet the authentic needs of their respective users. However, shrinking space, escalating costs, preservation problems of print media has made it complicated for institutions to cope up with information explosion [49]. Since, the volume of information published progressively increases, as did the expenditure of acquiring it [50]. Further, upholding of the information at an elevated level of currency obliges the influx of the printed material almost immediately following the publisher makes it available. However, this poses countless challenges. For instance, a print journal, which has been ordered from a vendor outside a particular region, can take up to months to arrive. On arrival, clearing and delivery can take days and even weeks due to lengthy customs processing. These delays associated with land-bound delivery of printed resources make the access to print material a bit complex [51]. Besides, dissemination of information was more complicated as it took time to distribute print material to users of different geographical locations since; information remains valuable only up to its currency, which apparently gets lost due to impediment in dissemination. Consequently, the relevant information is ignored, as it is certainly not revealed, which in turn leads to a great amount of replication of work and endeavours [52]. In addition, retrieving information from print material was much more hectic and time consuming, as users need to go through whole document to locate a particular chunk of information.

Advent of information technology paved a way to overcome these limitations. Information technology is the collective name for a group of technologies that are concerned with the storage, retrieval, manipulation, analysis, and transmission of information [53]. In broader sense, Information technology refers to mosaic of technologies, products and techniques combined to endow with new electronic dimensions to information and

retrieval activities. The term information technology represents convergence of three strands of technologies, namely computer, microelectronics and communications. It is used to describe products and services that came-up with swift transformations in computer and communication technologies and their fusion [54]. Thus, globalization and technological innovations are processes that have created a new global revolution. A revolution powered by technology fuelled by information and driven by knowledge. The emergence of this change has serious implications for the nature and purposes of educational institutions [55], particularly the institutions that are concerned with management of whole information cycle from generation, dissemination to archiving i.e. libraries. The beginning of this era is noticeable with the inventions past 17th century that generally require some kind of support to read the information from a particular storage media. Example of that include the punch cards (1750), punched tapes (1845), phonograph (1877) , telegraphone (1898), magnetic tape (1928), magnetic drum (1932), and the selectron tube (1946) [56]. Subsequently, the advent of computer technology in 19th century unlocked a new period in technological advances [51]. Computer technology transformed and enhanced the process of information storage, dissemination and retrieval beyond imaginations. The ever-changing technological development in the electronics and computer technology paved the way for the development of mass storage systems. Amid, technological advancements, storage media undergo myriad innovation to have improved versions of preceding media. Broadly, computer storage technologies can be grouped into magnetic and non-magnetic (optical) technologies [57].

To begin with, the magnetic storage media proved to be most reliable and convenient for data storage [58]. The oldest primary storage medium in use is magnetic drum. It facilitates direct random access of data. Launched around 1947–48, these have been in use since 1950s. However, currently their use is rather very limited [57]. Amid the advent of computers, it appeared that the crisis of data storage and retrieval of information had been solved, but curtly it was realized that even magnetic medium used for storing information was not ample [59]. Consequently, efforts were made to develop storage media with higher capacity and fast retrieval. As a result, magnetic discs soon, replaced the magnetic drums during 1956–57. In 1956, IBM invented hard disc, which was incredible storage media during that period. RAMAAC 305 was the first hard disc introduced by IBM [56–57]. Later on during 1970s, numerous evolutions in the field resulted in discs of larger capacities, advanced capabilities and lower costs [57]. Shortly, Alan Shugart at IBM invented another storage device in 1971 known as floppy disc [56]. Floppy disc became an essential part of the computers right from its introduction. These became acknowledged standards for removable storage and found broad acceptance owing to their economical price tag and cheaper transportability for sending textual data, articles, books, reports, etc. to remote locations and they still stay unchanged [57, 60]. Although, it was considered as an innovator device, for transporting data from one computer to another; yet, floppy disks were not able to store as much data as hard disks; however, they were much cheaper and more flexible. This invention was also the end for punch cards [56].

However, the competition amid the volume of information generated and the medium for its storage did not stop there [59]. With the technological developments in computers and opto-electronics, optical storage media have become popular [57]. Thus, a versatile medium of mass storage in the form of optical disc was found [59]. The first CD (audio) was released in the market in 1982. The compact disc-read only memory (CD-ROM) appeared in market in 1985 [57]. Although a range of technologies like magnetic tapes, cartridge tapes, digital audio tapes, floppy discs, removable hard discs, magneto-optical discs are available for use, users generally prefer optical media owing to their obvious advantages like accessing time, versatility, multimedia capabilities, compactness, transportability, excellent archival quality of stability, etc. The major features of optical mass storage media include: high optical as well as mechanical stability, high optical resolution, easy handling, low recording energy with high recording sensitivity, rewrite

and/or duplicate, and short recording time. Other features include relative low cost, ease of handling, compact size, and high portability [57, 59]. Since then various sorts of optical media, which flooded the market in the precedent few years, met with unpredictable degrees of success. However, the success of CD-ROM was exceptional. Until recently, CD-ROM was synonymous with optical media and electronic publishing. Wide ranges of optical devices/technologies are available to suit every need of the user. Broadly, the media can be grouped into three categories, viz., read-only, write once-read many (WORM), and erasable/rewritable. Most of these are being used in libraries, publishing, multi-media products, and software/database distribution [57].

However, there still existed the crisis of information access on real time basis because the information storage media was offline in nature i.e. they could not be transferred from one location to another location through computers for sharing. Consequently, this compelled the information technologist to find the way out for the same that lead to the development of novel concept known as information communication technology (ICT). In this milieu, precedent decades have witnessed exceptional developments in computer and communication technology. Since, remarkable storage and processing potential of computers are being completely comprehended through existing communication and networking technologies. As the two technologies are mutually dependent, inseparable and share a symbiotic relationship. Thus, the computer's ability to store and process vast amount of information and communication technology with its ability to transmit this information from one location to another converged to form "Information Technology" or "Informatics" or "Information and Communication Technology" [54]. Information and communication technology (ICT) is a comprehensive and parallel concept with information technology (IT) that signifies not only a particular unit of technology but also an assemblage of technologies like telecommunication equipments, data processing equipments, semiconductors, etc. The concept has brought an exceptional change in the information collection, preservation and dissemination scene of the world [60]. Hence, Information and Communications Technology (ICT) is an umbrella term that includes all technologies for the manipulation and communication of information [61]. In this perspective, one the most significant innovation of ICT that revolutionised the means of access to information and knowledge resources is the introduction of advanced communication network i.e., the Internet, the technology connecting a computer with millions of computers in the network [62].

Internet, can broadly be defined as; worldwide network of computers communicating via an agreed upon protocol (rules for exchange of information). It provides access to the most diversified source of information hosted by individuals and various organisations worldwide on a vast network of servers [62]. Thus, the emergence of Internet, particularly the World Wide Web (www) (Navigational tool that enables browsing information linked to other related information) as a new medium of information delivery, coupled with availability of powerful hardware, software and networking technology bring about an innovative impact on all facets related to information cycle [54]. Accordingly, the accelerated adoption and use of Information and Communication Technology (ICT) has resulted in the globalization of information and knowledge resources [60]. Hence, when scholarly communication was trapped in paper, its availability was restricted to those with access to the library (and copy machine). Once scholarly communication was digitized, it was able to move easily; and well outside the walls of the library. Here the noteworthy thing to mention is that scholarly communication is an umbrella term that describes communication such as faculty authored journal articles, conference papers, monographs, student works, and administrative documents [63]. In this milieu although the information produced is disseminated by different model of publishing information. Yet new technologies particularly ICT have transformed the process of publishing and distribution of information. Thus, ICT has not only changed the formats of

collection but has transformed the publishing world also and gave rise to the concept of electronic publishing [64]. Term introduced by William Dijkhuis in 1977 (Electronic publishing), electronic publishing can be represented as electronic publishing = electronic technology + computer technology + communication technology + publishing. One of the most complete definitions of electronic publishing appears in a popular electronic encyclopaedia (Grolier Electronic Publishing, 1995). This electronic publication defines electronic publishing this way: "the term E-publishing refers more precisely to the storage and retrieval of information through electronic communications media". It can employ a variety of formats and technologies; some are already in widespread use by businesses and general consumers and others still being developed [64]. The account of electronic publishing (e-publishing) is very short if compared with traditional forms of publishing, but packed of important events. The very first e-publication came in the 1980s in the form of plain text e-mails. They were sent to the subscriber via a mailing list. Afterwards CD-ROMs emerged to be a much more effective medium for e-publishing having features of excellent quality, pictures, figures, low-cost support, and long life. This kind of publication was quite successful for a number of years and, for particular publications (encyclopedias, dictionaries, atlases, handbooks), is still in use. Then ultimately, in the years 1994–95 appeared the very first e-journal. The first e-journal to be circulated was Electronics Letters Online by IEE (Institution of Electrical Engineers). IEE distributed the journal via OCLC. Web distribution started in 1995–96 and was an immediate success. It was possible to use the rich format PDF, Portable Data Format, to embed links in the text and to start to use multimedia tools [65]. In view of information explosion, electronic publishing has become a foundation for the new information society to get the right information to the right person at the right time. Changes in the publishing industry have a direct impact on the information systems and services. This information technology has altered the mode of publication in such a way that though the traditional sources of information continued to be flooded with the attractive electronic form of publications; the ultimate goal of electronic publishing is to provide fast and easy access to the information contained in the objective publications with simple, powerful search and retrieval capabilities. Thus, e publishing can be used effectively in the context of Dr. Ranganathan's fourth law "Save the time of user" for many purposes [64]. To present a comprehensible concept of e-publishing it is imperative, to introduce what categories are included in e-publishing which are as following:

- E-books,
- E-journals,
- Electronic databases,
- Print-on demand (POD),
- Electronic publishing on CD-ROMS,
- Electronic ink,
- Web publishing,
- Digital content,
- E-mail publishing [64, 48].

CONCLUSION

To précis, there have been unremitting transformations in the course of the library collection formats. Although, practically the main intent and rationale of the collection that is storing and preserving information is independent of its forms. However, technology has prejudiced the way in which the purpose was carried out. Information and communication technology have added supplementary features to collection formats. In the past, users had to visit the library to access a particular information resource but now a days a user can access it virtually outside the library.

In this perspective, keeping in view that transforming nature of collection formats, it becomes enormously imperative for libraries to have a hybrid collection, comprising of both print as well as non-print (electronic) media including both off-line as well as online-networked resources. Since, in context of up-to-the-minute advancements in information technology mere collection of books is meaningless for the reason that information can be accessed through various networks. Consequently, in the current electronic information environment, emphasis is towards excellent collection development than large collection and developing effective means of

getting access to remote databases [66]. In view of the fact, for a sound collection and development of information resources, every library, especially University libraries must procure information materials like books, journals and periodicals, thesis and dissertation, government publications, patent standards and specifications and non-print materials (e-sources) [67]. Thus, the fundamental rationale of libraries to offer a service is access to information [68], which the contemporary information and communication technologies, particularly computers, information networks and software applications, are making achievable for libraries to offer a variety of library and information services to their clients. Accordingly, in the contemporary Information based society, the library's main role is to mediate existing and accessible information resources to users, providing materials according to its areas of responsibility in the form of databases, electronic serials, full texts and traditional publications [69]. For that reason, academic libraries particularly the university libraries, that act as a key centre of learning and research must have up-to-date quality collection preferably in all formats viz.; print and non-print in order to accomplish the real purpose of libraries that is satisfying the information needs of diverse users in most opportune way.

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