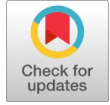




From Print to Digital: Technological Transformation in Printing and E-Book Readership in Bengaluru



Ashwatha Narayana S L, Rajeshwari R.

Abstract: Printing began around 3000 BCE, with the proto-Elamite and Sumerian civilisations using cylinder seals to authenticate clay tablets. The seal blocks followed them, hammered coins, pottery imprints, and fabric printing. In the 13th century, metal type characters were developed in China, Japan, and Korea. These printing systems provided the basis for advanced techniques. Johannes Gutenberg invented the Gutenberg printing press, which enabled faster, more efficient book production. The Gutenberg printing press enabled the mass production of printed materials. The offset press for metal printing was created by Robert Barclay in 1875. In 1904, Ira Washington Rubel applied the technology to paper, which relied on a basic chemical reaction that separates oil and water. The evolution of printing technology in books reached its peak with digitalisation, making the 21st century a significant period. In this context, the present research aims to examine the digital revolution in books from the 20th century to the 21st century. Its impact and implications on eBook readers in Bengaluru are also considered. The study employed both quantitative and qualitative research methods. Using the quantitative research method, a structured questionnaire was administered to 256 eBook readers in Bengaluru. Under the qualitative approach, a content analysis has been undertaken to examine the printing revolution from antiquity to the modern era. The study considers various news articles, research papers and books for the content analysis. As a developing country for 75 years, India has ambitious plans to become a developed country by 2047. So, knowing the status of e-books and their impact on readers is vital.

Keywords: Evolution, Printing Technology, Modern Era, Digital Revolution, eBooks, Readers

Nomenclature:

AM: Additive Manufacturing
UK: United Kingdom
CAD: Computer-aided Design

I. INTRODUCTION

The advancement of print technology has evolved alongside the development of civilisation.

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It has been essential for our growth as individuals and has played a significant role in promoting culture globally. Innovative methods developed by humans over the past 1,400 years have accelerated and automated the printing process, evolving from woodcut prints to modern digital techniques. Woodblock Printing, considered a classical printing method, is recognised as the oldest and originated in China approximately in 200AD. This process includes cutting a pattern into a piece of wood. After the wood is engraved, the elevated section is inked, then covered with paper. Developed by Bi Sheng during the Song Dynasty in China in 1041, Movable Type is akin to Woodcut in its purpose of printing scripts. Johann Gutenberg's invention of the printing press in 1440 is a significant milestone in the history of printing. He was credited with inventing the Printing Press. The introduction of this technology quickly accelerated the production of printed materials, making them more accessible to lower-class individuals in England. This led them to access a wealth of knowledge and educate themselves through reading.

Etching, a technique dating back to 1515, was initially used in the Middle Ages to embellish metal weapons and armour. Eventually, German artisan Daniel Hopfer incorporated etching into printmaking, utilising copper or zinc. Lithography emerged in the 1790s as an advancement in printing, focusing on the interaction between oil and water, which naturally repel each other. The Rotary Press, introduced in 1843, used cylinders around which the images to be printed were wrapped. In 1875, Offset Printing was developed, which involves transferring ink from a plate to a rubber blanket before it is transferred to the printing surface. It is frequently used alongside lithography to produce multiple copies of magazines, posters, and other large prints.

The photocopy feature, or xerox, was also integrated into printers for use. In 1938, this printer used a printing head to press an ink ribbon onto the paper. Inkjet printing (1951) now uses ink sprayed through jets for application. Laser Printing (1969) creates top-notch images by moving a laser beam continuously across a negatively charged cylinder inside the printer. It then gathers powder ink with an electrical charge to move the image onto the paper. In 1991, with the dawn of the digital era, printing became quicker, and it enabled printing directly from a digital file. 3D Printing was first patented in 1981, and it involves printing layers of material on a surface to form 3D objects [1].



Books have a lot of scope in the literary world. Reading electronic books (ebooks) provides many benefits, including a more profound understanding of a text, improved reading comprehension, expanded vocabulary, and improved writing skills. The transition of books to digital format coincided with the growth of the internet in the 1990's, leading to the popularity of ebooks. The release of Amazon's Kindle e-reader in 2007 revolutionized the book industry, affecting both the business side of publishing and the reading experience of online book enthusiasts. E-readers are a blessing for passionate readers due to their cheaper book prices, the immediate satisfaction of getting new books with just one click, and the option of carrying around a whole library in the palm of their hand. The e-book world has also reached Bengaluru, where the city has tremendous growth in the Electronics, IT, and Internet sectors. So, the ebooks are accessible and easy for the readers to access. In this background, the present study aims to find the impact of e-books on readers.

II. REVIEW OF LITERATURE

In the research paper titled 'A Study on Digital Reading Habits and Digital Reading Preferences among the College Students in Kamrup (Metro) District of Assam', Kalita et al. (2025) found that the digital reading behaviours of college students in the area and established a close relationship between digital reading habits and preferences. Additionally, it was found that students have yet to fully leverage the benefits of digital reading in their educational pursuits.

Tenopir et al. (2020) studied global trends in scholarly reading and reported a steady increase in digital content consumption due to mobile devices and online platforms. The study highlights that digital publishing has democratised access to information, especially in developing countries.

Singh R. (2018) studied the evolution of the Indian print media industry and its ownership patterns and noted that the 1990s saw a shift in the country's economic policy, leading the Indian public to adopt the latest technology devices to communicate and entertain themselves. For the editors and people who worked in newspapers, journalism was a mission. Even corporate houses that published newspapers treated it as their contribution to the struggle for freedom. Newspaper publishing was not profitable, and journalism was not as well paid as other professions, but things changed after Independence, and each year saw an acceleration of change.

In the research paper 'A Review Paper on 3D-Printing Aspects and Various Processes Used in 3D-Printing'. Gokhare V.G. et al. (2017) found that 3D-printable models can be created using CAD design software or 3D scanners. Although the printer-produced resolution is sufficient for many applications, printing a slightly oversized version of the object in standard resolution and then removing material with a higher-resolution process can achieve greater precision. Dr Hideo Kodama, a Japanese researcher, first invented the

modern layered approach to stereolithography, using UV light to cure photosensitive polymers. Laminated Object Manufacturing is a layer of adhesive-coated paper, plastic, or metal laminates successively joined together and cut to the appropriate shape with a laser cutter.

In the research paper 'A Review Paper on 3D-Printing Aspects and Various Processes Used in 3D-Printing'. Gokhare V.G. et al. (2017) reported that 3D printing, or additive manufacturing (AM), is a method for creating 3D objects in various shapes. It is widely believed that the first solid object from a digital design was printed by Hideo Kodama from Nagoya Municipal Industrial Research Institute. Nevertheless, the recognition for inventing the first 3D printer is mainly attributed to Charles Hull, who invented it in 1984 as the founder of 3D Systems Corp.

III. SCOPE OF THE STUDY

The vision of Viksit Bharat aims to make India a developed nation by 2047 and has crucial plans in place to achieve that goal. Technological progress is also a vital factor for Viksit Bharat. The digital revolution in the 21st century has brought significant changes in the availability of books. It has reduced the need for the book in hard copy and benefited the environment by saving paper. Knowing the status of e-books and their impact on readers will be crucial.

IV. OBJECTIVES

To know the printing evolution of books from the ancient to the modern era

To analyze impact and implications of the digital revolution on ebook readers in Bengaluru

A. Hypotheses

- i. *Null Hypothesis*: H0: There is no relationship between the age of the respondents and the adoption level of ebooks.
- ii. *Alternate Hypothesis*: H1: There is a relationship between the age of the respondents and the adoption level of ebooks.

V. RESEARCH METHODOLOGY

The present study aims to examine the transition from print to the digital era in book publishing and analyse the impact and implications of the digital revolution on ebook readers in Bengaluru. So, the study uses both quantitative and qualitative research methods. Using the quantitative research method, a structured questionnaire was administered to 256 Bengaluru city ebook readers to collect primary data. Under the qualitative, a content analysis is conducted to understand the book printing revolution from the ancient to the modern era. Secondary data have been collected from research journals, research articles, theses, websites, etc. A descriptive research design is used in the paper.



VI. DATA ANALYSIS

A. The Evolution of Printing Technology and Book Printing

S. No	Book Print Evolution	Year	Place & Used By	Remarks
1	Symbols on book tablets	3500 BC	Mesopotamia-Sumerians	Devised the Cuneiform Script (Consists of logophonetic, Alphabet, and syllabic signs)
2	Papyrus Scrolls	2400 BC	Egypt, Greeks, and Romans	It is the thick paper-like material from the stem of Papyrus, a swamp plant.
3	Standardized writing system	600 BC	Mediterranean cultures	Developed Arabic and Hebrew scripts
4	Parchment	500-200 BC	Pergamum, a Greek City.	From leather of Calfskin, Sheepskin or Goatskin. Herodotus also mentioned this.
5	The Paper Revolution	105 AD	China	With a combination of mulberries, hemp, old rags, and fish net for paper of different sizes.
6	First Printed Book	868 AD	China	Wood block/Block Printing-Ink was placed on the block of wood to create a print on paper.
7	The Gutenberg's Bible	1454- 1455 AD	Germany- Johannes Gutenberg	42-line Bible printed; used rubrication in print. With blackletters of Gothic text. Then, the press's endemic spread to Germany & other Worlds.
8	The march of the Penguin	1935 to 1945 AD	United Kingdom (UK)	Penguin was first published in paperback in 1935 by Allen Lane. It was popular, with 1 million books sold. Translations of Homer's Odyssey began.
9	The Internet and HTML arrive for public use	1989	USA	The World Wide Web was introduced by Tim Berners Lee and Team at CERN for publishing information on the internet.
10	Books sold online	1995	USA	Jeff Bezos launches Amazon, the first online bookseller, offering a vast selection of books for purchase.
11	Google is born	1996	USA	Internet search giant Google began life as a research project by Larry Page and co.
12	Start of the e-book market	2000-2007 AD	USA	The first e-books were published by the Gutenberg Project in 1970. Amazon's Kindle became the 1st ebook reader with 250 MB of storage
13	Speeding up the scanning of books	2007 AD		'Booksnap' is a fast, high-quality digital scanning system. Gollancz also helps with scans.
14	2014 AD and beyond	2014 AD to present		The smartphones, tablets, and e-readers popularised e-books. Audible books are also popular now with 1000's books copies.

B. The Impact of the Digital Revolution on eBook Readers of Bengaluru

Bengaluru is known as the IT capital of India and is the hub of book stores in India. Church Street in Bengaluru is a booklover's paradise. Regarding their preferred online bookstores in Bengaluru, among 256 respondents, Amazon is the most preferred (36%). in, followed by Flipkart.com (21%), sapnaonline.com (12%), The Blossombookhouse.com (11%), and booksscape.com. (9%), 99 Bookstore.com (7%), Gangarams Online Bookstore.com (3%), and only 1% of them said others.

Regarding their favourite eBook reading platforms, most (42%) chose Kindle eBooks on Amazon, followed by Goodreads.com (26%) and library.iimb.ac. In IIM Bengaluru (25%), manybooks.net (3%), eBooks.com (2%), and only 2% said others.

i. Adoption of Ebooks About the Gender and Age of the Respondents

Table I: (Gender and Age-wise Adoption of Ebooks)

Gender	16-25 Years	26-35 Years	36-45 Years	46-55 Years	Total
Male	49 (37.69%)	76 (58.46%)	4 (3.07%)	1 (0.76%)	130
Female	30 (23.07%)	85 (65.38%)	4 (3.07%)	7 (5.38%)	126
Total	79 (30.85%)	161 (62.89%)	8 (3.12%)	8 (3.12%)	256

Among the 256 respondents, 126 are female respondents (49.21%), and the remaining 130 are Male respondents (50.79%). Out of 126 females, 65.38%, 23.07%, 5.38% and

3.07% belonged to the age groups of 26-35, 16-25, 46-55, and 36-45 years, respectively. Out of 130 (50.79%) males, 58.46%, 37.69%, 3.07% and 0.76% belonged to the age groups of 26-35, 16-25, 36-45, and 46-55 years, respectively.

ii. Percentage-wise Factors Influencing the Adoption of Ebooks:

- **Reading eBooks is Easy and Convenient:** Among the respondents, the majority of them, i.e. 34.02% were found to be highly influenced by the first factor- easy and convenient, which means most of them found the eBooks highly convenient and easy to use.
- **Saves Money or Printing Costs:** The majority of the respondents, i.e. 31.25% were found to be highly influenced by the third factor- saves money or printing costs, which means most of them saw the ebooks as highly saving money or printing costs.
- **Anywhere and Anytime Access is Possible:** Among the respondents, most of them, i.e. 33.98% were found to be highly influenced by the fourth factor- anywhere and anytime access is possible, which means most of them found the ebooks highly accessible anywhere and anytime.
- **No Need for Physical Carrying of Books:** Among the respondents, most of them, i.e. 31.25% were found to be highly influenced by the fifth factor- no need for physical carrying of books, which means most of them discovered that



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ebooks are invaluable with no need for physical carrying of books

iii. Calculation of Mean, Median, and Mode Based on the Factors Influencing the Adoption of Ebooks

Factors Influencing the Adoption of Ebooks	Mean	Mode	Median	Skewness	Standard of Skewness
Easy and Convenient	3.62	4	5	-0.754	0.152
Saves Money & Printing Costs	3.81	4	5	-0.826	0.147
Anywhere and anytime access is possible	3.76	4	5	-0.825	0.149
No physical carrying is required	3.77	4	5	-0.822	0.147

Table no. 3 shows that the mean, median, and mode of the easy and convenient factor are 3.62, 4.00, and 5, respectively. For the 3rd factor, the Saves Money & Printing costs factor is 3.72, 4.00, and 5, respectively. For the Anywhere and Anytime access, possible factors are 3.81, 4.00, and 5. In the physical carrying of books, the mean, median, and mode are 3.76, 4.00, and 5, respectively.

iv. Impact of E-Book Adoption on the Reading Ability and its Challenges

Regarding eBook reading, most respondents read fewer than 2 books per week, with the 16-25 age group having 55 males (60.44%) and 75 females (65.21%). More than 14 books per week are chosen only by males and 8 females aged 16 to 25. People in the 46 to 55 years age group don't read more than 3 to 6 eBooks per week.

Regarding challenges in reading ebooks, among the 256 respondents, the majority (42%) said ebooks could lead to adverse effects, such as blue light from e-devices disrupting sleep patterns and vision. Followed by disruption of family and friends' relationships (23%), it led to more loneliness (11%), a poor internet connection can be a challenge for ebooks (10%), and only 4% chose other options.

VII. HYPOTHESIS TESTING

A. Correlations

The study found that the p-value (0.052) is equal to 0.05. So, the null hypothesis is rejected, and the alternative hypothesis is accepted, i.e., there is a significant association between respondents' age and their adoption of ebooks.

VIII. FINDINGS

With regards to the hypotheses, the above study found that: 1. The null hypothesis is rejected and an alternate hypothesis is accepted, i.e. there is a relationship between the age of the respondents and the adoption of ebooks.

IX. CONCLUSION

eBooks help reduce stress and promote relaxation, improve concentration and memory, strengthen writing skills, and

increase readers' imagination and creativity. Bengaluru is one of the hubs of online bookstores in India, and Church Street in Bengaluru is a booklover's paradise. The study highlighted that the adoption of ebooks amongst people in Bengaluru has increased significantly (Kindle eBooks on Amazon. in, Goodreads.com, and library.iimb.ac.in at IIM Bengaluru are popular amongst all, followed by manybooks.net, eBooks.com, etc.). Most of them (34.02%) found the ebooks highly convenient and easy to use. The study also found a positive relationship between age and the adoption of ebooks and the volume of reading books per week in the digital world. The study found that a significant proportion of participants aged 16-25 and 26-35 displayed a greater propensity to use ebooks. However, the majority of these respondents (106 males and 120 females) read fewer than 2 ebooks per week. Conversely, a minimal number of participants (16 males and 9 females) were situated in the category of reading ebooks more than 12 hours a week.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

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- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

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