CHAPTER-ONE

INFORMATION AND COMMUNICATION TECHNOLOGY SECTOR: AN OVERVIEW

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1.0: INTRODUCTION:

India is considered a favourable business destination today. India has achieved economic development mainly due to the revolution in Information and Communication Technology (ICT). ICT has changed the mindset of people in terms of enhanced organisational decision-making, innovative products, operational excellence, low costs and better risk management systems in almost all areas. The components of ICT, spiralling the growth in all areas, is composed mainly of hardware, software, and networks. It also includes media for collecting, storing, processing, transmitting and presenting information through voice, data, text and images. ICT also can develop energy-efficient solutions in all areas, be it manufacturing, transport, power, infrastructure, education, health care, travel, managing traffic, and surveillance for safety and security by reducing carbon footprints.

ICT is broadly classified into two sectors: Information Technology (IT) and Telecommunication.

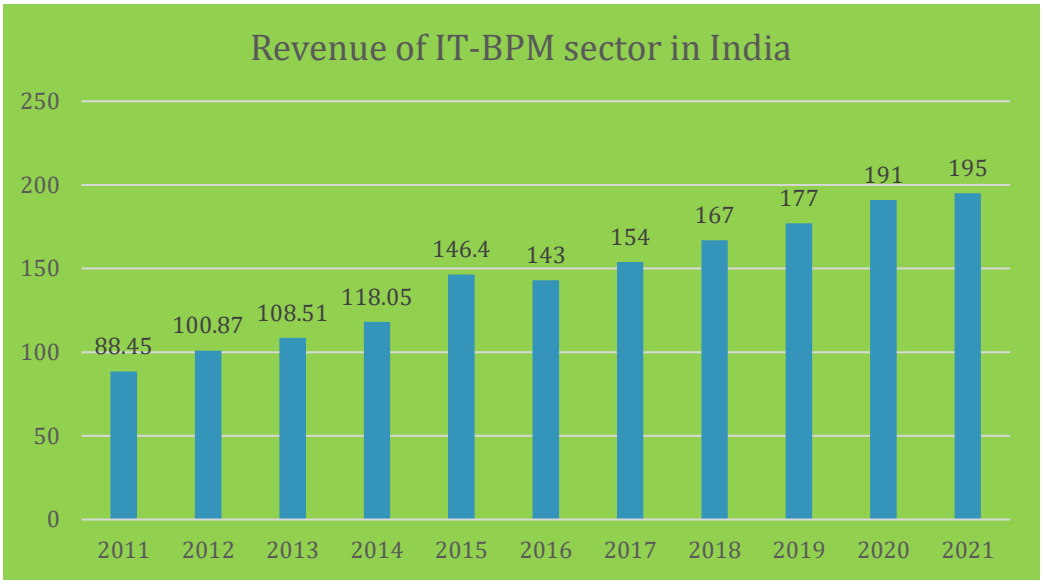
1.1: INFORMATION TECHNOLOGY(IT) SECTOR IN INDIA: AN OVERVIEW:

The growth of an enterprise can be measured by the extent of IT assimilation through various services like software, Information Technology Enabled Services (ITES) and Business Process Outsourcing, which offer personalised solutions catering to the enterprise's specific needs, thereby strengthening them to surge ahead and remain competitive. The ITES (Information Technology Enabled Services) improves the efficiency of any organisation by outsourcing the processes and services related to the manufacturing of goods, health, human resource, finance and telecommunication services. It provides various career options like back-office operations, content development, logistics management, medical transcription, enterprise resource planning, data warehousing, telecommunication services etc.

1.1.1: MARKET SIZE AND REVENUE OF THE IT-BPM SECTOR IN INDIA

FY20, the IT industry contributed 8 percent of India's GDP, 50 percent of foreign direct investment, and more than half of service exports (Shinde,2021)[1]. In FY21, the IT-BPM industry generated more than 195 billion dollars in revenue; by 2025, it is predicted to account for 10 percent of GDP (Sun,2021)[2]. With India developing as a desirable location for IT services, the country earned US$ 191 billion in the fiscal year 2020 (Sun,2021)[2] and is expected to reach US$ 350 billion by 2025 due to cost competitiveness(India Brand Equity Foundation (IBEF, 2021,d[3]; Kurup,2021[4]). Revenue of the information technology and business process management industry in India from the financial year 2011 to 2021 in billion US dollars (Sun,2021)[2] is given in Graph number 1.1

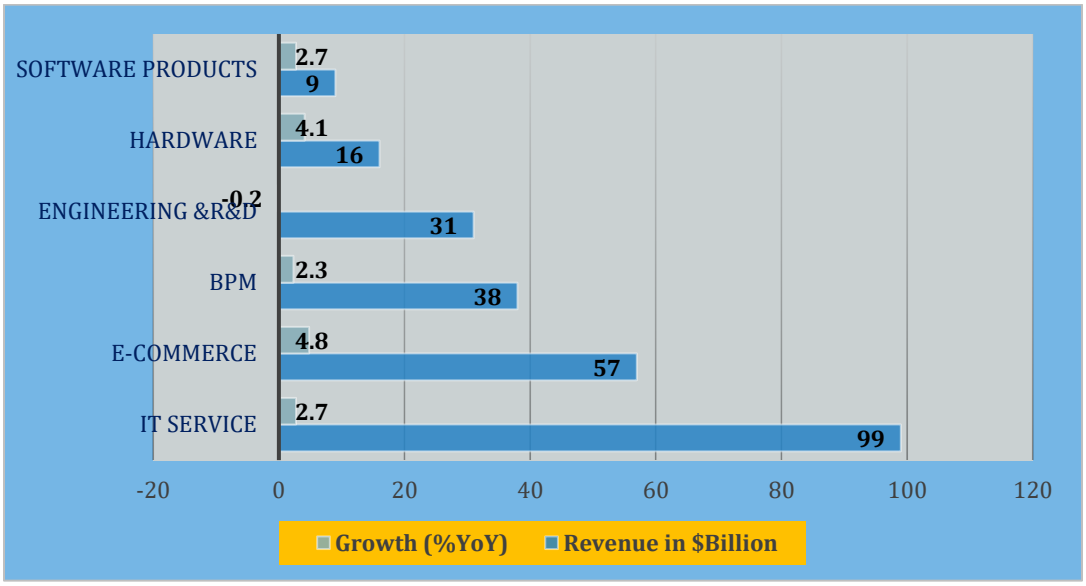
Graph Number 1.1:
Revenue of IT-BPM Sector in India 2011-2021(In Billion US Dollars)



Source: Statista 2022

According to the NASSCOM strategic review report, IT-BPM industry revenue is predicted to reach US$194 billion in FY21, with a 2.3 percent revenue increase (Shinde,2021)[1] and domestic and export revenue of US$ 45 billion and US$ 150 billion, respectively. By 2021, India's software product market is predicted to be worth US$ 100 billion, of which BPM (Business Process Management) accounts for US$ 50-55 billion of that total (IBEF,2021,d)[3]. In FY21, the Indian IT industry continued to add more than 138,000 net digital talent pools, bringing the overall employment base to 4.47 million (shinde,2021)[1]. Digital revenues account for over a third of industry sales ($50-53 billion) and are expanding at five times the rate of overall service growth (shinde,2021)[1.] Despite the world economy contracting as a result of the pandemic, Indian IT services grew by 2.7 percent to $99 billion, led mostly by e-commerce sector growth (4.8 percent to $57 billion), followed by a 4.1 percent year-on-year rise in the hardware segment with a revenue of $16 billion (Shinde,2021)[1].

Graph Number 1.2:
The National Association of Software & Services Companies (NASSCOM) Report 2021:



Source: Shinde,2021

1.1.2: IT 4.0: A BOOST TO INDIAN UNICORNS:

Industry 4.0 is digital transformation using cutting-edge next-generation technologies such as Blockchain, AI, Machine Learning, Cloud computing, and robots. IT behemoths like Infosys, Wipro, TCS, and Tech Mahindra are diversifying into next-generation technologies by bolstering their R&D centres through innovation hubs, which has resulted in the creation of the most significant number of jobs and has made India the preferred location for global IT firms (IBEF,2021,a)[5]. India is ranked 20th in the Global Start-up Ecosystem Index 2021, with 27,084 recognised start-ups in 551 districts (Annapurani, 2021)[6]. IT services take the top spot with 13.9 percent. Health care and life sciences account for 8.3 percent of the total, while education accounts for 7 percent. Byju's, Swiggy, Oyo Rooms, Paytm, and Zomato are just a few notable instances of companies that have revolutionised their respective industries (Soni,2021)[7]. According to NASSCOM, India has been able to create 1.17 million digital workforces by FY 2021, owing to AI (Artificial Intelligence), social media, mobility, data analytics, augmented reality, interconnected robots, machine-to-machine learning, cyber security, and SMAC (social, mobile, analytics, and cloud) technologies, as well as embedded systems (mint,2021)[8].

1.1.3: GOVERNMENT INITIATIVES TO PROMOTE THE IT SECTOR

The Union Cabinet passed the National Policy on Software Products-2019, intending to make India a one-stop shop for software products (IBEF,2019)[9]. NITI Aayog has partnered with Apollo Hospitals, Strides Pharma, and Oracle to launch and lead a blockchain pilot project in social welfare to eliminate the threat of counterfeit drugs in the market. If successful, the project can be replicated in other developing economies, saving lives. The NASSCOM-led 'Future Skills' initiative, in conjunction with state governments, aims to establish centres of excellence in AI (artificial intelligence), ML (machine learning), and cyber security (IANS,2020)[10]. Low-cost support services and software, along with the most significant number of talented youths supplying inexpensive labour, and a great business environment in terms of a thriving start-up ecosystem, will undoubtedly propel the country to become a technological giant in the years to come. Success, on the other hand, can only be sustained by constant innovation and technical advancement via Gen 2 cloud. If the fundamental growth target is Gen 2 Cloud adoption, India's vision of a $5 trillion economy can be accomplished. In the Union Budget for 2021, the Government has allocated Rs 53,108 crore (US$ 7.31 billion) to the IT and telecom industries. The Ministry of Communications, the Government of Japan, and the Department of Telecom, Government of India, have signed an MOU (Memorandum of Understanding to increase collaboration in the areas of 5G technologies, submarine optical fibre cable systems, and telecom security (IBEF, 2021,c)[11].

1.2: TELECOMMUNICATION MARKET IN INDIA:

The other main sector in ICT is the Telecom sector. India is the world's second-largest telecommunications market, with 1.20 billion subscribers. Tariffs affordable to the average person, Mobile Number Portability (MNP), and expanding 4G/5G coverage have propelled the business to new heights. The favourable regulatory environment and simplicity of FDI regulations have also contributed to the country's rise to the top five job creators (Thomas,2022)[12]. According to data from the Department for Promotion of Industry and Internal Trade (DPIIT), the telecom sector received US$ 37.97 billion in FDI from April 2000 to March 2021. (IBEF,2021,b)[13]. By 2022, the Indian Government expects to invest $100 billion under its National Digital Communications Policy. With an average wireless subscriber data usage of 11 GB per month, India is one of the world's most significant data consumers, with 18 GB projected by 2024(IBEF 2021,a)[5]. The rise of the telecom industry has been fuelled by a young population with a strong desire to consume data, high disposable income, and expanded rural involvement. The telecom advertising sector is also rapidly growing. By 2022, the mobile value-added service business will be worth $23.0 billion. According to a Zenith Media analysis, between 2020 and 2023, India's fastest-growing telecom advertisement industry will expand at an annual pace of 11 percent (Tewari, 2021)[14].

The amount of wireless internet data used in India increased about 7-fold from 2018(1.24 GB) to 2021(11 GB). India is a high data user. Each wireless data subscriber consumed 14.1 GB per month in Q1 2022, (Mankotia,2022)[15].By 2026, India will have 350 million 5G subscriptions, or 27% of all mobile subscriptions. India will need 22 million 5G-skilled workers by 2025, including cloud computing, robots, and the Internet of Things (IoT)(ETTelecom,2022)[16]. The Union Cabinet approved a Rs. 12,195 crore ($1.65 billion) production-linked incentive programme for telecom & networking gear. The Production-linked Incentive (PLI) Scheme approved 31 enterprises on October 14, 2021. The Department of Telecommunications (DoT) has formed a 6G innovation group to develop 6G technology. In the Union Budget 2022–23, the Department of Telecommunications received Rs. 84,587 crore ($11.11 billion). Telecom FDI reached $38.25 billion between April 2000 and December 2021(IBEF 2022)[17].

The telecom market includes the Wireless (mobile) segment and the wired/fixed-line segment, which also provides broadband services.

Wireless Subscribers: As of May 31 2022, India had 1,145.50 million wireless subscribers (out of which 1017.68 million were active wireless users), with 624.55 million urban subscriptions and 520.96 million rural subscriptions. Urban wireless subscribers make up 54.52percent of the total, while rural subscribers make up 45.48 percent. In India, the wireless tele-density is 83.20 percent. Private players had a market share of 89.87 percent of wireless subscribers as of May31, 2022, compared to 10.13 percent for BSNL and MTNL. Reliance Jio has the maximum number of wireless subscribers (35.69), followed by Airtel (31.62), Vodafone-Idea (22.56), BSNL (9.85), MTNL (0.28), and Reliance Communications (0.0003) (TRAI, 2022)[18].

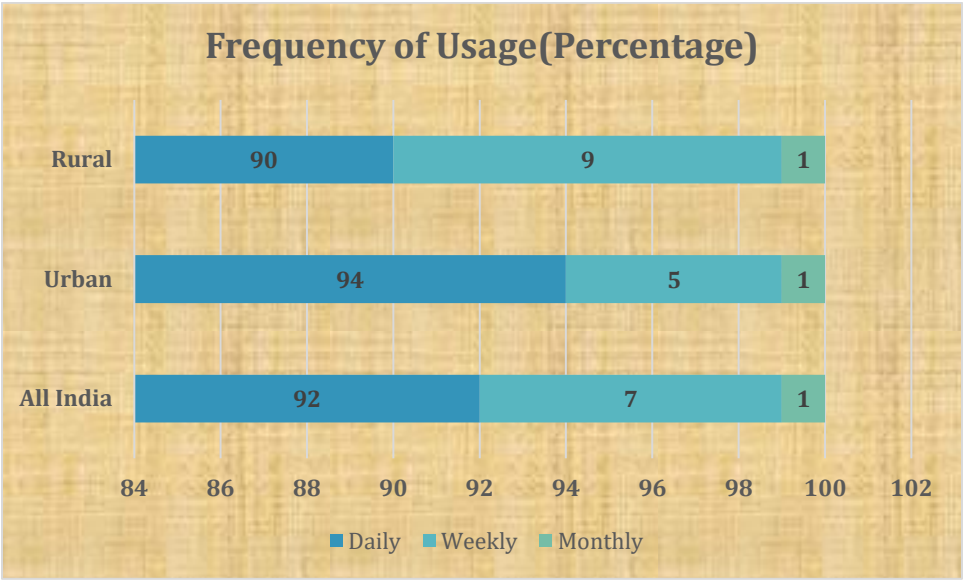
Wireline Subscribers: In India, while the number of wireless users increased, the number of landline subscribers decreased. By the end May 2022, it had dropped to 25.23 million. 92.21 percent of urban wireline subscribers and 7.79 percent of rural wireline subscribers, respectively. The wireline tele-density fell to 1.83, with BSNL and MTNL accounting for 39.17 percent of the total market share in the wireline category (TRAI, 2022)[18].

Broadband Subscribers: At the end of May 2022, there were 794.68 million broadband subscribers. Reliance Jio Infocomm Ltd (414.67 million subscribers), Bharti Airtel (217.09 million subscribers), Vodafone Idea (123.24 million subscribers), BSNL (25.52 million subscribers), and Atria Convergence (2.09 million subscribers) are the top five service providers. Reliance Jio Infocomm Ltd (5.89 million), Bharti Airtel (4.74 million), BSNL (3.82 million), Atria Convergence Technologies (2.10 million), and Hathway Cable and Datacom (1.11) are the top five wired broadband service providers. Reliance Jio Infocom Ltd leads the wireless broadband segment with 408.79 million subscribers, followed by Bharti Airtel (212.35 million), Vodafone Idea (123.23 million), BSNL (21.70 million), and Intech online private Ltd. (0.21 million) (TRAI,2022)[18].

1.3: INTERNET PENETRATION IN INDIA:

Internet penetration increased from 4 percent in 2007 to 45 percent in 2021 (Keelery,2021,a)[19], implying that nearly half of the 1.37 billion people have access to the internet. In terms of active internet users, India came in second. According to the IAMAI-Kantar' ICUBE 2020' report released in June 2021, India has a population of 1433 million people, with 622 million active internet users in 2020 (43 percent) and is expected to reach 900 million (45 percent) by 2025 (Sheth,2021)[20]. Even though urban India presently has two times more penetration than rural India, this position may change by 2025 as rural usership has been rising at a far quicker rate than urban usership, which may help bridge the rural-urban divide.

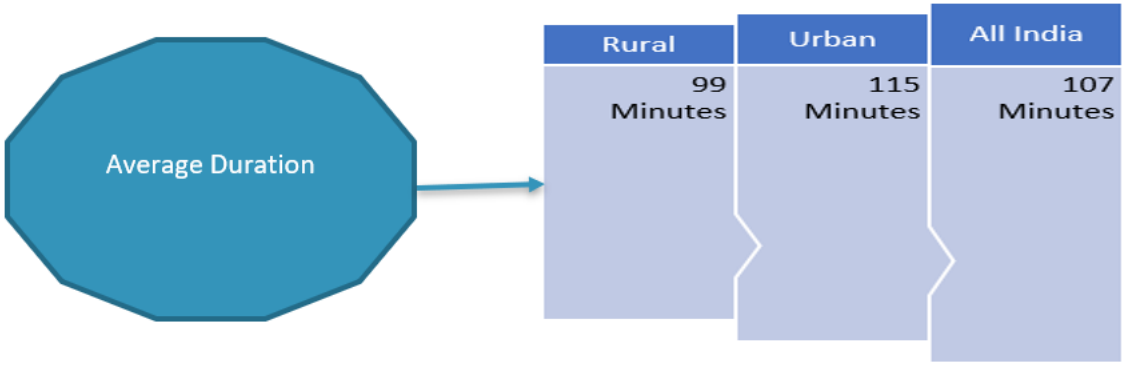
Graph Number 1.3:
Frequency of Internet Use (IAMAI-Kantar' ICUBE 2020):



Source: Business Standard (2021)[21]

According to the IAMAI-Kantar' ICUBE 2020' research, small towns account for nearly two out of every five active internet users in urban India. According to the report, nine out of ten active internet users browse the internet every day for 107 minutes (1.8 hours). The top nine metros account for 33 percent of active internet users. Urban India has a higher number of active daily users since they spend 17 percent more time than users in rural areas (Business Standard, 2021)[21].

Figure Number 1.1: Duration of Internet Use (IAMAI-Kantar' ICUBE 2020' Report

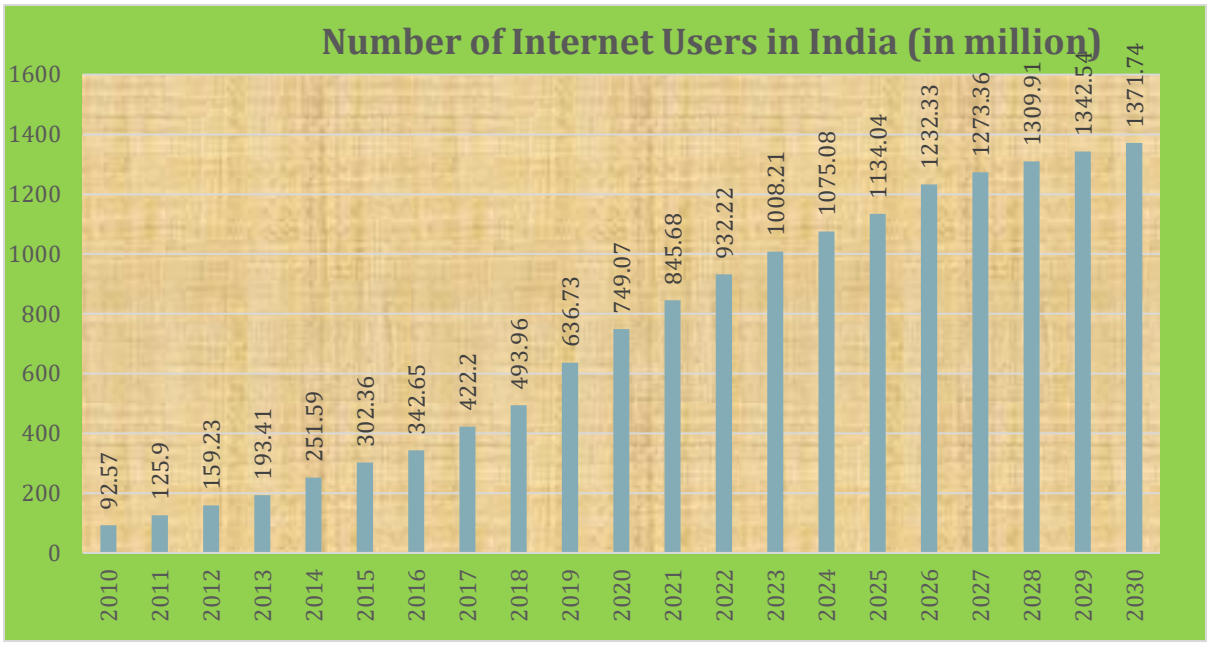


Source: Business Standard (2021)[21]

Due to the availability of smartphones and cheaper data plans, the mobile phone continues to be the device of choice for accessing the internet in both urban and rural locations, according to the survey. Male to female ratio is nearly the same in both urban and rural areas, with a ratio of 57:43 in urban areas and 58:42 in rural areas (Business Standard,2021)[21].

In 2021, India will have over 845.68 million internet users, which is predicted to climb to over 1.5 billion by 2040 (Keelery, 2021.a)[19], indicating a significant market for internet services in the south Asian country. Most internet users in the country access the internet via their mobile phones.

Graph Number1.4:
The Number of Internet Users in India from 2010 to 2030 (in million)



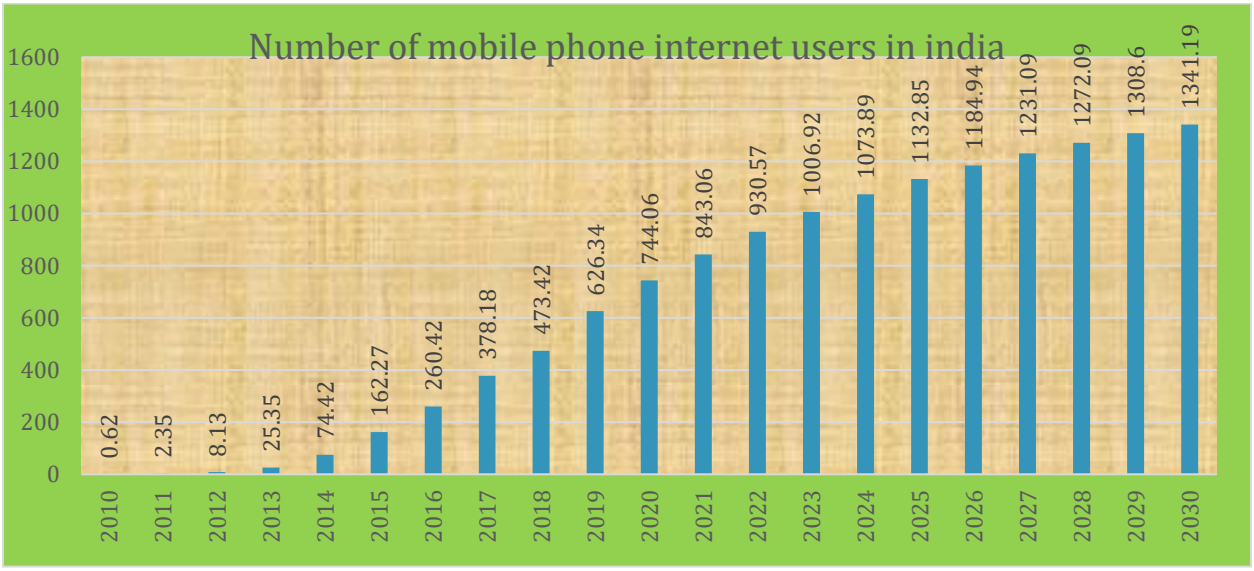
Source: (Keelery, 2021.a)[19]

Across the country, the number of smartphone users was roughly equal to the number of internet users (Keelery,2021,b)[22]. The COVID-19 shutdown made everyone more dependent on the internet than ever before; work from home became the norm, and even schoolchildren's classes were relocated to an online platform. And as a result, the number of internet users in India has exploded. According to a study undertaken by LIRNEasia in collaboration with ICRIER, 61 percent of Indian homes will utilise the internet in 2021, up from only 21 percent in 2017. In 2020 and 2021, almost 130 million users came online, with nearly 80 million of them coming online in 2020 and 43 percent of them (about 34 million) coming online as a result of the COVID-19 issue (Khanna,2021)[23].

1.3.1: MOBILE INTERNET USERS IN INDIA:

Reliance Jio's arrival into the telecom sector, equipped with low-cost 4G and free voice calls, has transformed the industry. Within six months, the corporation had gained 100 million new subscribers. Reliance Jio had the largest wireless telecom subscriber count in India by the end of 2019. Other established telecom operators lowered their prices due to competitive pricing, increasing the affordability and accessibility of mobile internet (Keelery,2021,b)[22].

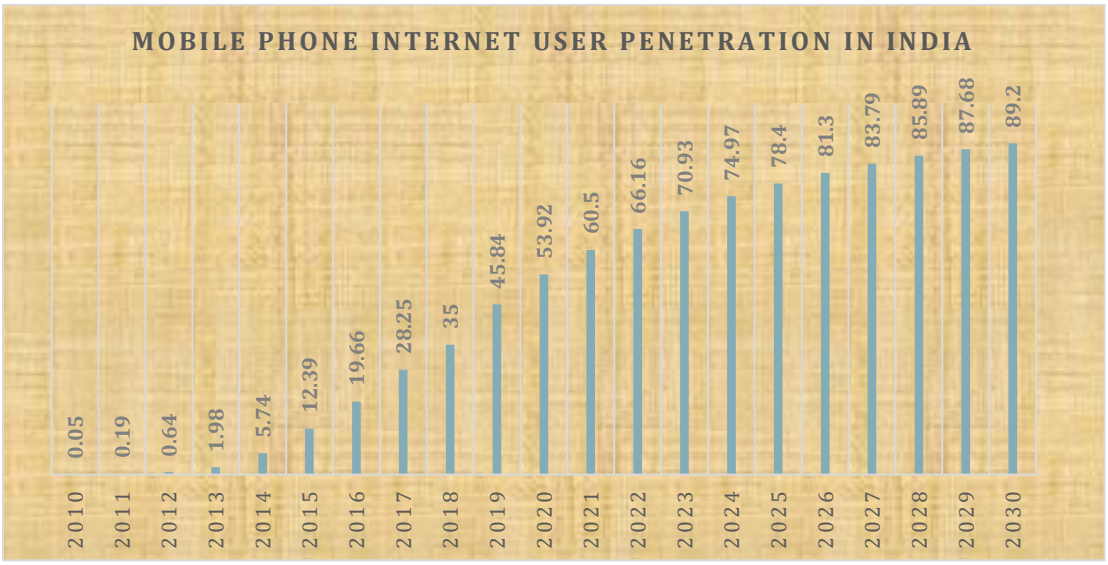
Graph Number1.5:
Number of Mobile Phone Internet Users in India (2010 to 2030)



Source: Keelery (2021,b)[22]

India's smartphone internet users reached 843.06 million in 2021, placing it second after China, and are anticipated to reach 1341.19 by 2030 (Keelery,2021,a). In 2021, 60.5 percent of India's population utilised mobile phones to access the internet. This percentage is forecasted at 89 percent in 2030 and 96 percent by 2040, suggesting a huge increase in the number of people using mobile internet in the country (Keelery,2021,b)[22].

Graph Number 1.6:
Mobile Phone Internet User Penetration in India 2010 to 2030



Source: Keelery (2021,b)[22]

According to the 18th edition of Ericsson Mobility Report, video traffic will account for three-quarters of all mobile traffic by 2025, with a 30 percent annual growth rate. The monthly mobile traffic in 2019 was 33EB (exabyte or one million GB). Video accounted for 63 percent of all mobile traffic. In 2025, 164 EB of mobile traffic is predicted, with video traffic accounting for 76 percent (Sen,2020).

1.3.2: IMPENDING 5G: A GAME CHANGER

The fifth generation of high-speed mobile internet, known as 5G, seeks to provide faster data rates and more bandwidth to handle increased web traffic. Due to the Covid 19 outbreak and the Indian Government's impending financial difficulties, the auction of 5G spectrum has been moved to May 2022 (economic times,2022)[25], with the auction process projected to conclude by August 2022, with services to follow (Choudhury, 2022)[26]. The advantage of 5G over 4G is its speed, which is a hundred times quicker, and its lag time, or latency, which is less than a millisecond, allows it to host one million devices per square kilometre. Digital business paradigms will be catalysed, and new business opportunities will emerge from this quick data (Mehta,2021)[27]. 5G would boost the production rate, provide delivery services with less use of limited resources, and, on top of that, create new jobs. By 2035, the impact on India's GDP would be USD 1 trillion (Srivastava,2020)[28].

The transition to 5G, 100 times faster than LTE (Long Term Evolution), will impact how people utilise mobile data. The new standard will also impact mobile commerce. Page speed affects conversion rate. It takes too long for the user's required information to appear on their smartphone screen. 5 G's faster page load times will undoubtedly accelerate this trend and enhance m-Commerce.

Online retailers must design more intuitive and user-friendly shopping systems to appeal to smartphone consumers. The 5G cellular standard's massive capacity will boost mobile commerce. Applications that require a lot of data can be integrated into online store systems without compromising page load time and customer experience. These include high-resolution video, VR/AR, and gamified mobile purchases. Users research and compare products on smartphones before buying them in-store. Applications of virtual and augmented reality (VR/AR) are already widely used. 5G will unlock the full potential of data-intensive apps that previously lacked interactivity and a multivalent experience. Mobile purchases will be enhanced by a physical world of experience (Infineon Technologies,2019)[29].

1.4: GOVERNMENT INITIATIVES TO PROMOTE ICT SECTOR IN INDIA

Data protection and privacy have recently been a significant concern in India. The Government has come up with various bills and guidelines for data privacy, protection and localisation. The Government has introduced Information Technology Intermediary Guidelines Rules-2018, a draft Personal Data Protection Bill, E-Commerce Policy, National Digital Communication Policy, and national policy on electronics and software products to develop the digital economy.

The Indian Government launched the 'Smart City Mission in 2015 to change the country's urban landscape. The Government's primary goal is to make all Indian cities smart by utilising technology and encouraging local development. A growing urban population requires the Government to renovate existing regions, generate jobs for people, and develop new areas (e.g., greenfield lands). Smart cities use technology, data, and information to improve infrastructure and services. A thorough development will enhance the quality of life, create jobs, and increase local income. Between 2019 and 2023, the Government has chosen 100 cities for area-based and pan-city development (IBEF,2021.a)[a]. Bharatnet has laid optical fibres in over 100,000-gram panchayats(Bhattacharjee,2020)[30]. For companies that manufacture mobile phones in India, the Government has devised a production-linked incentive (PLI) package worth over 42000 crores (Doval,2020)[31].

The Government has introduced the National Digital Communications Policy-2018 (NDCP-2018) to meet the modern needs of India's digital communications sector (DOT, 2018)[32]. The new telecom policy, which replaces the old National Telecom Policy of 2012, aims to make it easier for India to participate effectively in the global digital economy.

The policy's goals are set to be met by 2022 to ensure digital sovereignty. Some of the objectives to be accomplished by 2022 are 50 Mbps (megabits per second) broad connection to every Indian citizen, 10 Gbps (Gigabits per second) connectivity by 2022 to all Gram Panchayats, a target of US Dollar 100 billion of investments in sectors related to digital communications, provide training to one million people and equip them with skills and become competent in the digital era. It aspires to grow the Internet of Things ecosystem to 5 billion connected devices.

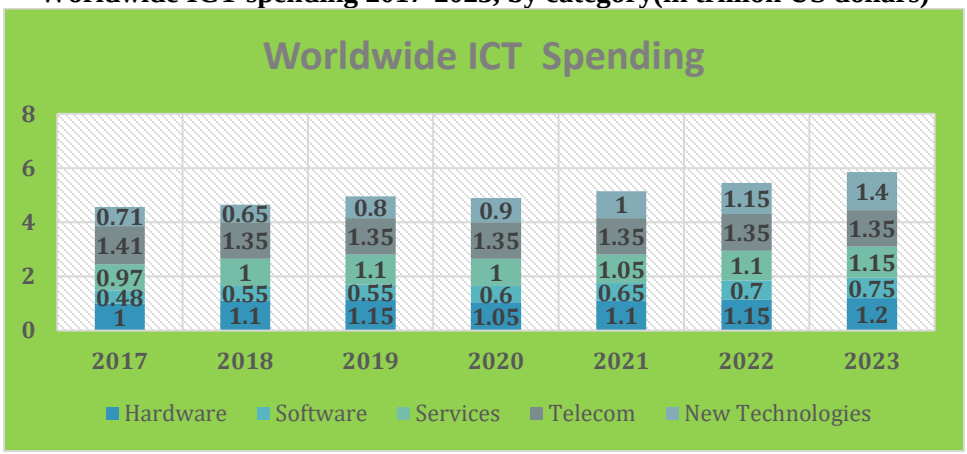
The strategy also aims to build a comprehensive digital communications data protection law that protects people's privacy, autonomy, and choice, which will provide safe and secure access to digital communications infrastructure and services to citizens by enforcing accountability through proper institutional procedures. (Indianexpress,2018)[33].

Swachh Bharat e-Learning Portal Officials were trained across India using Project Sangam (a cloud-hosted, mobile-first community learning platform). Ministry of Housing and Urban Affairs, in association with Microsoft, has trained over 110,000 municipal officials in over 4000 Indian communities (Microsoft,2019)[34]. The Government has established a National Broadband Mission (NBM) directorate as part of its attempts to close the digital divide. By 2024, the National Broadband Mission hopes to have everyone connected to the internet at 50 megabits per second. (Communicationstoday,2022)[35]. Under the National Broadband Mission, the Department of Telecommunications (DOT) is purportedly aiming for 100 percent broadband access in villages, 55 percent fiberisation of mobile towers, an average internet speed of 25mbps, and 30 lakh km of optic fibre rollout by 2022(communicationstoday, 2022)[35]. By 2024, the Government plans to have 70 percent of towers fiberised, 50 mbps average bandwidth, and 50 lakh kilometres of pan-India optic fibre installed. (Parbat,2020)[36].

1.5 ROLE OF ICT TOWARDS ECONOMIC AND SOCIAL DEVELOPMENT

No daily activity or transaction is feasible without ICT. The use of ICT has reduced transaction costs for both B2B and B2C transactions. Buyers and sellers can access global supply networks and engage across organisational boundaries. Business partners can collaborate despite differences in culture, history, and geography. As a result of ICT, structured inventory management can monitor manufacturing processes, diagnose problems, and reduce downtime. ICT has made government welfare and extension initiatives more transparent and efficient. This has aided impoverished households. Our society's impoverished and excluded people have had access to credit and financial services. ICT has helped them make and promote their products, thereby reducing poverty. The education sector has been able to supply quality content via ICT, allowing students from remote areas to compete globally. It has created three million direct jobs and approximately ten million indirect jobs. The worldwide spending category wise on (ICT) market (2017-23) (in trillion US dollars) is given in Graph number 1.7

Graph Number 1.7:
Worldwide ICT spending 2017-2023, by category(in trillion US dollars)



Source: Sava (2022)[37]

Global investment in information and communication technology (ICT) will exceed 5.3 trillion dollars in 2021. As a result of the COVID-19 pandemic, spending stayed essentially stable in 2020. In particular, new technologies are expected to surpass one trillion dollars in 2021. Artificial intelligence (AI), the Internet of Things (IoT), augmented reality (AR), and virtual reality (VR), as well as robots, are among them(Mint,2021). They are expected to capture a more significant part of the market as a group. New technologies are expected to account for more than a quarter of all ICT spending (Sava,2022)[37].

Next-generation technologies will benefit the global economy by boosting trade growth while lowering transaction costs. For example, AI may be used to automate a variety of procedures or to improve logistics efficiency by planning routes based on current road conditions. At the same time, IoT offers various applications in various industries, including tracking shipments in real-time to improve delivery services. In general, if effectively implemented, these technologies yield a quick return on investment while upgrading the way goods are manufactured and traded around the world.

India's economic growth has been fuelled by policies linked to software export and service-oriented areas based on ICT, with many countries turning to India as a role model for establishing similar policies, which, on the other hand, has benefited only the wealthy and educated. The advancement in the ICT sector continues to evade the 400 million individuals who do not have internet access. This is aggravated by the disparity in internet concentration between urban and rural areas, with many in rural areas unable to access the internet. The digital divide has also been exacerbated by gender, with women owning fewer cell phones than males (Ghani and Mishra, 2020)[38]. Economic progress has been hindered by political upheaval in many states, bureaucratic meddling, delays in processing business proposals, red tape, and corruption.

1.6: APPLICATIONS OF ICT IN DIFFERENT FUNCTIONAL AREAS:

The application of ICT in different functional areas is given as follows:

1.6.1: ICT IN PROTECTING ENVIRONMENT: Green ICT focuses on conducting business environmentally friendly. It attempts to lower its carbon impact by implementing environmentally friendly methods. Green buildings, efficient cooling and lighting management, non-conventional energy sources, Carbon Disclosure rating, green computing, and paperless transactions are just a few areas where ICT has the most impact. Using energy-efficient PCs, e-waste disposal, paperless corporate transactions through virtual meetings, and e-commerce are examples of ICT's green practices. The advancement of mobile phone technology boosts green practice adoption via ICT, which will help the globe become greener (TERI,n.d.)[39].

1.6.2: ICT IN GOVERNANCE: E-Government refers to the ordinary man's ability to access government services at the press of a button from a single window from wherever they are. It is about the engagement between the Government and the public by providing timely information to the public, providing excellent government services, and maintaining transparency and accountability through information portals. E-governance initiatives such as E-Choupal, Kissan Call Centers, Akashganga, Gyandoot, Tata Kissan Kendra, and others aim to make the system more transparent while educating and empowering people, particularly in rural areas. Digital India, Aadhar, myGov. UMANG, Digital Locker, Computerisation of Land Records, and Mobile Seva are some of the significant e-governance efforts.

1.6.3: ICT IN HEALTHCARE: The Indian health care system is not accessible to the entire population. As the population grows, gaps in health infrastructure, personnel, treatment, and care will inevitably widen. It is well known that urban dwellers have easy access to medical care than rural dwellers. Despite the Government's massive investment in the National Rural Health Management (NRHM), low-cost health care remains elusive. The development of electronic medical records (EMR) on electronic health data, supply of medicines, and exchange of information on the patient's medical history can all be addressed by ICT. Lifestyle disorders increased awareness of the necessity of health insurance, and more FDI contributed to the rise and integration of ICT in healthcare(express healthcare). The National Health Stack (NHS), a virtual digital platform for healthcare in the country, seeks to provide digital health records to everyone by 2022.

1.6.4: ICT IN EDUCATION:

Less academic interest is caused by rigid testing techniques, rote learning, insufficient professors, an unequal teacher-student ratio, and poor infrastructure. The ICT virtual classroom allows for two-step personalised learning from anywhere at any time. This teaching method has re-energised teachers, students, and parents. With Mobile Game-Based Learning, Social-Blogs and Academic Communities, Learning Management Systems (LMS), and Interactive Boards, ICT may bridge educational and geographic gaps.

Along with SWAYAM, the Government has launched ebasta (digital textbooks), RMSA (walkable secondary schools), Skill India, and Digital India. Universities, IITs, and other government entities distribute electronic periodicals and books. The MHRD has created a National Program on Technology Enhanced Learning (NPTEL), including video lectures on all courses. “Saransh,” a CBSE effort for affiliated schools, enabling schools, parents, and instructors to track a child's growth. It uses ICT and various educational approaches to enhance the abilities of students and teachers (Bajpai et al., 2019)[40].

1.6.5: ICT IN AGRICULTURE:

An increasing number of Indian farmers are using ICT to adopt the newest technical advancements to maximise productivity from limited agricultural land. Some of the ways ICT impacts agriculture are call centres, mobile apps, digital photography, community radio, video conferencing, and digital media platforms like WhatsApp and Facebook. ITC project, e-choupal helps farmers get better resources, increase productivity, and sell their products at higher rates. mkrishi, a TCS endeavour, enables farmers to address their issues through specialists in their regional language via mobile phone. Despite its many benefits, ICT in agriculture is not without its obstacles. Infrastructure, inconsistency in power supply, and remote connectivity are the key obstacles. Successful ICT integration with Agriculture can be ensured through SMS-based interaction, preferably in their native tongue(Singh et al.,2017)[41].

1.6.6: ICT IN MANUFACTURING:

ICT is used in product design, supply chain management, database management, corporate resource planning, quality control, and decision support systems. Computer-aided design improves manufacturing. The intricacy of the adoption mechanism, piracy and language issues, costly infrastructure and tax costs, and lack of qualified workers have hampered long-term adoption. The Indian Government's ‘Make in India' programme has increased the manufacturing industry. This plan aims to establish India as a manufacturing hub, gain global respect for the Indian economy, and create 100 million new employees by 2022. (IBEF,2021)[11]. Some of the government initiatives in the manufacturing sector are Skill India, which trains youths for jobs and entrepreneurship, Sharm Suvidha, a labour law web portal, NMP (National Manufacturing Policy), which promotes energy-efficient building technology, MUDRA Yojana, which provides loans for small and medium businesses, and Stand-up India, which promotes economic independence and job creation. (Karishma,2020)[42]. The Pradhan Mantri Kaushal Vikas Yojana taught 19.85 lakh persons, 13.23 percent of whom got jobs. The Government has allowed 100 percent FDI in contract manufacturing. Union Government, in the National Policy on Electronics (February 2019) predicts a $400 billion industry by 2025, with a 32 percent annual growth rate (IBEF,2021,c)[11].

1.6.7: ICT IN FINANCE, BANKING, AND INSURANCE:

One of the primary goals of the liberalisation programme was operational self-sufficiency, which improved banking standards. The new licence criteria allowed foreign banks with cutting-edge technologies to enter the market. Deregulation opened up new markets for banks, such as investments, insurance, credit cards, and mortgage lending. Banks have transformed from service providers to financial supermarkets. ICT has enabled banks to grow their customer base and provide cost-effective and secure services (Kumar 2018)[43]. Technology like cloud computing and chatbots (conversational agents, mainly robots that can mimic human speech) have transformed the banking industry for customer-centric business strategies. Using Google Wallet or Apple Pay, one may conduct contactless ATM transactions. ATM consumers are protected from ATM hacking by biometric authentication and iris recognition. Financial institutions will have to spend up to 20 percent of their revenue on security-based authentication techniques to build "digital trust" with their clients. Digital currencies, such as Bitcoin and Blockchain, will revolutionise the globe.

1.6.8: ICT IN RETAILING:

Returning in the current times is not just about customer experience but channelling their choice in the right way so that the consumers' purchase decision makes it enjoyable and satisfying. Rising disposable incomes, economic expansion, demographic shifts, and urbanisation boosted retail sales. Traditional and unorganised retail still dominate, but organised retail will expand to $1.4 trillion by 2024, up from $0.79 trillion in 2019. (IBEF,2021,b)[13]. Technologies like AI and Cloud can link consumers, increasing customer engagement, retention, and convenience. Supply chain, inventory management, and merchandising are retail's most significant ICT tools. Scanners, Card Readers, Video Surveillance, and Radio Frequency Identification track merchandise from warehouse to retailer and client. Programmatic advertising helps organisations reach consumers with targeted ads. Experiential retail allows for customer-brand connection and feedback. Customers can avoid direct touch with the product and try them on virtually using immersive technology. Big Data helps the retail business learn what customers want and customise products for them, while Social Commerce engages customers directly and promotes brand exposure by utilising visual media.

1.7: ELECTRONIC COMMERCE AND ICT

Electronic commerce (e-Commerce) is a virtual marketplace where users may purchase and sell goods. E-commerce is using telecommunication networks to transact tangible or intangible products and services physically and digitally. E-commerce helps build a consumer database and long-term relationships. The primary factors for E-commerce growth in India are rising disposable incomes, better internet access, lower inventory and product pricing, lower delivery charges, and cash on delivery.

E-commerce began to grow shortly after the internet was introduced to India in 1995, and the first online B2B directory was published in 1996. Time, communication, and geographic restrictions were reduced via B2B portals. B2C began in 1996 with the creation of matrimonial portals to arrange marriages between Indian families, followed by recruiting portals in 1997. In 1999, Rediff incorporated online shopping into its portal. Bazee.com, a website where users could buy and sell pre-owned items, was an instant hit and was eventually bought by e-Bay, a US-based e-commerce corporation. In the year 2000, India Times joined the competition. However, none of the companies could acquire customers' trust in online buying.

The introduction of online ticket buying by IRCTC in 2002 was a massive triumph for Indian Railways. Customers began to feel safe using credit cards as they came under Indian Government surveillance. With the introduction of low-cost airlines by Air Deccan in 2003, Make My Trip.com gained traction as an online ticketing platform in 2005. In addition to round-trip ticketing, the company now offers holiday packages and hotel reservations. Yatra.com began operations in 2006 with the booking of online aeroplane tickets. These portals overcame Indian clients' aversion to using credit cards online. The multiplex cinemas paved the way for Bookmyshow to become India's largest entertainment booking service, allowing users to select their preferred seats.

Amazon, Flipkart, Paytm, Jabong, Myntra, Zomato, MakeMyTrip, Swiggy, eBay, Cleartrip, AJIO, and Caratlane are some of the most well-known e-commerce companies in India. Flipkart, launched in 2007, is an Indian company that sells fashion, sports, and home appliances. Amazon, founded in 2020, is a leading e-commerce company. It has begun its operations with electronic items and has grown into sectors such as fashion and apparel, beauty, household needs, and healthcare. Snapdeal, which started as a daily deal platform and evolved into an e-commerce start-up through a marketplace model in 2011, now has e-bay as an investor. Jabong entered the Indian fashion and leisure market in 2012 and now processes approximately 7000 orders each day. Flipkart purchased Myntra.com in 2014 for an estimated Rs. 2000 crore. Walmart, the world's largest e-commerce company, invested 16 billion dollars in Flipkart to buy a 77 percent interest. Paytm began offering prepaid mobile and DTH recharging services in 2010 and made its first foray into e-commerce in 2014. After receiving an RBI licence, it established Paytm bank. Mukesh Ambani and Reliance Industries Limited created AJIO, an Indian e-commerce web start-up, in 2016.

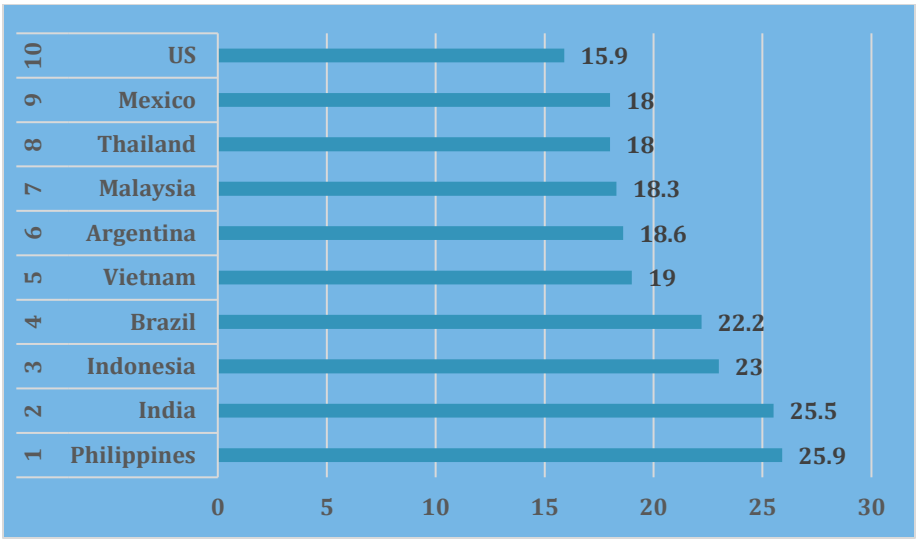
1.7.1: E-COMMERCE: MARKET SIZE:

The growth of Indian e-commerce is spiralling upwards. It is turning into the fastest growing online business industry fuelled by major government initiatives (like “Start-up India” and “Digital India”). It is expected to reach from US$46.2 billion in 2020 to US$111.40 billion in 2025, mainly due to the increased penetration of smartphones and the increase in internet users, which was 622 million in 2020 and is also expected to reach 900 million by 2025 (Economic Times,2021)[48].

Internet penetration, rising smartphone penetration, 4G/5G networks and increasing consumer wealth, advancements in payments and computing, changing consumer behaviour towards e-commerce, and availability of goods at the lower price have also played a major in the growth of the industry.

Graph Number 1.8:

Top 10 countries, Ranked by Retail e-Commerce Sales Growth,2022(Percentage of Change)

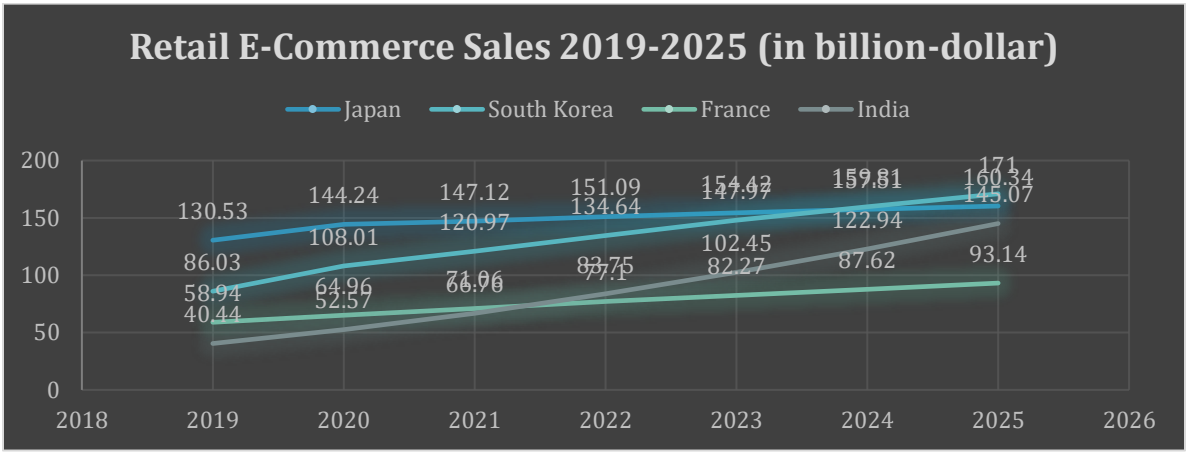


Source: eMarketer (2022)

Digital sales have benefited from consumers' reluctance to spend time shopping outside for extended periods of two consecutive calendar years. In 2022, India's e-commerce sales will expand by 25.5 percent, making it the world's fastest-growing e-commerce market this year. Even while India suffers from unemployment, social instability, and a stymied economic recovery, its ascension to the status of a digital retail superpower continues uninterrupted (eMarketer, 2022).

Graph Number 1.9:

Leading Countries Ranked by Retail E-Commerce Sales 2019-2025 (in billion-dollar)



Source:eMarketer (2022)[45].

Since China, the United States, and the United Kingdom are far ahead in e-Commerce sales, they are not included in the above graph. India, on the other hand, is rapidly climbing to the next tier of national marketplaces. Of course, India has a vast population regarding total e-commerce sales. Despite India being behind China by a large margin in terms of online customers and active e-commerce participants, India is expected to rank second in the world in terms of digital buyers in 2022, with a predicted 289.1 million. With 209.6 million buyers, the United States would come in third, while China will have 824.5 million (emarketer,2021)[46].

E-commerce is a democratic online marketplace open to all businesses regardless of small, medium, or start-up status. A better marketing approach, delivering services and systems whenever and wherever needed, coupled with customers having greater control over the production and delivery of products and services, are some of the primary advantages of E-commerce. Other benefits include increased consumer connections, lower transaction costs, price comparisons between vendors, customisation, lower inventories, and broader market penetration. Lack of enough bandwidth, reliability, security, and quality, expensive Internet access, poor logistics, underdeveloped transportation infrastructure, slow delivery of goods and services, poor customer service, lack of buyer trust, primitive payment gateway systems and lack of appropriate backend management systems (warehouse management. Enterprise Resource Planning etc.) are the main challenges. Added to this are a lack of competent people, resources, technology, cross-border challenges, and content restrictions in the media and entertainment sectors based on national security. After trying a product multiple times, customers who value personal interactions and touch are still reluctant to embrace e-commerce (Bhasin,2019)[47].

1.7.2: E-COMMERCE MODELS:

Business-to-Business (B2B) Model: The B2B model refers to cross-organisational business. Supply chain management (notably purchase order processing), inventory control, distribution, sales and support are some of its applications. It has the same role as a manufacturer of all accessories but buys them from other producers. Thus, the B2B model reduces search costs. B2B e-markets eliminate intermediaries and give market price information and transparency in all transactions.**Business-to-Consumer (B2C) Model:** B2C refers to financial transactions between a business and a consumer. This model covers product purchase information and personal finance management functions such as online banking, travel, and health. Flipkart.com, HomeShop18.com, Jabong.com, and Myntra.com are all examples. Customer trust is critical in this model because it demands that consumers disclose credit card and personal information for product purchases, which consumers are normally suspicious of. B2C e-commerce decreases transaction costs by offering the most competitive pricing for goods or services.

Business-To-Employee (B2E): This model focuses on the employee of an organisation by providing information regarding terms and conditions of employment, benefits, policies, standard operating procedure manual, company newsletters, services and products, etc. over the internet or intranet, which improves productivity, better time management and the efficiency to solve organisational issues effectively.**Consumer-To-Consumer (C2C):** Online transactions of buying and selling products taking place between individuals through forums, classifieds and auctions are referred to as the consumer-to-consumer model. Examples include eBay and bazee.com, where all stakeholders have to register, and the seller is obliged to pay a fee to the auction site, whereas the buyers need not have to pay. Craigslist is one of the top websites in the world and the leading service provider for classified ads in the C2C category.**Consumer To Business (C2B): In** this approach, the consumers are the sellers, and the organisations are the purchasers. The consumer sets a product's pricing. Consider the website monster.com, where users can submit a résumé detailing their education, expertise, and services. If his résumé is deemed suitable for the job, the company can hire him. Participants in this model must offer a service, company, or items. Since the C2B model is new, the legal concerns connected to invoicing and payment are not fully understood. The bright lining is that middlemen like PayPal and Google Wallet handle the legal and financial elements of all C2B transactions. (Sanfilippo,M.2022)[48].

1.7.3: E-COMMERCE EMERGING BUSINESS MODELS:

Private label: e-commerce entrepreneurs with innovative ideas about product design and manufacturing but lack resources to manufacture by themselves do so by placing their demands to manufacturing firms, label them, market them and sell them under a different label. The private label market is expected to quadruple in the next five years to cater to the growing demand. The two most convincing reasons for choosing private labels in the years to come are that personal label products are separated from their competitors since they are designed, manufactured, branded and sold by one company. The private label owners have complete control over their product since they own the design, specifications of the product, and techniques of manufacture and therefore are endowed with exclusive rights to sell them under their label. No manufacturer can guarantee products that are free from any defects; hence, quality control is a must to avoid problems. The main challenge is eliminating the right private label manufacturer for collaboration. **White label:** White label e-Commerce business refers to retailers repackaging products from a supplier with their brand names. While this business is bereft of manufacturing and quality control as the products have already undergone this process, White label vendors face extensive competition from other vendors since only the package design is under their control and the quality of the product or specifications is not under their control. A major obstacle in the white label business is the owners may land up with large batches of unsold inventory if vendors do not study the demand for the white label products since most suppliers set a minimum order quantity.

Dropshipping: Beginners in the e-commerce business with little or no capital can resort to what is termed as the genius in retail fulfilment known as Dropshipping, where vendors can market and sell products online without stocking the inventory of products. Dropshippers purchase items from the suppliers as the orders are being placed and directly ship them to customers. Dropshippers do not have to bother about warehouse space, store or manage stock, track inventory or handle any items. This business model can begin with a small budget, and they can upscale their business since the financial risks are minimal. They don't have to pay attention to the manufacturing side or inventory and can use their skills to design their website, develop customer support, and pay detailed attention to marketing and sales strategies. Trust and credibility are major risks arising from this business model, as there is no product control. Despite all the pros and cons of Dropshipping, it offers ample opportunities for new and ambitious online entrepreneurs to make it big in the field of the e-commerce business.**Print-on-demand:** This model lets anyone get any design printed on clothes, ceramic mugs and canvasses. The order placed is outsourced to other manufacturers in this business who print the designs of choice and deliver them directly to the customer in a branded package. There are some expected benefits between Dropshipping and print-on-demand, as both models do not require up-front capital, and the risks are low. Fees are paid to third-party suppliers in print-on-demand business as orders are shipped. The print-on-demand model requires graphical excellence and acute marketing strategies, and unwavering customer support to have the edge over other competitors to become successful. Prime examples of print-on-demand websites include My Face Socks and Lovimals.**Subscription service:** The subscription service is a time-based service where one can choose to avail of the same for some time at the customer's convenience. Depending on the experience of the service, a customer can choose to cancel or renew. For example, Healthy Surprise, a food subscription service website, is a meal delivery service that will bring food to one's doorstep over a set time by the customer. This model is tempting as an e-commerce venture to retain customer loyalty and trust.**Wholesaling:** This model is about bulk-selling products at discounted prices to retailers or customers, which was considered a B2B model, but with the advent of the internet, any produce or product can be offered wholesale in the C2B or B2C model. The increase in revenue to 550 percent by Beard and Beard and Laird Superfood is a striking example of wholesaling (Laurinavicius,2020)[49].

To choose the most acceptable e-commerce business strategy, companies must ask essential questions: Who is your target market? What are your short- and long-term goals for the company? What exactly are you hoping to recoup from this transaction? When starting a new company, how much time and money are you willing to invest? If you can find answers to these questions and keep working on them, it will be easy for businesses to reach great heights(Bigcommerce, n.d.,b)[50]

1.7.4: GOVERNMENT INITIATIVES TO PROMOTE E-COMMERCE:

To promote e-commerce, the Indian Government has launched Udaan, a B2B online trade platform, BHIM, encouraging consumers and merchants to pay digitally. The Indian Government amended the FDI (Foreign Direct Investment) e-commerce policy on February 1, 2019, to eliminate the distinction between online and offline enterprises. This was owing to traditional retailers complaining about e-commerce businesses' exploitative pricing and unfair trading practices. The new rules are expected to impact India's e-commerce industry. To remove middlemen and reduce corruption in all government sectors, e-commerce is undoubtedly the greatest approach to manage business. While eliminating middlemen in all commercial activity is difficult, online transactions will reduce criminal activities like money laundering and syphoning. Online business is an intelligent way to overcome all the obstacles in dealing with procurement and placing orders related to Government. The surge in digital payment was seen as a result of demonetisation, where the focusses was shifted to e-commerce. "Government e-Marketplace" is a platform created by the Indian Government under the Finance Ministry for Government purchases. The online purchase of goods and services worth up to 50,000 related goods and services can be made by Government employees. The Indian Government launched Mahila e-haat, an e-commerce platform where women are encouraged to trade their products online under the Ministry of Women and Child Development, and the Common Service Centers Scheme (CSCs), a village-level online portal retail chain where essentials are supplied and home deliveries are made through orders taken online and offline. In collaboration with the Ministry of Electronics and Information Technology (ME&IT), this programme targets 60 million consumers through 3.8 lakh points of sale (Mittal,2020)[51].

1.7.5: TOP TRENDS IN THE E-COMMERCE SECTOR:

The top trends in the e-commerce segment are given below:

Progressive Web Apps (PWA) are web apps that look and feel like mobile apps and may be viewed with or without a mobile app installed. A better user experience without downloading the app, which takes up a lot of mobile space, has increased conversions by 40 percent for Pinterest. More market players (even small e-tailers) will likely utilise PWAs to improve user experience, gain momentum, and grow their operations.

Customised subscription service concepts are becoming increasingly popular today. Subscription-based digital logistics platforms quickly learn client preferences and tastes. This strategy helps firms make business decisions, plan, and maintain inventory. Subscription services for logistics will grow in popularity this year as e-commerce platforms strive to cut non-delivery rates.To keep up with the ever-increasing conversational involvement, modern e-commerce processes require **end-to-end automation**. The sellers are increasingly opting for real-time cargo tracking, COD acceptance, AI-driven courier proposals, the convenience of arranging pickups, and better route planning. Sellers will prioritise real-time package tracking over simple arrival status. Less ambiguity will enhance client retention.

Business intelligence will lower non-delivery rates, lowering delivery costs. Swiggy, Dunzo, and Zomato all guarantee 30-minute deliveries. Delivery times of same-day and two-day deliveries are now possible.With more players entering e-commerce platforms and competitors feeling the heat, the consumer becomes the king, and their opinions and feedback are given greater weight. **User newsfeeds** on Facebook and Instagram are now tailored to their browsing habits. **Third-party logistics (3PL**) providers like Shiprocket, on the other hand, allow for personalisation through features like customised tracking pages (for re-marketing) and the creation of a free e-commerce website.A number of companies are actively exploring **drone delivery**. Drones can easily deliver roughly 80 percent of Amazon goods, which may lead to its launch in India, increasing competitiveness and saving shipping companies around $50 million.

The e-commerce industry has implemented a **voice-based search** tool to make searching more accessible by bringing technology to the next level. These features make finding a product simple and painless. Furthermore, because the English-speaking population in India is significantly smaller than the non-English-speaking population, several vernacular languages are being added to improve user experience – a trend fuelled primarily by social media and networking apps such as ShareChat, Trell, Helo, and others.

Video-enabled commerce/live commerce is another element that has quickly acquired popularity. With so many options available to customers today, capturing and keeping their attention is difficult. They constantly look for new shopping features and solutions to enhance their buying experience. Live streaming commerce, which combines rapid purchasing with entertainment, is quickly becoming a component of popular e-commerce. Video/live commerce will likely be a big revenue and growth driver for the e-commerce category this year, especially in Tier-II and Tier-III cities, where video content consumption is rising. **Social commerce** has grown in popularity over the last few years, with internet penetration, smartphone usage, and social media usage increasing continuously. Far from being a fad, social media-based commerce is now a channel used by several firms, particularly direct-to-consumer (D2C) brands. Social media impact in e-commerce has been one of the most favoured and long-lasting trends since it provides a frictionless, convenient experience through visually appealing and ephemeral material. According to Recogn, WATConsult's research branch, the total number of social commerce shoppers in India is predicted to grow at a 45 percent annual rate to over 228 million by the end of 2022(Tandon,2021)[52]. Convenience, comfort, and the overall experience are all important to today's consumers, so brands must engage them and deliver a user-friendly shopping experience. Consumers also want a personal touch in their purchases; therefore, product customisation is a significant concern for businesses. Brands can **personalise customer recommendations** and items based on their product browsing history, purchasing behaviours, and preferences, thereby improving the shopping experience.Another feature that consumers are increasingly favouring is the **BNPL (Buy Now Pay Later**).

The BNPL feature allows users to make purchases at the touch of a button, eliminating the need to get out your credit/debit card or hunt for the UPI ID. It's also a great technique to prevent cart abandonment, which occurs when customers reach the payment gateway. Brands can use the BNPL feature to reduce cart abandonment and enhance order conversions.Technology is at the heart of the e-commerce industry today, enabling many advancements that improve customer buying experience while lowering costs and speeding up the business process. **Chatbots** are one of the most widely used technologies in recent years. Chatbots, which AI/ML powers, are a more convenient approach for brands to respond to customer questions anytime without deploying a human resource. Chatbots will continue to dominate customer service in 2022.The days of brands selling their products/services through a single channel are long gone. In today's technologically advanced world, companies and customers rely on various channels to fulfil their e-Commerce needs, including social media, video, email, text, and adverts. To expand their reach, customer acquisition, retention, and satisfaction, especially stores that previously solely had an offline presence, are now transitioning to online channels. Customers benefit from **omnichannel marketing** because it makes it easier to find new businesses across numerous channels, giving them more options to choose from (Gupta,2022)[53]. In e-Commerce, **augmented reality (AR) and virtual reality(VR)** dramatically changes the purchasing experience by allowing buyers to understand and feel the goods visually. This immersive experience will enable consumers to engage with products in real-time while remaining in their location. Augmented reality (AR) helps clients bridge the gap between in-store and online shopping. The Covid-19 epidemic has closed retail businesses, preventing people from entering and physically handling products. Using augmented reality in e-commerce allows firms to inform and communicate with customers, even after buying. Younger generations want more interactive shopping. According to Gartner, 30 percent of millennials and Gen Z shoppers desire more AR and VR purchasing experiences online than 14 percent of previous generations (Gartner,2021)[54]. **Artificial Intelligence,** with its ability to understand user habits and preferences, is the key to providing intelligent and highly personalised recommendations to meet customers' desire for a personalised experience. A need for data accompanies the rise of artificial intelligence to train machine learning models, and several businesses collect personal data from their customers, creating a double-edged sword: on the one hand, it improves the shopping experience, but on the other, it poses a potential security risk. Amazon has long acknowledged the advantages of artificial intelligence and similar technologies. **Machine learning** is used by the colossal e-commerce giant to better product selection, customer experience, and logistics. Artificial intelligence is increasingly used to deliver individualised product recommendations, pricing optimisation, improved customer service, consumer segmentation, smart logistics management and sales and demand forecasting, among other things (bigcommerce, n.d.,a)[55].

According to a recent McKinsey analysis, **real-time customer analytics** will continue to be critical for monitoring and reacting to fluctuations in consumer demand that may be used for pricing optimisation or targeted marketing.

1.8: THE SHIFT TOWARDS M-COMMERCE

Having cell phones and tablets in daily life has become a habit. Mobile phones have changed our way of thinking and daily behaviours, whether personal or work-related. The handheld gadget has influenced how we communicate with other consumers and businesses. Consumers now easily access retailers worldwide due to technological advancements and innovation. In India, smartphones have a 54 percent penetration rate. With 4G networks (now 5G networks) and mobile app-based e-commerce playing a significant role in revenue creation, businesses are focusing on a 'mobile-first approach, with items and services available first through a mobile portal before being available through other traditional channels. To attract and maintain clients, mobile applications are increasingly striving for streamlined, intuitive user interfaces, individualised profiles, quick payment methods, and 24/7 access.

With the rising movement toward M-Commerce, entrepreneurs and consumers are becoming accustomed to developing difficulties with the ethical use of customer data, privacy protection, and the after-effects of M-Commerce adoption in the event of a breach of trust and data. As a result, assessing m-Commerce adoption and usage among Indian consumers is critical. What reasons drive people to m-Commerce while it is blooming becomes critical to understand for greater adoption and sustainability (Sreenivasan et al., 2010). This study has tried to shed light on that element of the situation.

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