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USTHB

Information and communications technologies

TIC report

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# **Introduction:**

The current era has witnessed an enormous knowledge and information revolution in all fields of science that significantly contributed to stimulating many essential developments in all aspects of life [1].

ICT, or information and communications technology (or technologies), is the infrastructure and components that enable modern computing. Among the goals of IC technologies, tools and systems, is to improve the way humans create, process and share data or information with each other. Another is to help them improve their abilities in numerous areas, including business; education; medicine; real-world problem-solving; and even leisure activities related to sports, music, and movies.

The use of ICT technologies and application has started since 1990’s. Data and Communication Technology system embody computers, laptops and tablets, fixed and mobile phone systems, communication network software-even wearable’s [2].

There is no single, universal definition of ICT because the technologies, devices and even ideas related to ICT are constantly evolving. However, the term is generally accepted to mean all devices, networking components and applications. When combined, these help people and organizations interact in the digital world [3].

ICT encompasses the internet-enabled sphere and the mobile one powered by wireless networks. It includes antiquated technologies, such as landline telephones, radio and television broadcast – all of which remain widely used alongside today’s cutting-edge ICT pieces, such as artificial intelligence and robotics.

The internet, virtual reality and social media are also part of ICT, as are cloud computing services, video conferencing and collaboration tools, unified communications systems and mobile communication networks. Emerging, work-in-progress or still-nascent technologies like 5G/6G, Web3, and quantum computing are also in the ICT universe.

In the business world, ICTs have become essential tools for organizations to improve efficiency, enhance productivity, and gain a competitive advantage. Hayes and Finnegan (2017) highlight how ICTs have revolutionized business operations, from digital marketing strategies to e-commerce platforms [4]. The integration of ICTs has enabled companies to streamline processes, automate tasks, and access real-time data for informed decision-making.

Within the education sector, ICTs have brought about significant changes in teaching and learning methods. According to Kozubík and Stašová (2019), the implementation of ICTs in education has opened new opportunities for personalized learning, interactive lessons, and distance education. Virtual classrooms, online course platforms, and digital resources have made education more flexible and accessible to a broader range of learners [5].

However, along with the benefits, ICTs also pose challenges. The issue of digital divide, characterized by uneven access to technology and internet connectivity, remains a concern [6]. Additionally, privacy and security concerns have become prominent due to the vast amount of personal data being shared and stored online [7].

In this report, we aim to provide an in-depth understanding of ICTs, their impact on society, and their potential for shaping our future. By exploring the various aspects of ICTs, we seek to shed light on the immense opportunities and challenges they present and emphasize the importance of responsible and ethical use.

# **Information and communication technologies (ICT):**

ICT stands for “Information and communication technology”. It refers to technologies that provide access to information through telecommunication. It is similar to Information Technology (IT) but focuses primarily on communication technologies. This includes the internet, wireless networks, cell phones and other communication mediums [8].

According to UNESCO “ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters”.

The UNESCO glossary also defines Information and communication technologies (ICT) as a diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players, and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.) [9].



# **Evolution of ICT:**

ICT is evolving at a very fast pace. Our grandparents grew up in a society without telephones, our parents in a society where radio was the first and television the last source of information. We live in an Internet world. And the new generation is living in a wireless world. As a result, the world around us has changed dramatically over the years. This dramatic change in ICT is a result of innovations in science, defense and business. These innovations have reduced the size of technological tools and increased the speed at which they work to process data and communicate information. We can identify five stages of ICT evolution. They are the evolution of the computer, the PC, the microprocessor, the Internet, and wireless connections [10].

# **Google services:**

Google has become a household name and a dominant force in information and communications technology (ICT) in today’s digitally driven world. Google offers a wide range of innovative services. Google has revolutionized the way individuals, businesses and organizations interact with technology. Google’s services have become an integral part of our daily lives through its user-friendly interfaces, advanced algorithms and robust infrastructure.

## **Google search:**

Google Search enables users to access vast amounts of information in seconds and is the cornerstone of Google’s services. It is a powerful information retrieval tool with advanced search algorithms, semantic understanding and personalized features. Google Search is an invaluable asset to the ICT industry, transforming the way we gather knowledge, conduct research, and stay informed [11].

## **Google Maps:**

The way we navigate and explore the world around us has been revolutionized by Google Maps. Using satellite imagery, geospatial data and real-time updates, the service provides accurate and detailed navigation, traffic and street views. Additionally, Google Maps’ impact on the ICT landscape is being expanded through the Google Maps APIs, which allow developers to integrate mapping capabilities into their own applications [12].

## **Google Drive:**

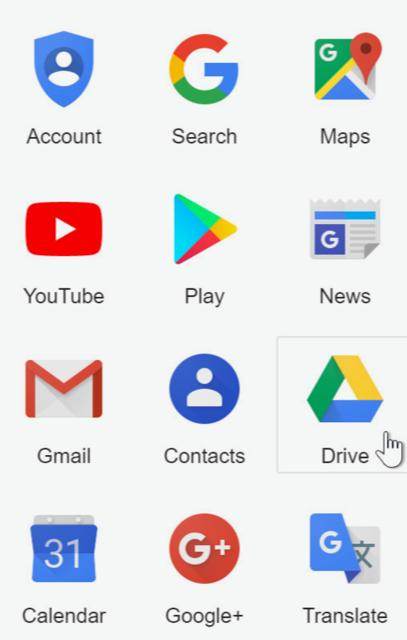
Google Drive is our cloud storage platform for storing, sharing, and collaborating on documents, presentations, and other digital content. Accessible from any device with an Internet connection, users can store files securely on Google’s servers. It also promotes seamless teamwork and remote collaboration through its collaborative features, which allow users to edit and share at the same time [13].

## **Gmail****:**

## Gmail, the e-mail service from Google, has changed the way people communicate. Gmail has become one of the world’s most popular email services with an easy-to-use interface, powerful spam filtering, and plenty of storage space. It also integrates with other Google services to help increase productivity and allow users to seamlessly manage tasks, appointments, and files [14].

## **Google Meet:**

Over the past few years, Google Meet has gained immense popularity due to the growing demand for remote work and video conferencing. It is a service that enables high quality video meetings, screen sharing, and real-time collaboration. Meet, part of Google Workspace, is transforming how people communicate in traditional and virtual ways, enabling organizations to stay connected no matter where they are [15].



# **Microsoft Tools:**

With today’s technology-driven world, businesses need to communicate efficiently and effectively to keep their operations running smoothly. Microsoft, one of the world’s leading technology corporations, provides an array of powerful tools to support this communication and improve the overall ICT environment. In this text, we will explore some notable Microsoft tools and their importance in the ICT field.

## **Microsoft Teams:**

Teams is a collaborative platform designed to optimize communication and teamwork within businesses. Features include instant messaging, audio and video conferencing, file sharing, and project management. Using Teams, team members can discuss, share ideas, and collaborate on projects in real time, regardless of their geographic location. It also provides seamless document sharing and increased productivity through integration with other Microsoft tools, such as Office 365 and SharePoint. Organizations that use Teams experience a 17.9 % increase in productivity and a 16.4 % decrease in communication costs, according to a recent study by Forrester Consulting [16].

## **Microsoft SharePoint:**

## Another valuable tool that facilitates ICT operations is Microsoft SharePoint. SharePoint provides a web based platform for document management, content collaboration and intranet building. It ensures the smooth flow of information throughout the organization by enabling teams to securely access and share documents. With features such as version control, document libraries and workflow automation, SharePoint can significantly improve collaboration and knowledge management. Organizations implementing SharePoint have experienced a 25 % reduction in document duplication and a 10 % reduction in content creation costs, according to Microsoft (n.d.) [17].

## **Azure DevOps:**

It is a comprehensive toolset that empowers developers and IT operations teams as part of the Microsoft Azure cloud computing platform. It facilitates agile development practices, automating the software delivery process and ensuring continuous integration and deployment. Azure DevOps promotes seamless collaboration among everyone involved, including developers, testers, and project owners, with a single place for planning, tracking, and discussing project progress. Organizations that adopt Azure DevOps experience a 22 % reduction in development time and a 30 % reduction in unplanned work, according to an IDC study [18].

## **Microsoft Power BI:**

## Microsoft Power BI provides organizations with a sophisticated data visualization and business intelligence platform. With Power BI, users can connect multiple data sources. They can create interactive dashboards and generate insightful reports. With powerful features such as AI-driven insights and automated data refreshes, this tool eliminates the need for manual data analysis. Organizations using Power BI reported a 250 % ROI (Return on Investment) within three years and a 60 % reduction in report creation time, according to a study conducted by Forrester Research [19].

# **Git and GitHub:**

In recent years, with the advent of version control systems like Git and online platforms like GitHub, the field of Information and Communication Technologies (ICT) has undergone a significant transformation. The creation of Git by Linus Torvalds in 2005 and the launch of GitHub in 2008 have revolutionized the way software development and collaboration is done.

## **Git:**

Git is a distributed version control system. It allows developers to efficiently track changes to their code base. It provides a distributed approach where each developer has his own local repository and can work on his code independently. The most important feature of Git is its ability to handle branches, which allows developers to create multiple versions of their code and merge the changes together seamlessly. This ability to branch makes it easier to collaborate and eases the process of integrating code, which ultimately increases developer productivity.

## **Github:**

GitHub is an online platform for the hosting of Git repositories and collaborative software development. It enables collaborative software development.

GitHub improves the overall software development process with features such as issue tracking, pull requests, and code reviews. In addition, GitHub serves as a hub for open source projects. Developers from around the world can contribute to the code base, fostering innovation and building vibrant communities.

|  |  |  |
| --- | --- | --- |
| **Feature** | **Git** | **GitHub** |
| Definition | Distributed version control system. | Web-based platform for version control using Git. |
| Functionality | Manages source code history and version control. | Provides a platform for hosting and collaborating on Git repositories. |
| Collaboration | Primarily local, can be used for collaboration within a team. | Facilitates remote collaboration with features like pull requests, issues, and discussions. |
| Access Control | Limited to local machine settings. | User authentication, access control, and collaboration tools. |
| Repositories | Can be created locally on any machine. | Hosted online on GitHub, can be public or private. |
| Cost | Free and open source. | Offers both free and paid plans, depending on usage and features. |
| Type | Software/Tool. | Web service |

# **Comparison of technologies:**

|  |  |  |
| --- | --- | --- |
| **Technology** | **Advantages** | **disadvantages** |
| Google Services | Cloud-based, Collaboration | Privacy concerns |
| Microsoft Tools | Office integration, Enterprise solutions | Cost for some features |
| Git and GitHub | Distributed version control, Collaboration | Learning curve |

# **Importance of ICT in Business:**

Information and communication technology (ICT) has become a vital part of modern business operations. With the increasing amount of data being generated, businesses need ICT tools to help collect, store, and analyze this data. This has led to the development of sophisticated software and hardware solutions that enable businesses to manage their operations more efficiently.

From inventory management to customer relationship management, ICT has become an integral part of every aspect of a business.

Without these technologies, businesses would face major disruptions, as seen in scenarios where Google or news channels experience downtime. Additionally, ICT plays a critical role in e-commerce, location flexibility for employees, and analyzing business performance [20].

For businesses, advances within ICT have brought a slew of cost savings, opportunities and conveniences. They include the following:

* Highly automated businesses processes that have cut costs.
* The big data revolution, where organizations are turning the vast trove of data generated by ICT into insights that drive new products and services.
* ICT-enabled transactions such as internet shopping and telemedicine and social media that give customers more choices in how they shop, communicate and interact [21].

# **Information and Communication Technologies in Education:**

ICT implementation has immensely transformed teaching and learning methodologies. Technology significantly influences student-centered teaching and learning processes [22]. Thus it provides an opportunity for teachers to empower their learners by integrating digital skills.

* www - www stands for World Wide Web, which is one of the most important and widely used services (such as IRC, email, etc.) of the Internet. Its popularity has grown dramatically, simply because it’s very easy to use and because of the colourful and rich in content.
* E-learning - also known as online learning. E-learning encompasses learning at all levels, both formal and non-formal, using an information network – the Internet, an intranet (LAN) or an extranet (WAN). Its components include e-portfolios, cyber-infrastructures, digital libraries, and online repositories of learning objects. All the above components create a digital identity of the user and connect all stakeholders in education. It also facilitates interdisciplinary research.
* Group Discussion - Internet Relay Chat (IRC) is one of the popular Internet services that people mostly use for live chatting. Group of people with common interest can exchange views /opinions with each other instantly through Internet. Description of Internet technologies needed to support education through ICT (www, videoconference, tele-conference, mobile conference, CD database, word processor, intranet, internet etc.).
* E-Modules - Written modules are converted and stored in a digital version in a computer using a word processor accessible by the user through the Internet.
* Teleconferencing

1. Audio - Conferencing - It involves the live (real time) exchange of voice messages over a telephone network when low - bandwidth text and still images such as graphs, diagrams or pictures can also be exchanged along with voice messages.
2. Video - Conferencing - It allows the exchange of not only voice and graphics, but also moving images. Video conferencing technology does not use telephone lines, but either a satellite link or a television network
3. Web-based Conferencing - Web-based conferencing, as the name implies, involves the transmission of text and graphic, audio and visual media over the Internet; it requires the use of a computer with a browser and a web browser. Communication can be either synchronous or asynchronous.
4. Open and distance learning.

All of these services made available through ICT play a major role in the training of teachers. It allows for greater participation and interaction. It also improves the quality of education by facilitating learning by doing, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn [8].

# **Challenges in implementing ICT:**

ICTS encompass various tools, applications, and technologies that enable the efficient collection, processing, storage, and dissemination of electronic information.

However, despite their numerous benefits, implementing ICTs can pose several challenges.

* **Infrastructure constraints:** One of the foremost challenges in implementing ICTs is the lack of robust infrastructure. Insufficient connectivity, inadequate bandwidth, and outdated hardware can hinder the effective utilization of ICTs [22].
* **Digital divide**: Digital divide refers to the disparities in access to and use of ICTs among different regions, demographics, and socioeconomic groups [23].
* **Resistance to change:** Often, organizations face resistance to technology adoption from employees who fear job displacement or lack the necessary skills to navigate new ICT systems [24].
* **Hacking:** The access to our various accounts is through user ids, and these services are provided through internet. Through internet people steal and gather security passwords of others, get access to others’ accounts. This is termed as hacking. Hackers also get into users’ banking accounts and inflict financial losses. Not sharing password with others and frequent change of password has become a necessity for safe internet usage.
* **Trolls and abuses:** Internet is also a platform to express personal enmity in the form of trolling and abusing people online. Since it is easy to conceal identity in internet, people resort to this practice more frequently.
* **Viruses:** Viruses are relatively simple programs written by humans to cause annoyance or damage to computers or their files. They are also responsible for data corruption and loss.
* **Security and Privacy concerns:** The exponential growth of ICTs has exposed organizations to increased cybersecurity threats and privacy risks. Protecting sensitive data and ensuring compliance with regulation are key challenges in ICT implementation [25].
* **Health:** Internet and social networking addiction is a popular and recognized side of the emergence of ICT. Excessive Internet use is also associated with attention problems [10].

# **Future Trends in ICT:**

Information and communications technologies are constantly evolving, shaping the future of various industries and revolutionizing the way we live and work.

1. **Quantum Computing:** Quantum Computing holds immense promise for solving complex problems at unprecedented speeds. To manipulate and process massive amounts of data, this emerging technology uses quantum mechanics. Its potential applications include cryptography, optimization, drug discovery, and simulations of intricate systems [26].
2. **Blockchain Technology**: Blockchain is gaining attention for its decentralized and secure nature, providing trust and transparency in various sectors. In addition to cryptocurrencies, blockchain has potential applications in supply chain management, healthcare record keeping, legal contracts, and secure voting systems [27].
3. **Extended Reality (XR):** It refers to technologies that combine virtual reality (VR), augmented reality (AR), and mixed reality (MR) to create immersive and interactive experiences. Industries such as gaming, education, healthcare, and training simulation have the potential to be transformed by XR applications [28].
4. **Edge Artificial Intelligence (AI):** Edge AI is a trend that has great potential for applications such as autonomous vehicles, surveillance systems, and healthcare devices, by bringing AI capabilities to edge devices and enabling real-time processing and analysis of data locally, rather than relying solely on cloud computing [29].

# **Conclusion:**

In our daily lives, information and communication technology (ICT) has become increasingly important. Various sectors of the world’s economy, including business, tourism, banking, medicine, architecture, and engineering, have been greatly influenced by ICT.

Google’s services have undoubtedly transformed the field of ICT. From its powerful search engine to its cloud-based storage and collaboration tools, Google has made information more accessible, communication more efficient and collaboration more seamless. By staying at the forefront of technological advancements, Google continues to shape the way we interact with ICT, and its services remain indispensable in our increasingly digital world.

Microsoft tools play a critical role in enriching an organization’s ICT landscape. Teams, SharePoint, Azure DevOps, and Power BI collectively empower businesses with efficient communication, collaboration, agile development, and data-driven decision-making capabilities. The referenced studies demonstrate the tangible benefits organizations can realize by adopting these Microsoft tools. By leveraging these powerful tools, organizations can enhance their ICT capabilities and drive productivity, innovation, and business growth.

Git and GitHub have revolutionized software development and collaboration in the ICT landscape. Git’s distributed version control system allows developers to track changes and manage code efficiently, while GitHub provides a collaborative platform for code sharing, review, and community building.

While there are many challenges to implementing ICTs, organizations can over-come these obstacles through strategic planning, infrastructure development, training programs, and robust cybersecurity measures.

Future trends in ICT, including quantum computing, blockchain technology, augmented reality, and edge AI, will revolutionize various industries and create new opportunities for innovation and growth.

By staying informed and adapting to these emerging trends, organizations can harness the transformative power of ICT and gain a competitive edge in the digital era.

Adopting responsible practices is key to maximizing the benefits of ICT while mitigating the risks. This report advocates a forward-looking and collaborative approach to unleashing the full potential of ICTs for the betterment of society.

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