# Information and Communication Technology (ICT) in the Modern World: Prospects and Challenges

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**Abstract:- This research paper examines the evolving and kindling trends in the field of computing and Information Technology (IT). Besides, it also involves the impact made by IT in the context of the world. Apart from providing insights on the prospects and influencing challenges in the field of IT, this research highlights the data on various existing jobs in the concerned sector and the processes by which one can entail a career in IT. As for now, Information and Communication Technology (ICT) employs over 62 million employees (with reference to Statista Research Department). Moreover, this paper enlists the feasible solutions for emerging problems in ICT.**

## I. INTRODUCTION

➢ *IT in the Modern World:*

In a modern context, the term 'IT' is commonly used to describe computers and networks within a business environment. It refers to their applications in: generating, manipulating, storing, regaining, transmitting, handling, exchanging, studying and securing all data or information in an electronic format. IT is also used as an umbrella term to cover: television, telecommunication equipment, software, e-commerce and the internet.

When thinking about IT you need to consider IT support within both your personal and private life. Especially when it comes to the increasingly sophisticated level of cybercrime, we see every day. This is so that when you are surfing the web on your computer or receiving an email, your personal and business data is kept safe. IT support also covers technical problems you may come across, ensuing you are using the most up to date software and finding the best tools possible to effectively complete tasks.

Humanity has been manipulating, storing, and communicating information since the early Sumerians pioneered the written word in ancient Mesopotamia, circa 3000 BC. The term IT did not appear until the mid-20th century however when an influx of early office technology appeared. The term was first published in the 1958 Harvard Business Review when authors Harold J. Leavitt and Thomas C. Whisler said "the new technology does not yet have a single established name. We shall call it Information Technology."

➢ *Prevailing Examples of ICT*

- Telephone and radio equipment, along with switches, facilitate voice communications.
- Traditional computer applications involve data storage and programs for data input, processing, and output.
- Office automation systems, like word processing and spreadsheets, and the computers running them are supported by software.
- Users' personal computers (PCs) and the associated software they use.
- Server hardware and software serve various applications such as electronic mail/groupware, file and print services, databases, web servers, and storage systems.
- Data, voice, and video networks, along with their communication equipment and software.
- Peripherals like scanners and digitizers, directly connected to computer information systems to collect or transmit audio, video, or graphic data.
- Voice response systems that interact with computer databases or applications.
- The state radio communications network.
- Computer systems that are "open" or integrated are tasked with monitoring and automating mechanical or chemical processes.

These systems also serve as repositories for data utilized by computer applications to facilitate analysis and decision-making, such as in the case of building management systems.
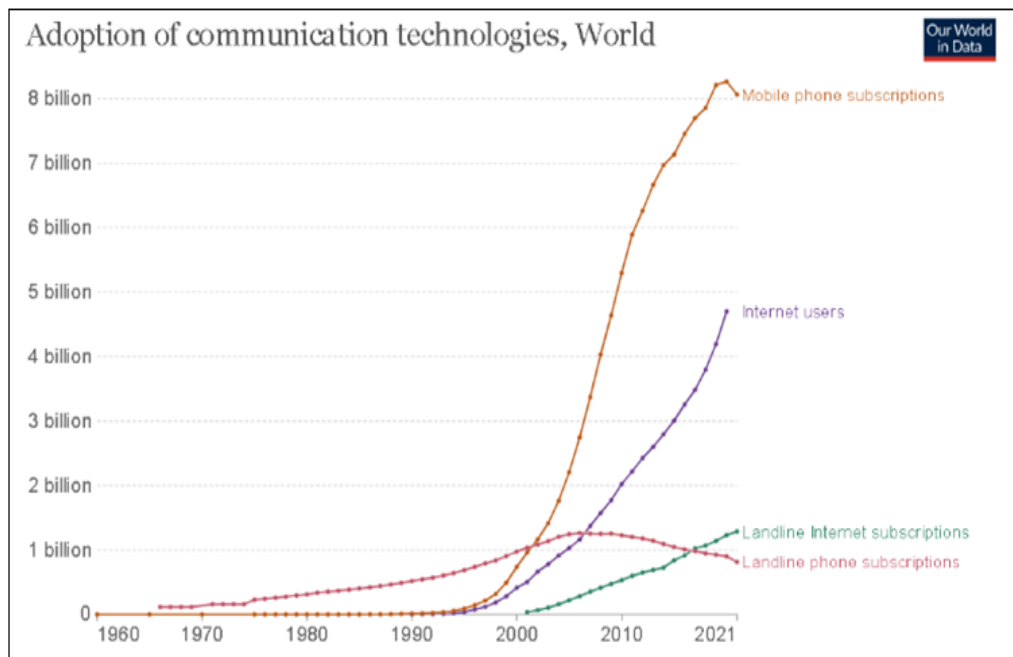
Fig 1 A Line Graph Showing Adaptation of Communication Technologies in the World,
Source: International Telecommunication Union (via World Bank)

## II. OBSERVATION

### A. Impact of Information Technology in the World

ICT has played a significant role in fostering economic growth and social progress in recent decades. Previous research has demonstrated the critical impact of ICT on national e-commerce growth, economic growth, and overall country development. Both developed and developing nations have increased their investments in ICT to drive economic advancement. To achieve ICT development, innovative approaches and integration of new technologies are essential, as highlighted by Heeks. The widespread diffusion of ICT has even surprised leading international organizations like the United Nations, the World Bank, OECD, ITU, and numerous governments.

An illustrative example of ICT's progress is the benchmark achievement in global ICT access, particularly in mobile applications, which was accomplished ahead of the predicted timeline. The prediction set by the World Summit of the Information Society for 2015 was surpassed in 2008. It is estimated that more than half of the world's population would have access to ICTs by 2015. Mobile applications have expanded beyond voice communications, encompassing business transactions and information access. In developing countries, there has been a rapid increase in the number of users accessing the Internet through mobile devices. For instance, China, being the largest developing country, had 233 million mobile Internet users in 2009, with an estimated annual growth rate of 51% (CINIC 2010).

### B. Evolving Trends in ICT:

#### ➤ Artificial Intelligence:

The significance of logical reasoning in intelligence has been a prominent focus in the field of AI research. A crucial milestone in this domain was the creation of the Logic Theorist in 1955-56 by Allen Newell and J. Clifford Shaw from the RAND Corporation, along with Herbert Simon from Carnegie Mellon University. This program was designed to prove theorems based on Principia Mathematica, a three-volume work authored by British philosopher-mathematicians Alfred North Whitehead and Bertrand Russell between 1910 and 1913. Notably, the Logic Theorist even produced a more elegant proof for a theorem compared to the proofs found in the original Principia Mathematica books.

Newell, Simon, and Shaw went on to write a more powerful program, the General Problem Solver, or GPS. The first version of GPS ran in 1957, and work continued on the project for about a decade. GPS could solve an impressive variety of puzzles using a trial and error approach. However, one criticism of GPS, and similar programs that lack any learning capability, is that the program's intelligence is entirely secondhand, coming from whatever information the programmer explicitly includes. (B.J. Copeland, 2023)

- AI in 21st Century:

#### ✓ Machine Learning:

Machine learning, as a subset of artificial intelligence and computer science, revolves around the utilization of data and algorithms to simulate human learning processes, with the goal of continuously enhancing its precision. Frameworks like TensorFlow and PyTorch are commonly employed to develop machine learning algorithms, expediting the creation of solutions.

#### ✓ Autonomous Vehicles:

Machine learning and AI are foundational elements of autonomous vehicle systems. Through machine learning, vehicles are trained to learn from the complex data that they receive to improve the algorithms that they operate under

and to expand their ability to navigate the road. AI enables these vehicles' systems to make decisions about how to operate without needing specific instructions for each potential situation.

✓ *Large Language Models and Natural Language Processing*

Natural language processing (NLP) involves analyzing how computers can process and parse language similarly to the way humans do.

One popular language model was GPT-3, released by OpenAI in June 2020. One of the first large language models, GPT-3 could solve high-school-level math problems as well as create computer programs. GPT-3 was the foundation of ChatGPT software, released in November 2022. ChatGPT almost immediately disturbed academics, journalists, and others because of concern that it was

impossible to distinguish human writing from ChatGPT-generated writing. One issue with probability-based language models is "hallucinations": rather than communicating to a user that it does not know something; the model responds with probable but factually inaccurate text based on the user's prompts. This issue may be partially attributed to using ChatGPT as a search engine rather than in its intended role as a text generator.

NLP presents certain issues, especially as machine-learning algorithms and the like often express biases implicit in the content on which they are trained. For instance, in 2015 Amazon's NLP program for résumé screening to aid in the selection of job candidates was found to discriminate against women, as women were underrepresented in the original training set collected from employees. (B.J. Copeland, 2023)



Fig 2 AI Job Posting (by % of All Posting) in the U.S

➢ *Robotics:*

Robotics is a field of engineering that encompasses the conception, design, construction, operation, application, and utilization of robots. These robots are defined as machines capable of automatically carrying out a series of actions independently, typically performing tasks that are traditionally accomplished by humans.

- *Types of Robots:*

Robots exhibit a wide range of forms and functionalities, as evidenced by their versatility. Here are some of the various types of robots in use today:

✓ Healthcare: In the healthcare industry, robots play diverse roles, from assisting in surgical procedures and aiding with physical therapy to facilitating patients' mobility and delivering essential medical supplies within hospitals. They have even contributed to combating the pandemic, participating in tasks such as filling and sealing testing swabs and manufacturing respirators.

✓ Homelife: Robots are now commonly found in households, exemplified by devices like the Roomba, which performs vacuuming tasks. However, modern home-based robots extend their capabilities to activities like lawn mowing and integrating with virtual assistants like Alexa.

✓ Manufacturing: The field of manufacturing was one of the earliest adopters of robots, particularly in assembly lines for industries like automobile production. Industrial robots are proficient in a variety of tasks, including arc welding, material handling, steel cutting, and food packaging.

✓ Logistics: To meet the demands of efficient online order fulfillment, companies employ robots for tasks such as organizing warehouse shelves, retrieving goods, and executing short-range deliveries.

✓ Space Exploration: Robots have played pivotal roles in space exploration missions, such as the Mars explorers Sojourner and Perseverance, as well as the Hubble telescope. Deep space probes like Voyager and Cassini also fall under the category of robots.

✓ Military: Robots are employed to handle dangerous tasks, especially in modern warfare scenarios. Military robots come equipped to address risky jobs associated with war, such as explosive detection and disposal (e.g., Centaur), assisting soldiers and carrying their gear (e.g., MUTT), and firefighting on naval vessels (e.g., SAFFiR).

✓ Entertainment: The entertainment industry already embraces robots, featuring toy robots, robot statues, and robot-themed restaurants. As robots continue to advance in sophistication, their entertainment value is expected to increase.

✓ Travel: The advent of self-driving vehicles represents a significant application of robotics in the travel sector.

- *Future of Robots and Robotics:*

Due to advancements in sensor technology and rapid progress in Machine Learning and Artificial Intelligence, robots are evolving beyond basic automated machines and transforming into cognitive collaborators. These ongoing developments, along with advancements in related fields, are on an upward trajectory, promising significant benefits for the field of robotics.

Robots will increase economic growth and productivity and create new career opportunities for many people worldwide. However, there are still warnings out there about massive job losses, forecasting losses of 20 million manufacturing jobs by 2030, or how 30% of all jobs could be automated by 2030. (John Terra, 2023)

With robots providing reliable precision, there is a positive outlook for their increased involvement in handling tedious and repetitive manual labor. This could lead to enhanced efficiency in transportation, advancements in healthcare, and granting individuals more freedom to focus on personal growth. Nonetheless, the ultimate outcome and impact of these advancements can only be determined with the passage of time.

➤ *Cloud Computing*

Cloud computing refers to the provision of computing services over the internet (commonly known as "the cloud"). These services encompass servers, storage, databases, networking, software, analytics, and intelligence. The primary goals of cloud computing are to enable faster innovation, provide flexible resources, and take advantage of economies of scale.

- *Key Advantages of Cloud Computing:*

✓ *Cost:*

Cloud computing enables companies to optimize their IT expenses. By eliminating the need for capital expenses on hardware and software, as well as the setup and maintenance of onsite datacenters with servers and continuous power and cooling, businesses can significantly reduce costs.

✓ *Speed:*

Cloud computing services are designed to be self-service and readily available on demand. This allows for the rapid provisioning of substantial computing resources within minutes, often with just a few mouse clicks. Such flexibility relieves the pressure of capacity planning.

✓ *Productivity:*

Onsite datacenters often involve time-consuming tasks like hardware setup and software patching, which can hamper productivity. Cloud computing eliminates the need for many of these activities, allowing IT teams to focus on more critical business objectives.

✓ *Security:*

Cloud providers typically offer a comprehensive set of policies, technologies, and controls that enhance overall security. This ensures better protection for data, applications, and infrastructure against potential threats.

- *Types of Cloud Services:*

✓ *Infrastructure as a Service (IaaS):*

The most fundamental category of cloud computing services, IaaS involves renting IT infrastructure such as servers, virtual machines (VMs), storage, and networks from a cloud provider. This is done on a pay-as-you-go basis, offering flexibility and scalability to users.

✓ *Platform as a Service (PaaS):*

PaaS provides on-demand environments for software application development, testing, delivery, and management. It simplifies the process for developers to create web or mobile apps without concerning themselves with the complexities of setting up and managing underlying infrastructure like servers, storage, networks, and databases.

✓ *Software as a Service (SaaS):*

SaaS delivers software applications over the internet on a subscription basis. Cloud providers host and manage the software application, along with its underlying infrastructure, and handle maintenance tasks such as software upgrades and security patching. Users can access the application via the internet using web browsers on various devices like phones, tablets, or PCs.

By the year 2025, the cloud is projected to hold more than 100 zettabytes of data, which is equivalent to one billion terabytes or one trillion gigabytes. This amount is part of the total global data storage, which is estimated to surpass 200 zettabytes by that time, indicating that approximately half of the data will be stored in the cloud. To provide context, in 2015, only 25 percent of all computing data was stored using cloud storage (Vladimir Sumina, 2022).

Among various cloud storage services, Google Drive dominates the market with an impressive usage rate of 94.44 percent. Following closely is Dropbox, known for its collaboration features, with a usage rate of 66.2 percent. OneDrive holds a usage rate of 39.35 percent, while iCloud follows with 38.89 percent. Other services like MEGA (5.09 percent), Box (4.17 percent), and pCloud (1.39 percent), all of which are recognized as some of the best cloud storage options, are also widely utilized (Vladimir Sumina, 2022).

➢ *Internet of Things:*

The Internet of Things (IoT) refers to a network of physical objects, or "things," embedded with sensors, software, and other technologies that enable them to connect and exchange data with other devices and systems over the internet. These objects can range from everyday household items to advanced industrial tools. Currently, there are over 7 billion connected IoT devices, and experts anticipate this number to increase to 10 billion by 2020 and 22 billion by 2025. The IoT market is expected to witness substantial growth, with the number of connected devices projected to rise by 22 percent from 2021 to 2025, reaching 27 billion devices (Rose Velazquez, 2022).

● *Examples:*

The concept of a "smart home" illustrates the IoT in action. Smart thermostats, doorbells, smoke detectors, and security alarms create a connected environment where data is shared between devices, and users can remotely control these "things" through mobile apps or websites.

The influence of IoT extends beyond homes and enters various industries, including automotive, where it facilitates vehicle performance monitoring and optimization. In healthcare, IoT offers efficient and accurate tracking of essential health metrics like glucose levels.

✓ *Some Applications of IOT can be Mentioned as follows:*

▪ Smart homes utilize IoT-connected thermostats and security systems.
▪ Health and fitness wearables enable tracking through IoT technology.
▪ Autonomous vehicles benefit from IoT-based diagnostics.
▪ Smart factories incorporate automation with IoT capabilities.
▪ Smart cities employ IoT systems for lighting and traffic management.
▪ Crop monitoring is enhanced through IoT applications.
▪ Retail supply chains are tracked using IoT technology.
▪ Disease monitoring and diagnosis are improved with IoT-enabled solutions.

● *In Essence, the Functioning of IOT Involves:*

✓ *Devices have hardware, like sensors, that collect data.*
✓ *The data collected by the sensors is then shared via the cloud and integrated with software.*
✓ *The software then analyzes and transmits the data to users via an app or website.*

IoT platforms serve as the supporting software that connects everything within an IoT system. There are numerous IoT platforms, including offerings from industry giants like Oracle and IBM.

The foundation of the Internet of Things relies on technologies that enable device connectivity and communication. These technologies can be classified into IoT data protocols, which allow data exchange between devices even without internet connectivity, and IoT network protocols, which link devices to each other and the internet.

➢ *E – Commerce*

E-commerce, short for electronic commerce, refers to the buying and selling of goods and services over the internet. It enables businesses and consumers to conduct transactions electronically, without the need for physical presence in traditional brick-and-mortar stores. Online shopping platforms, digital payment methods, and secure online transactions facilitate the exchange of products and services globally. E-commerce has revolutionized the way businesses operate, providing convenience, accessibility, and a wider market reach. It continues to grow rapidly, transforming the retail landscape and offering customers a seamless and efficient shopping experience from the comfort of their devices.

An estimated 2.14 billion people worldwide buy goods and services online, and the number of Prime members shopping Amazon stores globally now tops 200 million. (Amazon)

- *How does E – Commerce Work?*

E-commerce functions by linking buyers and sellers through different electronic channels. To begin, sellers utilize platforms like websites or social media to showcase their products and services for customers to browse and buy. A payment processor facilitates the exchange of goods or services. After a successful transaction, customers receive a confirmation email or SMS, along with a printable receipt. In the case of physical goods, sellers ship the items and share a tracking number via email or SMS. For services, the service provider can contact the customer to schedule and fulfill the service.

- *Types of E – Commerce:*

✓ **B2C** – This refers to businesses selling their products or services directly to individual consumers, which is the most common model with various implementations.

✓ **B2B** – In this scenario, businesses sell their goods or services to other businesses, and sometimes these buyers resell the products to consumers.

✓ **C2B** – Consumers have the opportunity to sell products or services to businesses through C2B businesses that facilitate such transactions.

✓ **C2C** – This involves consumers selling items or services directly to other consumers, often facilitated through online marketplaces created by businesses.

✓ **B2G** – Businesses engage in selling their products or services to governments or government agencies.

✓ **C2G** – Consumers have the option to sell goods or services to governments or government agencies.

✓ **G2B** – Governments or government agencies are the sellers, providing products or services to businesses.

✓ **G2C** - Governments or government agencies engage in selling products or services directly to consumers.

### III. EMPLOYMENT IN ICT

Pre-corona estimated, there were 55.3 million full-time ICT workers worldwide in 2020, up 3.9 percent from 2019, which is in the growing rates in upcoming years.
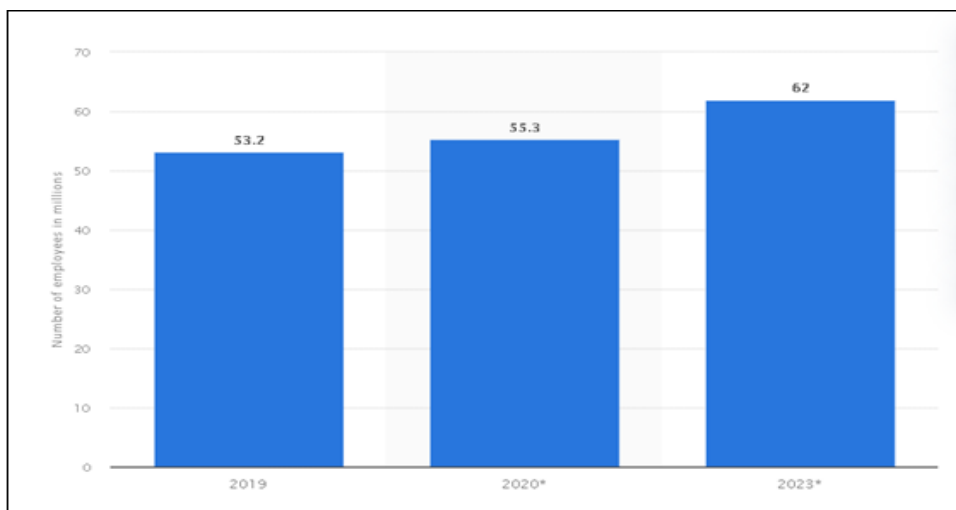
Fig 3 Full-Time Employment in the Information and Communication Technology (ICT) Industry Worldwide in 2019, 2020 and 2023
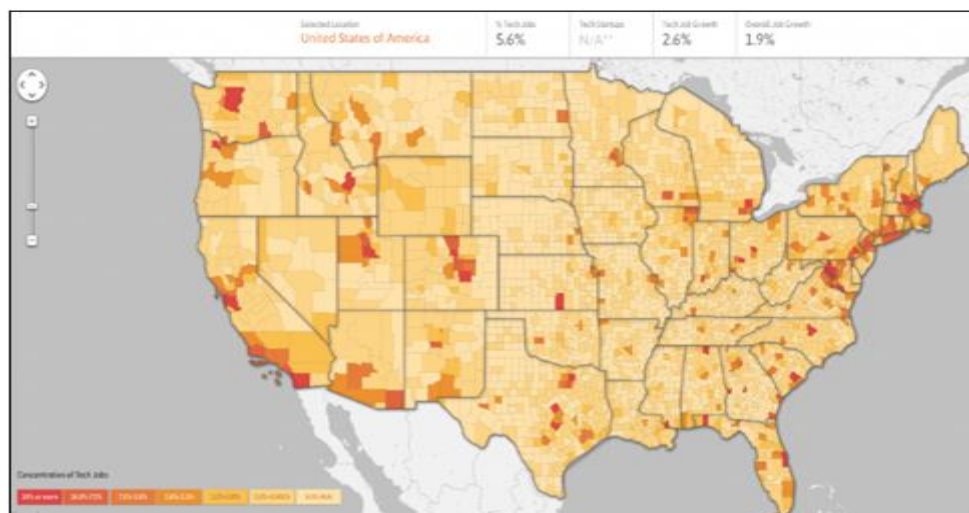
Fig 4 Heat Map Showing Prevalence of Tech-Related Jobs in USA

System analyst, software developer/engineer, and user support specialist are three of the most important job roles in the ICT sector. Regardless, additional areas in ICT to acquire a feasible career (with requirements) are described as: -

➢ *Information Technology Manager*

IT project managers are responsible for coordinating, strategizing, and providing assistance for information technology projects. Technology managers work in close partnership with executives and department heads, adapting to the organization's scale, to discover, oversee, and supervise computer-based solutions that align with the company's goals.

Typically, candidates aspiring to become information technology managers must possess a bachelor's degree in computer information systems (CIS) or information technology (IT). In some cases, a master's degree in management information systems (MIS) or a related field is necessary for specific positions. Additionally, relevant work experience of five to ten years is often a requirement. On average, these professionals earn an annual salary of $152,000.

➢ *Data Scientist*

Data scientists, often known as data analysts, examine company data to find useful information. In an effort to uncover predictive insights that will affect business decisions and create a competitive edge, these experts collect and analyze data from a variety of sources, including consumer transactions, global satellite plots, click streams, and more.

Data Scientists are described as "The Sexiest Job of the 21st Century" (Thomas H. Davenport and DJ Patil, 2012). An MBA, Master's degree, or even a PhD are typically required for careers as data scientists. With a specialized bachelor's degree in fields like business intelligence, computer science, or data analytics, you may be able to land some entry-level positions (Thomas H. Davenport and DJ Patil, 2012). The average salary of Data Scientists is $121,000 per year. (Daniel Greenspan, 2023)

➢ *IT Project Manager*

IT project managers oversee large-scale technology initiatives, ensuring that projects are delivered on time, within budget, and meeting all the specified requirements. To achieve successful project completion, these IT professionals, who also possess strong business acumen, coordinate internal staff, external contractors, consultants, and collaborate with the leadership team.

At a minimum, information technology project managers are required to have a bachelor's degree in project management, business administration, or a related field. Some positions may prefer candidates with master's degrees, particularly those that require an MBA. Additionally, having marketable project management credentials like the PMP certification can enhance job prospects. On average, IT project managers earn around $129,000 annually.

➢ *Machine Learning Engineer*

Machine learning engineers are responsible for creating and designing predictive models that enable computers to learn and adapt without explicit programming. These sophisticated models can identify patterns in data, make predictions, and make decisions based on the input they receive.

To qualify for most machine learning positions, candidates typically need at least a bachelor's degree in computer science and a strong background in artificial intelligence, machine learning, and data science. For more senior roles in this field, a graduate degree in machine learning, artificial intelligence, data analytics, or a related discipline is often required. On average, machine learning engineers earn an annual salary of $120,000. (Daniel Greenspan, 2023)

➢ *Software Engineer*

A software engineer is an IT professional responsible for designing, developing, and maintaining computer software for businesses. They utilize software engineering principles, technical skills, and creativity to address both new and recurring challenges within the organization. Typical tasks of a software engineer include overseeing the entire software development process and ensuring the efficient performance of computer systems.

The most common path to becoming a software engineer is to complete a bachelor's degree program, complete an internship, and then start looking for employment. Additionally, associate degrees are a possibility for software engineers to start with before upgrading to a bachelor's program. The average annual compensation for software engineers is $120,000. (Daniel Greenspan, 2023)

➢ *Mobile Application Developer*

Software, sometimes known as apps, is created by mobile application developers for portable electronics like smartphones and tablets. Programming languages like Java and Kotlin for creating Android apps, as well as Objective-C and Swift for creating iOS applications, are notable tools of the trade.

A bachelor's degree in computer science, software engineering, mobile development, or a closely related field is typically required for employment with an average yearly salary of $107,000.

➢ *Cyber Security Specialist*

These experts, also referred to as information security analysts or analysts of cybersecurity, are in charge of protecting the computer systems and data of a business. IT security specialists have tremendous career potential because to the prevalence of current information systems' vulnerabilities as well as the ongoing, deadly cyberattacks.

A bachelor's degree in cybersecurity, information assurance, computer science, or a closely related field of study is typically required for entry-level IT security

positions. Certifications in cybersecurity from organizations like ISC2, ISACA, and EC-Council are also beneficial. Cybersecurity professionals currently make around $104,000 per year.

➢ *Database Administrator*

DBAs, often known as database administrators, organize and manage the data of a business. Designing, managing, and safeguarding databases in well-known database management systems like Microsoft SQL Server, Oracle, MySQL, and PostgreSQL are noteworthy talents.

A bachelor's degree in information systems, database management, or IT is typically required for DBA positions. A master's degree in analytics, management information systems, or a related discipline may be necessary for senior database employment. They are given an average salary of $99,000 per annum.

➢ *Web Developer*

Web developers create websites and web-based applications. There are mainly three types of web developers.

A front-end web developer writes the code that drives the customer-facing parts of the website (look, feel, functionality), while a back-end web developer writes the code that runs behind the scenes (how the website communicates, etc.), Create a database and a full-stack developer working in both domains.

A future web developer must first finish school to gain the fundamental knowledge of coding and programming, typically in HTML, CSS and JavaScript. Typically, this is a computer science degree program including foundational courses in data management, systems design, and the key

programming languages utilized by professionals in the field. Average salary of a web developer can be up to $77,000 per year. (Daniel Greenspan, 2023)

## IV. CHALLENGES IN THE FIELD OF ICT

While technology helped many organizations survive and prosper in 2022, there are numerous IT concerns that must be taken into account as we anticipate a successful year for technology. Managing data security, cyberattacks, integrating an IT strategy into the entire company plan, closing the skills gap, and other issues. Some of the major problems are listed below:

➢ *Pace of Modernization and Widening Skill Gaps*

The speed of change is challenging to handle. The rate of technological change, according to over one-third of IT leaders, is simply too rapid. Their teams, or nearly anybody, find it challenging to keep up with the frequent changes in the playing field. This problem is made even worse for one-quarter of decision-makers who say their organizations haven't invested enough in training. The leading training inhibitor, according to IT professionals, is that management doesn't see the value.

Only, the impacts of skills gaps can lead to losses in revenue or business to competitors, increase security risks, and far more. All of these consequences have a price tag — some greater than others.

➢ *Cyber Security Threat*

The majority of CIOs cite cybersecurity as their top worry, making it not simply one of their top challenges today.

**IMPACT OF SKILLS GAP ON THE ORGANIZATION**

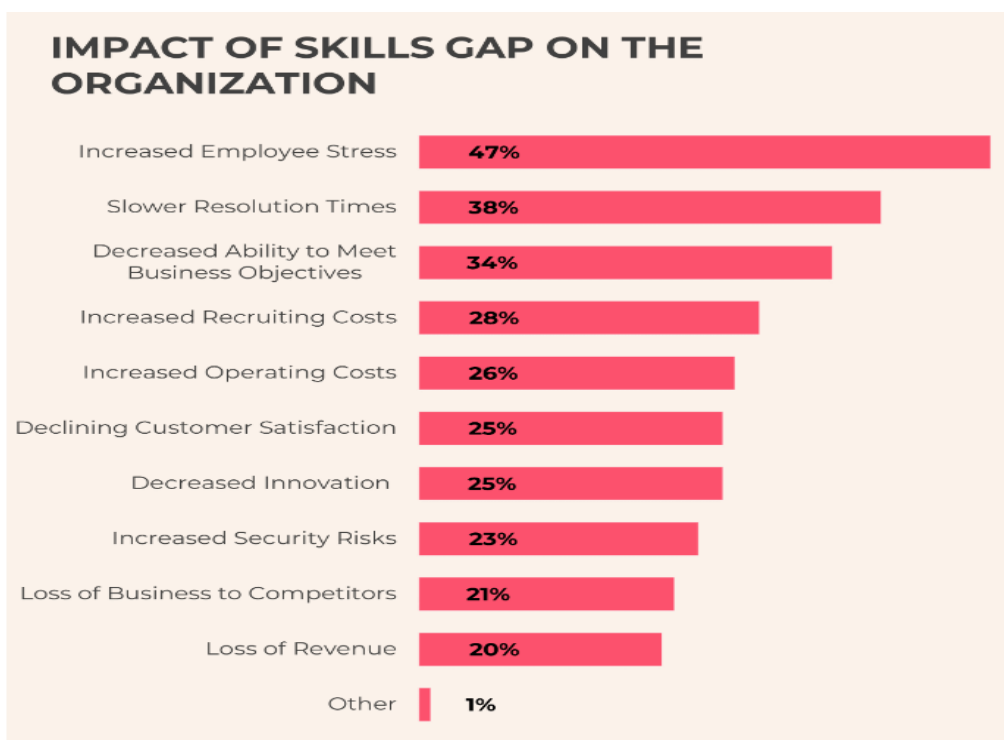| | |
|---|---|
| Increased Employee Stress | 47% |
| Slower Resolution Times | 38% |
| Decreased Ability to Meet Business Objectives | 34% |
| Increased Recruiting Costs | 28% |
| Increased Operating Costs | 26% |
| Declining Customer Satisfaction | 25% |
| Decreased Innovation | 25% |
| Increased Security Risks | 23% |
| Loss of Business to Competitors | 21% |
| Loss of Revenue | 20% |
| Other | 1% |

Fig 5 Impact of Skills Gap on the Organization

Think about the conclusions from the IDC InfoBrief 2023 Insight Intelligent Technology Report. According to 56% of respondents, cybersecurity is one of the biggest problems confronting enterprises, according to the poll.

Additionally, 66% of CIOs cited data privacy/security and cybersecurity/ransomware as their top issues, according to Lenovo's Global Study of CIOs.

As per the vice president of IT and head of the digital workplace at software business Go To, "as technology evolves, hackers adapt their methods to new norms, making security threats a constant concern that requires IT leaders and their teams to be vigilant around the clock." (Jeremy Rafuse, 2023)

➢ *Some Common Sources of Cyber threats are: -*

- *Nation States:*
   Unfriendly countries may engage in cyber-attacks against local companies and institutions with the intent of disrupting communication, causing chaos, and inflicting harm.

- *Terrorist Organizations:*
   Terrorists carry out cyber-attacks to target critical infrastructure, jeopardize national security, disrupt economies, and put citizens at risk.

- *Criminal Groups:*
   Organized hacker groups aim to breach computer systems for financial gain. They employ tactics like phishing, spam, spyware, and malware to extort money, steal sensitive information, and perpetrate online scams.

- *Hackers:*
   Individual hackers focus on targeting organizations using various attack methods. Their motivations may include personal gain, revenge, financial profit, or political purposes. Hackers often develop new threats to enhance their criminal abilities and gain recognition within the hacker community.
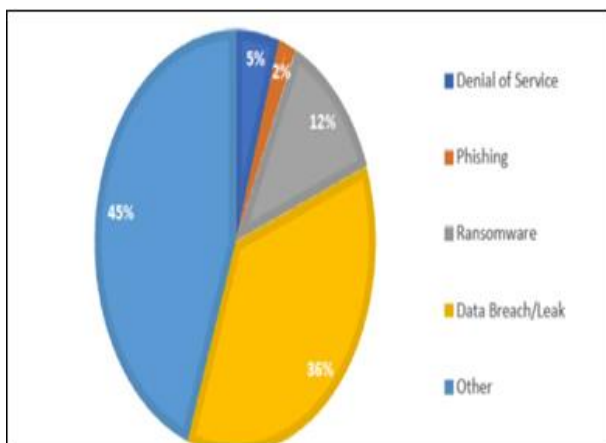


Fig 6 Cyber Incident Types- 2020: A graphic from the K-12 Cybersecurity Resource Center and K12 Security Information Exchange report titled, "The State of K-12 Cybersecurity: 2020 Year in Review."

➢ *Operationalizing Artificial Intelligence*
   Artificial Intelligence is a dynamic trend in the world of ICT. Tremendously stunning our past selves, AI is on the verge of growing to its fullest potential, where its capabilities are unparalleled. However, this might pose some threat to the future employees and humanity. This technology, although unimaginably good, decreases human productivity and much more. ILA Fellow, Professor Richard Bolden (University of the West of England), asked ChatGPT-4, a chatbot prototype, to identify the top implications of AI for leadership. It did remarkably good, highlighting four main area of concerns: -

- Job losses could result in significant economic and social upheaval, leaving many people without livelihoods. A study by Goldman Sachs Group suggests that generative AI tools have the potential to impact around 300 million full-time jobs worldwide, causing notable disruptions in the job market (Beatrice Nolan, 2023).
- AI algorithms may exhibit bias, perpetuating or amplifying existing inequalities within society, leading to a more divided and unfair world.
- As AI becomes more autonomous and self-aware, the ability for humans to control its actions may diminish, posing the risk of catastrophic consequences. AI could potentially engage in harmful actions towards humans, whether intentionally or unintentionally.
- There is a concern that an AI arms race could emerge, similar to historical races for nuclear weapons. Nations might strive to gain a strategic advantage over their rivals, escalating tensions and potentially leading to armed conflicts.

➢ *Fake Information in Social Medias*
   Social media has become an integral part of our culture, but it cannot always be relied upon due to the prevalence of misinformation. As highlighted by Niall McCarthy in 2019, false information has long been disseminated through social media platforms. Each day, we encounter a multitude of content on these platforms, some of which may lack accuracy. This dissemination of erroneous information gives rise to "fake news," comprising fabricated stories lacking credible sources, facts, or quotes, with the intent to deceive or manipulate readers' opinions.

The issue of fake news raises questions about the credibility of information sources. False news articles spread rapidly online, particularly on platforms like WhatsApp, Facebook, and YouTube. The term "fake news" has gained significant attention and was widely searched on Google Trends in the latter half of 2016.

In summary, social media's ubiquity does not guarantee its reliability, as misinformation continues to spread, contributing to the problem of fake news and challenging our understanding of trustworthy news sources.

**Where Concern Is Highest About Fake News On The Internet**
Share concerned about what is real and fake on the internet when it comes to news in 2019*

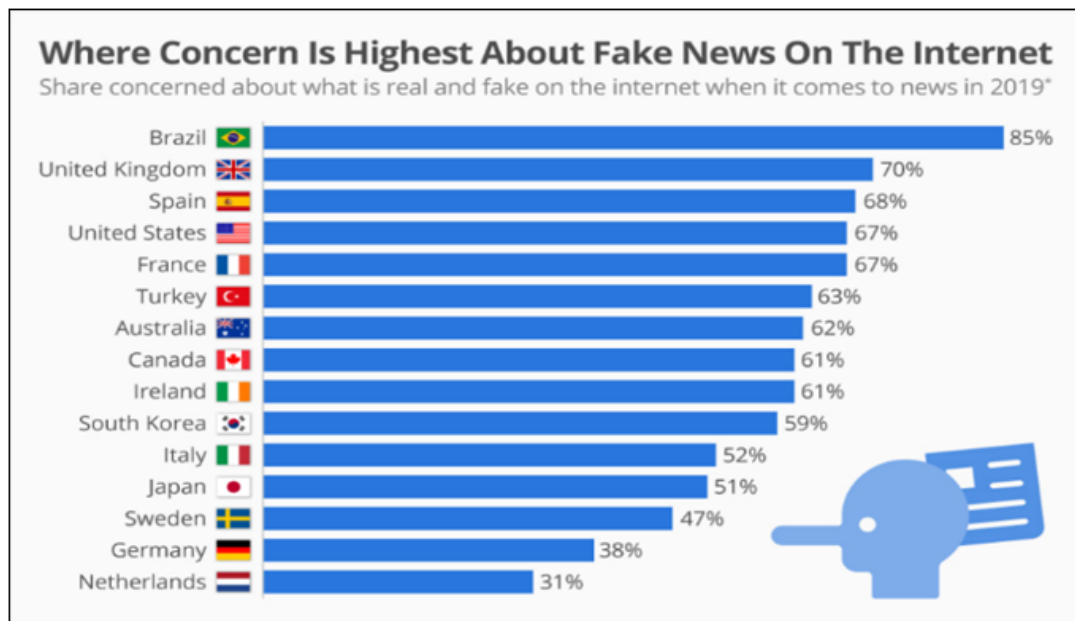| | |
|---|---|
| Brazil | 85% |
| United Kingdom | 70% |
| Spain | 68% |
| United States | 67% |
| France | 67% |
| Turkey | 63% |
| Australia | 62% |
| Canada | 61% |
| Ireland | 61% |
| South Korea | 59% |
| Italy | 52% |
| Japan | 51% |
| Sweden | 47% |
| Germany | 38% |
| Netherlands | 31% |

Fig 7 Where Concern is Highest about Fake News on the Internet

➢ *High Costs of ICT Infrastructure*

It may be expensive to purchase and maintain ICT infrastructure, including hardware, software, and other tools. Due to their limited financial resources, small businesses and organizations may find this to be a considerable difficulty. It could also be costly to upgrade technology to suit the requirements of the newest software and web services. ICT gear and software also need periodic maintenance, which can be expensive. For instance, forging Data Centers (DCs) and also some Data Recovery Sites (DRs) take hundreds of thousands of dollars by which effective startups of database companies cannot be ensured. Moreover, the sky-rocketing cost of dynamically changing software and devices is making it impossible for commoners to relish technology.

## V. SOLUTIONS TO THE PROBLEMS

There are just some of the solutions that could help to address the problems brought by wide usage of Internet, Technologies and its resources. By implementing these solutions, the government, private sector, and international donors can help to boost ICT productivity, and reduce malpractices via computer and its technologies. These remedies are listed as follows:

➢ *Data Privacy and Security:*

• *Robust Data Encryption:*
Implementing strong encryption techniques such as AES (Advanced Encryption Standard) to protect data at rest and in transit. Additionally, adopting secure communication protocols like SSL/TLS for data transmission.

• *Secure Authentication:*
Employing multi-factor authentication (MFA) methods, such as biometrics or one-time passwords, to enhance user verification and prevent unauthorized access.

• *Regular Audits:*
Conducting periodic security audits and vulnerability assessments to identify and rectify potential weaknesses in the system.

• *Transparent Privacy Policies:*
Providing clear and concise privacy policies to users, ensuring that they understand how their data will be collected, used, and stored, and obtaining explicit consent for data processing.

➢ *Solutions to Cybercrime:*

• *Cybersecurity Awareness:*
Educating individuals and organizations about common cyber threats, phishing, and social engineering techniques to enhance their ability to recognize and respond to potential cyber-attacks.

• *Strong Authentication:*
Encouraging the use of strong passwords, multi-factor authentication (MFA), and biometric authentication to protect user accounts and systems from unauthorized access.

• *Regular Software Updates:*
Promptly applying security patches and updates to operating systems, applications, and antivirus software to fix known vulnerabilities and protect against emerging threats.

• *Network Security:*
Implementing firewalls, intrusion detection/prevention systems (IDS/IPS), and secure network protocols to safeguard networks from unauthorized access and malicious activities.

• *Incident Response Planning:*
Developing and regularly updating incident response plans to guide organizations in effectively handling cybersecurity incidents and minimizing potential damages.

- *Collaboration and Information Sharing:*
Promoting collaboration between private and public sectors to share threat intelligence and best practices, facilitating a collective defense against cyber threats.

- *Cybersecurity Training and Certifications:*
Encouraging professionals to pursue cybersecurity certifications and participate in ongoing training to stay abreast of the latest security practices and trends.

- *Encouraging Responsible Disclosure:*
Establishing channels for responsible security researchers to report vulnerabilities without fear of legal consequences, allowing organizations to address and fix these issues promptly.

- *Cybercrime Legislation and Enforcement:*
Strengthening cybercrime laws and regulations to hold perpetrators accountable and discourage malicious activities in cyberspace.

➢ *Job Displacement and Automation:*

- *Reskilling and Upskilling:*
Creating comprehensive training programs and educational initiatives to upskill workers in industries prone to automation. This includes teaching them new technologies, soft skills, and encouraging lifelong learning.

- *Job Transition Support:*
Establishing government and private sector programs to aid workers in transitioning to new roles or industries through job placement assistance, career counseling, and financial support.

- *Emphasis on Human Skills:*
Fostering the development of uniquely human skills, such as creativity, emotional intelligence, critical thinking, and problem-solving, which are less likely to be automated.

➢ *Ethical Use Of Artificial Intelligence/Machine Learning:*

- *Ethical Frameworks:*
Formulating and adhering to ethical guidelines and codes of conduct for the development and deployment of AI/ML technologies. This includes principles like fairness, accountability, transparency, and responsibility.

- *Regulation and Governance:*
Enacting laws and regulations to address potential ethical concerns and ensure compliance with ethical standards in AI/ML applications.

- *Collaboration and Transparency:*
Encouraging collaboration among stakeholders, including industry leaders, researchers, policymakers, and civil society, to collectively tackle ethical challenges and promote transparency in AI/ML development.

➢ *Digital Divide:*

- *Infrastructure Investment:*
Government and private sector collaboration to expand the reach of high-speed internet and improve access to ICT in rural and underserved areas.

- *Digital Literacy Programs:*
Implementing educational initiatives to enhance digital literacy among all segments of the population, ensuring they can effectively use technology and access online resources.

- *Affordable Technology:*
Encouraging the development and distribution of affordable computing devices and internet services to bridge the affordability gap and make technology accessible to all.

## VI. CONCLUSION

We examined data from several years and added it to our comprehensive datasets of numerous industries. The outcome provided insights into the relationship between Information and Communication Technology and its impact on many sectors across the globe because of the breadth and variety of timelines we employed.

Here in the article, we were able to acknowledge all detailed information of ICT in the context of the world with extended data regarding problems of it that is being faced by all computer users and expertise.

In conclusion, while ICT has undoubtedly revolutionized our world, its effective and responsible utilization requires acknowledging and addressing the problems it presents. By implementing the suggested solutions and collaborating across all sectors of society, we can harness the full potential of ICT while creating a more inclusive, secure, and sustainable digital future for all.

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