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Digital technology techniques and their role in supporting the activity of economic institutions

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Abstract

The pervasive integration of digital technologies has revolutionized various sectors, including education, communication, and business. These technologies, such as smartphones, computers, and AI, enhance efficiency and connectivity but also pose significant challenges related to cybersecurity, cybercrime, and online safety. This paper examines the evolution and impact of digital technologies, from early innovations like the internet to contemporary advancements such as artificial intelligence and blockchain. It highlights the importance of digital literacy and responsible usage to mitigate associated risks. The role of digital technologies in promoting sustainability and improving business operations is also explored. The study emphasizes the need for strategic adoption and ethical management of digital tools to maximize benefits while addressing challenges.

Keywords: Digital technologies, cybersecurity, artificial intelligence, sustainability, digital literacy.

Introduction

In the present day, the use of digital technologies is extensive, with individuals employing them across all settings. Digital technologies influence what, why, where, and how individuals learn and what they learn from. The widespread use of digital technologies is in the form of computers, laptops, tablets, smartphones, or mobile phones. The main objective of digital technologies is to create connections between individuals rapidly, effortlessly, and cost-effectively. The individuals are connected with a wide range of digital services and

resources. Learning with digital technologies has several benefits, but it also brings forth some challenges and risks for the learners. The digital challenges are real and prove to be impediments to acquiring knowledge, and information measures are necessary to overcome the problems and challenges associated with digital technologies.

The three main digital challenges are cyber-safety, cyber-crime, and cyber-security. Cyber-safety involves conduct or behavioural concerns. Cybercrime involves illegal activity. Lastly, cyber-security involves unauthorized use of the computer system. The preventive approaches that individuals need to take into consideration when they make use of digital technologies include the development of knowledge, skills, and abilities for safe and responsible use, learning how to manage digital technologies appropriately, the development of a pro-social culture, and the cooperation of the whole community in preventing and responding to the incidents. Online safety of students in education and other individuals is the main area that needs to be considered. Digital information is different from its physical counterpart in many ways. It can be rapidly duplicated, distributed in a manageable way, and stored in various locations.

1-Digital technology space

1.1 Definition of digital technologies

Etymologically, 'technology' has its roots in the Indo-European root tek, ' a term that probably referred to the building of wooden houses by Watling, that is, weaving sticks together. ‘That is why 'textile' and 'technology' sound similar. From this comes the Greek techne, initially of working but soon broadened to specialized expertise, 'know-how,' knowledge of how to make things that would otherwise not exist. Techne, therefore, is concerned with the artificial. Nevertheless, there were already disputes. Medicine was a form of techne, at least to some of the Hippocratic authors. But was, say, rhetoric techne? Plato said no, and Aristotle said yes. In the Nicomachean Ethics, Aristotle went further: while techne was a form of knowledge (of how to make, an art), it was to distinguish it from phronesis (moral knowledge, knowledge of how to act well) and episteme (knowledge of the eternal). Crucially, these three were set in a hierarchy. Knowledge of how to act was better than knowledge of how to make. This hierarchy led to the separation of means and ends. Ends might be valued, but the mere means of getting there would not be, and upon insisting on this point, techne became 'morally neutral.'

Philip Kotler, a renowned marketing expert, views digital technology as a crucial aspect of modern business. According to Kotler, digital technology is increasingly moving at the heart of most modern businesses today. He emphasizes the importance of integrating technological and business model evolution with the dramatic shifts in consumer behaviour in the last decade.

Digital technology refers to electronic systems and resources that help us learn, communicate, play, and more. It encompasses digital devices, systems, and resources that create, store, and

manage data. Digital technology is based on microprocessors, which enable the development of computers, the net and other devices such as video cameras, mobile phones, and personal digital assistants (PDAs).

Digital technology means electronic tools, devices, systems, and resources organizations utilize as they process or store data and complete many other functions, increasing employee productivity and efficiency. Examples include digital cameras, personal computers, and all devices that utilize increasingly fast data transmission speeds and that store or process data using digital signals.

In the digital world, words and pictures are represented in binary codes made of combinations of numbers 0 and 1, commonly known as bits. Immense volumes of data may become pressed using digital technology and stored on tiny storage devices that can be readily protected and transferred. Data transmission speeds also increased because of digitization.

One example of technologies businesses use to utilize tools is cloud platforms, such as Microsoft 365 or Google Docs, that users can use on mobile phones. The reason for using digital technology is that it speeds up processes, allowing staff to focus on higher-level functions that technology cannot handle.

1.2. The history of technology

The history of technology begins even before the beginning of our species. Sharp stone flakes used as knives and larger unshaped stones used as hammers and anvils have been uncovered at Lake Turkana in Kenya. The tools were made 3.3 million years ago and thus were likely used by an ancestor such as Australopithecus.

When humanity first used fire is still not definitively known, but, like the first tools, an ancestor of Homo sapiens probably invented it. Evidence of burnt material can be found in caves used by Homo erectus beginning about 1 million (and maybe even 1.5 million) years ago.

- **20,000 to 15,000 years ago: Neolithic Revolution**

During the Neolithic Period, several fundamental technologies arose together. Humans moved from getting their food by foraging to getting it through agriculture. People came together in larger groups. Clay was used for pottery and bricks. Clothing began to be made of woven fabrics. The wheel was also likely invented at this time.

- **6000 BCE: Irrigation**

The first irrigation systems arose roughly simultaneously in the civilizations of the Tigris-Euphrates River valley in Mesopotamia and the Nile River valley in Egypt. Since irrigation requires extensive work, it shows a high level of social organization.

- **4000 BCE: Sailing**

The first sailing ships were used on the Nile River. Since the Nile did not allow as much space for free sailing as the ocean, these ships also had oars for navigation.

- **1200 BCE: Iron**

About this time, the production of iron became widespread as that metal supplanted bronze. Iron was much more abundant than copper and tin, the two metals that make up bronze, and thus put metal tools into more hands than ever before.

- **850 CE: Gunpowder**

Alchemists in China invented gunpowder during their search for life-extending elixirs. It was used to propel rockets attached to arrows. The knowledge of gunpowder spread to Europe in the 13th century.

- **950: Windmill**

Nearly 5,000 years after the first sailing ships, the wind was used to operate a mill. The first windmills were in Persia. They were horizontal windmills in which the blades were set on a vertical shaft. Later, European windmills were of the vertical type. It has been speculated that the windmill may have been invented independently in Persia and Europe.

- **1044: Compass**

The first definitive mention of a magnetic compass dates from a Chinese book finished in 1044. It describes how soldiers found their way by using a fish-shaped piece of magnetized iron floating in a water bowl when the sky was too cloudy to see the stars.

- **1250–1300: Mechanical clock**

Hourglass and water clocks had been around for centuries, but the first mechanical clocks first appeared in Europe toward the end of the 13th century and were used in cathedrals to mark the time when services would be held.

- **1455: Printing**

Johannes Gutenberg completed printing the Bible, the first book printed in the West using movable type. Gutenberg's printing press led to an information explosion in Europe.

- **1765: Steam engine**

James Watt improved the Newcomer steam engine by adding a condenser that turned the steam into liquid water. This condenser was separate from the cylinder that moved the piston, which meant the engine was much more efficient. The steam engine became one of the most important inventions of the Industrial Revolution.

- **1804: Railways**

English engineer Richard Trevithick improved James Watt's steam engine and used it for transport. He built the first railway locomotive at an ironworks in Wales.

- **1807: Steamboat**

Robert Fulton put the steam engine on water. His steamboat, eventually called the Clermont, took 32 hours to go up the Hudson River from New York City to Albany. Sailing ships took four days.

- **1826/27: Photography**

In the early 1820s, Nicéphore Niépce became interested in using a light-sensitive solution to make copies of lithographs onto glass, zinc, and a pewter plate. He then had the great idea to use his solution to make a copy of an image in a camera obscure (a room or box with a small hole in one end through which a picture of the outside is projected). In 1826 or 1827, he made an eight-hour-long exposure of the courtyard of his house, the first known photograph.

- **1831: Reaper**

For thousands of years, harvesting crops was very labour-intensive. That changed with Cyrus McCormick's invention of the mechanical reaper. The earliest reaper had some mechanical problems, but later versions spread worldwide.

- **1844: Telegraph**

Samuel Morse was a successful painter who became interested in the possibility of an electric telegraph in the 1830s. He patented a prototype in 1837. In 1844, he sent the first message over the long-distance telegraph line, which stretched between Washington, D.C., and Baltimore. The message: "What hath God wrought?"

- **1876: Telephone**

Once it was possible to send information through a wire represented with dots and dashes, the next step was actual voice communication. Alexander Graham Bell made the first telephone call, on 10 March 1876, when he asked his assistant Tom Watson to come to him: "Mr Watson—come here—I want to see you."

- **1876: Internal-combustion engine**

German engineer Nikolaus Otto built an engine that, unlike the steam engine, used the burning of fuel inside the engine to move a piston. This type of engine was later used to power automobiles.

- **1879: Electric light**

After thousands of trials, American inventor Thomas Edison got a carbon-filament light bulb to burn for 13½ hours. He and others in his laboratory were also working on an electrical

power distribution system to light homes and businesses, and in 1882, the Edison Electric Illuminating Company opened the first power plant.

- **1885: Automobile**

The internal combustion engine improved, becoming smaller and more efficient. Karl Benz used a one-cylinder engine to power the first modern automobile, a three-wheeled car he drove around a track. However, the automobile did not make a commercial splash until 1888, when his wife, Bertha, exasperated with Karl's slow and methodical pace, took the car without his knowledge on a 64-mile trip to see her mother.

- **1901: Radio**

Guglielmo Marconi had been experimenting with radio since 1894 and was sending transmissions over longer and longer distances. In 1901, his reported transmission of the Morse code letter S across the Atlantic from Cornwall to Newfoundland excited the world.

- **1903: Airplane**

On 17 December, Orville Wright made the first airplane flight, of 120 feet, near Kitty Hawk, North Carolina. He and his brother Wilbur made four flights that day. On the last, Wilbur flew 852 feet.

- **1926: Rocketry**

As a young boy in the late 1890s, H.G. Wells' 'The War of the Worlds and the Possibilities of Space Travel' inspired Robert Goddard'. As a middle-aged man in the mid-1920s, he achieved the first test flight of a liquid-fuelled rocket from his aunt's farm in Auburn, Massachusetts. It flew 12.5 meters (41 feet) in the air.

- **1927: Television**

After the development of radio, the transmission of an image was the next logical step. Early television used a mechanical disk to scan an image. As a teenager in Utah, Philo T. Farnsworth became convinced that Mechanical systems could not perform accurate scans and assemble pictures multiple times a second. Only an electronic system would do that. In 1922, 16-year-old Farnsworth designed a plan for such a system, but it was not until 1927 that he made the first electronic television transmission, a horizontal line.

- **1937: Computer**

Iowa State mathematician and physicist John Atanasoff designed the first electronic digital computer. It would use binary numbers (base 2, where all numbers are expressed with the digits 0 and 1), and its data would be stored in capacitors. In 1939, he and his student Clifford Berry began building the Atanasoff-Berry Computer (ABC).

- **1942: Nuclear power**

As part of the Manhattan Project to build the first atomic bomb, it was necessary to understand nuclear reactions in detail. On 2 December, underneath the football stands at the University of Chicago, a team of physicists led by Enrico Fermi used uranium to produce the first self-sustaining chain reaction.

- **1947: Transistor**

On 23 December, Bell Labs engineers John Bardeen, Walter Brattain, and William Shockley gave the first public demonstration of the transistor, an electrical component that could control, amplify, and generate current. The transistor was much smaller, used less power than vacuum tubes, and ushered in an era of cheap and small electronic devices.

- **1957: Spaceflight**

The Soviet Union surprised the world on 4 October when it launched the first artificial satellite, Sputnik 1, a small 83.6-kg (184.3-pound) metal sphere. The space race began between the Soviet Union and the United States, opening up a new front in the Cold War.

- **1974: Personal computer**

The first computers that emerged after World War II were gigantic. Nevertheless, with technological advances, especially in putting many transistors on a semiconductor chip, computers have become smaller and more powerful. Finally, they became small enough for home use. The first such personal computer was the Altair, which was soon supplanted in 1977 by the Apple II, the TRS-80, and the Commodore PET.

- **1974: Internet**

Vinton Cerf and Robert Kahn produced the TCP/IP (Transmission Control Protocol/Internet Protocol), which describes how data can be broken down into smaller pieces called packets and how these packets can be transmitted to the right destination. TCP/IP became the basis for data transmission over the net.

- **2012: CRISPR**

American biochemist Jennifer Doudna and French microbiologist Emmanuelle Charpentier developed CRISPR-Cas9, a method for editing genes, which means modifying DNA sequences. Gene editing can treat many diseases, but also, opens up the ethical grey area of creating designer humans.

- **2017: Artificial intelligence**

The team behind the Alpha Go artificial intelligence program announced that it had become the world's best Go player. Go is a game with simple rules but many possible positions. The previous year Alpha Go had defeated the great player Lee Sedol in a match 4–1. Alpha Go then played itself and, through continual improvement, managed to win over the version that

had defeated Lee, 100–0. Through machine learning, Alpha Go had become better at the game than any human had.

❖ **Digital Technology Examples:**

➢ **Websites**

Websites are one of the most popular methods for individuals to access the web, which is a result of several pieces of digital technology. Websites provide us with a wealth of information.Moreover, they have grown increasingly interactive—for example, you may not only view what is playing at your local movie theatre but also purchase tickets.

➢ **Smartphones**

Smartphones are the main reason why Digital technology has grown at such a pace. Mobile phones changed the way people communicated, both verbally and through texting. We now have smartphones, which have cameras, calculators, and mapping capabilities, among other digital technologies. Consumer selections are becoming even more diverse because of mobile apps.

➢ **Video Streaming**

Streaming videos may be utilized for a variety of reasons. You may view movies and TV shows on the internet. With programs like Skype, you can talk with people online and see them in real time. Live streaming allows you to watch or stream live events. Other viewing alternatives for knowledge or enjoyment may be found on sites like YouTube. Streaming technology is becoming available on many devices, including computers, TVs, and smartphones.

➢ **E-Books**

There is now a plethora of digital alternatives to conventional print. Users may now access a wide range of reading materials from a single, portable device, eliminating the need to lug about many bulky, heavy books. It is simple to change the font size and style to fit the preferences of your readers. Furthermore, unlike print books, no trees are chopped down to create them.

1.3. The Different Types of Digital Technology

It is helpful to be aware of the different types of digital technology available today to ensure you have the best tool for the job. There are over thirty types of digital technology, but we have curated a list of the technologies most relevant to business in priority order starting with business technology.

➢ **Business technology:**

Business technology refers to the application of technology to solve business problems. It includes various software, hardware, and services organizations use to manage data and information, automate processes, and communicate with customers, suppliers, and employees. This concept encompasses any technology a company employs to help it operate, including software applications and hardware devices.

Businesses use technology in a variety of ways, including:

- **Payroll:** With computer systems, specialized software and scheduled payroll programs, a business uses technology to transfer payment to employees and contractors during each pay period. Some of these processes are entirely automatic.
- **Hiring:** With the internet, businesses can access job forums to gain talent worldwide. Networking and computer systems give managers access to software that creates flyers, job descriptions, and scheduling tools for finding talent.
- **Inventory management:** Data storage systems allow businesses to create elaborate spreadsheets to record and locate inventory. These software programs may have an active classification system that informs employees if certain inventory is present in a warehouse or transit.
- **Task allocation:** offline and online software systems can help managers allocate work to employees. They can assign tasks virtually through custom websites and use internet chat rooms to discuss objectives.
- **Communication:** Communication software allows businesses to discuss projects and plans with employees, even remotely. Some system seven have optimization options for enterprises that have exclusively remote staff.
- **Data storage:** Data storage systems allow companies to file records, financial statements, and company data in a secure database that employees can access almost anywhere. For production companies, a data storage system can help managers track orders, manage stock, and oversee general production.
- **Security:** Security software helps keep electronic content safe, preventing unauthorized users and inputs. It can also help employees remain compliant with safety standards in the company.

1.4 Information technology:

Information technology (IT) is the use of computer systems to manage process, protect, and exchange information. It is a vast field of expertise that includes a variety of subfields and specializations with the common goal of employing technology systems to solve problems and handle information.

Everyone from enterprise companies down to one-person businesses and local operations uses information technology. Global companies use it to manage data and innovate their processes. Even flea market sellers use smartphone credit card readers to collect payments and street performers give out a Venmo name to gather donations. If you use a spreadsheet to catalogue which Christmas presents you bought, you are using information technology.

Information technology is a broad term that involves using technology to communicate, transfer data, and process information.

The different trends within information technology include, but are not limited to:

-Analytics

-Automation

-Artificial intelligence

-Cloud computing

-Communications

-Cybersecurity

-Data/database management

-Infrastructure

-Internet of things

-Machine learning

-Maintenance and repair

2. Communication technology

2.1 Communication in the Past:

Communication has always been a part of American culture; it has been the most crucial part of people's social life. Over time, the means of communication have changed according to the times, people's living situations, and technological advancements. In the past, people used smoke signals for communication; however, smoke signals could only send a few simple messages. As the population grew, people needed to send longer messages further in distance. Therefore, people replaced smoke signals with letter writing. People wrote letters to communicate with friends and family separated by distance because it was the only way to communicate long distance, at least until the invention of the telegraph in the 19th century. The telegraph was invented by a man named Samuel Morse, hence the "Morse Code."

Samuel Morse was an artist and inventor who developed the first successful electromagnetic telegraph system. He studied both art and electricity at Yale College, and after graduation, he pursued an art career. Samuel travelled to England to continue studying art. On his voyage, he overheard two men talking about electromagnets. One of those men, Charles Jackson -who also studied electricity, told Morse that electric impulses could be carried through long wires.

The first telegraph was invented in the late 1700′s and early 1800′s. The télégraphe system was a form of communication that transmitted electric signals over wires from different locations to translate messages. Claude Chappe invented the first telegraph in 1794. This telegraph was not electric. It was a "semaphores, or tall poles with movable arms, and other signalling apparatus, set within physical sight of one another." Many others tried to reinvent and improve the way telegraphs worked. However, Samuel Morse was the only one who perfected it. Morse took the significance of those facts found by previous inventors and invented a more practical and commercial system.

2.2 Communication in the Present:

The telegraph was the first major milestone in the development of communication technology because it led to many of the things we use today, and it is similar to the techniques we use today. Expansion in this past technology has made it possible for many of the things we use today, such as telephones, radio, cable television, Internet, and mobile phones.

It was not long after the telegraph became a success before the next progression of technology came along, the telephone. The telephone was used to transmit speech electronically. Like the telegraph, the telephone was also a wire-based electrical system. It used the same cables that made the telegraph a success. Unfortunately, it failed because underwater cables did not have a strong enough signal.

Another major advancement in technology that most people have benefited from is cell phones. Cell phones have evolved immensely since 1983, in both design and function. This involvement brought a completely new meaning to the term multitasking. Cell phones today can do anything and everything from sending text messages and emails, to uploading videos and pictures, and most importantly downloading applications for everything.

Whether it is a smartphone or an Android phone, people want it to operate faster, because communication in today's society plays a major role in the public and private sphere. Nowadays, communication globally is at the tip of your fingers, literally. Many different forms of technology have made this possible from iPads to Kindles, to the Blackberry playbooks, and many more. Tablets and wireless Internet have allowed many.

2.3 Technology in the Future:

However, the advancement in technology like the Internet, computers, and tablets has changed the dynamics of the print industry tremendously. Newspaper, Magazine, and Book circulation is at its lowest. The print industry is expected to lose 25% of its jobs over the next few years. The print industry is drastically declining because the Internet shapes how we communicate continuously. The future of print is not very bright, in my opinion. I do not believe that print will be a part of the future because there will be no need for anything printed. While the print industry is suffering, it is predicted that applications like eBooks,

iBooks, and audiobooks are expected to increase vastly. In a few years, newspapers, books, and advertisements will all be created and made only for online.

Therefore, future technology should be more compatible with people's needs; tablets should be Nano-sized, light and slick, interactive, and portable. Users should be able to explore endless possibilities from writing Word documents to creating and designing websites. Future tablets should be able to bend, fold, and roll while giving the user the experience of reading a book or a magazine. Prospective tablets should allow users to browse the web, take pictures, upload, and watch videos. Upcoming tablets should not take away people's interaction with each other but they should enhance people's interaction globally. Upcoming tables should translate different languages making it easy for users to communicate internationally.

The future holds immense promise for auto-voice translating and interpreting, which will remove all language barriers. The future progression in technology will change the dynamics of communication worldwide, in the classroom, the workplace, and in the public sphere. It is unknown what the future may hold for the advancement of communication technology, but it is not far-fetched to say that we may one day be able to send emails with our thoughts or brain waves wherever we are.

2.4 Important About Communication Technology:

- **Education**

Students in a communication technology degree, such as a Bachelor of Science in Information and Communications Technology (ICT), take classes that cover various topics, including technology, business, and management. A hands-on approach is significant in any communication technology program because it gives students insight into the future of this industry. The curriculum includes classes in web production, enterprise technology, technical writing, and project management.

- **Skills and Abilities**

Graduates entering the communication technology field need to develop engineering and computer science skills. The ability to communicate allows professionals to understand and explain problems that arise within this technology. Individuals also need to have skills in business, critical thinking, and a strong knowledge of computer programming. Additionally, individuals must possess skills in troubleshooting and repairing defective communications technologies or malfunctions.

- **Career Opportunities**

Careers in communication technology can be found in most industries and are vital to the success of companies and organizations. Professionals need to be able to install networks catered to an organization's particular needs. Opportunities are available in communications management, technical support, retail or service, small business, or telecommunications.

- **CCNT Certification**

To increase their chances of employment, professionals in the communication technology field might pursue their CCNT (Certified in Convergent Network Technologies) certification. This demonstrates their high-level competence in data, audio, and video technologies, as outlined by Certification Partners.

2.5. OT – Operational technology

Operational technology (OT) refers to the hardware and software used to detect or cause a change in industrial equipment, assets, processes, and events. It is a category of computing and communication systems that focuses on managing, monitoring, and controlling physical processes and devices.

OT, or operational technology, is the practice of using hardware and software to control industrial equipment, and it primarily interacts with the physical world. OT includes industrial control systems (ICSs) like programmable logic controllers (PLCs), distributed control systems (DCSs), and supervisory control and data acquisition (SCADA) systems.

OT environments supervise physical processes such as manufacturing, energy, medicine, building management, and ecosystems within other industries.

However, it should be noted that there is currently no industry consensus on what is and is not considered OT versus what is considered IT, nor where there is overlap between the two. For example, it is obvious that all Microsoft products fall into the IT category, but it could be argued that production management software, AVEVA PI, RtDUET, MPA, and TCard are examples of OT (see diagram below).

- **Adaptive AI/ Superintelligence**

Adaptive AI refers to artificial intelligence (AI) that can adapt to new situations, learn from experience, and improve its performance over time. This is achieved through machine learning algorithms and neural networks that can modify their behaviour based on new data and feedback.

Superintelligence refers to a hypothetical AI system that possesses intelligence far beyond that of the best human minds. It is often described as an AI capable of solving complex problems, making decisions, and learning exponentially fast, potentially leading to breakthroughs in various fields.

A big step toward developing an ASI would be to realize an artificial general intelligence (AGI) or Strong AI. An AGI is a next-generation AI system that can understand the world, learn, and apply problem-solving intelligence as broadly and flexibly as a human can. AGI would be capable of cross-domain learning and reasoning with the ability to make connections across different fields. Just like ASI, true AGI has yet to be developed.

- **Educational Technology**

Educational technology, also known as EdTech, is the use of technology to enhance learning and teaching in the classroom. It involves the design, development, implementation, and evaluation of instructional systems, devices, and resources to improve teaching and learning. EdTech can take many forms, including digital tools, online courses, simulations, games, and virtual reality experiences.

Big Data, Machine Learning, and the Internet of Things (IoT) were the biggest educational 2019 technology trends. However, distance learning has become the one trend that rules them all. The COVID-19 pandemic has drastically changed the way we teach and learn. Students now have to get used to distance learning via digital platforms due to social distancing. Even though some schools are reopening, this trend may continue until 2021. The latest 2020 EdTech trends and further into 2021 are being revolutionized with a strong focus on connectivity, versatility, and student-centred learning. Let us look at the latest top 10 trends in educational technology.

- **Block chain technology**

Block chain technology is associated with the financial industry, but it can also be applied to other sectors. The supporting architecture of block chain has the immense potential to transform the delivery of healthcare, medical, clinical, and life sciences due to its distributed ledger's extended functionality and distinct features. The potential scale of impact is comparable to that seen with the introduction of TCP/IP. Block chain technology has captured the interest of healthcare providers and biomedical scientists within various healthcare domains, such as longitudinal healthcare records, automated claims, drug development, interoperability in population health, consumer health, patient portals, medical research, data security, and reducing costs with supply chain management. It is unclear if block chain will disrupt healthcare, but healthcare organizations are monitoring its potential closely for prospective concepts like secure patient IDs. Realistically, the adoption and implementation of block chains will evolve gradually, but now is the time to take a fresh look at its possibilities in healthcare and biomedical sciences. Block chain technology revolutionary solutions are bringing us closer to the possibility of every patient record being able to send updates to an open-source, community-wide trusted ledger that is accessible and understood across organizations with guaranteed integrity.

Block chain technology facilitates untrusted parties to reach a consensus on a common digital history. A common digital history is important because digital assets and transactions are theoretically easily faked and or duplicated.

Block chain technology solves this problem without using a trusted intermediary.

- **Best block chain stocks to consider**

Dozens of publicly traded companies now incorporate block chain into their operations, offer block chain-related services to customers, or play a role in the cryptocurrency industry. Some are exclusively focused on block chain innovation and or cryptocurrencies, while others are using block chain-related products and services to complement an existing successful business.

. Nvidia

Nvidia (NVDA 4.57%) is the leading manufacturer of graphics processing units (GPUs), which are essential components in such important technological areas as artificial intelligence, autonomous vehicles, and gaming.

. Block

Financial technology (fintech) company Block (SQ -0.22%), formerly known as Square, has two main components to its business -- its payment-processing ecosystem for small businesses and its Cash App personal financial platform. The company also has operations in business lending, a stock trading platform, and buy-now-pay-later financing. The company also operates the Square Online Store platform, which helps merchants build out e-commerce and Omni channel capabilities.

. IBM

Although IBM's (IBM -0.89%) performance in recent years has not been stellar, the company recently made some big moves to jump-start growth. For example, its acquisition of open-source software developer Red Hat gave it plenty of cross-selling opportunities with its enterprise clients.

On the block chain side of things, IBM Block chain has already provided transformative solutions for clients such as Home Depot (HD -0.4%), Renault (RNSDF -9.62%), Albertsons (ACI 0.1%), and many more. It could have a major growth runway if block chain-based solutions gain future traction, for example, IBM Block chain is focusing on helping customers build more dependable and efficient supply chains.

. MasterCard

Payment processing giant MasterCard (MA 0.79%) has grown tremendously for several years as the trend toward a cashless economy has led to increasing volumes of debit and credit card transactions. Block chain technology has the potential to transform the cashless payment space, particularly when it comes to cross-border money transfers, which have historically been slow and costly.

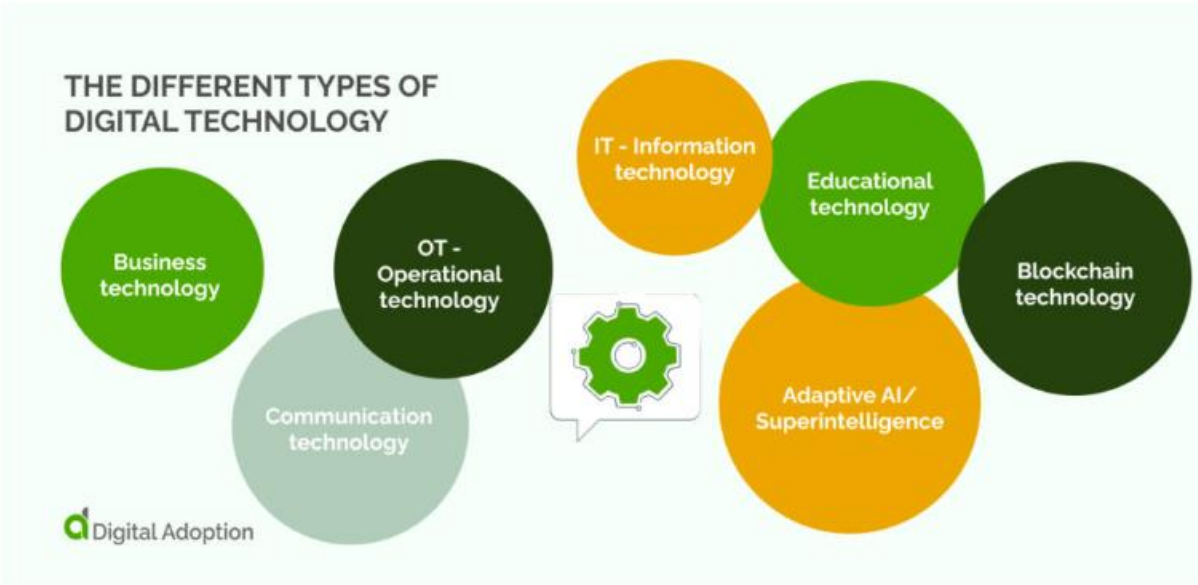
MasterCard has announced partnerships with block chain technology companies and has formed a Crypto Card partner program, joining several leading Asia-Pacific cryptocurrency companies to launch crypto-funded MasterCard payment cards. MasterCard also recently helped launch the first crypto-backed payment card in partnership with crypto lender Nexo.

. Amazon

In addition to operating the world's largest e-commerce platform, Amazon (AMZN -1.21%) also operates the leading cloud infrastructure service, Amazon Web Services. The AWS platform offers Amazon Managed Block chain, which allows customers to create and manage their block chain networks.

There is also definite potential for Amazon to incorporate block chain technology into its massive e-commerce business eventually. Block chain currently makes up a minuscule percentage of Amazon's revenue, but as the technology evolves, there are possibilities for much more.

Types of Digital Technology



3. Artificial intelligence (AI)

Today's AI loosely stems from the 19th-century invention of Charles Babbage's "difference engine" – the world's first successful automatic calculator. British code-breaker Alan Turing, who was a key figure in the Allies' intelligence arsenal during WWII, amongst other feats, can also be seen as a father figure of today's iterations of AI. In 1950, he proposed the Turing Test, designed to assess a machine's ability to exhibit intelligent behaviour distinguishable from that of a human.

From that point onward, advancements in AI technology began to accelerate exponentially, spearheaded by such influential figures as John McCarthy, Marvin Minsky, Herbert Simon, Geoffrey Hinton, Yoshua Bengio, Yann LeCun, and many others. However, it was notall-smooth sailing. While AI flourished in the early years, with computers' capability to store more information, it soon hit a roadblock: computers could not store enough information or

process it as fast. It was not until the 1980s that AI experienced a renaissance, sparked by an expansion of the algorithm tool kit and increased funding.

To cut a long story short, here are some key events and milestones in the history of artificial intelligence:

1950: Alan Turing publishes the paper "Computing Machinery and Intelligence", in which he proposes the Turing Test as a way of assessing whether or not a computer counts as intelligent.

1956: A small group of scientists gather for the Dartmouth Summer Research Project on Artificial Intelligence, which is regarded as the birth of this field of research.

1966-1974: This is conventionally known as the "First AI Winter," a period marked by reduced funding and progress in AI research due to failure to live up to early hype and expectations.

1997: Deep Blue, an IBM chess computer, defeats world champion Garry Kasparov in a highly publicized chess match, demonstrating the fabulous potential of AI systems. In the same year, speech recognition software developed by Dragon Systems was implemented on Windows.

2011: In a televised Jeopardy! Contest, IBM's Watson Deep QA computer defeats two of the quiz shows' all-time champions, showcasing the ability of AI systems to understand natural language.

2012: The "deep learning" approach, inspired by the human brain, revolutionizes many AI applications, ushering in the current AI boom.

2016: Developed by a Google subsidiary, the computer program Alpha Go captures the world's attention when it defeats legendary Go player Lee Sedol. The ancient "Go" is one of the most complex board games.

2017 to date: Rapid advancements in computer vision, natural language processing, robotics, and autonomous systems are driven by progress in deep learning and increased computational power.

2023: The rise of large language models, such as GPT-3 and its successors, demonstrates the potential of AI systems to generate human-like text, answer questions, and assist with a wide range of tasks.

2024: Breakthroughs in multimodal AI allow systems to process and integrate various data types (text, images, audio, and video) for more comprehensive and intelligent solutions. AI-powered digital assistants are now capable of engaging in natural, contextual conversations as well as assisting with a wide variety of tasks.

The exponential growth of computing power and the Internet has brought forth the concept – and the reality – of machine learning, the development of AI algorithms that can learn without being programmed by processing large datasets. This is known as "deep learning" which powers computers to learn through experience. Over the past decade, AI has become integral to everyday life, influencing how we work, communicate, and interact with technology.

3.1Definition of artificial intelligence

Artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from experiences. Since their development in the 1940s, digital computers have been programmed to carry out very complex tasks—such as discovering proofs for mathematical theorems or playing chess—with high proficiency. Despite continuous advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over broader domains or in tasks requiring modern-day knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in executing certain specific tasks, so artificial intelligence, in this limited sense, is found in applications as diverse as medical diagnosis, computer search engines, voice or handwriting recognition, and chatbots.

Artificial intelligence is "a technical and scientific field devoted to the engineered system that generates outputs such as content, forecasts, recommendations or decisions for a given set of human-defined objectives." This definition of artificial intelligence is accurate technically.

Today, this AI meaning has evolved beyond mere data processing to include the development of machines capable of learning, reasoning, and problem solving. Machine learning has become so "competent" to generate everything from software code to images, articles, videos, and music. This is the next level of AI, the so-called regenerative AI, which differs from traditional AI in its capabilities and application. While classic AI systems are primarily used to analyse data and make predictions, generative AI goes even further by creating new data similar to its training data.

3.2 The four types of AI

Artificial intelligence (AI) encompasses multiple capabilities, each serving distinct functions and purposes. Understanding the four types of AI sheds some light on the evolving landscape of machine intelligence:

-Reactive machines: These AI systems operate within predefined rules but cannot learn from new data or experiences. For instance, chatbots that interact with online customers often rely on reactive machine intelligence to generate responses based on programmed algorithms.

While they perform well within their designated functions, they cannot adapt or evolve beyond their initial programming.

-Limited memory: Unlike reactive machines, AI systems with limited memory can learn from historical data and past experiences. By processing information from previous interactions, these AI system types can make informed decisions and adapt to some extent based on their training. Examples include self-driving cars equipped with sensors and machine-learning algorithms that enable them to navigate through dynamic environments safely. Natural language processing applications also use historical data to enhance language comprehension and interpretation over time.

Theory of mind: This type of AI is still a pipe dream, but it describes the idea of an AI system that can perceive and understand human emotions, and then use that information to predict future actions and make decisions on itself. Developing AI with a theory of mind could revolutionize various fields, including human-computer interactions and social robotics, by enabling more empathetic and intuitive machine behaviour.

Self-awareAI: refers to the hypothetical scenario of an AI system that is self-aware or has a sense of self. Self-aware AI possesses human-like consciousness and understands its existence in the world, as well as the emotional state of others. So far, these types of AI are only found in the fantastical world of science fiction, popularized by iconic movies such as Blade Runner.

These four types of AI highlight the rich diversity of intelligence seen in artificial systems. As AI continues to progress, exploring the capabilities and limitations of each type will contribute to our understanding of machine intelligence and its impact on society.

3.3AI MODELS

Artificial intelligence is a broad term referring to a group of technologies that use machines to simulate how the human mind works. Machine learning (ML) and deep learning (DL) are subsets of AI, each with its processes for training machines to perform human-like cognitive processes.

- **ML models**

Machine learning is a branch of AI that trains machines to learn from experience. ML models are provided with training data that has been labelled (supervised learning) or with unlabelled, raw data (unsupervised learning). ML models mimic the way humans learn—by trial and error. Over time, well-trained models will make increasingly accurate predictions. ML models are widely used, with applications around forecasting (e.g., predicting next month's sales), segmentation (e.g., determining whether a transaction is fraudulent or not), clustering (e.g., identifying items shopped by similar customers), and other recommendation systems.

- **DL models**

Deep learning is a subset of machine learning. A DL model is essentially a multi-layered neural network, with each layer comprising a series of interconnected nodes. The "depth" of the deep learning model depends on its purpose. Some advanced DL models consist of a thousand or more layers, with each successive layer refining the accuracy of the model's predictions even more. This type of AI model powers many applications that use large amounts of unstructured data (e.g., images, video, documents) such as self-driving vehicle technologies, digital voice assistants, and social listening solutions.

3.4. Negative Effects of Technology

- **Isolation**

Technologies, such as social media, are designed to unite people, yet they may have the opposite effect in some cases. A 2017 study of young adults aged 19–32 found that people with higher social media use were more than three times as likely to feel socially isolated than those who did not use social media as often.

Finding ways to reduce social media use, such as setting time limits for social apps, may help reduce feelings of isolation in some people.

- **Eyestrain**

Technologies, such as handheld tablets, smartphones, and computers, can hold a person's attention for long periods. This may lead to eyestrain.

Symptoms of digital eyestrain can include blurred vision and dry eyes. Eyestrain may also lead to pains in other body parts, such as the head, neck, or shoulders.

Several technologicalfactorsmay lead to eyestrain, such as:

-screen time

-screen glare

-screen brightness

-viewing too close or too far away

-poor sitting posture

-underlying vision issues

Taking regular breaks away from the screen may reduce the likelihood of eyestrain. Anyone regularly experiencing these symptoms should see an optometrist for a check-up.

- **Reduced physical activity**

Most everyday digital technologies are sedentary. More extended use of these technologies promotes a more sedentary lifestyle, which is known to have negative health effects, such as contributing to:

-obesity

-cardiovascular disease

-type 2 diabetes

-premature death

Taking breaks from sedentary technologies may help promote a more active lifestyle. Other forms of technology may help, however.

Research from 2017 Trusted Source indicates that active technologies, such as app notifications, emails, and wearable technologies that promote exercise may reduce short-term sedentary behaviour.

This could help people set healthful patterns and become more physically active.

- **In children**

Children's brains are still developing and may be more sensitive to the effects of technology and its overuse than adult brains.

A 2018 review of various studies noted the possible adverse effects of children using different technologies. Children who overuse technology may be more likely to experience issues, including:

-low academic performance

-lack of attention

-low creativity

-delays in language development

-delays in social and emotional development

-physical inactivity and obesity

-poor sleep quality

-social issues, such as social incompatibility and anxiety

-aggressive behaviours

-addiction to these technologies

-higher BMI

The research also noted the importance of teaching children to interact with these technologies healthily by monitoring their time using them and providing interesting alternatives.

Additionally, a study of teenagers aged 15–16Trusted Source found that those who had high digital media use had an increased chance of developing symptoms of attention-deficit hyperactivity disorder (ADHD).

This does not mean digital media use causes ADHD; rather there is an association between the two. More research needs to determine what this association means.

The authors of the 2015 research Trusted Source found that technology appears to affect the overall health of children and teenagers of all ages negatively. Researchers noted the importance of parents and caregivers controlling screen time in all children.

The American Academy of Paediatrics recommend children under 18 months old avoid screen time altogether, while 2–5-year-olds have no more than 1 hour a day of high-quality viewing with an adult.

.35. Digital Technology and Sustainability

As the main contributors to global warming, organizations are under the spotlight from international climate change groups, world governments, and increasingly mindful consumers. Although it is now common knowledge that climate change is threatening our planet, there is a disconnect between what business leaders are saying and what they are doing. Around 90% of executives consider sustainability important, but only 25% have incorporated it into their business model. There seems to be a misconception about sustainability and it effecton business operations. In this blog, we will explore how businesses can simultaneously integrate digital sustainability and increase efficiency and profitability.

Digital sustainability focuses on the everyday technology businesses employ to reduce environmental impact. It usually means adapting existing infrastructure or introducing new initiatives to help reach sustainability goals.

For example, if an office was trying to reduce its carbon footprint, it might opt for a digital filing system over a paper-based one. A factory might install sensors on machinery to increase efficiency and decrease energy waste. And a steel manufacturer could reduce waste with clever automated software.

All of these approaches have a significant impact on how much an organization damages the environment and how efficiently their day-to-day processes run. Let us take a closer look at how these examples are bringing us closer to a leaner, greener future.

Let us take the example of signing documents. Traditionally, processes such as invoicing, contract drafting, and contract signing have been paper-based. Paper documents take time to ship to customers, they can be lost or damaged and they are susceptible to human error. However, as document-signing software becomes more common, these lengthy verification processes are being cut down.

Documents that only exist digitally can be backed up, so they do not get lost. This streamlines all processes. They can be sent to customers instantly, at the click of a button. Now they can be signed online, thanks to digital signing software. This reduces paper usage significantly – consider all the invoices, contracts, and work orders you send and receive each year.

Creating greater digital sustainability is all about reducing blind spots. Gaining greater visibility of everything you are doing, and then optimizing the way you do it, can bring environmental benefits, as well as greater visibility and greater efficiency to your organization. Nevertheless, finding these blind spots manually can take weeks, months, and even longer. Thankfully, modern-day process discovery and optimization software can slash these time frames and reduce the workload associated with process optimization.

- **Why is digital sustainability a little-discussed topic?**

When we hear about sustainability, we are always redirected to more easily observable and tangible phenomena such as waste management, car pollution, and the problem of incinerators. However, the biggest difficulties are always the most hidden ones, which is why the issue of digital pollution is not often mentioned. On the contrary, during the unfortunate greenwashing campaigns we are accustomed to today, it is repeatedly claimed that a product or service does not pollute because "it is online," as if the digital world had nothing to do with environmental impact.

One of the reasons for omitting the need for digital sustainability is also often due to certain barriers to implementing virtuous practices. Research by The Guardian found four main obstacles to reducing the environmental impact of online platforms:

-Lack of awareness: as mentioned earlier, there is little public awareness of the environmental effects of digital. Digital actions are indiscriminately perceived as positive for the environment.

-Lack of transparency and oversight: billions are online movements that cause an environmental impact every day, making it difficult to track every corresponding CO2 emission.

-Speed of updating: due to the speed of changes and updates on digital platforms, it is increasingly harder to detect constants in environmental impact.

-Lack of assessment tools: many of the current environmental assessment methods of web platforms are inadequate because they cannot assess the evolution of impact over time.

Statistics on technologies and the Internet

INTRODUCTION

The Internet has become an undeniable force shaping our lives. Its impact is vast and ever growing, from communication and entertainment to education and business. It is also known as a global communication system that connects thousands of individual networks, sends, and receives information and media across various devices. This article will help you better understand all current facts and trends about the Internet in 2024 and 2023. So, let us delve into some key internet statistics to understand its current state and trajectory.

The digital landscape is continuously growing and evolving. There are many interesting facts about the internet, internet statistics, and ways to use the internet more than you can imagine.

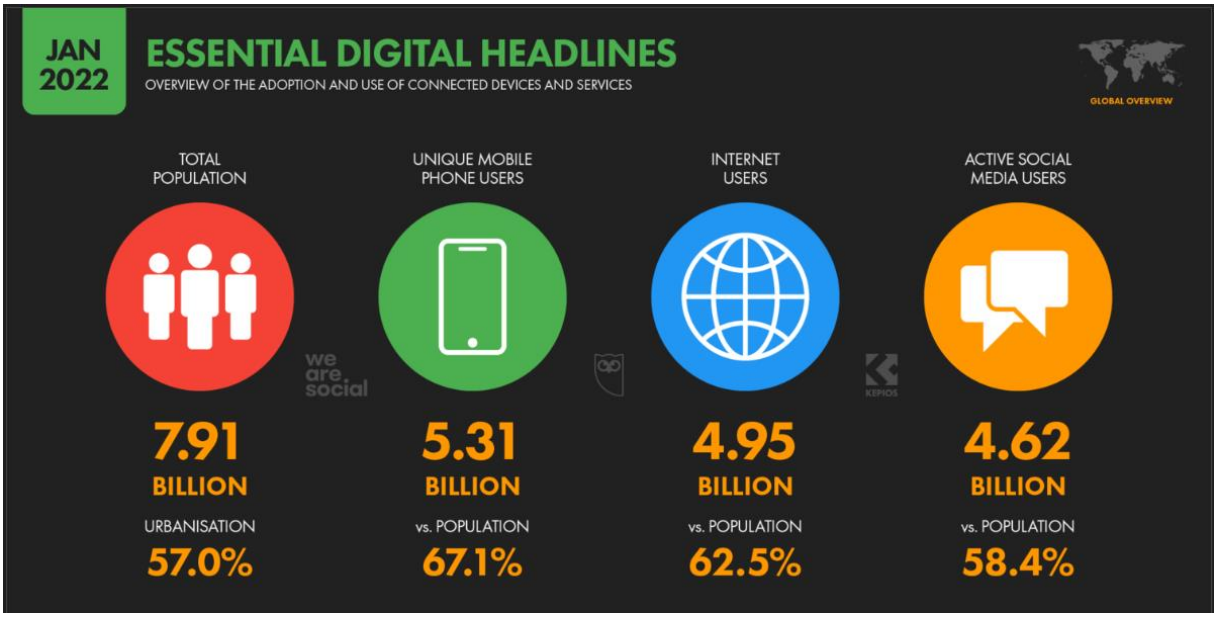
1. Statistics on technologies and the Internet around 2020

The Internet's transformative journey, from its origins as a research project to its current global ubiquity, has revolutionized communication, information access, commerce, and entertainment. Enabling instant connectivity, online shopping, streaming, remote work, and social interaction, the Internet has reshaped societal dynamics. However, it represents privacy issues, cybersecurity threats, and digital disparities.

As technology advances, including mobile Internet, IoT, and AI, the future of Internet usage holds exciting possibilities and complex considerations, making it a crucial focal point in today's interconnected world.

There are more than 4.5 billion Internet users worldwide (59% of people), of whom more than 3.8 billion people (49% of people) use social media.

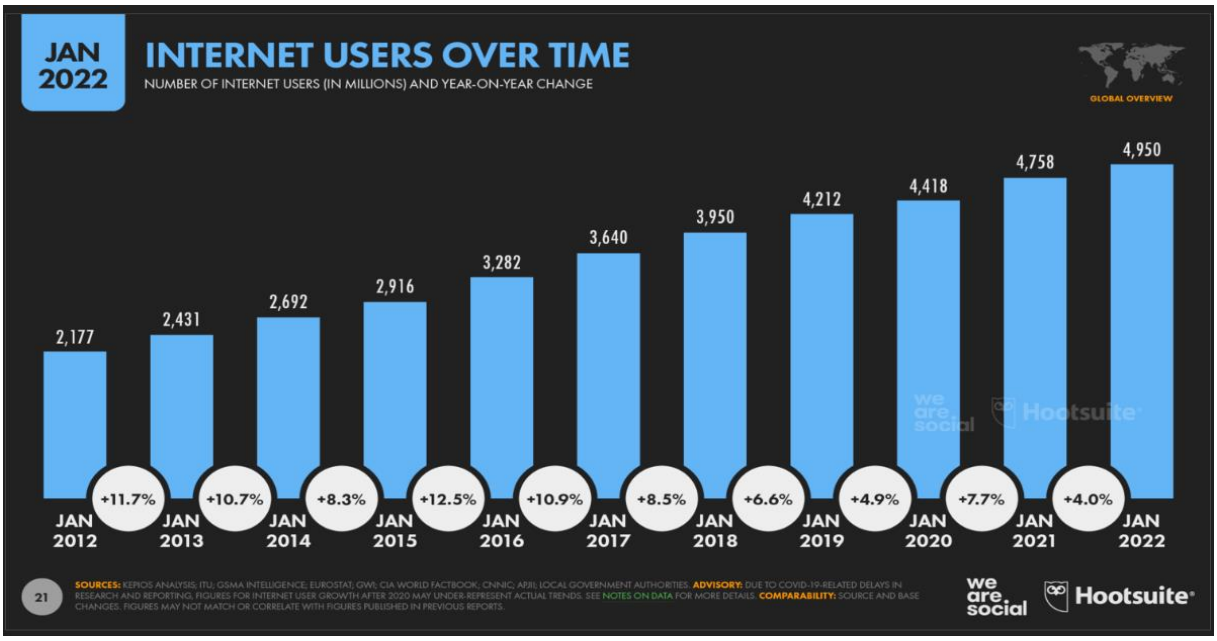
ESSENTIAL DIGITAL HEADLINES



The latest data indicates that internet users have grown by 192 million over the past 12 months, resulting in annual growth of just 4.0 percent in 2021.

However, we strongly suspect that this low growth figure is more likely a result of challenges associated with data collection and reporting during the COVID-19 pandemic and that these numbers do not reflect the actual growth of Internet users over the past year.

INTERNET USERS OVER TIME



What is the rate of Internet penetration in the Arab world?

The number of Internet users has increased in the Arab world due to the increased ease of access to the Internet and the decrease in the prices of electronic devices. Kuwait, Qatar, the Emirates, and Bahrain are at the forefront of countries in the world after Iceland in terms of the spread of Internet use, as 99% of people in these countries use the Internet, and in general:

The number of Internet users in Egypt jumped in 2021 to reach about 54.7 million people (54% of Egyptians), a massive increase of 22% compared to 2020 (about 9.8 million new users), and the number of social media users in Egypt reached 42 million.

In Saudi Arabia, the number of Internet users reached 32.2 million (93% of Saudis), an increase of 15% over 2020, while the number of social media users reached 25 million.

In Iraq, the number of Internet users reached 29.8 million people (75% of Iraqis), a massive increase of 55% over 2020 (more than 10.6 million new users), while the number of social media users reached 21 million.

In Morocco, the number of Internet users reached 25.3 million (69% of Moroccans), an increase of 13% compared to 2020, while those who use social media reached 18 million.

In general, globally, women are less active on the Internet. In 2020, 48% of women in the world used the Internet, compared to 58% of men in the world used the Internet.

According to the International Telecommunication Union 2020 report, the Internet penetration rate among men and women in the Arab world is 58.5% of men and 44.2% of women connected to the Internet.

2. Number of internet users worldwide from 2005 to 2023

As of 2023, the estimated number of internet users worldwide was 5.4 billion, up from 5.3 billion in the previous year. This share presents 67 percent of the global population.

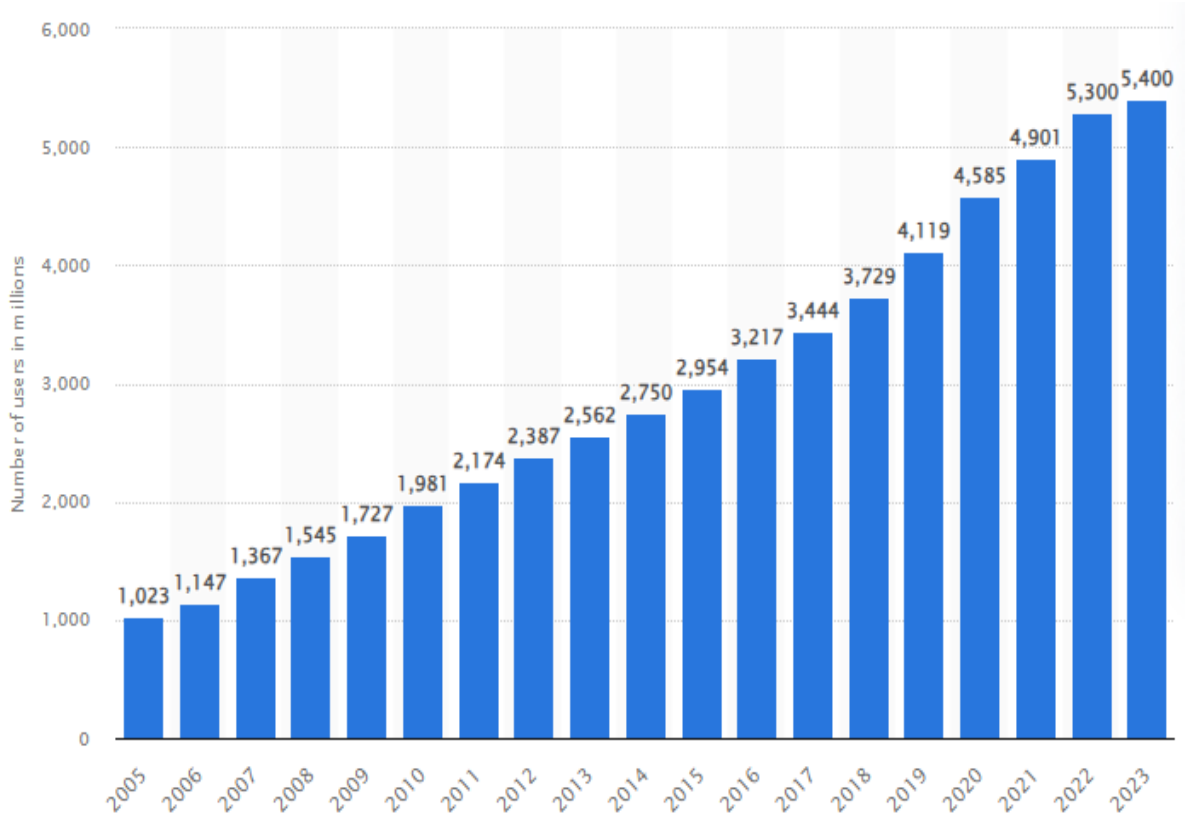
- **Internet access around the world**

Easier access to computers, the modernization of countries worldwide, and increased utilization of smartphones have allowed people to use the internet more frequently and conveniently. However, internet penetration often pertains to the current state of development regarding communications networks. As of January 2023, there were approximately 1.05 billion Internet users in China and 692 million in the United States.

- **Online activities**

Social networking is one of the most popular online activities worldwide, and Facebook is the most popular online network based on active usage. As of the fourth quarter of 2023, there were over 3.07 billion monthly active Facebook users, accounting for more than half of the internet users worldwide. Connecting with family and friends, expressing opinions, entertainment, and online shopping are among the most popular reasons for internet usage.

Number of internet users worldwide from 2005 to 2023



The global number of internet users was forecasted to continuously increase between 2024 and 2029, with a total of 1.1 billion users (+16.92 percent). After the fifteenth consecutive

increasing year, the number of users is estimated to reach 7.3 billion. Therefore, a new peak in 2029. Notably, the number of internet users was continuously increasing over the past years.

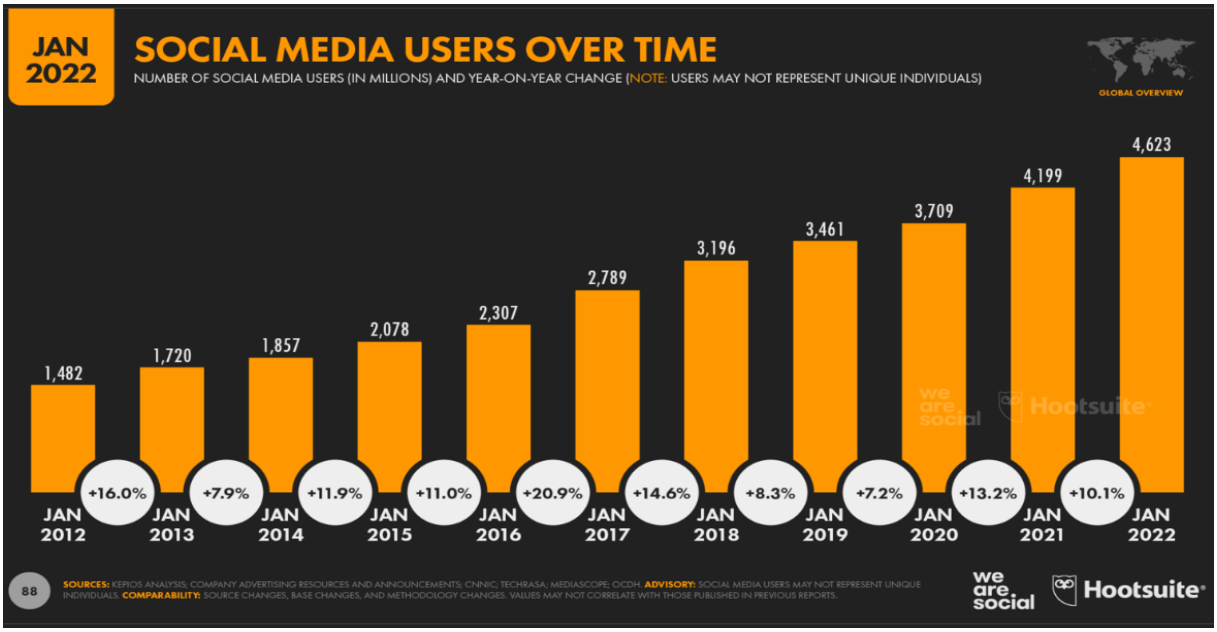
Depicted is the estimated number of individuals in the country or region at hand that use the internet. As the data source clarifies, connection quality and usage frequency are distinct aspects not considered. The shown data are an excerpt from Statista's Key Market Indicators (KMI). The KMI is a collection of primary and secondary indicators on the macroeconomic, demographic, and technological environment in up to 150 countries and regions worldwide. All indicators are sourced from international and national statistical offices, trade associations, and the trade press and they are processed to generate comparable data sets (see supplementary notes under details for more information).

- **Statistics of the development and growth of social media platforms**

Social media users have continued to grow at a double-digit 10.1 percent rate over the past 12 months as well, but I admit I am surprised that the growth rate between 2021 and 2022 has remained above pre-pandemic levels.

In this context, the latest data indicates that 424 million users began their journey on social media during the past year, which equates to an average of more than one million new users per day, or approximately 13 new users every second.

SOCIAL MEDIA USERS OVER TIME



Anyone reluctant to join social media before the pandemic hit was more likely to do so during the early days of lockdown in 2020, so I am hesitant to attribute any meaningful share of the growth over the last 12 months to some sort of 'effect "COVID."

Furthermore, with social media users now equalling 58.4 percent of the world population, we should expect to see growth rates start to slow over the next few years, and this may be the last time we report double-digit annual growth in social media users.

The good news is that we should see social media users reach the equivalent of 60 percent of the global population at some point in 2022, so even if growth rates decline, the overall reach potential of social media still offers a lot to be excited about.

Market leader Facebook was the first social network to surpass one billion registered accounts and currently sits at more than three billion monthly active users. Meta Platforms owns four of the biggest social media platforms, all with more than one billion monthly active users each: Facebook (core platform), WhatsApp, Facebook, Messenger, and Instagram. In the third quarter of 2023, Facebook reported around four billion monthly core Family product users.

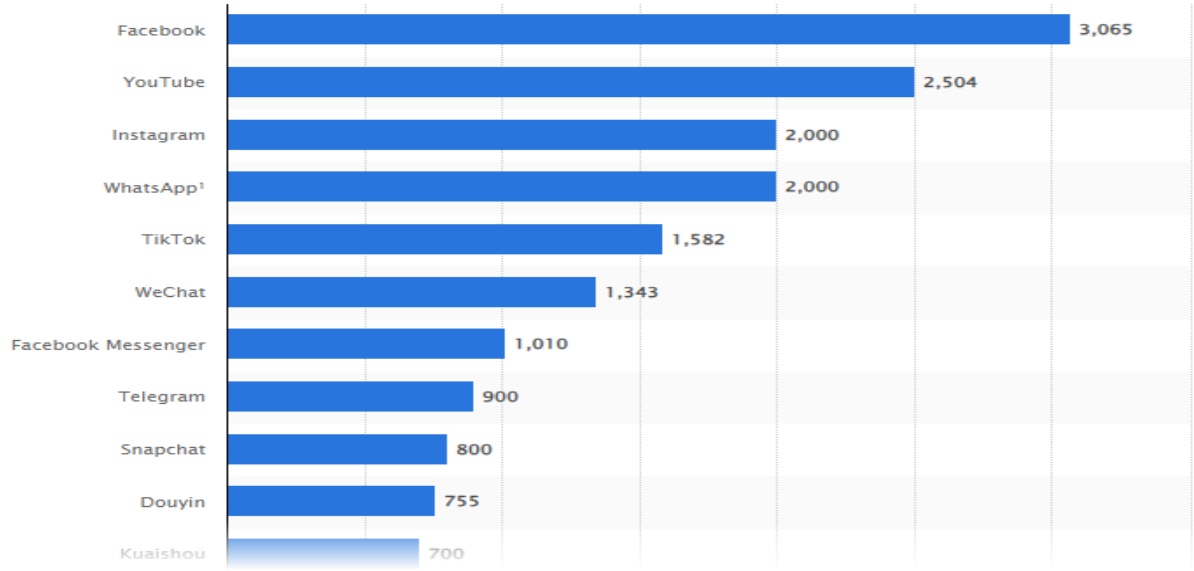
The United States and China account for the most high-profile social platforms.

Most top-ranked social networks with more than 100 million users originated in the United States, but services like Chinese social networks WeChat, QQ, or video sharing app Douyin have also garnered mainstream appeal in their respective regions due to local context and content. Douyin's popularity has led to the platform releasing an international version of its network: a little app called TikTok.

How many people use social media?

The leading social networks are usually available in multiple languages and connect users with friends or people across geographical, political, or economic borders. In 2022, Social networking sites are estimated to reach 3.96 billion users. These figures are still expected to grow as mobile device usage and social networks increasingly gain traction in previously underserved markets.

Most popular social networks worldwide as of April 2024 ranked by number of monthly active users.



- **Artificial intelligence (AI) investment**

In 2022, the global total corporate investment in artificial intelligence (AI) reached almost 92 billion U.S. dollars, a slight decrease from the previous year. In 2018, the yearly investment in AI saw a slight downturn, but it was only temporary. Privateinvestmentsaccount for a bulk of total AI corporateinvestment. AI investment has increased more than six fold since 2016, a staggering growth in any market. It is a testament to the importance of the development of AI around the world.

- **What is Artificial Intelligence (AI)?**

Artificial intelligence, once the subject of people's imaginations and the main plot of science fiction movies for decades, is no longer a piece of fiction but rather a commonplace in people's daily lives whether they realize it or not. AI refers to a computer or machine able to imitate the capacities of the human brain, which often learns from previous experiences to understand and respond to language, decisions, and problems. These AI capabilities, such as computer vision and conversational interfaces, have become embedded throughout various industries' standard business processes.

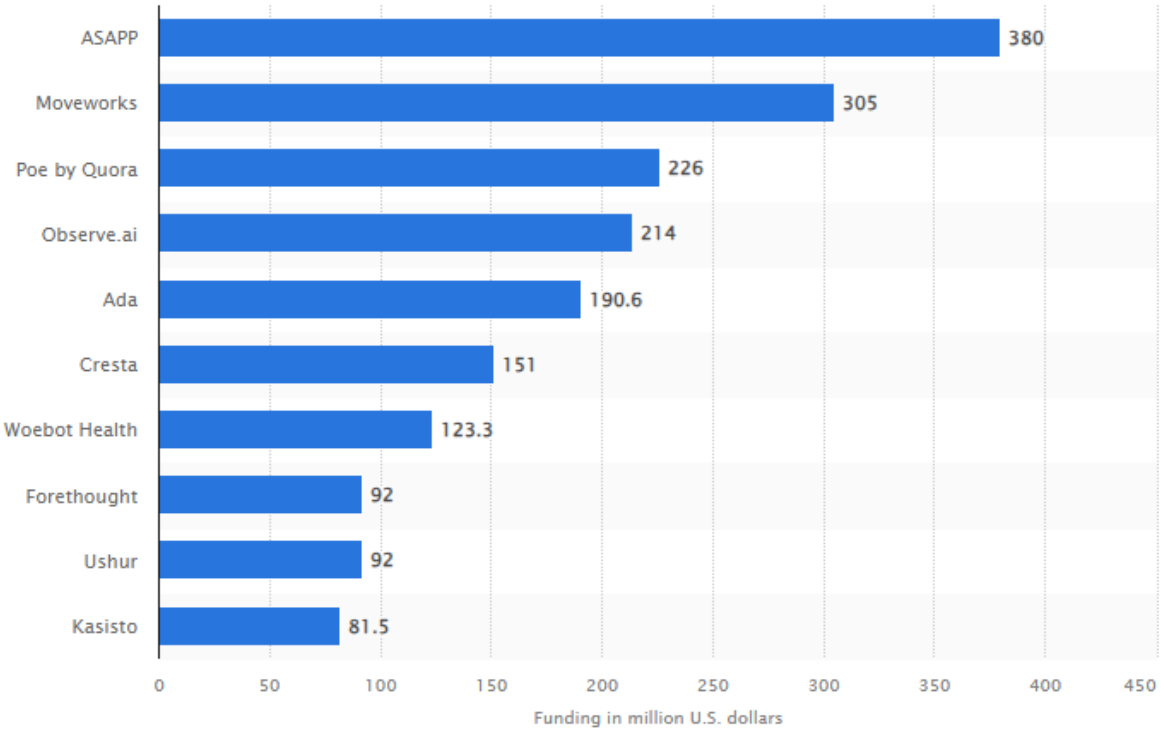
- **AI investment and start-ups**

The global AI market, valued at 142.3 billion U.S. dollars as of 2023, continues to grow driven by the influx of investments it receives. A rapidly growing market looking to expand from billions to trillions of U.S. dollars in market size in the coming years. From 2020 to 2022, investment in start-ups globally, particularly AI start-ups, increased by five billion U.S. dollars, nearly double its previous investments, with much of it coming from private capital from U.S. companies. The most recent top-funded AI businesses are all machine learning and chatbot companies, focusing on human interface with machines.

Leading chatbot/conversational AI start-ups worldwide in 2023

The generative AI market is expected to grow consistently between 10 and 20 percent through the decade until 2030, slowing as the decade draws close, following a staggering 100 percent growth from 2021 through 2023.

Leading chatbot/conversational AI start-ups worldwide in 2023



As of December 2023, the company ASAPP was the most funded chatbot/ conversational AI worldwide, with around 380 million U.S. dollars. By contrast, the next company operating in the same field had over 300 million U.S. dollars.

- **What are AI chatbots?**

A chatbot, or a conversational bot, is an AI software that simulates human conversation via audio or text on the internet. They are designed to answer basic questions, recommend products, and provide customer support so organizations and companies can save human resources, money, and time. Recent developments have produced more advanced chatbots that utilize deep learning algorithms to find answers to complex problems and questions. Different chatbot types exist, such as menu-based, keyword-based, social messaging, and

voice bots. Popularchatbots are Netomi, atSpoke, and the new ChatGPT, launched in November 2022.

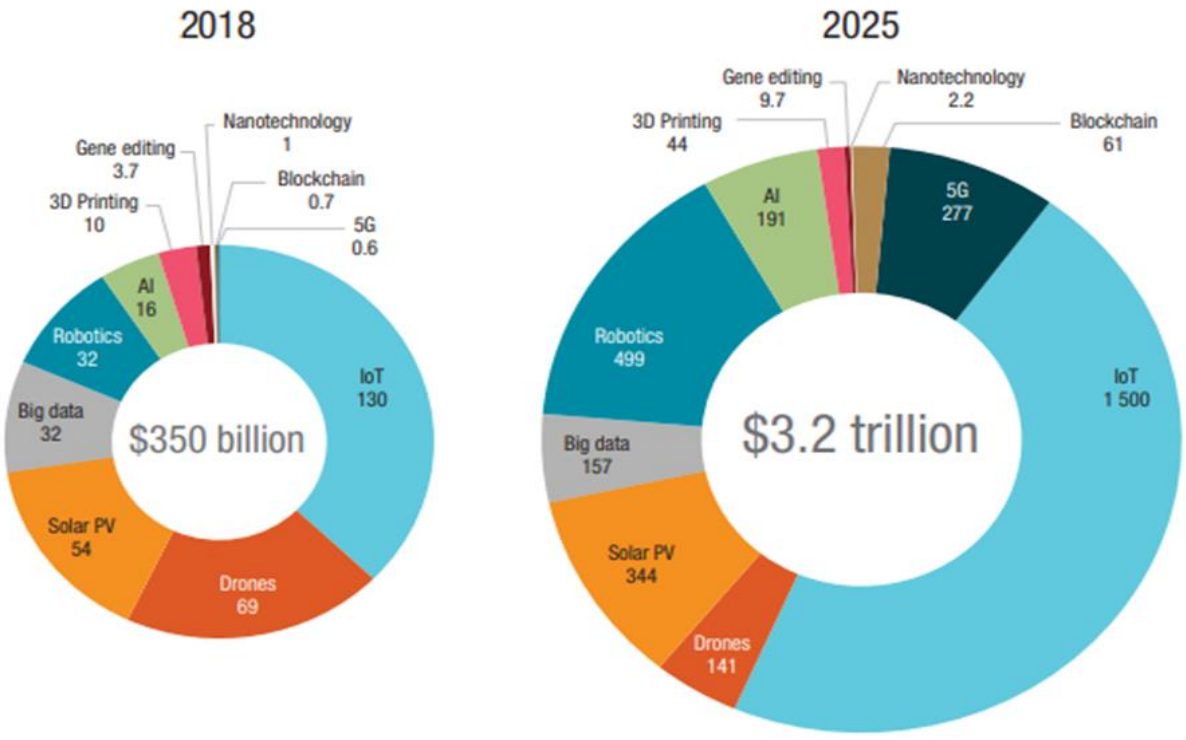
3. RAPID GROWTH OF FRONTIER TECHNOLOGIES

According to some estimates, frontier technologies already represent a $350-billion market and one that by 2025 could grow to over $3.2 trillion. To put this into perspective, the current global laptop market is $102 billion, and $522 billion for smartphones. Some estimates for frontier technologies may be over-hyped, and there may be considerable double counting, for example, in IoT, which is also based on AI and big data, but market analysts have high expectations.

Among the frontier technologies, the largest by market revenue is IoT. In 2018, sales totalled $130 billion, and in the next five years, could grow to $1.5 trillion – around half of frontier technology revenues.11 this is because IoT covers such a vast range of devices: in 2017, there were already more IoT devices in use than people on Earth – 8.4 billion. Another area of the future

Expansion is the industrial internet of things (IIoT), which uses multiple interconnected devices for various forms of manufacture, for the Airbus and Boeing factories of the future, for example, Amazon'swarehousing, or for agriculture for self-driving tractors.

Market size estimates of frontier technologies, $billions



- **Duration of biotech companies' response to COVID-19**

Biotech companies started clinical trials on potential treatments for COVID-19 just three months after the genetic sequence of the virus was made public. In comparison, companies entered clinical trials 20 months after the viral genome of the SARS coronavirus was sequenced.

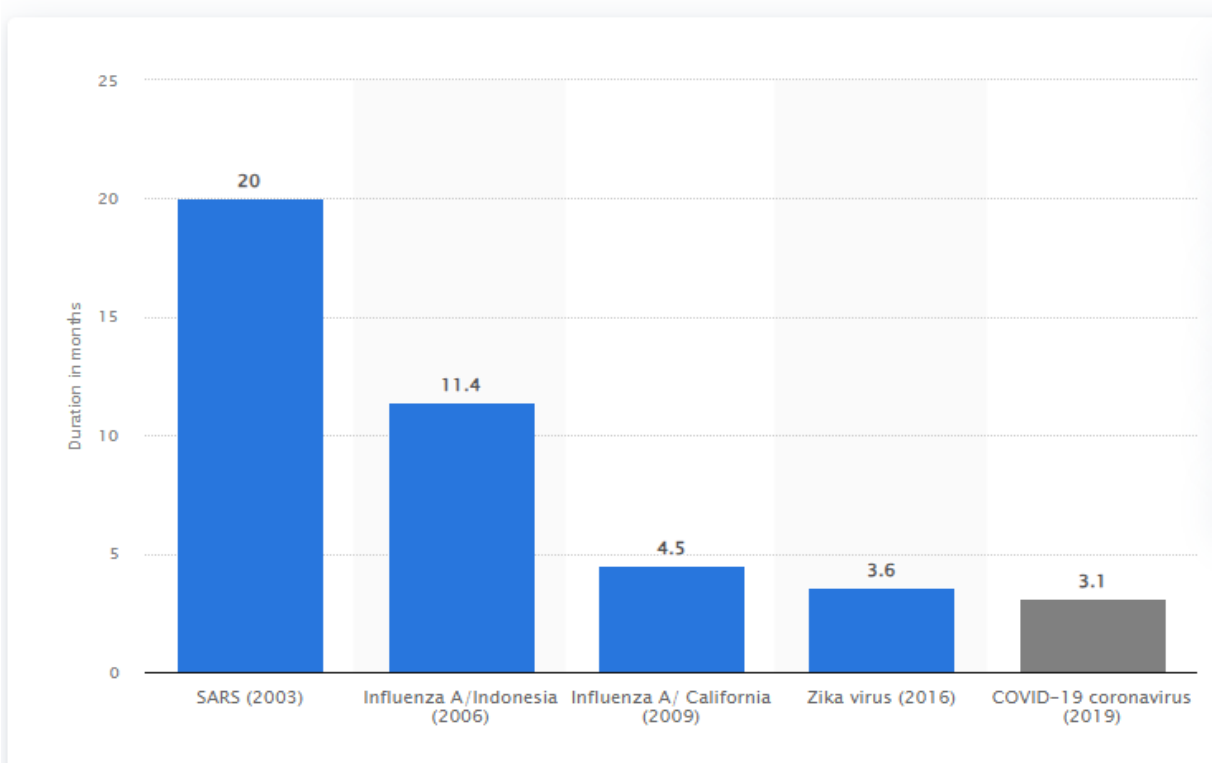
- **A cure could take several more months.**

Chinese authorities shared the genetic sequence for the SARS-CoV-2 virus in early January, allowing research groups to analyse how the virus infects human cells and makes people sick. Treatments are now in development; several have entered early clinical trials. Assuming all tests go well, a cure for COVID-19 could still take up to 18 months before being approved for public use. New vaccines typically take years, and there is enormous pressure to make them safe and effective for all members of the diverse population.

- **Parallels with the SARS epidemic**

The SARS coronavirus was responsible for the outbreak of severe acute respiratory syndrome (SARS) that first affected humans in the Guangdong province of China in 2002. The official name for the coronavirus is SARS-CoV, which is very similar to the SARS-CoV-2 name chosen for the coronavirus that causes COVID-19 disease. While genetically related and believed to spread similarly, the two viruses are different. There were more than 8,000 reported cases of SARS before it was brought under control in 2003.

Duration of biotech companies' response to COVID-19 pandemic compared to other health threats between 2003 and 2019



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