The State of Broadband: Our digital world

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The State of Broadband: Our digital world

December 2025

Introduction: Digitizing our Connected World

Our societies are undergoing significant digital transformation. There is strong, but uneven, growth in connectivity infrastructure, driven by the expansion of digital services, the introduction of Artificial Intelligence (AI) into various aspects of our society, and a huge yet invisible exchange in data. Any one of these trends has far-reaching implications; taken together, they are changing the way we live.

Today, unprecedented innovation and massive leaps forward in AI technologies are reshaping many aspects of our lives, as well as our societies. AI is revolutionizing the way in which decisions are taken and services are provided. It offers vital opportunities, as well as potential risks, some of which may be unforeseen. Regulators and policy-makers are racing to identify key considerations in AI policy and standards for the ethical use of AI tools and applications, and considering how best to develop appropriate policies, as AI technologies continue to advance at a rapid pace.

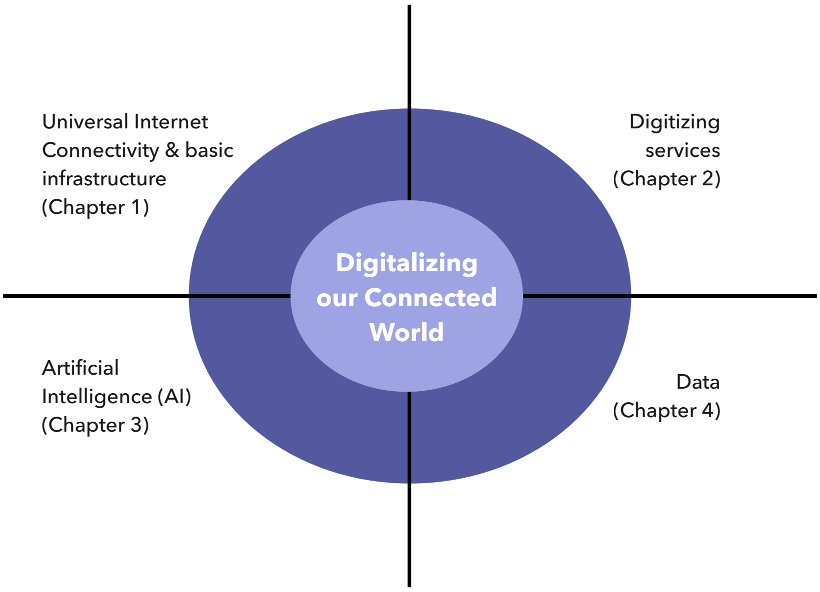
Our mobiles now generate significant real-time data streams – not just about our physical activity, location or movements, but also inferable metadata about our health, vitality, interests and preferences. There are huge asset classes of stored, exchanged, sold and traded data. Data standards, data formats and data sharing have become significant issues for the attention of regulators and policy-makers alike.

This report presents an overview of the key ways in which our world is digitizing, and the growth in digital services:

- Historically, bridging the digital divide was seen as an issue of providing good-quality **infrastructure** to unconnected areas and communities, but this is now seen as just one initial step towards universal and meaningful Internet connectivity (Chapter 1). Addressing affordability issues and skills gaps are also essential to ensuring people in developing countries can access the Internet to find relevant and meaningful content and services.
- Digitizing real-world **services** raises various other issues (Chapter 2), including accessing relevant and real-time services on the move.
- Fast-changing **AI** has broad implications (i.e. across various sectors), cross-cutting implications (e.g. moving from search engines to more specialized, assisted search) and deep implications (shifting decision-making to the edges of the information network). Among many different fields of AI (Table 4), this report focuses particularly on national AI strategies and AI in healthcare, education, and the telecommunication and broadband sectors (Chapter 3).
- Finally, **data** is everywhere, generated by all of us as we go about our daily activities, and increasingly, between machines, with limited or no human input. New and important issues are arising in how governments approach data, its use, storage and transmission (Chapter 4).

These areas are now inter-related in complex ways. Growth in telecom networks must now be accompanied by massive investments in computing infrastructure and data centres powered by reliable energy supply and cooling systems. AI models are trained with vast quantities of data (including new forms of synthetic data), but such data must be robust and representative, to avoid introducing bias into AI models. The overlap of these trends is raising important challenges – for example, how to balance individual rights to privacy and control over personal data with the collective benefits and important insights from analysis of vast datasets? The field of data governance has gained priority and is now at the top of the policy agenda.

Figure 1: Structure of this Report



Source: ITU/UNESCO Broadband Commission for Sustainable Development.

The ITU/UNESCO Broadband Commission for Sustainable Development is considering how AI can best be used to enhance people's lives and improve development outcomes. This report, '*The State of Broadband Report 2025: Our Digital World*', offers an initial overview of some of the ways in which AI applications are already being used to boost development across several domains. It considers the implications of the digital divide, as well as the impact of AI, across fields of e-government, healthcare, education and broadband telecommunications, a sector that still provides much of the vital infrastructure needed for our digital world.

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1

Universal, Meaningful Internet Connectivity

The first step towards a fully digital world is to connect humanity with universal, meaningful Internet connectivity. Traditionally, this challenge was perceived mainly as a problem of infrastructure. Headline connectivity statistics of the type in Table 1 give broad indications of the size and evolution of the digital divide, especially from end-users' and consumers' point of view.

According to this traditional view, connectivity gaps can be monitored in terms of the speed of connection, new generations of mobile telephony, and gaps in last-mile as well as middle-mile infrastructure. In our increasingly digital economies, additional factors also affect digital infrastructure, including a reliable electricity supply, the presence of an Internet Exchange Point (IXP) for the local exchange of data traffic, transit arrangements and supporting infrastructure such as data centres.

Table 1: Counting Connectivity – Key Connectivity Statistics

	2025*	2024	2020
Number of fixed broadband subscriptions	1.6 billion (ITU)	1.5 billion (ITU)	1.2 billion (ITU)
Number of mobile subscriptions	9.1 billion (GSMA)	8.7 billion (GSMA)	8.3 billion (GSMA)
Number of Internet users	6.0 billion	5.5 billion (ITU)	4.2 billion (ITU)
Number of 5G connections	2.9 billion* (Ericsson)	2.1 billion (GSMA) 2.3 billion (Ericsson)	70m (GSMA)
Number of social media users	5.3-5.4 billion* (WeAreSocial)	5.04 billion (WeAreSocial)	3.8 billion (WeAreSocial)

Source: Various. Note: ITU data refer to year-end data; however, other sources may refer to other months or be subject to revision over the course of the year. 2025* refers to estimated projections or the most recent data available.

For the majority of users, mobile phones have become their portal to many services, including for government, healthcare and education, among others.

Our mobile has become our constant companion, holder of most of our information (and most of our secrets) and many users may now be lost without it.

Mobile statistics include number and type of subscribers, mobile coverage, network upgrades, devices, throughput and connection speeds. Looking forward, it is anticipated that 5G will become the dominant mobile access technology across the world by 2029. The GSMA estimates that there were some 2.1 billion 5G mobile connections in 2024, projected to reach 5.6 billion by 2030. Ericsson estimated that 5G exceeded 2 billion connections in 2024, and will reach 2.9 billion subscriptions by the end of 2025 and 6.3 billion subscriptions by 2030 (Figure 2, left graph).

The number of 5G base stations in China reached 4.25 million in January 2025[1], up from 3.92 million by June 2024 (then equivalent to one-third of all the mobile base stations in China[2]). The number of 5G mobile subscribers exceeded 927 million in June 2024 (over half or 52.4% of total mobile subscribers in China) and is now expected to have surpassed one billion 5G subscriptions[3]. According to Ericsson, 5G subscriptions in India exceeded 270 million by the end of 2024 (equivalent to a quarter or 23% of the total mobile subscriptions in India[4]. Despite these impressive growth statistics, the research group Dell'Oro believes that the roll-out of 5G by operators may have slowed in the short-term, as some operators delay deployments with a more gradual build cycle[5].

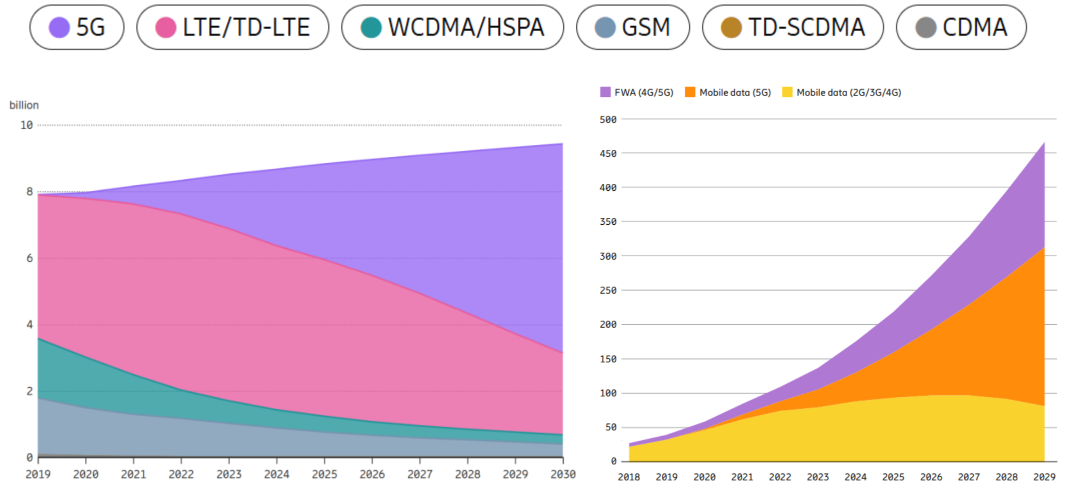
Consumers' mobile phones generate significant real-time data streams, including location, mobility and movements, but also implicit and inferable data about their users' health, vitality, interests and preferences. Data is now a huge asset class – stored, exchanged, sold and traded. Data standards, data formats and data sharing have now become significant issues for the attention of regulators and policymakers alike. Chapter 4 considers some of the implications of data transmission, storage and transfer for policy-makers.

The growth in demand for data carried over networks (including from fixed wireless access solutions) is fuelling massive traffic growth. Total mobile data traffic is estimated to triple between 2023 and 2029. Total mobile network traffic was estimated at around 170 EB per month at the end of 2024, rising to over 450 EB per month by the end of 2029 (Figure 2, right graph). Ericsson predicts that 5G will account for around three-quarters of total mobile data traffic by 2029.

1 http://english.scio.gov.cn/pressroom/2025-01/22/content_117678998.html#:~:text=The%20number%20of%205G%20base,of%20Industry%20and%20Information%20Technology
2 https://english.www.gov.cn/archive/statistics/202407/23/content_WS669f8be0c6d0868f4e8e9625.html
3 www.rcrwireless.com/20240627/5g/china-reach-1-billion-5g-subscriptions-end-2024-gsma
4 https://economictimes.indiatimes.com/industry/telecom/telecom-news/number-of-5g-subscribers-in-india-may-triple-to-970-mn-by-2030-report/articleshow/115691585.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
5 Dell'Oro forecasts mixed bag for mobi... - Mobile World Live

Figure 2: Growth in Global Mobile Subscriptions and data traffic, 2019-2030

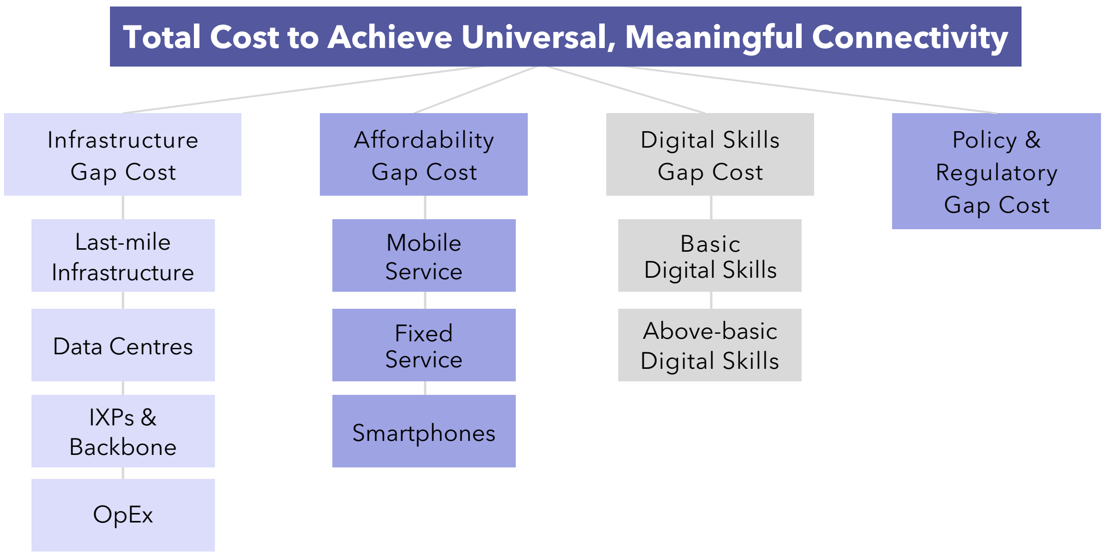
Total number of mobile subscriptions, billions (left graph); Data traffic in Exabytes per month (right graph)



Source: Ericsson Mobility Report, June 2025 (left graph) www.ericsson.com/en/reports-and-papers/mobility-report/dataforecasts/mobile-subscriptions-outlook; Nov 2024, www.ericsson.com/4ad0df/assets/local/reports-papers/mobility-report/documents/2024/ericsson-mobility-report-november-2024.pdf

Today, however, broader divides have emerged, not just in digital connectivity, but in the digital economy and digital empowerment for individuals. The digital divide is now viewed through a broader lens (Figure 3). On the supply side, policy & regulation can enable the necessary private sector investment in the deployment of infrastructure. On the demand side, affordability is vital in enabling consumers to use broadband effectively, as highlighted by the Broadband Commission's target on affordability. Digital skills are increasingly important to make full use of digital connectivity, as highlighted by the Broadband Commission's target on digital skills.

Figure 3: The Evolving Digital Divide for Achieving Universal Connectivity



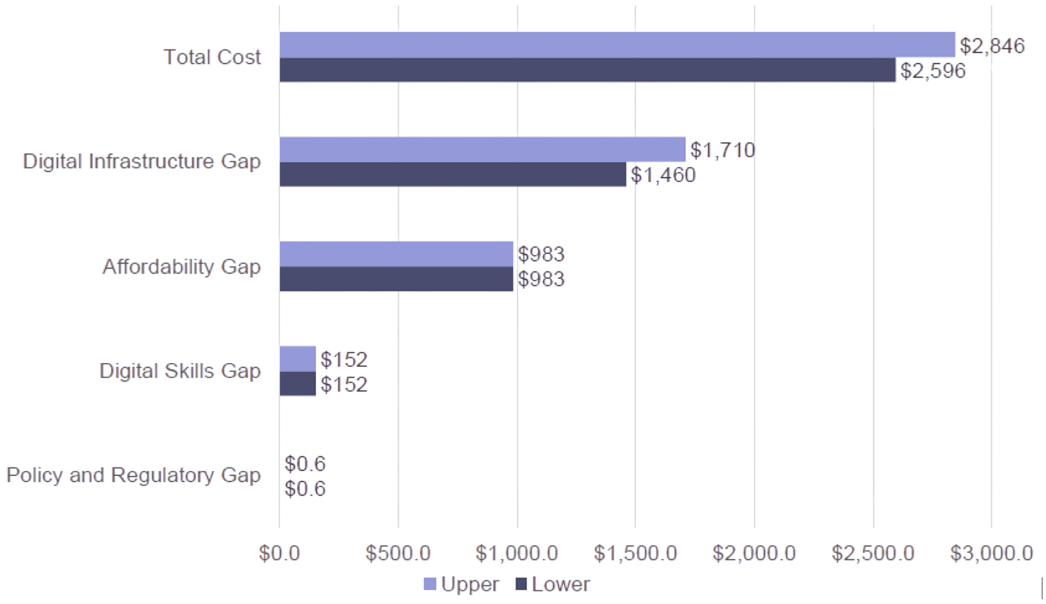
Source: ITU.

The ITU recently commissioned a study, '*Connecting Humanity*', to estimate the cost of achieving ITU's Aspirational Goals for 20 Mbps connectivity for every household by 2030. This report used geospatial data to explore the availability of three different technologies for the provision of last-mile connectivity: fiber in urban and peri-urban areas, 4G in rural areas and satellite connectivity in the most remote locations. This study estimated the full cost to achieve universal, meaningful Internet connectivity by 2030 as USD $2.6 - 2.8 trillion at current prices.

The global digital infrastructure gap remains important, accounting for around half the estimated cost of achieving universal and meaningful connectivity, estimated to amount to around USD $1.5-1.7 trillion (Figure 4). This represents the additional cost to cover 2.3 – 2.6 billion people, or some 498 to 574 million households worldwide (according to the technological mix used to provide service to underserved communities). The *Connecting Humanity* study estimates that it may cost approximately USD $983 billion at current prices to close the broadband affordability gap and USD $152 billion to bridge ICT skills gaps.

The estimated cost to update policy & regulatory frameworks to third-generation regulatory frameworks in the ITU Tracker was relatively low, estimated at US$ 600 million globally. This is because the report only considered the relatively well-known field of telecom regulation and the costs to upgrade countries' telecom frameworks. The report did not consider digital regulation, which is more recent, fast-encroaching and much broader than telecom regulation, as Chapter 2 shows. Indeed, several major aspects of policy-making for digital services are only just becoming apparent (such as their energy requirements and possible socio-economic consequences).

Figure 4: Estimated Cost to achieve Universal Connectivity through 2030 (USD billions)



Source: Connecting Humanity Action Blueprint: Advancing Sustainable, Affordable and Innovative solutions (ITU, September 2025).

Expanding telecom networks and increasing densification must now be accompanied by massive investments in computing infrastructure and data centres, powered by reliable energy supply and cooling systems. Large data centres often now need large amounts of water as well as electricity. Data centre water consumption varies based on factors such as facility size, cooling system type, and external temperature and humidity[6].

Data centres in some countries can be used to provide digital services in other countries, which partly explains why North America is exceedingly well-provisioned in data centres. Box 1 presents the newly announced plans by one telecom services provider in Canada to showcase some of the considerations in the provision of the infrastructure needed to underpin digital and AI services. Box 2 describes the AI infrastructure cluster Stargate UAE in the United Arab Emirates, which illustrates the range of services that may be needed from a coalition of tech companies, from the planning and design stages through to operations, energy and cybersecurity.

Box 1: Bell Canada unveils a major AI infrastructure initiative in Canada

The Canadian telecom services provider Bell Canada has unveiled a major AI infrastructure project in 2025. Bell AI Fabric will create a national network starting with a data centre cluster in British Columbia that will aim to provide upwards of 500 MW of hydro-electric powered AI compute capacity across six facilities:

- **Two 7 MW AI facilities that will go live** in Kamloops in June 2025, powered by Groq's LPUs, which are designed to accelerate AI inference tasks, particularly for large language models (LLMs). The second facility will open in Merritt, British Columbia by the end of 2025.
- **Two additional 26 MW AI data centres in Kamloops**. The first will open in 2026 at Thompson Rivers University (TRU) and will be followed by a second 26 MW data centre in 2027.
- **Two AI data centres** in advanced planning stages, which will be designed for high-density AI workloads, powered by clean hydroelectricity and with a total capacity of more than 400 MW.

Bell aims to support Canadian enterprises and governments in their full range of AI needs, from strategy and applications development through infrastructure deployment. "Bell's AI Fabric will ensure that Canadian businesses, researchers and public institutions can access high-performance, sovereign and environmentally responsible AI computing services," stated Mirko Bibic, president and CEO at Bell Canada. With this investment, Bell seeks to bolster Canada's sovereign AI compute capacity, while laying the groundwork for growing the AI economy. The first of Bell's AI Fabric facilities was planned to come online in 2025 in partnership with AI inference provider, Groq and the launch of their 7 MW AI inference facility in British Columbia. Additional AI facilities will come online by the end of 2026, including a 26 MW AI data centre built in partnership with Thompson Rivers University. Further facilities are in the planning stages across the country to add to the capacity of Bell AI Fabric. Advanced LPUs are needed to deliver faster inference performance at lower costs.

Source: Bell Canada unveils Bell AI Fabric.

6 https://dgtlinfra.com/data-center-cooling/

Box 2: The AI infrastructure cluster Stargate UAE in the United Arab Emirates

A new project, Stargate UAE, aims to develop a powerful AI infrastructure cluster in the newly established 5-gigawatt UAE–U.S. AI Campus in Abu Dhabi. Tech company G42 will lead the development of Stargate UAE, while OpenAI and Oracle will operate the cluster. Cisco will provide cybersecurity and AI-ready network infrastructure, while Nvidia will supply Grace Blackwell GB300 systems to power the compute platform. The facility will eventually offer 1 gigawatt of compute power, with the first 200-megawatt cluster expected to come online by 2026. The project aims to provide "best-in-class infrastructure, nation-scale compute and low latency inferencing to deliver AI that will meet the demands of an increasingly intelligent world. In particular, the cluster is hoped to support advancements in sectors including health care, energy, finance and transportation.

Source: Nvidia, OpenAI, Cisco, Others Launch Stargate UAE AI Infrastructure Project

2

Digital Services

Digital technologies contribute to national and local development, facilitate the sharing of knowledge and guidance, and enable the provision of online services and solutions. Connectivity statistics point to, but do not fully reflect or capture, the transformative impact of digital services on economic sectors. Digital transformation is a broad term capturing the extent to which digitalization is reinventing the provision of existing services, and enabling new services.

Next-generation networks are important in terms of the services they enable through increased data throughput rates and reduced latency. For example, Table 2 shows how 5G use cases are helping drive digital transformation across sectors as diverse as transportation, healthcare, education, industry and agriculture. Table 2 also suggests an important role for verticals and sectors, with the provision of digital services now taking place via important channels and actors – national governments for education and digital e-government services, tech hubs for specific industries and smart cities for transport services.

Table 2: 5G Driving Digital Transformation in Different Sectors

Vertical sector	5G use cases facilitating digital transformation	Potential outcomes and benefits
Transportation	5G data from smart vehicles may enable increased public transport efficiency, address complex traffic situations, and decrease congestion.	• Optimized transport routes and improved commutes • Reduced pollution • Decreased fatalities
Health care	5G and better-connected health care devices can provide a platform to develop virtual training, remote cooperation, and remote diagnostic services.	• Improved health care quality and access • Lower health care costs • More wearable sensors and devices
Education	5G, along with virtual reality and augmented reality, provides a platform on which remote access to high-quality learning applications can be developed, especially for activities requiring fine manual skills, such as surgery.	• Improved access and availability • Improved quality (due to real-time feedback during training)
Public safety	5G provides a platform for the development of applications to deliver mission-critical communications, as well as enabling connected ambulances and drones.	• Faster, more efficient emergency responses • Increased safety • Better remote monitoring of developing events
Industry (manufacturing)	5G provides a platform for developing applications for smart factories, improving efficiency and quality assurance, while remote control will minimize danger to operators.	• More efficient production processes • Increased safety
Agriculture	5G provides a platform for the development of applications for smart agriculture to improve the efficiency of processes and sustainable farming through better remote monitoring and automation.	• More efficient agricultural production • Reduced waste • More environmental sensors and devices

Source: Wilson 2020.
Note: 5G = fifth generation mobile network technologies.

Source: P.33, World Bank (2023), The Path to 5G in the Developing World (worldbank.org).

2.1 Policies underpinning Digital Transformation

Policy-making for the digital world has multiple different aspects. From 2005 to 2015, national broadband plans initially established a policy basis for a discrete sector, the broadband sector. From 2012 onwards, growth in the number and focus of national Digital Agendas recognized that digital policy now underpinned and impacted the provision of services in other sectors (e.g. healthcare, education)[7]. National governments had a clear role and responsibility for setting telecommunication policy throughout the 1990s and the first decade of the millennium.

This rapid technological change creates a 'pacing problem', where innovation raises the risk of outpacing the ability of laws and regulations to keep up, where they are needed. In 2015 already, the Broadband Commission found that the average age of a National Broadband Plan was 7 years across those countries with a national broadband strategy. The first approved national AI strategies date back to 2017, when Canada and China approved their national strategies (with work already underway in Japan, Singapore and the UAE). Denmark, Finland, India, Italy, and New Zealand approved their national AI strategies in 2018 [see section 3.1 for the most recent statistics].

Technological transitions are accelerating, with far-reaching policy consequences. Policy-making for the digital world can be implemented in horizontal ways that avoid creating sector specific approaches, and are focused on outcomes rather than prescriptive rules. Table 3 sets out a broad overview of some of the transitions in selected policy considerations in the move from telephony to Internet worlds, and more recently, our digital society (also encompassing AI).

Joined-up digital policy-making also introduces new actors into the policy arena. Telecom regulators now have to work hand-in-hand with data protection authorities. However, municipalities and local authorities are now coming to the forefront – for example, in determining policy for smart cities or for authorizing testing zones for autonomous vehicles for specific cities or areas. Health authorities are playing a key role in permitting pioneering multiple different uses of AI in medical practice in hospitals or across heath foundations. The ability of AI to empower devolved decision-making to the edges of intelligent networks may create tensions with a top-down, 'command from the centre' approach to national policy-making[8].

A National Digital Transformation Strategy should address major digital policy issues, cross-cutting challenges governments face when going digital and help put in place key enablers of digital transformation. According to ITU's most recent statistics, by mid-2025, 125 countries had a national Digital Transformation Strategy, that provided policy priorities across multiple sectors covering multiple areas (e.g. governance, infrastructure, skills, regulation, innovation and security). The next two sections consider the role of national governments and e-government services offered by governments, as well as smart cities.

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7 'Planning for Progress: Why National Broadband Plans Matter' (2013), available at: www.broadbandcommission.org/publication/%e2%80%8bplanning-for-progress/

8 The role of decentralized decision-making is considered in the third part of the book *Nexus*, by Professor Yuval Harari. Algorithms are already making many decisions in digital societies (e.g. college places, job offers, welfare benefits, loan decisions). Professor Harari suggests humans should be entitled to an explanation of algorithmic decision-making (page 331, Nexus), although he notes that this is problematic in practice due to potential lack of transparency in algorithms.

Table 3: Transitions in Selected Policy Considerations

	Analogue world	Internet world	Integrated digital world
Infrastructure & service provision	Phones, lines, switching centres, power supply. Telephone network separate from TV broadcasting	Fibre, nodes, IXPs Power supply, Telephony (VoIP) integrated with broadcasting over IP networks.	Backbone infrastructure, data centres, massive power infrastructure, water cooling. Distributed edge computing. Services run over integrated, seamless networks
Measures of success	No. of subscribers Volume of minutes Market share, revenues	Subscribers, data volumes market share, revenues, Innovation & first-mover advantage	Richness & versatility of data Agility, time spent online Multiple granular datasets Volumes of data gathered
Stakeholders in regulation	National state-owned incumbents, Ministries & telecom regulators	ICT regulators, data protection agencies, ISPs, Private & public sector players may have codes	Collaborative regulation, including end-users and data providers; smart cities as hubs integrating services, regions
Identifiers	Telephone number Name & address & age	IP address (contains geographic information) eSIM	Biometric – retinal imprints, voice imprint, facial template GPS coordinates, EHR in health Digital identity & records – Digital criminal records
Search & index	Phonebook	Search engines (e.g. Bing and Google)	ChatGPT, DeepSeek, Bard & AI-assisted search, chatbots, assistants & agents providing curated search
Policy considerations	Universal service Emergency numbers Number portability Network load & performance Pricing per minute (time)	Domain names & addresses, IXPs Interconnection Taxation of digital assets Wholesale & retail prices Interoperability Net neutrality Move to data bundles for pricing	Privacy, data protection, data sovereignty, data quality Data provenance & labelling Content expiry & the right to be forgotten Taxation Wholesale v. retail prices Data portability, data value, interoperability Digital skills, capacity-building Cultural contexts

Table 3: Transitions in Selected Policy Considerations (continued)

	Analogue world	Internet world	Integrated digital world
Network Performance	Quality of service Call drop rate Network management	IP transit Packet loss, latency, jitter, bandwidth, service reliability, wireless coverage Net neutrality	Network efficiency Service reliability Energy efficiency Successful handovers between integrated networks
Security	Spoofing, phone hacking, Eavesdropping, recording conversations, accessing voicemails	Identity theft Cloud security Cybercrime, hacking, phishing.	Cybersecurity, encryption Identity theft & theft of biometric data, deepfakes, attacks on critical infrastructure Data pollution, data contamination Password security

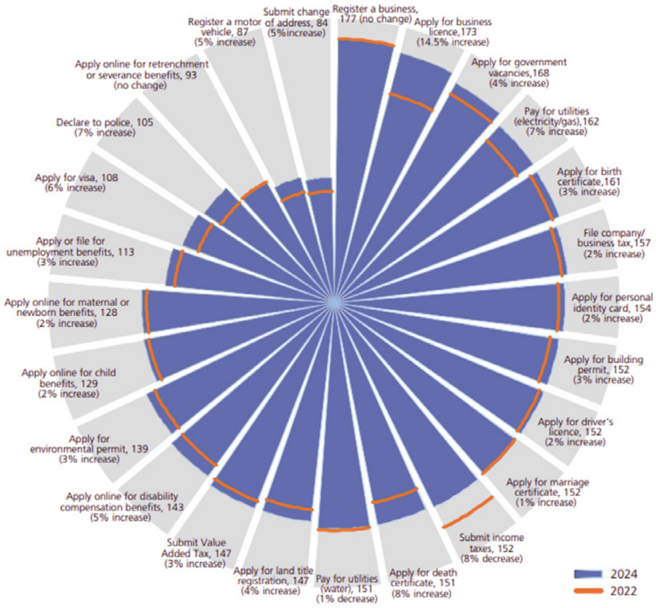
2.2 National E-Government Services

Many countries have introduced e-government services, with some countries and municipalities moving to introduce AI tools and services. Historically, E-government services played an important role in the initial development of online services in developing countries. The online provision of nearly all e-government services is broadly growing. The most authoritative source of data and research into e-government services is the United Nations Department of Economic and Social Affairs, which has conducted its e-government survey since 2001.

UNDESA notes in its survey of E-Government services that globally, the average number of online services provided increased from 16 in 2022 to 18 in 2024. The most popular services for countries include business registration (177 countries) and license (173 countries); the least popular services remained registering changes in address (84 countries) and motor vehicles (87 countries), although both these services were offered by 5% more countries in 2024 than in 2022.

Figure 5: Trends in the provision of online transactional services, 2022-2024

(Number of countries and percentage change)

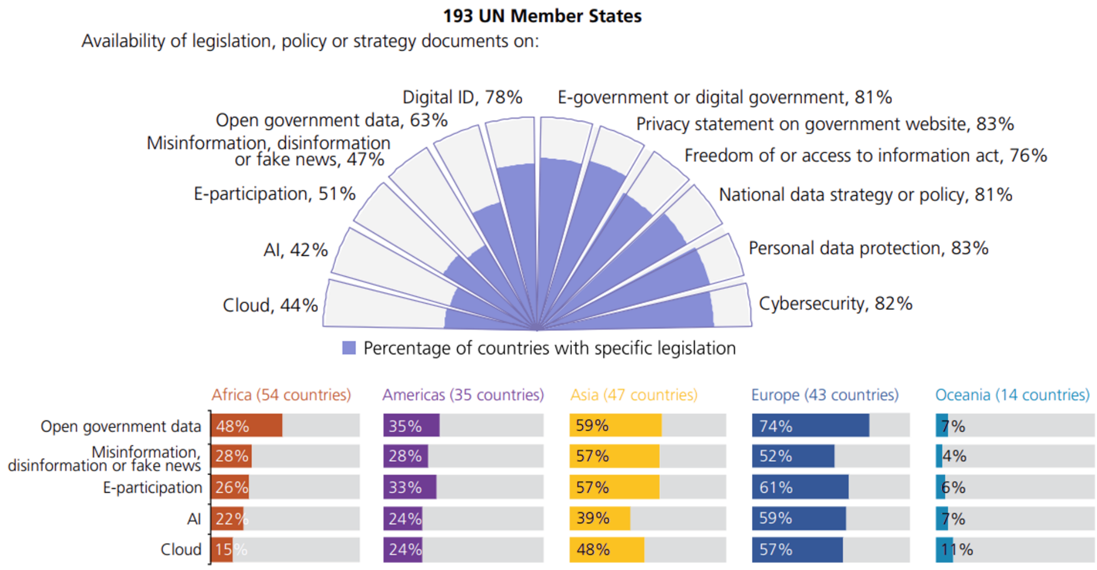


Source: Page 62, UNDESA E-Government Survey, 2024, available at: https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2024.

The number of countries that allow companies to register a business (177) and apply for retrenchment or severance benefits online (93) did not change between 2022 and 2024. Four online services were offered by fewer countries in 2024 than in 2022, including submitting income taxes online and paying water bills (reflected in declines of 8% and 1%, respectively). UNDESA considers that these decreases are likely due to services being moved to the private sector payment platforms (e.g. for utility payments) or temporary problems in the availability of government platforms at the time of assessment.

Policies and regulations play an important role in underpinning the growth in digital e-government services. Figure 6 shows some of the major policy and regulatory considerations necessary, including infrastructure and services (e.g. cloud, security) and data considerations (e.g. open government data, privacy and data protection).

Figure 6: Countries with legislative frameworks relevant to e-government development, 2024



Source: Page 54, UNDESA E-government Survey, 2024, available at : https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2024.

2.3 Smart Cities

Given that at least 55% of people currently live in urban areas, a proportion that is expected to rise to 68% by 2050[9], local governments as well as national governments take on a particularly important role in planning, designing and deploying digital smart city services. Smart cities are becoming important agents in the provision of digital services (including infrastructure) in their immediate vicinity. Cities are powerful engines of economic growth, fuelled by communication hotspots and high concentrations of people with specialized skills. ITU defines a smart city as "an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects"[10].

Cities are especially responsible for organizing services in:

- **Transport**: Smart systems improve traffic flow, enhance public transit, and reduce emissions, leading to more efficient and sustainable mobility solutions;
- **Healthcare**: Telemedicine, predictive health analytics, and efficient hospital management systems revolutionize urban healthcare delivery.
- **Energy**: Smart grids, renewable energy integration, and energy-efficient practices reduce consumption and promote sustainability.
- **Public administration**: Digital platforms streamline citizen services, enhance transparency, and strengthen governance.

[9] World Urbanization Prospects (2018), UNDESA, available at: www.un.org/uk/desa/68-world-population-projected-live-urban-areas-2050-says-un

[10] https://www.itu.int/en/ITU-T/focusgroups/ssc/pages/default.aspx

- **Manufacturing**: Smart factories and optimized supply chains increase productivity while reducing waste and environmental impact.

Smart cities can make use of sensor networks to provide real-time information about the status, movement or condition of various types of equipment. Connecting sensors and devices across urban systems can enable the real-time monitoring and optimization of services such as traffic management, energy distribution, and public safety. A growing number of cities are making use of digital twins to simulate immersive virtual environments and simulations to support city planning, predictive maintenance, and operational efficiency. Such digital twins offer cities the opportunity to innovate in a risk-free digital space. AI models are further enabling the analysis of vast datasets to enhance decision-making, automate processes, and drive improvements in municipal services.

ITU-T Study Group 20 on "Internet of Things, digital twins and smart sustainable cities and communities" develops technical standards on the Internet of Things (IoT), digital twins, and smart sustainable cities to provide guidance on deploying secure, accessible, and impactful digital solutions that benefit both urban and rural communities. ITU also leads the United for Smart Sustainable Cities (U4SSC) initiative as a platform for the exchange of knowledge, best practices, and policy innovation. This initiative unites cities, governments, academia, industry, and civil society to co-create people-centred, digitally inclusive, and climate resilient cities and communities. The U4SSC Key Performance Indicators (KPIs) are used by over 200 cities worldwide to benchmark progress and guide strategic planning.

To foster dialogue and knowledge-sharing, ITU hosts Digital Transformation Dialogues and maintains a comprehensive Digital Transformation Resource Hub, offering open access to cutting-edge research and best practices. ITU has also developed the Toolkit on Digital Transformation for People-Oriented Cities and Communities with other UN entities to support the strategic planning and implementation of digital transformation in cities and communities.

By way of example, Insight 1 describes Saudi Arabia's Smart City Revolution and how stc Group is contributing to the provision of digital services in cities in the Kingdom of Saudi Arabia.

Insight 1: Saudi Arabia's Smart City Revolution

stc Group has demonstrated an unwavering commitment to bridging the digital divide, notably through the growth of our 5G network and fiber optic internet connectivity for millions of households. stc Group has also embedded sustainability into the core of its operations and offering. For instance, we have utilized AI-powered solutions to reduce energy consumption across 4G and 5G networks by 13%.

Digital transformation and sustainability are becoming increasingly intertwined, but at stc Group, we are going further. We are building the cities of the future, fully sustainable communities with unmatched connectivity and access to digital services. Connectivity lies at the heart of a smart city and stc Group's high speed internet, IoT, and 5G networks ensure residents can thrive, offering greater convenience and security whilst also attracting business and stimulating economic growth.

stc Group's subsidiaries are spearheading the implementation of the technologies required for smart living, in line with Vision 2030's objectives of improving quality of life in Saudi Arabia. For example, stc Square is a mega mixed-use project designed as a sustainable community. It integrates innovative technologies for enhanced city administration, water supply, smart vehicles and parking, security systems, urban transport, and waste management. Utilizing IoT, big data analytics, and AI, the project aims to boost socio-economic potential and daily life quality. stc's subsidiary, iot squared, offers IoT and AI platforms for waste management, smart parking, disaster management and energy optimization.

IoT Squared, a joint venture between stc Group and the Public Investment Fund, aims to establish a model system for the Middle East's IoT sector, while offering a range of solutions for the development of smart cities. These solutions include designing connected public spaces through assets that gather environmental data and encourage community interaction and creating an intelligent mobility ecosystem which provides comprehensive traffic monitoring and ensures safer experiences for users. IoT Squared also conducts onsite environmental testing that quantifies the impact of various activities on the environment, mitigating the risks to surroundings, and safeguarding the health of residents.

Solutions by stc, the pioneer in information technology services in the kingdom, is facilitating ICT service distribution for smart cities, focusing on integrated mobility platforms and digital twin technology. In line with Vision 2030, stc Group is working with government entities in the development of smart cities in Saudi Arabia, such as NEOM, powered by cutting-edge digital infrastructure.

Our smart cities initiatives incorporate world-class technology to create efficient and sustainable urban areas. We're transforming cities into sustainable, inclusive, and efficient communities where people can flourish. At stc Group, we are pioneering the cities of the future, today.

Source: stc Group.

3

Artificial Intelligence (AI)

Artificial Intelligence (AI) generally refers to machine-based systems that, for a given set of objectives, make predictions, recommendations, or decisions influencing real or virtual environments and can 'learn' somewhat independently through training. AI systems can use inputs to: perceive real and virtual environments; abstract perceptions into models through analysis in automated ways; and use model inferences to develop conclusions or options for action. AI is no single technology, but instead comprises hundreds of microservices, multiple models, and the connection of "many different data sources", distributed across hybrid IT infrastructure[11]. Indeed, some observers distinguish between a set of technologies and applications in different fields, including:

- Machine learning, a subset of techniques that can be used to train AI algorithms to improve performance of various tasks, based on data.
- Natural language processing (NLP) and Large Language Models (LLMs);
- Voice recognition and cloning;
- Computer vision and imagery generation;
- Self-driving vehicles and autonomous (and assisted) driving;
- Facial recognition;
- Geospatial data (e.g. satellite, archaeology, animal tracking);
- Robotics and drones (Unmanned Aerial Vehicles or UAVs).

To complicate matters further, AI is increasingly embedded as more powerful automation and decision-making algorithms into many existing systems to improve their analysis and make them self-learning over time. This includes new and existing online and offline services for many telecom operators, governments and companies; social security systems, health imagery & insurance; individual employees using AI; and consumer uses (e.g. filters, targeted advertising social media). This chapter briefly considers some key milestones for AI in major sectors of healthcare and education, before going on to consider the use of AI in telecommunications.

Insight 2 considers the need for a trusted AI ecosystem for public good.

11 Feature: Nvidia, HPE chiefs address A... - Mobile World Live

Insight 2: Building a Trusted AI Ecosystem for Public Good

Among many emerging technologies, AI holds great potential. However, to fully realize its benefits, we must first address attendant risks and concerns about how AI models are used. Good governance is key to building a trusted AI ecosystem, and this in turn will support widespread adoption of AI, ensuring that all individuals and sectors and can benefit from it.

To achieve this, IMDA developed the **Model AI Governance Framework** in 2019 to promote responsible use of traditional AI. This work was then extended to Generative AI governance in January 2024. Our Generative AI governance framework was developed in consultation with over 70 stakeholders, including local and international big tech companies. It was endorsed by respondents as a comprehensive and robust approach to addressing generative AI concerns. The framework identifies nine dimensions, spanning the entire AI lifecycle, that should be considered to enable trusted development globally.

Practical Testing Toolkits

In the nascent space of AI testing, it is essential to have a balanced governance framework developed with industry input, as this provides a credible foundation for creating and using testing toolkits. Singapore's AI Verify Foundation (AIVF) has developed open-source testing tools based on its Model Governance Framework to test both traditional and generative AI models.

These tools include AI Verify which tests traditional AI models for fairness, explainability and robustness, and Project Moonshot which streamlines the evaluation processes of Generative AI by integrating benchmarking, red teaming and testing baselines in one platform. We have open-sourced both tools to lower the barriers of access to third-party testing and users to conduct their own tests. To build a trusted AI ecosystem, governments and regulators should encourage the adoption of such toolkits and promote a culture of AI testing and evaluation, while AI standards are being developed.

Towards Global Inclusivity

Countries are at different levels of development, with some well-equipped to manage these advances, while others still face challenges in the development of policy frameworks and infrastructure. Global partnerships and cooperation are essential to bridge this disparity. IMDA is committed to advancing AI initiatives for the global good. We actively contribute to platforms such as ASEAN and Digital Forum of Small States (FOSS), providing capacity development to support other countries. Through knowledge sharing programmes, we offer technical expertise and best practices to help countries build their AI capabilities. This approach not only fosters global partnership but also ensures that all countries, regardless of size, can harness the benefits of AI technologies effectively.

Source: Mr. Lew Chuen Hong, Chief Executive, Infocomm Media Development Authority (IMDA).

Today, AI is accelerating digital transformation in different sectors, in new and sometimes unexpected ways. Table 4 considers how AI is being integrated and used in the provision of digital services across a few sectors, which is further accelerating the digital transformation in services already driven by improvements in digital infrastructure. Some use cases are noticeably and visibly different (e.g. self-driving cars and taxis). Other use cases may be more hidden (e.g. algorithmic recommendations or decision-making in sentencing or parole decisions). Virtually all use cases offer positive benefits, as well as possible risks that need to be mitigated.

Table 4: How AI is Accelerating Digital Transformation in Different Sectors

Sector & Benefits	Selected Milestones	Potential Risks
Healthcare: AI can be used to optimize decision-making, cut staff and costs, improve efficiency, improve early diagnosis rates, health chatbots, telemedicine, improve preventative care, improve our understanding of health[12], develop personalized precision medicine, enhance treatments, improve systems in hospitals, pharmacies and insurance firms.	• China established an 'AI Agent hospital' in 2025[13]. AI is being integrated into scans, devices & imagery[14]. • The role of federal versus State licensing of AI in health is under debate in the US[15]. • The United States FDA announced an accelerated roll-out of AI for scientific reviews in May 2025[16]. FDA has published guidance on the use of AI for drugs[17]. It maintains an AI portal[18] & list of ML-enabled devices[19]. • Open AI released HealthBench, a LLM dataset with 5,000 "realistic health conversations" in May 2025. • Mental health apps (e.g. Rejoyn, DaylightRx) might save money & improve outcomes in some cases[20]. • A number of US medical schools are replacing the dissection of human bodies with virtual reality tools[21].	• The role of machines versus humans (e.g. can patients be informed of fatal diseases by robot assistants?). • Patient consent – do & can patients understand AI in order to consent to its use in treatments[22]? • The role of registries in national healthcare, the confidentiality of health & genetic data in clinics, hospitals, government and insurance. • Biases inherent in data resulting in poor diagnoses. • Insurance and hospitals use AI model predictions to make treatment decisions versus patients' real needs. • Tech firms end up knowing more about people's health than patients or doctors, changing health provision. • AI can be used to design bio-weapons[23] and drugs. • Chatbots might induce 'AI psychosis' in a few cases.

12 Apple just launched a major health study. Here is how you can join
13 https://med-tech.world/news/china-worlds-first-ai-hospital-milestone-in-healthcare-innovation/
14 https://english.ckgsb.edu.cn/knowledge/article/ai-applications-in-china-healthcare-system/
15 House bill would override state AI laws, including in health care | STAT
16 www.fda.gov/news-events/press-announcements/fda-announces-completion-first-ai-assisted-scientific-review-pilot-and-aggressive-agency-wide-ai#:~:text=In%20a%20historic%20first%20for,AI%20pilot%20for%20scientific%20reviewers
17 www.fda.gov/regulatory-information/search-fda-guidance-documents/considerations-use-artificial-intelligence-support-regulatory-decision-making-drug-and-biological
18 https://www.fda.gov/science-research/science-and-research-special-topics/artificial-intelligence-and-medical-products
19 https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-aiml-enabled-medical-devices
20 Mental health apps show cost savings, boost adoption case | STAT
21 Medical schools must keep offering cadaver-based education | STAT
22 AI use in health care sparks questions about liability | STAT
23 An AI-simulated bioterror attack is a very real threat to public health | STAT

Sector & Benefits	Selected Milestones	Potential Risks
Education & Learning: AI can be used to optimize resource & time allocation, develop lesson plans, train students, monitor students' attention, improve performance monitoring, chatbots, develop personalized learning.	• Firms have launched AI training toolkits for teachers. • Online learning platforms replaced in-person teaching during the pandemic (UNESCO portal). • Italy initially banned use of ChatGPT for homework. • The OECD records an overall decline in PISA scores that extends beyond the impact of COVID-19 pandemic. • A growing number of countries are introducing bans on mobiles in schools (e.g. France, Australia, Switzerland). • Australia introduced age limit of 16 for social media.	• Students may be drilled & trained to respond to platforms, with minimal improvement in actual understanding of a topic. • Students may lose ability to think critically, 'trusting the AI'. • Student distraction is a key topic – students may go online, but deviate into entertainment. • Algorithms may foster addiction, as well as distraction.
Judiciary & Legal Systems: smart prison monitoring & surveillance, sentencing, parole, to monitor prison populations, give prisoners new skills, support correctional officers[24], simulate and predict rehabilitation, improve judicial or administrative decision-making[25].	• The Council of Europe issued its Recommendation[26] on the use of AI in prisons in October 2024[27]. • AI algorithms are used to identify & detect violent crimes (e.g. murders and massacres) on social media. • An AI avatar was barred as legal defence in US[28]. • An AI avatar was permitted to give a victim impact statement on behalf of a deceased victim[29]. • AI hallucinations are creeping into legal defences[30] and fake legal citations[31].	• The role of national versus regional courts. • The role of consent – do the accused understand how AI may have been used, and can they opt out? • AI surveillance introduces further risks into prison environments, with security back doors for hacking[32] and may remove dignity from prisoners[33]. • Prisoners as a new source of labour (e.g. labelling data in Finland[34]).

24 https://www.corrections1.com/technology/harnessing-ai-and-robotics-to-reinvent-corrections
25 https://prisonsystems.eu/artificial-intelligence-in-prisons-towards-harmonised-guidelines-and-innovative-it-solutions/
26 https://search.coe.int/cm#{%22CoEIdentifier%22:[%220900001680b1d0e4%22],%22sort%22:[%22CoEValidationDate%20Descending%22]}
27 https://www.coe.int/en/web/prison/-/ai-in-prisons-and-probation-new-council-of-europe-recommendation-aims-to-ensure-respect-for-human-rights-and-dignity
28 https://www.theverge.com/news/646372/ai-lawyer-artificial-avatar-new-york-court-case-video
29 https://www.npr.org/2025/05/07/g-s1-64640/ai-impact-statement-murder-victim
30 https://www.reuters.com/legal/government/trouble-with-ai-hallucinations-spreads-big-law-firms-2025-05-23/
31 https://www.businessinsider.com/increasing-ai-hallucinations-fake-citations-court-records-data-2025-5
32 https://itlawco.com/ai-in-prisons-a-brave-new-world-or-just-more-bars/
33 https://raccomandino.medium.com/smart-prison-and-the-future-of-dynamic-security-with-ai-dfe4b2da7afa
34 https://www.wired.com/story/finland-ai-prisons/

Table 4: How AI is Accelerating Digital Transformation in Different Sectors (continued)

Sector & Benefits	Selected Milestones	Potential Risks
Agriculture: AI can be used to manage crops in real-time, assess crop health, undertake field surveillance and spraying, model & predict crop yields, soil quality, irrigation, fertiliser needs, autonomous machinery, detect pests and weed, predict drought, famine, heatwaves.	• Microsoft has launched Farm-beats for Students to help interest the next generation in farming. • FAO's Hand-in-Hand Geospatial Platform uses satellite analytics and data to monitor food security. • Strategic foresight has been used to model the impact of AI in agriculture by FAO and CIRAD[35]. • FAO's WaPOR tool uses satellite data to track water consumption in cropping fields . • FAO's forest cover monitoring tool SEPAL enables end-users with a mobile to follow forest coverage and detect landscape changes.	• Satellite imagery can be used by enemies as well as allies. • Private players may profit from agricultural information. • AI can be used to design new poisons, as well as new fertilisers. • Sensor networks can be hacked and potentially manipulated remotely.
Transport: self-driving cars could provide mobility to visually challenged people & persons with disabilities. They can also substantially reduce the cognitive load for drivers, through hands-free driving and parking.	• Autonomous vehicles have been licensed in over ten countries, for specific towns, roads or zones. • Although the USPTO has received the most AV patent applications, Chinese carmakers have filed the most patents since 2021[36]. • California has issued over 60 companies with test permits, China has issued over 500 licenses & Germany has 50 cities with approved testing zones[37]. • Alphabet's Waymo surpassed 10m trips in May 2025[38]. • Tesla aims to launch robotaxi service in Austin, Texas (US) in 2025. • China banned pioneer user beta testing in April 2025 as one of a set of regulatory changes[39].	• Definitions - automated processes (e.g. parking assistance) contribute, but are not full self-driving. • Acceptable accident rates & safety need to be defined. • Different performances in different driving environments (e.g. urban versus motorway driving). • Self-driving cars could be hijacked. • Robo-taxis risk putting taxi drivers out of business. • Data could reveal passengers' movements. • First-mover advantage is represented in terms of the data training available.

35 'Shaping sustainable agrifood futures' (2023), https://openknowledge.fao.org/server/api/core/bitstreams/d462cc1d-0e8e-4b34-805f-b0ab899618ae/content and 'Harvesting Change' (2023), https://openknowledge.fao.org/server/api/core/bitstreams/03d82fe7-49e5-4077-8aa6-2d0f3c1893b4/content

36 https://www.selectcarleasing.co.uk/news/article/which-countries-are-driverless-car-ready

37 https://patentpc.com/blog/autonomous-vehicle-testing-top-countries-and-cities-leading-the-av-revolution-latest-stats

38 Waymo CEO says company hit 10 million trips, doubling in five months

39 https://carnewschina.com/2025/04/17/chinas-miit-tightens-regulations-on-autonomous-driving-features-banning-key-functions/

Table 4: How AI is Accelerating Digital Transformation in Different Sectors (continued)

Sector & Benefits	Selected Milestones	Potential Risks
Smart cities: AI can be used to improve public transport, optimize transport linkages, smooth traffic flow and reduce traffic jams. AI can optimize power supply and consumption, and reduce carbon emissions through more efficient power grid.	• Los Angeles launched its urban big data project Cluster Analysis of Los Angeles" in 1974. • Amsterdam created a prototype digital city in 1994. • In 2009, the American Recovery and Reinvestment Act (ARRA) provided funding for US smart grid projects. • In 2009, the EU Electricity Directive required EU states to roll out smart meters to 80% of consumers by 2020. • The first Smart City Expo World Congress was held in Barcelona, Spain in 2011. • The Smart Cities Council was created in 2012. • Yokohama (Japan) in 2010, Barcelona in 2012, China in 2013, London in 2013, Vienna in 2014, Singapore and Copenhagen experiment with smart solutions to improve quality of life and promote sustainability.	• Data governance & interoperability – lack of common frameworks, open standards, and trusted data-sharing mechanisms across diverse city systems and platforms. • Gaps in connectivity and infrastructure – unequal access to broadband in peri-urban communities. • Cybersecurity and privacy risks – Growing vulnerabilities linked to IoT deployments, personal data use, and critical city services. • Financing and capacity constraints – Limited resources and skills in many municipalities to plan, procure, and sustain smart city solutions. • Sustainability & inclusivity – Ensuring smart city initiatives are environmentally sustainable and accessible to citizens, including marginalized groups.

The following sections present a preliminary overview of some developments in key sectors, including healthcare, education, telecommunications and the broadband industry.

3.1 National AI Strategies

International collaboration around AI governance has become a more recent priority for governments, as shown by the recent series of AI Safety Summits. However, given that developments in AI are moving at warp speed, and now measured in terms of weeks and months, rather than years or decades, digital policies now need a process of constant revision. AI is now used in many different contexts at the grassroots level via automated decision-making, so governments will have to work closely with new and different types of actors, who have now become empowered and important for policy purposes.

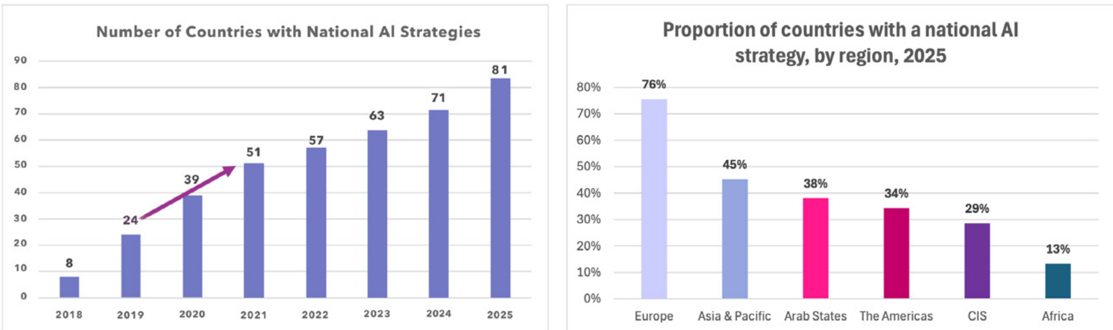
At the national level, AI governance can take the form of AI strategies and roadmaps. Countries in fact introduce and maintain multiple instruments, from 'hard law' (Acts and legislation) to strategies, plans, objectives, guidelines, statements of principles (e.g. Japan) and statements or policy positions on ethics. There are a range of approaches possible, which are not exclusive and are often complementary (e.g. Japan has both an Act and Principles, while Austria has a number of plans for each sector).

To build an enabling environment for AI, the United Nations Development Programme (UNDP) has been conducting AI Landscape Assessments (AILA), a comprehensive analysis of national AI ecosystems, infrastructure, capacities, policy and regulatory frameworks, and ethical approaches. Since its launch in 2023, through AILA, UNDP provided governments from 10 countries with actionable insights and recommendations to inform their AI strategies and identify areas for targeted intervention (Sri Lanka, Colombia, Bhutan, Rwanda, Montenegro, Ecuador, Vietnam, etc.) More than 15 additional countries were set to launch AILA processes in 2025 under the UNDP's AI Sprint. UNDP's AILA insights provide countries with a strong evidence base around which to develop their national AI agendas and governance frameworks. In Sri Lanka and Colombia, UNDP's AILA has often helped to shape these countries' first national AI strategy.

According to ITU's latest research into national AI strategies, the number of recognized national AI strategies has been steadily increasing since Canada and China approved the first national strategies for AI in 2017. There was a surge in policy-making activity in 2018/19 and 2020/21, when the number of countries with a national AI strategy more than doubled from 24 to 51 (Figure 4). This rapid increase arose partly in response to policy initiatives at the European level and the call by the European Commission (EC) for EU Member States to develop an AI strategy. Since 2022, the number of national strategies published annually has in fact slowed to eight additional countries each year.

Partly as a result of this call by the EC, Europe is the region with the highest number of AI strategies, with three-quarters or 76% of all European countries having developed a strategy, a number set to grow (with Greece and Croatia already working on their AI strategy for some time). Nearly half or 45% of all Asia-Pacific countries have an AI strategy (Mauritius, Nepal, New Zealand and Sri Lanka are all working on a strategy). 38% of Arab countries and 34% of the Americas have strategies, and 29% of Commonwealth of Independent States (CIS) countries. African countries lag behind at 13%, but Nigeria and South Africa are actively preparing national strategies.

Figure 7: Number of AI Policies, Total and by Region



Source: ITU.

3.2 AI in Healthcare

There is a body of research that seeks to improve wellbeing and preventative care, to try and ensure that people do not fall sick or get injured in the first place. The fields of AI in medicine can be divided into virtual and physical branches (which includes medical devices).

In healthcare, AI is being integrated into fields of virtual and physical medicine (Yang et al, 2017). The **virtual branch** included big data and Machine Learning (ML) models for data analysis, early diagnosis, information management, control of health management systems (including electronic health records or EHR) in hospitals to training medical students, guidance of doctors and physicians in diagnosis and treatment decisions (pathology, image analysis, diagnosing retinal diseases, glaucoma or cardiovascular diseases). For example, medical records and health records can be scanned with natural language processing (NLP) to help identify high-risk patients at risk of specific diseases or conditions for possible follow-up.

The **physical branch** is best represented by devices and AI robots, used in surgery, clinical robots, rehabilitation robots (robot arms, intelligent wheelchairs, prostheses), hospital service robots and medical teaching robots (including VR experiences, which may eliminate the dissection of human bodies).

STAT Health describes how advances in technology and computing have enabled new classes of AI models (Table 5). However, STAT Health notes that the quality of these AI models depends on the quality of the data they were trained on (with various types of problems), the way they were trained (depending on method and evolution), and the contexts in which humans will use them (also posing various problems). For example, Omada Health recently announced an AI bot meant to help people achieve their health goals, including guidance around nutrition. There was some excitement surrounding the use of chatbots for mental health issues, to try and reduce isolation and anxiety experienced by some patients. However, there have been a few cases of 'AI psychosis' where individuals with distorted perceptions have experienced endorsement and validation of their distorted beliefs from online AI chatbots[40]. The phenomenon of 'AI psychosis' has contributed to the State of Illinois in the US becoming the first state to ban the use of AI for therapeutic purposes without involving a licensed therapist[41].

In terms of **data**, Apple has launched a health study in the US to collect data from iPhones, Apple Watches and AirPods, as it delves deeper into healthcare research for its users[42]. This study will investigate activity, ageing, cardiovascular, circulation, cognition, hearing, menstrual, metabolic, mobility, neurological, respiratory and sleep. It is being conducted in conjunction with Brigham and Women's Hospital, a leading research hospital and affiliate of Harvard Medical School. The health company Regeneron is trying to buy consumer genetics firm *23andMe* seeking to use its wealth of genetic data to develop new drugs[43] .

Table 5: Uses of AI in Healthcare

Biotech/Pharma	How the models are trained
• Generative drug design & AI-guided drug discovery • Clinical trials • AI-based data from biomarkers on wearable devices • Reducing paperwork and preparing regulatory filings.	Drug design can be trained on public datasets, clinical trials can be simulated using digital twins. However, in many other use cases, it is unclear how the AI models have been trained due to their proprietary nature.

40 https://www.bbc.com/news/articles/c24zdel5j18o
41 Can prolonged use of chatbots increase the risk of psychosis? | STAT
42 Apple gathers health data from devices - Mobile World Live
43 https://www.statnews.com/2025/05/19/23andme-regeneron-bankruptcy-genetic-testing-patient-data/?utm_campaign=health_tech&utm_medium=email&_hsenc=p2ANqtz-9BKfg42dEgh9LRVHZtq1XMaiH1B6vOAS-P0UyzpBqgu3WxuF45nic7BaFfud0Jq-jvNMgTSw3LwOU8xDEDrNzWWdNjSA&_hsmi=362342942&utm_content=362342942&utm_source=hs_email

Table 5: Uses of AI in Healthcare (continued)

Clinical care • Predictive algorithms for disease & treatment. • Vision algorithms in imagery. • Text/audio-based generative AI (e.g. ambient medical scribes, LLMs for drafting notes or phonecalls (Doximity GPT, Open Evidence, Atropos, ChatGPT). • Reducing administrative paperwork and workflow and preparing revenue cycles. • Consumer-facing devices & algorithms (e.g. wearable watches or glucose monitors). • There was considerable initial excitement around the use of AI chatbots as cheaper, more accessible therapists (e.g. to reduce isolation etc). However, in August, Illinois became the first US state to ban the use of AI for therapeutic purposes without involving a licensed therapist[44].	How the models are trained The proprietary nature of algorithms in products from companies make it hard to compare their performance with more open-source ones. The FDA has called for AI device makers to include more data about the development and testing of their tools in their applications. It has been suggested that keeping a "human in the loop" might eventually become just an exercise in endorsing AI-generated results (e.g., a clinician clicking "OK" on AI output).
Insurance • Utilization management for prior authorization • Payment integrity and audit purposes (e.g. Optum's Case Advisor). • Streamlining paperwork and preparing filings in the revenue cycle.	It is unclear how these algorithms are trained, or on which data. Even where large datasets of patient data are involved, these patients may not be comparable or representative of other patients. If AI tools are developed internally by insurers, or by other companies serving insurers, there may be little verification of patients' interests in these models.

Source: Brittany Trang, STAT Health's AI Prognosis, 12 February 2025.

Insight 3 considers how AI can be integrated into cities to tackle health inequities through data, technology and AI. Insight 4 explores how the Global Partnerships Forum is using AI and holographic calls to combat mental health issues.

[44] Can prolonged use of chatbots increase the risk of psychosis? | STAT

Insight 3: AI4HealthyCities – Tackling health inequities through data, technology and AI

AI4HealthyCities is an initiative by the Novartis Foundation run in partnership with the cities of New York, Singapore, Helsinki, Lisbon and Basel. It applies advanced analytics and AI to existing datasets from health and health-influencing sectors, and aims at progressing the understanding of the factors truly driving health in large populations.

Many factors influence our health: economic, education level, social status and connections, environmental, food or housing security, etc. While all these social determinants of health (SDoH) influence our risk for disease and health outcomes, they are not always well-understood, least of all their combined effect on health. This is where AI offers opportunities to decipher influential drivers of health inequities.

Identifying drivers can be difficult, due to different types of, and lack of quality and harmonization of data. Analyzing disconnected datasets as done in AI4HealthyCities, can support a much-needed paradigm shift from reactive care systems into proactive, predictive, and preventive health systems. AI's transformative force is certainly promising for population health, on the condition that newly generated insights get translated into action. Data insights delivered by AI4HealthyCities will be integrated into the Novartis Foundation's population health initiative, CARDIO4Cities, planned for replication in 30 cities around the world.

Source: The Novartis Foundation and AI4HealthyCities: www.novartisfoundation.org/AI4HealthyCities.

Insight 4: Improving mental health through holographic technologies and AI

Over the last several years, the Global Partnerships Forum has continued to expand its focus on health and well-being, including mental health. In 2023, it co-initiated the Global Mental Health Task Force with the Deepak Chopra Foundation. Traditional mechanisms to address mental health issues are not always effective, particularly in their outreach. Loneliness remains one of the biggest silent diseases of our time, with over 2 billion people impacted worldwide with social isolation. Social connectedness is vital not only for mental health, but overall health and well-being. The Global Partnerships Forum is collaborating with Emerge.io, a start-up focused on building a multi-sensory communication platform to bridge distance and time, by adding the sense of touch and emotion recognition to holographic communications. Emerge has developed a patented device that emits precise ultrasonic forcefields, enabling users to physically feel and interact with one another in a holographic call.

This technology can be beneficial for internally displaced persons (IDPs), those impacted by conflict, immigrant families, those suffering from loneliness, and patients under long-term care. Research has shown that touch is vital for human development, mental and physical health, interpersonal connection, and cognition. Feeling the soothing caress of a loved one and holding hands across the globe offers a profound emotional connection. Additionally, physically interacting with 3D digital shared content opens the possibility for more accessible educational experiences. The platform has already been used by people around the world, with a particular focus on those with greater emotional connection deficit and mental health needs, such as immigrants and families separated by war.

The Global Partnerships Forum is guiding Emerge on its social good mission, and to align its work with SDG 3: Good Health and Wellbeing. Incorporating AI-driven emotion recognition and haptic technology, Emerge's platform can harness the power of multisensory communication to bridge physical and emotional divides. By integrating these advanced technologies, we are striving to enhance human connectivity while also creating new avenues for mental health support, particularly for those who are most isolated. This initiative demonstrates the potential of AI and technology to transform traditional approaches to well-being, making meaningful connections more accessible and impactful.

Source: Amir Dossal, President & CEO, Global Partnerships Forum.

3.3 AI in Education and Learning

Digital technologies offer the potential for personalized learning strategies and intelligent tutoring applications to improve learning and education throughout life. In developing countries, learning platforms offer benefits for helping cope with larger class sizes, enhance teaching techniques and materials, and improve learning outcomes. Learning apps and platforms offer the opportunity to train and practise old skills, acquire new skills and knowledge online or engage in online learning communities.

In terms of nationwide efforts, school mapping has been used as an initial effort to locate schools and assess their connectivity needs to reduce inequality of opportunities. The ITU/UNICEF Giga project aims to connect schools to the Internet and open up online learning opportunities for students and communities. To date, the Giga project has mapped some 2.2 million schools in 40 countries, out of approximately 7 million schools worldwide.

According to UNESCO, globally, only 40% of primary, 50% of lower secondary and 65% of upper secondary schools were connected to the Internet in 2023 (UNESCO, 2023). 85% of countries have policies to improve school or learner connectivity, but only 16% of countries explicitly guarantee data privacy in education by law (UNESCO, 2023).

Despite the benefits of digital learning in educational settings, there are growing concerns about the impact of digital technologies, and particularly social media and smartphones on young people's wellbeing. For example, the influential book, 'The Anxious Generation', published in March 2024 by New York University Professor Jonathan Haidt, compiles evidence for the harmful impact of a smartphone-influenced childhood on young people's wellbeing in developed countries. It also finds different and gendered impacts of smartphones and social media on boys' and girls' wellbeing, with girls more susceptible to visual comparisons, relational aggression and sexual harassment online[45]. Indeed, UNESCO (2024) found that greater interaction on social media since the age of 10 has been found to be associated with worsening socioemotional difficulties with age among girls, although no cross-associations were found among boys[46].

In Europe particularly, there is a growing policy move towards limiting and restricting the use of mobile phones in schools. Notifications and online chat can distract some students, and they have also been implicated in bullying, harassment and even tragic suicide cases for a few students in a number of high-profile cases. The Netherlands banned the use of mobile phones, laptops and other devices in January 2024[47]. France has prohibited the use of mobile phones in primary and secondary schools since 2018, but an experimental 'digital pause' introduced in 199 schools from the start of the 2024/25 school year was expected to be generalized from 1 January 2025, with exemptions for students with medical or special needs[48]. Greece banned the use of mobile phones in schools during the summer of 2024[49].

The Australian Government passed the Online Safety Amendment (Social Media Minimum Age) Bill in November 2024 to ban young people under the age of 16 from using certain social media

45 'The Anxious Generation', Jonathan Haidt, March 2024.
46 UNESCO Gender Report 2024.
47 https://www.euronews.com/2023/12/16/dutch-school-phone-ban-to-come-into-force-next-month
48 https://www.education.gouv.fr/interdiction-du-telephone-portable-dans-les-ecoles-et-les-colleges-et-pause-numerique-7334#:~:text=L'utilisation%20des%20t%C3%A9l%C3%A9phones%20mobiles%20%C3%A0%20l'%C3%A9cole%20et%20au,bien%20s'approprier%20la%20mesure.
49 https://greekcitytimes.com/2024/08/30/mobile-phones-should-not-have-a-place-in-schools-greek-prime-minister-outlines-11-changes-for-the-new-school-year/

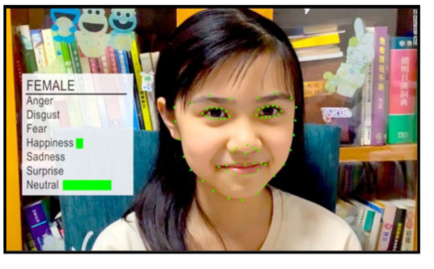
platforms[50]. This move has inspired debate around the world. Some commentators argue that blanket bans are unhelpful in terms of helping students and children develop a meaningful relationship with technology; others worry about the impact of social media on young brains, concentration, academic performance, social skills and interpersonal communications.

The potential for AI in education is double-edged. AI can enhance and take online search-and-apply techniques further, by generating comprehensive answers to search enquiries, homework questions, essays and research projects in different styles. Generative AI can enhance personalized learning, provide virtual tutoring, and create immersive experiences to make learning more interesting and engaging. In some classrooms in China, the attention of students can be monitored by teachers in real-time through headbands, while students' receptiveness and emotional wellbeing can be characterized through facial and emotional recognition techniques (Image 1).

Teachers can access dashboards of student attention and performance while teaching. Robots have been introduced and trialled as an engaging addition to teachers (e.g. the Iris robot in the Indian state of Kerala, the Captcha robot in Germany). However, to date, such prototypes are more experimental and there are no known examples of robots being rolled out as part of a national curriculum. There is anecdotal evidence that some teachers are using generative AI to create lesson plans and teaching materials. For example, Microsoft has worked with the Sikshana Foundation to help teachers create lesson plans and teaching materials using AI in states in India[51]. AI translation software can also help facilitate the understanding of children taught in languages other than their mother tongue, in countries with sizeable language minorities.

Image 1: Use of AI in school settings

Attention headbands (left image) and emotion recognition (right image) in China.



Source: https://www.youtube.com/watch?v=JMLsHI8aV0g (Wall Street Journal).

However, observers worry about the loss of privacy and of independence in learning. Children mature at different ages and learn at different speeds, in different ways; introducing more and better performance data may change teacher and parental expectations about what their child should be learning – and 'achieving' – by which age. Becoming more preoccupied with immediate attention issues and short-term performance may detract from, rather than enhance, both the student-teacher relationship, and the student's longer-term understanding and performance. Exam boards and universities are grappling with how to detect and accept AI-generated texts in applications, coursework, exams and assessments.

50 https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r7284
51 https://news.microsoft.com/source/asia/features/indias-schoolteachers-are-drafting-better-lesson-plans-faster-thanks-to-a-copilot/

In further education and research, some observers are worrying about the power of AI to shape and pre-condition research. AI models that offer to do people's writing and analysis for them effectively 'outsource' learning and may detract from learning outcomes or risk making them more stupid. As the Economist observes, "the risk of outsourcing all your research to a super-genius assistant is that you reduce the number of opportunities to have your best ideas"[52]. The accuracy and authenticity of online knowledge and sources may be jeopardized (including for legal or academic sources), as deepfakes become easier and cheaper to generate.

There is also an important multilingual aspect to the use of AI in research. Many Large Language Models (LLMs) were initially created in English, and are used by developed countries, which host a wealth of training data and digitized records. Many stakeholders are calling for training data in other languages. For training AI models in education and research, important biases can creep into AI models based on the origin and biases inherent in the training data, the quality of the data they are trained on, the ways in which they are trained, and the contexts in which humans use them. Special attention should be given to equality of cultural context in the training data to avoid 'baking' bias into AI models.

3.4 AI in Telecommunications & Broadband

As an innovative industry, telecommunication network operators have used big data and AI for some time, from automating network management to monitoring network performance and consumer satisfaction. Today, telecommunication networks are being enhanced and reinforced with AI tools, from the equipment (AI chips, switches and routers) and extending into the core backbone network. AI is being used for services and features such as dynamic configurations, performance monitoring, modelling traffic, load balancing, energy efficiency and mobility optimization.

Operators use AI to reduce costs and optimize deployment and data traffic management across their network, as well as improve operations (e.g. through the detection of spam and fraud). Additional networks are being enhanced and extended to support the use of AI and its demands for compute power, bandwidth, latency, data centres (including those with Graphics Processing Unit (GPU) clusters and GPU-as-a-Service or GPUaaS).

AI tools that leverage network data enable telecom operators to automate network operations and service assurance, cut costs, increase agility, and improve subscriber experience. AI can proactively detect and resolve network, service, and device issues before customers are impacted. It monitors and troubleshoots the network service quality, service usage, and traffic in real time at a network-wide level down to individual cells for subscribers and devices in mobile and fixed networks.

For example, AT&T is using AI to help perform tasks such as fraud alerts, network optimization and software development. GenAI can help employees to make decisions or take specific actions – for example, large and small language models help harvest information based on

52 https://www.economist.com/finance-and-economics/2025/02/13/the-danger-of-relying-on-openais-deep-research?utm_campaign=a.io_fy2526_q1_conversion-aistasc-cbdr-sub_prospecting_global-global_auction_facebook-instagram&utm_medium=social-media.content.pd&utm_source=facebook-instagram&utm_content=discovery.content.non-subscriber.content_staticlinkad_np-automatedThedangerofrelyingonOpenAI%E2%80%99sDeepResearch-n-apr_na-na_article_na_na_na_na&utm_term=sa.int-all&utm_id=120221663884030437&fbclid=IwY2xjawKPBL5leHRuA2FlbQEwAGFkaWQBqyDxMJeflWJyaWQRMGlmeGU4QUlVZGJ3YkdzUkYBHrDoh1QM5_ecHWvzj3-7Pzg4YJu9KN5XzyJbrb5Y4ov_fjwPVFzWnbO17VH__aem_q02Lhv688sKh9737GT3qvA

prompts. AI helps AT&T in its software development cycle by assigning specialized agents for specific tasks such as creating user stories, writing code or executing test scripts. By mid-2024, AT&T had 138 'autonomous assistants' and expected that number to increase rapidly[53].

Insight56 describes how telcos are using AI-powered speech analytics solutions for customer service, for network planning and optimization. Insight 6 describes the GSMA's Responsible AI (RAI) Maturity Roadmap, which seeks to help balance the pace of innovation in AI with the use of guardrails in the mobile industry. Insight 7 explore the consequences of AI in telecom. Insight 8 details Millicom's investments in digital infrastructure and AI in Latin America.

Insight 5: Artificial Intelligence (AI) in Telcos

Internet usage takes many forms, from basic communications to more sophisticated and strategic use of broadband. AI is dominating tech headlines; however, the use of Artificial Intelligence (AI) in the telco industry is not new. Telco operators have in fact used AI for many years already – for example, to improve quality of service to customers.

Today, there is vigorous innovation in ICTs supported by new data, modern computer equipment, and new software, which provides new products and services, influencing the way many tasks are realized. The digital footprint of each person, its digital searches, and geolocalization information, can be fed into detailed and valuable databases. These databases, together with innovative algorithms and powerful computers, have driven AI. AI and generative AI are being incorporated in many devices and smartphones, with different language models, which may grow the use of AI by individuals and institutions.

Not all AI applications may be useful and profitable. The impact and convenience of AI use need to be assessed, and "misinformation" avoided. Promising applications of AI in the telco industry include:

a) Personalization in *marketing activities*, tailoring offers according to customer profiles, likely and projected requests.
b) Improved *customer services* via customer's history of services received, and quality of service obtained.
c) Improved efficiency of *internal processes*, such as optimizing fiber roll-out with of coverage of future traffic demand and/or maximizing profitability.
d) Data are at the centre of all this, and its systematization and coding contribute to the use – for example – of generative AI. Using generative AI, telcos can enrich their daily operations through AI and generative AI in various areas (administration, finance, human resources, network operations, etc.).
e) Operators can improve their support to clients (academic institutions, government entities, and enterprises) through the application of AI in their tasks covering a wide range of activities. This can increase their productivity and competitiveness. Given the innovation underway in telecom, it is clear that we are just at the start of a promising road.

Source: Dr. Carlos Jarque, Executive Director, International Relations & Corporate & Government Affairs, America Movíl.

[53] AT&T arms agents for next phase of ge... - Mobile World Live

Insight 6: The GSMA's Responsible AI (RAI) Maturity Roadmap

AI holds the promise of significantly transforming the world. The expanded use of AI in the telecom sector is estimated to be as high as US$680 billion over the next 15-20 years[1]. Considering this opportunity, it is paramount that responsible AI is engrained in the design, development and deployment of AI. To support this goal, the GSMA collaborated with various mobile operators, AI experts and influencers to create a comprehensive, actionable 'Responsible AI (RAI) Roadmap'. The roadmap has components adjusted to the overall AI maturity and ambition, helping balance the pace of innovation with guardrails. The roadmap allows telecom organizations to assess where they currently are on their responsible AI maturity journey and provides clear guidance and recommendations on next steps, including step-by-step guides and telco-specific best practice principles, including: fairness; human agency and oversight; privacy and security; safety and robustness; transparency; accountability; and environmental impact.

The Roadmap provides a structured framework to assist operators in evaluating and enhancing their practices. Depending on an organisation's level of AI ambition and maturity, the roadmap provides concrete steps to be followed against 5 key dimensions. These are the vision, values and strategic goals of an organisation; its operating model and how to maintain AI governance across all operations; technical controls aligned with regulatory requirements; collaboration with third-party ecosystems; as well as corporate change management and communication strategies.

The Roadmap extends beyond just risk management by detailing additional dimensions such as operating model and third-party management and also encompasses all the essential components outlined in ISO 42001 and NIST frameworks, ensuring a model that aligns with established standards. It is supported by a digital tool that organizations can use to test and identify any gaps in existing processes, and receive clear recommendations on areas for improvements.

[1] McKinsey Global Institute for GSMA, July 2024.

Source: GSMA. See also [GSMA tackles AI ethics with industry-... - Mobile World Live]

Insight 7: Telecom Networks, Big Tech & the Arguments for Fair Share

The Olympic Games in 2024 demonstrated the usefulness of AI and how it can bring efficiencies to mobile networks. For example, French operators used AI and 5G networks to simultaneously livestream coverage of the games while also keeping 15 million users in Paris connected. The introduction of AI has been transformative for networks in key areas such as network optimization, predictive maintenance, dynamic spectrum management and by enhancing network security. Networks in the developing world and elsewhere have benefitted from these innovations.

The Internet para Todos project was one of the early examples of AI being used to optimize network design. Internet para Todos is a company that operates a 4G wholesale network in rural Peru and which is jointly owned by Telefonica, Facebook (Meta), IDB Invest and the Development Bank of Latin America and the Caribbean. Facebook, which owns 24.7% of the business, brought its AI knowledge to bear to optimize the design of the network referencing the likely future usage of data by consumers. Average data usage by consumers exceeded expectations and the project generates sufficient revenues to cover its costs, build cash reserves, and pay dividends to the four equity shareholders.

AI can only drive efficiencies and improvements on networks that already exist and, while AI powered 5G networks have become the norm in countries such as France and most parts of developed countries, the challenge of rolling out networks in the developing world remains. Big Tech data volumes on telecoms networks impose unsustainable costs on network operators and undermine the business case for investment. This is a particular problem in developing countries where investors require higher returns and ARPUs are lower than in the US or the EU.

The Big Tech companies that benefit the most from telecom networks, profit the most from the Internet, and which stand to profit enormously from the global race to dominate AI must support the rollout of broadband networks in the developing world by paying their fair share towards the cost of these networks. This would improve the business case for investments in networks and would make the difference between the two-tier digital world we currently have and the connected globe we strive for.

Every year, new reports demonstrate the investment gap in Africa, Latin America and the Caribbean. This can only be bridged through fair share contributions by Big Tech. Over the past year, fair share legislation has been proposed in the United States, and investigations commenced in Brazil and the Caribbean. Calls for fair share are also growing in Latin America, South Africa, and the Pacific Islands.

Big Tech will always resist costs to their business until they have no choice. At our London meeting the financial industry was clear in their view that Big Tech are more likely to be receptive to Government initiatives. There are now three clearly established models for Big Tech contributions and policy makers can choose which model is right for their country. In race for AI and the digital future, it is unclear whether the developing world will even qualify for a place. If it is to have a chance at competing, Governments must bring Big Tech to the table and demand that they pay their fair share.

Source: Denis O'Brien, Chairman of the Digicel Group.

Insight 8: Millicom's Programmes in Latin America

The connectivity landscape of Latin America is evolving – some 420 million people or 65% of its population is now connected to mobile Internet, an increase of 75m people over the past five years[1]. As a convergent operator with a presence in 9 countries, Millicom aims to help make this region a sustainable and inclusive digital ecosystem – AI can accelerate this vision. From network performance to service delivery, AI is creating and boosting new layers of digital ventures.

As connectivity improves, AI may become a cornerstone of Latin America's digital economy. AI can enhance service delivery, optimize network performance, and enable new highly scalable business models. Bridging the different digital gaps has never been so vital. As investors responsible for digital infrastructure amongst other things, in a region where in remote areas 45 million people still lack access[2], operators need to ensure connectivity with the objective of making these revolutions attainable, available and affordable.

Favourable public policies are key to stimulating the necessary long-term investment in digital infrastructure. Governments can play a pivotal role by implementing regulations, including price reductions and the unlocking of spectrum, as recently occurred in Panama, Brazil, Colombia and Paraguay. Collaboration has proved key to creating an inclusive and thriving digital economy, which enables users. Skilling and making sure we create and share knowledge is not a goal in digital inclusion, it is a prerequisite. Millicom's Conectadas programme addresses the digital gender gap, trained 1 million trained women in Q2 2024. Millicom's programme dedicated to educators Maestr@s Conectd@s has succeeded in training 500,000 educators and teachers. However, PPPs are only one successful example. More successful examples will follow, as we try to make the digital world a reality for everyone.

1 GSMA, *The Mobile Economy Latin America 2024*, https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/wp-content/uploads/2024/06/The-Mobile-Economy-Latin-America-2024.pdf
2 Ibidem

Source: Mauricio Ramos, Millicom Chairman of the Board.

While AI is being used in a number of innovative and beneficial ways, cybercriminals and fraudsters are also using AI. The very same AI and ML techniques that can make legitimate services more specific and personalized to customers can be used to deceive and trick customers. Some of the risks and attacks using AI are not specifically targeted at broadband infrastructure, but target end-users via applications (e.g. email or SMS) on their devices.

Deloitte's Annual Global Cyberthreat Trends Report 2024 notes that "social engineering, with the aid of AI, will become a top threat vector in 2025 and beyond. Technical measures to detect AI-generated content and interactions are lagging, increasingly exposing end users to this threat"[54]. The UK's National CyberSecurity Centre (NCSC) notes that "AI will almost certainly continue to make elements of cyber-intrusion operations more effective and efficient, leading to an increase in frequency and intensity of cyber-threats"[55]. It concludes that "the growing incorporation of AI models and systems into the technology base, particularly within critical national infrastructure (CNI), almost certainly presents an increased attack surface for adversaries to exploit".

54 us-annual-cyber-threat-trends-report-2025.pdf
55 https://www.ncsc.gov.uk/report/impact-ai-cyber-threat-now-2027

Historically, the best-quality cloned voices were achieved when a voice dataset consisted of at least 45-60 minutes. Shorter voice sample clips resulted in lower quality AI-generated audio, while longer clips resulted in more realistic audio replicas. Microsoft trained VALL-E on Meta's LibriLight, an audio library containing 60,000 hours of speech from more than 7,000 English speakers[56]. This reduced the required voice sample to a duration of just 3 seconds long, from which VALL-E can generate realistic audio of the original voice saying new things, in different emotional tones (e.g. angry, depressed) with the same or different background noise.

According to the US security provider CrowdStrike, AI-powered cyberattacks have five main characteristics: attack automation; efficient data-gathering; customization; reinforcement learning; and employee targeting[57]. They observe that AI is very adept at data scraping and harvesting information from public sources, including social media sites and corporate websites. For cyberattacks, this information can then be used to create hyper-personalized, relevant, and timely messages that serve as the foundation for phishing attacks and other attacks leveraging social engineering techniques. Ultimately, the very same techniques of data scraping and customization that make AI powerful for personalizing services and improving customer care can be used for nefarious purposes as well, to devastating effect.

56 https://www.freethink.com/robots-ai/voice-cloning-vall-e
57 https://www.crowdstrike.com/en-us/cybersecurity-101/cyberattacks/ai-powered-cyberattacks/

4

Data across Society

Underpinning all these developments is data, which is carried over the connectivity infrastructure, shapes the services offered, and constantly feeds and sustains algorithms and AI models. All this data is created, transmitted and stored across a wide range of systems, including cloud servers, enterprise networks, cloud platforms, IoT sensor networks, digital platforms and consumer devices (e.g. streaming services or social media). Cloud storage is often used for many forms of data, due to its flexibility, outsourced operations and scalable size. IoT devices and distributed and edge computing solutions can help reduce the bandwidth needed as well as latency, boosting efficiency and enhancing real-time data processing capabilities.

Some types of data are transient with a limited lifetime, and discarded and suppressed quickly, while other types of data are stored for longer-term use in archives, backups, or active datasets. For example, Facebook Stories and Instagram Stories are only 'available' for users for 24 hours. Facebook live broadcast videos can be replayed, downloaded or shared from Facebook Pages or profiles for a period of 30 days[58]. Most direct messages do not expire, but some platforms (including Snapchat and Instagram) allow users to send expiring direct messages. Indeed, ChildNet International note some risks associated with expiring content[59] as:

- People may share more private and risky content, when they believe that content disappears.
- Information can still be taken and shared by others, even after it has expired (e.g. through reposts of static screenshots taken of the content on many services, including Snapchat).
- Expiring content can be used by online bullies and can make reporting more difficult for victims, when victims are unable to screenshot the content as evidence before it disappears.

Modern trends include metadata (or 'data about data', based on analysis of other primary data sources that can also generate insights into everything from climate change to business operations to consumer preferences) and synthetic data (or artificially generated data that is trained to reproduce the characteristics and structure of the original data). Synthetic data retains

[58] https://about.fb.com/news/2025/02/updating-our-facebook-live-video-storage-policy/
[59] https://www.childnet.com/help-and-advice/expiring-content-parents/

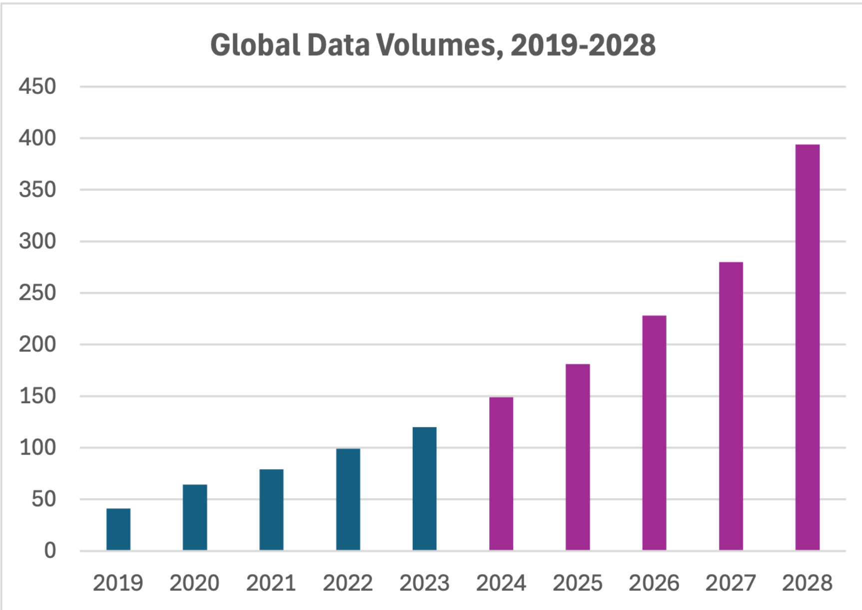
useful statistical information, whereas mock data (generated not from a sample, but from a rule) contains no relevant statistical information.

In view of these many different types of data, it is not easy to estimate data volumes accurately, as data is stored and transmitted by many agents and carriers. A vast trade in data has sprung up, including business services, automated updates and transmissions between sensors, machines and within networks. Since these are largely invisible (and largely unmeasured), it is difficult to estimate or verify such data estimates.

What is clear is that the volumes of data transmitted and stored globally are growing at an astounding rate. The global volume of data created, captured, copied, and consumed globally is increasing rapidly, reaching an estimated 149 zettabytes in 2024, according to IDC (Figure 8). Over the next five years up to 2028, global data creation is projected to grow to more than 394 zettabytes. Analysis by IDC suggests that approximately 90% of the world's data has been generated within the past two years, and the volume of data stored globally is doubling approximately every four years. Such rapid growth requires both infrastructure and capacity, and the number of data centres has also been growing strongly.

Figure 8: Growth in Global Data

Growth in Global Data, 2019-2028 in Zettabytes

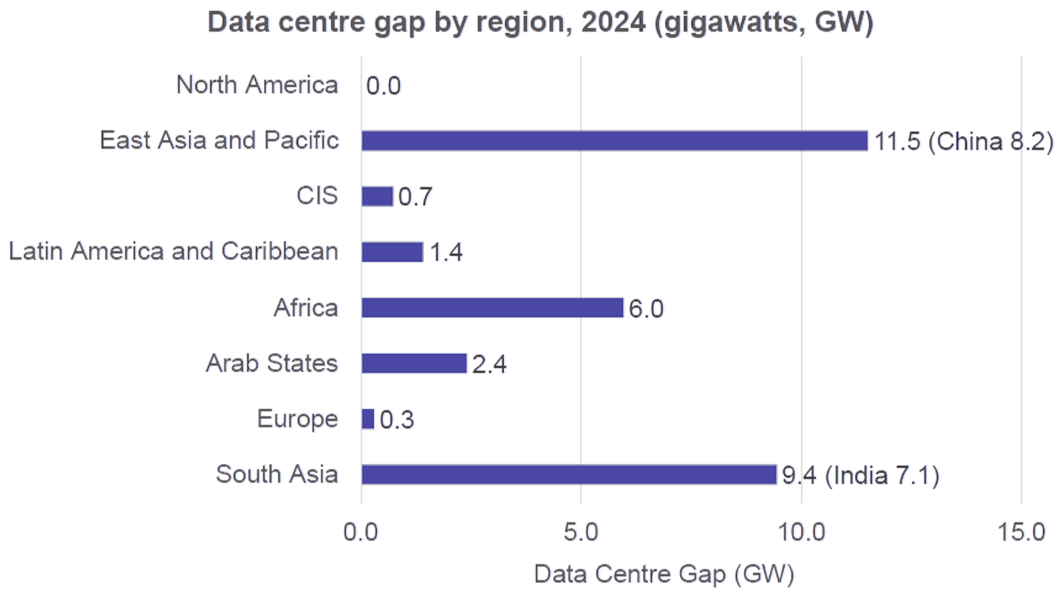


Source: IDC.

Analysis by regions shows that the largest gaps in data centre provision for servicing online services exist in areas with the lowest levels of development and digitization, as well as the largest populations. East Asia and South Asia have the largest capacity gaps in data centres, with significant variability between countries in these regions in terms of data centre capacity per household. Many countries are well-served with data centres and possess at least one. However, some countries are poorly served with data centres – e.g., in East Asia, the island of Hong Kong has over a dozen data centres, while Laos and Mongolia each only have one.

Indeed, data centre capacity needs in these regions are heavily influenced by China and India (which account for one-sixth of the global population each, and, taken together, account for over half the overall gap). Once China and India are removed, Africa and the Arab States have the largest data centre capacity gaps. At the global level, North America has practically no data centre gap relative to other regions, at least for the near future – in fact, the United States hosts data centres used to provide service in countries in other regions. Data from the Cloudscene platform suggests that there were over 11,800 operational data centers worldwide[60] in 2023/4, with around 45% or nearly half of them in the US.

Figure 9: Global Data Centre Capacity Gap by Region, 2024



Source: ITU, Connecting Humanity through Sustainable, Affordable and Innovative Solutions 2025.

In an increasingly data-driven world, the ability to govern data responsibly, inclusively, and effectively has become a defining challenge for governments, institutions, and societies. From climate action and health systems to transportation, education, and AI development, data plays a central role in underpinning the digitization of our societies. Data should be of high-quality and representative, with strong data governance mechanisms in place, to avoid introducing and perpetuating biases in AI applications, generating privacy violations and/or amplifying inequalities. Data governance can be understood as one cornerstone of the ethical and responsible use of AI.

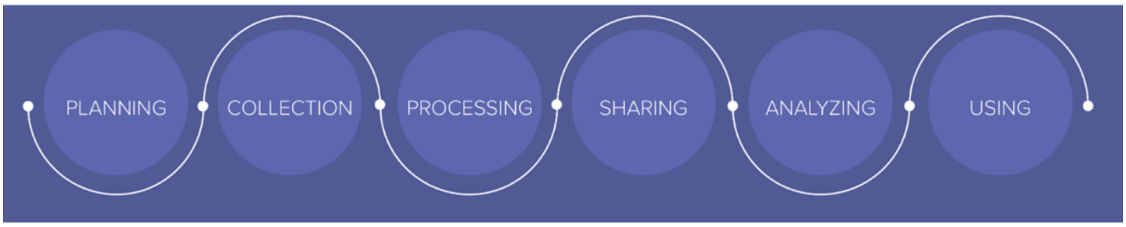
The data life cycle is a concept often used in analyzing data trends. It refers to the various stages data is subject to, from initial planning to the ultimate use of data in decision-making (Figure 10). At each stage, data governance decisions—such as who has access, how data quality is maintained, and how privacy is protected—must be made. These decisions are cumulative and can significantly shape what is possible in later stages. Poor governance early on (e.g., unclear purpose or unstructured collection) can generate negative consequences or limit the value and/or usability of data downstream. While different frameworks may highlight different stages or use varying terminology, commonly recognized phases in the data lifecycle include:

- **Planning** – Identifying data needs, intended uses, and governance requirements.

[60] https://datacentre.solutions/news/68654/the-united-states-counts-5388-data-centres

- **Collection** – Gathering data through surveys, sensors, transactions, mapping, imagery or other means.
- **Processing** – Cleaning, validating, and organizing data for use.
- **Sharing** – Making data accessible to others, whether through platforms, APIs, or data collaboratives.
- **Analyzing** – Interpreting the data to generate insights.
- **Using** – Applying those insights to inform decisions, policies, or services.

Figure 10: The Data Life Cycle



Source: Broadband Commission, Data Governance Toolkit: A Guide to Navigating Data in the Digital Age

Data governance can be defined as the processes, people, policies, practices and technology that seek to govern the data life cycle toward meeting the purpose of increasing trust, value and equity, while minimizing risk and harm in alignment with a set of core principles. However, data governance can take many forms, ranging from high-level policy frameworks to more detailed mechanisms for implementing data governance and embedding governance into everyday processes (Box 3).

The Broadband Commission recently released its Data Governance Toolkit: A Guide to Navigating Data in the Digital Age, which provides a modular resource to support public institutions, civil society, industry and other stakeholders in designing and implementing data governance systems that are both fit-for-purpose and adaptable to local realities. The field of data governance is moving very quickly, and the report offers a user-friendly taxonomy of key issues, as well as a compilation of resources and different guiding questions to help policy-makers and data practitioners design data tools that respond to their needs.

Box 3: Different Types of Data Governance Mechanisms

To implement data governance principles and decisions across the data life cycle, various mechanisms can be considered, including:

1. **Contractual mechanisms:** Legally binding agreements can set terms and assign responsibilities for data access, sharing, usage, and limitations on third-party interaction with data access and use, rights of third parties, access to data, e.g. data sharing agreements, Service-Level Agreements (SLAs), license agreements, terms of service, usage policies.
2. **Policies & guidelines**: Institutional and governmental guidelines that outline how principles for data governance should be implemented e.g. open data policies, AI Ethics Guidelines.
3. **Technology & governance by design**: Technical solutions embedded within systems to enforce governance principles e.g. privacy guidelines, federated learning, encryption, access controls, technical protection measures (TPMs), data architectures and integration design.
4. **Standards and vocabulary:** common protocols and definitions to document and ensure data quality, security, interoperability, consistency, and usability e.g. ISO 27001 (information security management standard), DCAT (Data Catalog Vocabulary).
5. **Codes of conduct**: Voluntary or mandatory frameworks guiding responsible data use e.g. the EU's Code of Conduct on Disinformation.
6. **Procurement & vendor management**: Integrating data governance requirements into procurement processes e.g. public sector data-sharing requirements in vendor contracts.
7. **Licensing:** Mechanisms defining permissions for data reuse and distribution e.g. Creative Commons Licenses, Open Data Licenses.
8. **Data stewardship & institutional arrangements:** establishing roles and responsibilities for managing data in alignment with governance goals e.g. Data stewards, data trusts, auditors.
9. **Audit & compliance mechanisms**: Methods to monitor and enforce adherence to governance policies e.g. impact assessments, compliance audits, algorithmic transparency.
10. **Training and cultural change initiatives:** Mechanisms to embedding data training and cultural change in the organization e.g. mandatory training courses (privacy, data security) in-person or virtual sessions, and data governance training.

Source: Broadband Commission, Data Governance Toolkit: A Guide to Navigating Data in the Digital Age

5 Conclusions

Our societies are undergoing significant digital transformation. There is strong, but uneven, growth in connectivity infrastructure, driven by expansion in digital services, the introduction of Artificial Intelligence (AI) into many different aspects of our society, and a huge but invisible exchange of data. Any one of these trends has far-reaching implications; taken together, they are changing the way we live.

This report has explored some of the ways in which our world is digitizing, and the growth in digital services. It has presented the most recent assessment of the global digital divide in infrastructure, as well as how infrastructure is evolving in order to cater to the needs of the expansion in AI and digital services (Chapter 1). It explored some of the issues in moving from telecom regulation to broader digital regulation, including more collaborative regulation across different sectors and new issues, in particular relating to data (Chapter 2).

Fast-changing AI has broad implications, as well as deep implications. Progress in AI is accelerating, posing challenges for regulators and end-users alike. Among the many different advances, the report considered advances in AI in healthcare, education, telecommunications and broadband (Chapter 3). Finally, the massive growth in data generated by digital services is considered in Chapter 4, along with new and important issues emerging in how governments approach data, its use, storage and transmission (Chapter 4).

All these areas are inter-related in complex ways, making it vital for regulators and policymakers to have a coherent overview of progress in different areas. This report has sought to provide an initial overview of some of the areas for further policy considerations.

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