

Document CWG-SFP-1/6-E 25 August 2021 Original: English

#### **Contribution by the Secretariat**

#### TRENDS IN THE ICT ENVIRONMENT IN THE POST COVID ERA

#### Summary

This document presents report and trends in the ICT environment, in the post COVID-19 pandemic era, to be considered for the development of the ITU strategic and financial plans for 2024-2027.

#### Action required

The CWG-SFP is invited **to note and consider** this document for the development of the ITU strategic framework for 2024-2027.

References

# Trends in the ICT environment in the post COVID era

Documents and Reports related to the Strategic and Financial Plans

> 1st meeting of the CWG-SFP 29-30 September 2021



## **Documents and Reports for consideration**

- A. G20 Connecting Humanity by 2030
- B. Digital Trends Report by regions
- C. Regulatory uplift for financing digital infrastructure, access and use
- D. Financing Universal Access to Digital Technologies and Services
- E. The economic impact of broadband and digitization through the COVID-19 pandemic
- F. Understanding COVID-19's impact on the ICT market Facts & Figures
- G. Tech Trends
- H. ITU experts' vision on Emerging Trends towards 2025
- I. State of Broadband Report 2021 (under development)



ITU contribution as the lead Knowledge Partner of the G20 Digital Economy Task Force (August 2020)

## **Connecting humanity by 2030**

Assessing investment needs of connecting humanity to the Internet by 2030



# Assessing investment needs of connecting humanity to the Internet by 2030

- Nearly half the global population (~3 billion people) aged 10 years and over has never used the internet. Many in rural and remote areas, and a disproportionate number are women. Most are poor, lack basic literacy, and, with only limited digital exposure, see little value in getting online.
- Within the Covid-19 pandemic we face a real and present danger of those without broadband access being left even further behind.
- We need innovative ways of connecting people, fostering innovation, and promoting new technologies. Enabling regulatory frameworks can play a big part.
- Government policies need to prioritize broadband as basic infrastructure, as essential for development in the digital age as transport, energy and water networks.



## Investment needed to achieve universal access to broadband connectivity by 2030

~USD428 billion is needed to achieve universal access to broadband connectivity across the world



Sources: Estimates based on ITU, GSMA, A4AI, operator and regulator data

450

400

350

300

250

200

150

100

50

0

**USD** billion



## Investment needed by regions and income groups



\*Country and ncome groups based on World Bank classification. SSA (Sub-Saharan Africa) and MENA (Middle East and North Africa) Sources: Xalam estimates based on ITU, GSMA, A4AI, operator and regulator data



#### Trends in the ICT environment

## Financing the investment needs: Indicative cost sharing





## Summary of key findings:

- Bringing over three billion people online in the next ten years has an **estimated cost of USD428 billion**.
- No single actor alone can achieve the ambitious goal of connecting everyone to universal, affordable broadband connectivity by 2030. Different stakeholders should come together to tackle the challenge.
- The investment should take a regional approach with a special focus on Sub-Saharan Africa and South Asia — to bring the unconnected online in the next 10 years.
- While infrastructure investment is the main challenge, investing in policy and regulatory reform, digital skills and local content development are also critical.
- Complementary efforts on improving affordability of data, devices and services will be key to helping close the global digital divide.

#### G-20's discussions:

**ITU** as a Co-champion of the Expert Group on Global Connectivity (Recommendation 1A) of the UN Secretary-General's High-Level Panel on Digital Cooperation, could be ready **to provide the global platform for the alignment and cooperation to move from vision to impact.** 



ITU Digital Trends Reports 2020

## **Digital Trends by Region**



## Africa

- There is a significant use gap, where individuals who live within the footprint of a network are not using the Internet because of lack of affordability, skills or meaningful/quality access:
  - Mobile broadband totalled 33.1 per cent and use of fixed broadband remains very low;
  - Only one country meets the UN Broadband Commission target of 2 per cent of GNI per capita for both mobile and fixed broadband.
- > Need for more targeted initiatives to bring more women online.
- > Increased efforts in **data collection** are key to addressing the skills gap going forward.
- > Most countries have put in place **cybercriminal legislation** and **cybersecurity regulation**.
- There is an ample room for ICT infrastructure development and integrated technologies such as AI, IoT and cloud computing.
- The COVID-19 pandemic has brought a surge in demand and network congestion on both mobile and fixed networks, as people have shifted to work from home and access more entertainment and education resources online, highlighting areas that require increased attention.
- There are steady improvements in regulatory frameworks that are increasingly based on a new regulatory paradigm of collaborative regulation.



## Americas

- > Lack of connectivity:
  - pointing to a large **usage gap**;
  - **ICT prices**, while increasingly affordable, remain mixed, given the diversity of the region.
- > The only region that **achieved gender parity** with a 2019 gender parity score of 1.01 per cent.
- > There is significant room for **improvement in basic**, **standard and advanced ICT skills**.
- There is still ample room for developing artificial intelligence capabilities and capacities, which can be fostered by advancing standardization to achieve the necessary scale and by addressing gaps in digital infrastructure, including cybersecurity.
- The COVID-19 pandemic has had a profound impact, having pushed consumers and businesses alike to adopt digital services and technologies and having accelerated digital transformation in some areas of business. Yet infrastructure gaps posed a significant constraint to mitigate the huge impact on the economy and on society.
- Steady improvement in regulatory frameworks, which are increasingly based on a new regulatory paradigm of collaborative regulation.



## **Arab States**

- > A key barrier to accelerated progress is the lack of meaningful and affordable connectivity:
  - Significant use gap, where individuals are covered by the Internet but are not using it owing to lack of affordability, skills or meaningful/quality access.
- Need for more targeted initiatives to bring more women online. It should be noted, however, that the gender gap does not apply to GCC countries, where either more women than men use the Internet or near parity exists.
- > Increased efforts in data collection key to addressing the skill gap going forward.
- > Most countries have **cybercrime legislation** and **cybersecurity regulation** in place.
- GCC countries are frontrunners across AI, IoT and cloud computing technologies, but still significant room to build on AI capability and capacity development. Key challenges to be overcome to accelerate the development of AI, IoT and the Cloud are issues relating to data sharing and hygiene.
- > Digital transformation accelerated due to Covid-19.
- Where positive ICT developments have emerged, they have been underpinned and accompanied by steady improvements in regulatory frameworks that are increasingly based on a **new regulatory** paradigm of collaborative regulation.



## **Asia-Pacific**

- Continued growth in most areas of ICT infrastructure, access and use, but many challenges persist magnified by the COVID-19 pandemic.
- > ICT prices, while increasingly affordable, remain mixed, given the diversity of the region.
- While the digital divide persists, the gender gap has decreased, with a difference of only 7 percentage points remaining between women's and men's Internet use.
- Most countries achieved a basic ICT skill level of above 40 per cent, but great variation remained in standard and advanced skill levels.
- The region has made significant progress in cybersecurity; 35 countries have cybercriminal legislation in place and 31 have cybersecurity regulations.
- There is still ample room for developing artificial intelligence capabilities and capacities, which can be fostered by advancing standardization to achieve the necessary scale.
- Digital transformation accelerated due to Covid-19
- Positive ICT developments and trends underpinned and accompanied by steady improvement in regulatory frameworks, which are increasingly based on a new regulatory paradigm of collaborative regulation.



## CIS

- Persistent use gap, where individuals are covered by the Internet but are not using it owing to lack of affordability, relevant content, skills or meaningful/quality access.
- In the context of increased demand for data-intensive applications, cloud-based services and growing numbers of Internet users, the availability of international bandwidth is key.
- While a digital divide persists, the gender gap has marginally decreased, with a gender parity score of 0.97 the CIS region is one of two regions where the gender gap is the least pronounced.
- A significant skills gap exists in the region across all skill categories. Increased efforts in data collection are key to addressing this gap.
- Most countries have either started to initiate or have already developed complex commitments in cybersecurity.
- Still significant room to build on AI capability and capacity development. The IoT market is still evolving. Lack of native cloud platforms, and international partnerships on the rise. Key challenges to be overcome to accelerate the development of AI, IoT and cloud are issues around data sharing and data hygiene.
- Regulatory frameworks have not advanced up ITU's collaborative regulation "generation ladder" as rapidly as in most other regions, leaving significant room for reform and improvement.



## Europe

- > Continued growth in most areas of ICT infrastructure, access, use and leads across all ICT indicators.
- > Europe has the **most affordable ICT prices**.
- While a digital divide persists, rural Internet access by household increased to 78 per cent and gender gap decreased, with a 5% difference remaining between women's and men's Internet use.
- Most countries have achieved levels of basic ICT skills, but great variation remains in relation to standard and advanced skills.
- Europe has progressed significantly in the area of cybersecurity, with all countries having cybercriminal legislation and cybersecurity regulation in place.
- Ample room with regard to Al capability and capacity development. While in the area of IoT, Europe is well-positioned and at the forefront of adoption across a number of countries, fragmented policy environment stands in the way of accelerated progress. On the other hand, Europe is leading the way in cloud technology governance and policy development, a key enabler of IoT and other ICTs.
- The positive ICT developments and trends underpinned and accompanied by state-of-the-art G5 regulatory frameworks based on a new regulatory paradigm of collaborative regulation.



ITU GSR-21 Best Practice Guidelines

# Regulatory uplift for financing digital infrastructure, access and use



### Prototyping regulatory patterns for the post-COVID digital world

The post-COVID digital world needs a new take on regulation to **enhance regulatory foresight**, **harness data to target interventions and create space for regulators and industry to experiment together**. This is key in finding **market solutions to new challenges** as new technologies, business models and players continue to test existing regulatory paradigms.

#### > Novel regulatory tools can unlock the power of new and emerging technologies

Adoption of multi-modal regulatory frameworks, extending ex-post approach to regulation and competition to digital markets, promoting broadband network infrastructure competition, creating safe space for regulatory experimentation, broadening legal frameworks for experimental regimes for digital innovation using regulatory sandboxing to multiple sectors;

### Spectrum innovation is key for the digital future

Setting policies that guarantee an effective use of spectrum, adopting a multifaceted approach to freeing up additional spectrum, including releasing spectrum for the establishment of community networks on a technology-neutral basis, enabling more efficient spectrum usage by balancing both licensed and unlicensed uses and consider new rules for expanding unlicensed broadband, setting up trial platforms for new technologies;

#### > Data is the silver bullet of digital regulation

Building research and data analytics capabilities, adopting data-driven tools in decision-making, ensuring regulators are empowered to collect relevant data from market players and have capacity to develop regulatory tools to address identified failures in ICT and digital markets



## Transformational leadership to unleash the power of emerging technologies and business models

The COVID-19 pandemic highlighted the need for agile, responsive regulatory action and leadership. Transformational leadership will be rooted in new and revisited approaches to digital and collaborative regulation.

#### > Regulators and policy makers are the master builders of the digital transformation

Clear, ambitious but executable regulatory roadmaps, regulatory governance structures adapted to the new digital mandates, ensuring engagement of regulators in the legislative initiatives, developing the advisory role of regulators across sectors towards industry and citizens;

#### > A regulatory paradigm shift is needed to deliver on the digital dividend for all

Building accountability, focusing on outcome in the design and implementation of collaborative regulation practices, reinforcing regulatory agility and transparency, enhancing the design, administration and effectiveness of regulation, de-regulating areas that no longer require extensive regulatory oversight and reconfiguring regulatory capacity to address gaps and new areas;

#### > National regulators and policy makers have a role to play at the international arena

Stepping up national and international engagement strategies, cooperating and building a common understanding at the international level on issues surrounding anti-competitive behaviours in the digital economy, encouraging regional and international cooperation on data privacy and cybersecurity, intensifying international cooperation on cross-border data flows.



ITU GSR-21 Discussion paper

## Financing Universal Access to Digital Technologies and Services



## This paper provides guidance on the financing mechanisms and the shift of mindset needed to move from funding to financing.

Whether pooling financial resources, sharing open access infrastructure, or leveraging public money to raise private funds, goal is to stretch limited financial and non-financial resources as far as possible. Key trends include:

- Using a combination of monetary and non-monetary, or in-kind contributions, based on the needs of the project and the various strengths of collaborative financiers;
- Making smarter investments and thus a move away from "funding" (out of a moral imperative) to "financing", which is more commercially grounded and relates to making good investments, while contributing to socio-economic development; and
- Collaboration between governments, commercial banks, development finance institutions, the private sector, and bilateral and multilateral donor organisations to meet funding gaps is increasing, including through "blended finance" or the strategic use of development finance to mobilise additional finance for sustainable development in developing countries.



ITU Publication (June 2021)

# The economic impact of broadband and digitization through the COVID-19 pandemic



## Covid-19 drove several changes in ICT investment, deployment and service adoption trends in 2020:

- 1 Internet traffic by ~30%, with changes in time of day and geographic distribution patterns (i.e. from enterprise to residential access, partly from mobile broadband to fixed broadband/Wi-Fi);
- Telecommunication/ICT capital investment in developed countries to accommodate increase in traffic, combined with the deployment of 5G and optical fibre infrastructure;
- J Telecommunication/ICT capital investment in developing countries, indicating a widening of the digital divide;
- Lapital expenditures (CAPEX) per capita in developing countries, resulting in decreasing growth rate of 4G coverage and lagging deployment of 5G (5G currently reaching 3.34 per cent of the population in Latin America, and 0 per cent of the population in Africa);
- **î** Fixed broadband adoption in response to teleworking, distance learning, remote entertainment and telemedicine;
- **Broadband prices**, which has **increased affordability** (although, in some regions, fixed broadband prices as a percentage of GNI per capita have increased, due to incomes decreasing at a higher rate than prices in the context of the severe economic recession);
- 1 Use of Internet platforms, driven by pandemic-induced lockdowns.



Changes in the ICT ecosystem driven by the disruption of the pandemic have not substantially altered the importance of ICTs as a driver of economic growth:

- Percentage increment in per capita GDP, resulting from an increase in 10 per cent broadband penetration worldwide, remained stable both for fixed (from 0.77 per cent to 0.80 per cent) and mobile broadband (from 1.50 per cent to 1.60 per cent);
- Economic contribution of fixed broadband greater in developed countries than in developing countries, reflecting the increasing "returns to scale" effect;
- Impact of digitization in developed economies higher than in emerging economies, again confirming "returns to scale". Digitization also associated with an increase in labour productivity and total factor productivity;
- Economic dividend of mobile broadband greater in countries with lower economic development, confirming the diminishing returns effect linked to mobile broadband saturation and highly adopted fixed broadband capturing a large portion of the economic contribution;
- Economic contributions of mobile broadband in less developed countries, and fixed broadband in middleincome and developed countries higher than estimated before COVID-19.



Economic losses of the COVID-19 pandemic during 2020 not equal for every country affected. Countries with better broadband infrastructure were able to mitigate part of the negative economic impact, allowing households, enterprises, and governments to continue functioning.

The confirmation of the economic contribution of ICTs and the assessment of the value of broadband in mitigating economic disruption caused by the pandemic provide support for the measures taken so far by policy-makers and regulators to accommodate the resulting changes in sector dynamics. Those measures include:

- > granting mobile operators the use of additional spectrum in pre-determined regions of the country;
- temporarily reducing the traffic generated by some video-streaming providers by reducing the definition of video content;
- accelerating the deployment of a large number of base stations for mobile broadband, reducing the permit requirements for the deployment of antennas; and
- addressing some factors of the digital divide by providing devices (personal computers, tablets, Wi-Fi modems, subsidized broadband services) to vulnerable consumers, and combining this with distance learning training on e-education and telemedicine.



## The evidence generated in this study provides additional guidance for some forward-looking actions:

- Policy-makers and regulators in developing countries need to consider initiatives for reversing the declining capital spending trend and stimulating telecommunications investment to ensure continuous roll-out of networks.
- The importance of ICTs in mitigating some of the pandemic-induced economic damage illustrates the need for policy-makers to reduce demand-side barriers (affordability, digital literacy, local content development) and stimulate the adoption of mobile broadband.
- The high value of fixed broadband as a mitigant of pandemic-induced economic disruption brings to light the urgency with which countries with underdeveloped fixed connectivity need to explore ways to expedite the roll-out of fixed networks, with an initial emphasis on high density urban concentrations.



Facts & Figures of the ICT market

# Understanding COVID-19's impact on the ICT market



## **Unprecedented demand on communication networks**



The 'Lockdown Effect': How networks have been impacted since the coronavirus outbreak.

How global networks are adapting to the new normal – Ericsson, April 2020

#### Figure 1. Internet bandwidth at Internet exchange points, by country



Notes: Data shows the median IXP peak traffic aggregated by country in September 2019, December 2019 and March 2020, based on public sources. Tbps = terabits per second.

Source: OECD based on data from Packet Clearing House.

Keeping the Internet up and running in times of crisis (oecd.org)



## Network resilience out and out positive



The pandemic has brought the systemic importance of scaled network infrastructure into sharp relief.

**GSMA Intelligence: Global Mobile Trends** 



## New & increased digital consumer behavior



Base: Smartphone users aged 15–69 within Brazil, China, France, Germany, India, Italy, South Korea, Spain, Sweden, the UK and the US Source: Ericsson Consumer & IndustryLab, Keeping consumers connected during the COVID-19 pandemic (June 2020)

Ericsson: Keeping consumers connected

- ↑ Online shopping
- ↑ E-learning
- ↑ Video on demand
- ↑ Remote working
- ↑ Online banking
- ↑ Video calling & mobile voice traffic
- Virtual appointments with health practitioners



# Cloud-based solutions particularly important to support teleworking

FIGURE 1

#### Cloud spend has done better than overall IT spend

YoY growth in spend, percent

Global noncloud IT infrastructure Hyperscale cloud revenues Data center chip revenues



Source: Deloitte analysis of quarterly and annual financial statements.

Cloud migration trends and forecast | Deloitte Insights



# Impact on Telecoms less severe than on the broader economy

Because of its consumer-facing nature, the telecoms sector behaves cyclically relative to the economy.

Aggregate change in 2020 versus pre-pandemic levels in 2019 Five worst-hit countries\*



#### Real GDP Mobile revenues

\*Ranked by deaths from Covid-19 as of 30 September. Revenues = 9 months to September versus same period of 2019. GDP = forecasts for 2020 versus 2019.

Source GSMA Intelligence, IMF World Economic Outlook (October 2020)

### The Covid-19 impact has focussed on roaming, handsets and enterprise

Breakdown of Covid-19 impact on revenue for AT&T

Q2 2020. Figures are expressed as a share of overall revenue for the same period of the prior year (Q2 2019).



Source GSMA Intelligence, AT&T

#### GSMA Intelligence: Global Mobile Trends



## 5G network rollouts continued unabated

Despite the global pandemic and associated economic constraints, new 5G networks continue to be launched

As of Q3 2020, 'new' spectrum specifically earmarked for 5G had been assigned in 35 countries. The remaining countries are either waiting on auctions or redeploying existing bands for 5G use



Data as of 30 September 2020 - GSMA Intelligence: Global Mobile Trends 2021



Industry Reports
Tech Trends



## **Deloitte: Macro Technology Forces**



Progressing from enabling technologies of the past decade to disruptors of the 2020s and to the technologies beyond the horizon, the macro forces framework shows the inextricable links between the defining technologies of the past, present, and future.



## **Deloitte: Global TMT Predictions 2021**





C

**Cloud migration** For cloud computing, a sunny forecast

Amid lockdowns, COVID-19 made cloud a rare focus of growth. Soon it will be standard.

> 45 In 2020 Total IT spend down 10%, hyperscale cloud revenue up 25%, cloud chip sales up 45%

2x Cloud internet traffic doubled 2019 volume during the pandemic.

30% In 2021 Cloud revenue will grow >30% annually through 2025.

\$150B In 2022 Hyperscale capital spending will top \$150 billion.

The more the cloud grows, the more space there is to mine it for value creation.



**5G and health** Facts versus fears

New 5G cellular networks use far less energy than radio or TV and present no proven health risks. But some people still fear it causes cancer and spreads COVID-19.

 Public perception

 13% to
 13% to 36% of people in

 14 countries believe 5G presents health risks.

Power output 5G base station: 100–200 Watts TV and FM radio: 100,000 Watts AM radio: 500,000 Watts

FM radio and TV expose people to 5 times the radio energy they absorb from cellular.

5G actually uses less transmitting power than 4G. Clear, consistent messaging will be necessary to overcome myths about its danger.



**Open RAN** Proprietary no more

Advanced mobile services will rely on the flexibility of open, virtualized Radio Access Networks (RAN).

10+ By 2021 More than 70 open RAN trials active, doubling current activity.

80% By 2023 80% of core wireless network deployments will be virtualized.

> Open RAN share of the RAN market may grow 10 times or more.

History repeats itself as closed gives way to open and hard gives way to virtual.



Ready for the spotlight

Women's sports still trail men's sports in market value—but they're growing faster and targeting the \$1 billion mark.

**84%** of sports fans want to watch at least one women's sport

•22% The 2019 Women's World Cup football final had 22% more US viewers than the 2018 Men's World Cup final.

Keys to growth: more investment, more content, more stories, bigger venues.



Athletes everywhere are finding a new edge in data and analytics. How can sports benefit effectively—and ethically?

\$500M In 2019 \$500 million lost to injuries in the NFL alone.

> **3K** Since 2014 3,000 sports tech deals.

Global sports betting will reach \$150 billion.

Leagues will need new policies built on a foundation of openness and trust.

TMTPredictions 2021 (deloitte.com)



 $\bigcirc$ 

## **McKinsey:** The top trends in tech



#### The technologies beneath the trends

- Industrial Internet of Things
- Digital twins
- Robots/cobots/robotic process automation
- 3D or 4D printing
- 5G
- Internet of Things
- Cloud Computing
- Edge computing
- Quantum computing
- Neuromorphic chips

- Computer vision
- Natural-language processing
- Speech technology
- Software 2.0
- Zero-trust security
- Distributed-ledger technology
   and blockchain
- The Bio Revolution
- Next-generation materials
- Clean technologies

The top technology trends | McKinsey



## **Ericsson: Keeping consumers connected**

Five predictions for a post Covid-19 world

Networks redefined	Autonomous commerce	Borderless workplace	Synchronous care	Virtual experience economy
Three in four value network resilience and say internet connectivity is most critical during such a crisis.	Six in 10 believe automated delivery drones or fleets of driverless cars might replace delivery people.	Working remotely will be the new normal, according to 6 in 10 workers.	Six times more consumers in the US expect to use real-time online health consultations than during 2019.	Of VR users, 7 in 10 think that virtual symbols will drive status rather than physical ownership of goods, and that social VR will help ease isolation.
୦ ଜୁ ୦			••••] ••••]	

Base: Smartphone users aged 15–69 within Brazil, China, France, Germany, India, Italy, South Korea, Spain, Sweden, the UK and the US Source: Ericsson Consumer & IndustryLab, Keeping consumers connected during the COVID-19 pandemic (June 2020)

Ericsson: Keeping consumers connected



### **GSMA Global Mobile Trends 2021 – Growth beyond connectivity**

#### Operators around the world see manufacturing as the largest B2B revenue opportunity going forward

Which sectors do telecoms operators see as the largest revenue drivers for services beyond connectivity over the next five years?



Scores reflect where a given sector was ranked 1st or 2nd in revenue potential by operators (n=100).

Source GSMA Intelligence Operators in Focus Survey



### GSMA Global Mobile Trends 2021 – 5G outlook

### The timetable for standalone networks has been brought forward





### **GSMA Global Mobile Trends 2021 – IoT and enterprise verticals**

#### IoT revenues will triple by 2025



### Connectivity needs to be bundled with services Percentage of total IoT revenues 70% 67%



Measuring success of IoT deployments: compliance on the rise Percentage of respondents

			2018	2020
	ন্থ	Cost saving	85%	65%
	000	Revenue generation	58%	68%
r	*	Regulatory compliance	31%	53%

#### Top three challenges among enterprises remain the same, with employee resistance on the rise





## **GSMA Global Mobile Trends 2021 – The next billion**

#### Despite improving coverage, internet user growth is slowing

#### State of mobile internet connectivity globally



#### Even if costs have come down, affordability remains a problem

Affordability of entry-level phones and 1 GB of monthly data As a percentage of monthly GDP per capita



#### Smartphone adoption matters, but the impact is far greater with LTE

Even in emerging markets, most smartphones are now running LTE (with Africa the exception)



Since 2015, the mobile industry has increased its contribution to fulfilment of the Sustainable Development Goals (SDGs) every year. 2019 was the most impactful year so far, driven by the acceleration in phone usage across the board. However, industry and government action will need to ramp up significantly – as it has on climate change – to get back on track and avoid a repeat of the previous global action plan on poverty (MDGs)

#### On the development front, mobile is helping the SDGs, but the world is set to fall short

SDG mobile impact scores



2015 ■ 2016 improvement ■ 2017 improvement ■ 2018 improvement ■ 2019 improvement
 For each SDG, an 'impact score' is calculated out of 100. A score of 0 means the mobile industry is having no impact at all, while
 a score of 100 means the industry is doing everything possible to contribute to that SDG.
 See www.gama.com/better/uture/2020/adjimpactreport

Source GSMA Intelligence



ITU Survey answered by members of ITU Study Groups & Academia (2019)

# ITU experts' vision on Emerging Trends towards 2025



# Survey results – emerging trends in electronics and photonics







## Survey results – emerging trends in system software







# Survey results – emerging trends in infrastructure equipment







## Survey results – emerging trends in network operations







## Survey results – emerging trends in user devices







# Survey results – emerging trends in application software





#### Reasons



## Challenges identified in each ecosystem category



### **Overall key trends**





#### Trends in the ICT environment

## All the information presented in this document could be summarized in these other reports, developed by different stakeholders, on the impact of COVID-19 and the ICT Sector:

- COVID-19 demonstrated importance of digital readiness for countries and businesses to stay competitive World Economic Forum
- COVID-19 exacerbated effects of digital divide: Ability to participate in education, medical and other government services, to communicate and to access e-commerce services completely dependent on affordable connectivity <u>ITU</u>
- COVID-19 is pushing companies to work together in new ways, creating ecosystem-wide innovation. Long-term, the rules around innovation will never be the same. The world is changing faster than anyone expected, and businesses need to be more flexible than ever. Many leaders are weaving together new innovation strategies and forming new partnerships to help them pivot quickly and continuously during this crisis. We need bold innovation to get through this, and we will still need bold innovation when it passes. Accenture
- The COVID-19 crisis has shown us that **emerging technologies** like the Internet of Things and artificial intelligence are not just tools, they are **essential to the functioning of our society and economy**. Particularly in this time of instability, we need to think of them as **critical infrastructure**...If, in response to this pandemic, we can **match technology with the appropriate institutions, standards and norms**, we will emerge stronger than before. <u>World Economic Forum</u>
- COVID-19 recovery efforts present an opportunity for governments and the international community to use frontier and emerging technologies to reduce inequalities <u>UNCTAD</u>



#### Summary of trends:

**Technology:** Digital transformation (accelerated as an answer to the unexpected demand) / Data, devices & services to prioritize QoS & price / Cloud - Distributed platforms - Quantum / IoT & AI as critical infrastructure / Virtual experience / 5G

**Policy & Regulation:** Broadband as basic infrastructure / Scaled network infrastructure / Network operation & maintenance / Cybersecurity / Spectrum innovation / Remote areas coverage / Affordability / Investment - Financing / Data collection & sharing / Collaborative regulation - New regulatory tools

**Cross-cutting:** Innovation / Partnership - Collaboration / Regional approach / Digital skills / Local content / Gender

