Global Gateway

The Open Internet as cornerstone of digitalisation

The Global Gateway Partnership Opportunities between the European Union and Africa

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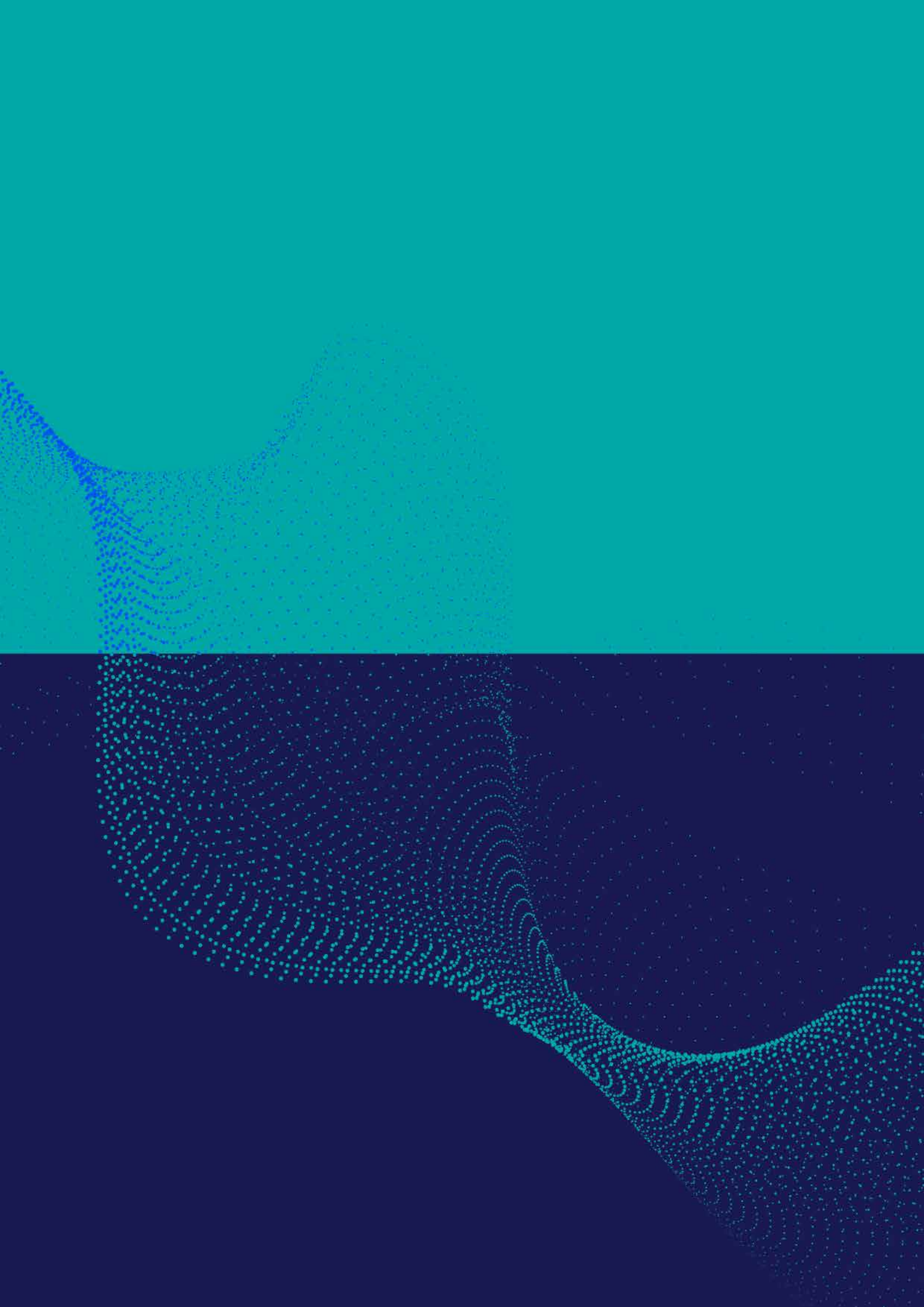
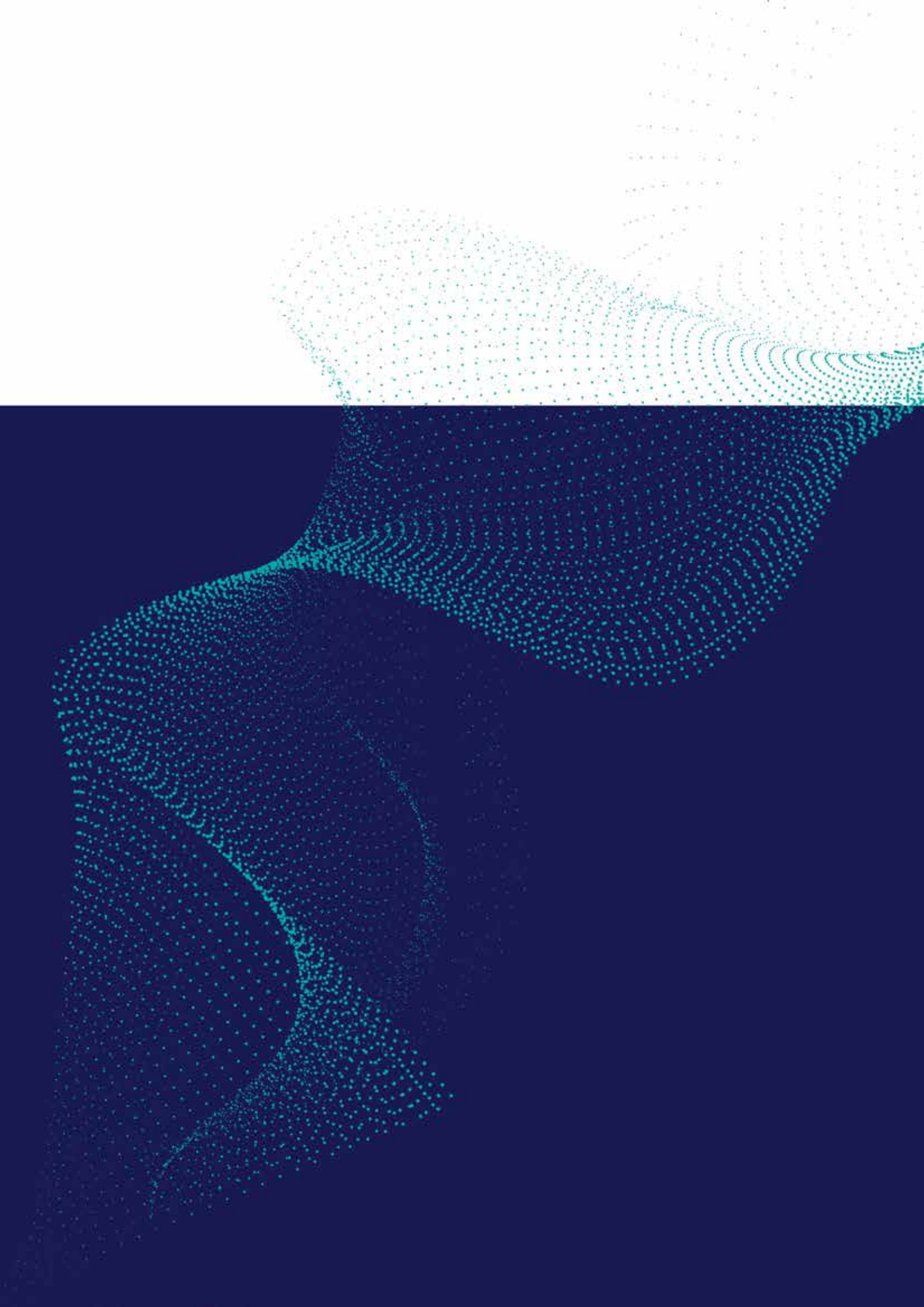


TABLE OF CONTENT



Executive Summary

Digital technologies and the Open Internet are two distinct concepts that are often mixed up or confused. In reality, ensuring that the two go intrinsically together in the digitisation processes of countries and regions is an important policy and investment choice, which has an impact on all key drivers for social and economic growth.

Key international actors share a vision of the internet that is open, free, global, interoperable, reliable, affordable, trustworthy and secure. Open Internet connectivity is recognised as a promoter of the **United Nations Sustainable Development Goals (SDGs)**[1] and the goals of the **African Union's 'Agenda 2063**: **The Africa we want**.'[2] The African Union Declaration on Internet Governance[3] and the recent Declaration for the Future of the Internet,[4] for example, embrace this logic and provide fertile ground for new and strengthened digital partnerships between Europe and Africa.

The European Union (EU) identifies the deployment of 'digital networks and infrastructure' as a key international investment priority in the **EU Global Gateway,**[5] which will mobilise up to **300 billion euros by 2027** for developing global infrastructure. At the same time, **the Global Gateway makes these investments in digital infrastructure intrinsic to the promotion and development of the Open Internet**, which the EU identifies, following the success of its own digitisation model, as a key driver of innovation, investment, and socio-political, economic and cultural development.

The key to the success of the **Open Internet is its decentralised architecture, built on stable open standards and protocols that are developed in open and consensus-driven processes**. This means that these standards evolve with the expansion of the internet and with the growing number of connected users and devices; they can accommodate innovation and cope with new and future challenges.

A multistakeholder internet governance model, driven by organisations and forums such as the Internet Engineering Task Force (IETF), the Internet Cooperation for Assigned Names and Numbers (ICANN), the Internet Governance Forum (IGF), and many regional and national dialogues, underpins the Open Internet. This has proven to be an effective system for making the internet evolve, while striving to keep technology at the service of people-centred development and embedded in human rights through democratically developed principles, regulations and public policies. Indeed,

1 https://sdgs.un.org/goals
2 https://au.int/agenda2063/sdgs
3 African Union Declaration on Internet Governance, adopted by African ICT Ministers in Algiers, February 2017.
4 'A Declaration for the Future of the Internet', April 2022, https://digital-strategy.ec.europa.eu/en/library/declaration-future-internet
5 'Joint Communication to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, The Global Gateway', December 2021, https://ec.europa.eu/info/sites/default/files/joint_communication_global_gateway.pdf.

in the application layer, **the Open Internet is no longer without rules**. As shown by the European Union example, democratic regulations and principles can be put in place regionally or even nationally, so that fundamental rights are respected, and big economic and political players do not interfere with locally driven empowerment and development.

In the context of expanding digitisation, however, significant **challenges limit the full realisation of the Open Internet's potential**. Divides in access to the internet persist between regions and countries, between rural and urban populations, between men and women. The COVID-19 pandemic has accentuated the importance of universal access and basic connectivity but has also set back human capital development to harness its potential. Moreover, risks persist that in trying to accelerate the process of digital transformation, governments are further compelled to support and deploy closed internet models, even if they are against their political vision and interests, instead of focusing their efforts on advancing and promoting multidimensional internet openness. This report argues that **attempts to deploy closed and centralised alternatives to the Open Internet, while they might seem attractive in the short term, come with significant economic, political and societal costs and carry a significant risk of technical isolation and loss of investments**. Closed models bear strong risks of leading to fragmentation, which in turn impacts technological progress, hinders innovation, limits regional integration as well as local business opportunities, creates long-term dependencies, and poses new privacy and security concerns.

The aim of the EU's Global Gateway is to leverage the specific role of the Open Internet in supporting a **human-centric sustainable development through EU-Africa partnerships** and empowering local African communities to reap the full benefits of open digitisation. The present report takes stock of the state of play in internet development in Africa for the purpose of identifying EU-Africa Open Internet partnership and investment opportunities in five areas:

- Digital infrastructure for Open Internet connectivity
- Open Internet, enabling policy and regulatory environments, and e-government
- Open Internet skills and competences
- Open internet economy, trade, innovation and startups
- Participation in Open Internet governance.

DIGITAL INFRASTRUCTURE FOR OPEN INTERNET CONNECTIVITY

Global internet connectivity has expanded rapidly, with an additional boost during the pandemic. In 2021, 63% of the global population was using the internet. Africa is clearly a central part of this ongoing expansion, even though it is still lagging behind the rest of the world with only 33% of its population using the internet, concentrated among the young and people living in urban areas.[6] Digital divides between Africa and other parts of the world, as well as divides within the continent and within countries, remain a challenge. Meaningful access is still not affordable for many people, even if they have some form of connectivity.

The diversified and trusted buildout of digital infrastructure, while generally agnostic to what type of internet applies, is the inevitable first step for everyone to be digitally connected. Yet affordable and competitive digital infrastructures (e.g. backbone infrastructure, novel solutions for remote or sparsely populated regions, affordable devices) do not guarantee the technological development of the Open Internet as such. Internet-specific infrastructures, such as Internet Exchange Points (IXPs), a robust Domain Name System (DNS) and a vibrant DNS sector, carrier neutral data centres that host content locally, promotion of the use of the latest standards and protocols including the transition to IPv6, and the support for Digital Commons are necessary to build a human-centric Open Internet that empowers local socio-economic growth and development. The existing gaps in these areas provide good opportunities for new European and African partnerships.

6 Measuring digital development, Fact and Figures 2021, ITU-D, 2021.

OPEN INTERNET, ENABLING POLICY AND REGULATORY ENVIRONMENTS, AND E-GOVERNMENT

While digital policy strategies are growing in substance and sophistication, African states continue to face difficulties in implementing and updating these strategies to keep up with the fast-changing digital sector and preserve the Open Internet. As the Open Internet expands, so does the range of policy, legislation and regulation needed to create an enabling environment for maximising its potential for socio-economic development as well as the risks that ill-placed policies harm internet openness. African policymakers and regulators face a double burden: (1) enabling investment and innovation in basic affordable access, and (2) properly responding to cutting-edge Open Internet challenges and opportunities such as privacy-respecting digital identities, open digital trade and services, data protection, human-centric artificial intelligence, disinformation, cybercrime and e-government, among others.

The evolving EU digital regulatory framework, which includes the General Data Protection Regulation (GDPR), the new Digital Markets Act (DMA) and Digital Services Act (DSA), to name just a few, can be considered a source of inspiration for Africa, in particular for its contribution to shaping the real socio-political and economic dynamics of the Open Internet to support local empowerment. It does so by upholding values such as competition, privacy and respect for human rights in very concrete ways. This enables the Open Internet to provide opportunities for local content to thrive and local economies to grow through innovation in the digital sphere, following a strict democratic vision that puts people's empowerment at its centre. The EU's Global Gateway and Open Internet commitment should develop an offer for country-level technical assistance to empower local regulatory models.

OPEN INTERNET SKILLS AND COMPETENCES

Human capital in Africa grew significantly in the decade before the pandemic. However, Africa still trails behind most other parts of the world in overall levels of education, particularly in STEM (science, technology, engineering and mathematics). Entry-level skills, such as digital literacy, are often lacking along with demand-side skills to create online content, build applications and develop new e-services. At the same time, the cross-border nature of the Open Internet means that Africa not only needs to develop talent but also has to retain it.

The African Union Commission's (AUC) Digital Transformation Strategy prioritises skills development and the Open Internet through customised applications and services, and this presents a multitude of new opportunities for human capital development tailored to local African needs. A multi-pronged approach is needed, starting with incorporating Open Internet skills like digital and media literacy and online citizenship into standard educational curricula. Next, those outside the formal education system need practical skills, for example, to use e-government services. Specialised Open Internet skills, including for developing internet protocols, online teaching, online trade, machine learning and quantum computing, must be developed. Apart from the technical skills, there's a need for training in project management, monitoring and evaluation, and for capacity building to make policy and regulation, and to understand and meaningfully participate in multistakeholder internet policy processes. Lastly, by better linking skill-building initiatives to local opportunities for employment, internships, further education, access to startup capital and participation in policy processes, African communities will be in a better position to retain talent and knowledge. In short, all of these elements represent opportunities for EU and African partners, including but not limited to universities, educational institutions, and public and private sector organisations, to share knowledge, experience and practical learning.

OPEN INTERNET ECONOMY, TRADE, INNOVATION AND STARTUPS

Africa's growing internet economy is home to an increasing number of dynamic e-commerce businesses that commercialise new ideas, adapt their offer to the challenges of the African markets and lay the foundations for a viable Africa-driven Open Internet economy. The African Continental Free Trade Area (AfCFTA), once realised, is expected

to come with a tremendous opportunity for local e-businesses to market and trade across the continent. Investment in Africa's digital start-up ecosystem has grown significantly, up to sixfold over the past five years, however, overall investment in research and development is only a quarter of the global average.[7]

The Open Internet provides a space for innovation and entrepreneurship, where a mix of creativity, skills, availability of funding and access to an online marketplace creates a dynamic digital startup ecosystem. Each of these elements provides opportunities for EU-Africa partnerships. Africa-driven digital platforms that tailor their offer and operation to local demand and environment stand a better chance of effectively competing with global players. Partnerships between fintech entrepreneurs within Africa and between African and EU players should be encouraged. At the same time, opportunities for longer term support that allows successful ideas to scale up should be explored. The establishment of African tech entrepreneur networks and associations should be stimulated, as well as cooperation with their European counterparts. Digital innovation hubs and tech labs play a vital role in supporting entrepreneurs and small businesses as they provide safe spaces for them to launch new ideas, scale their companies, and network. However, many hubs depend on external funding from international donor partners and would benefit from partnerships and cooperation with European hubs and startup initiatives.

PARTICIPATION IN OPEN INTERNET GOVERNANCE

Participating in global internet governance discussions can be challenging for African stakeholders. They do participate in the Internet Governance Forum (IGF), the Internet Corporation for Assigned Names and Numbers (ICANN) community, the Internet Engineering Task Force (IETF) and other global forums, but this participation needs to be strengthened to become a more influential instrument for African voices to be heard. African governments are relatively active in multilateral institutions with indirect involvement in internet governance, such as the International Telecommunication Union (ITU). However, what is often lacking is national multistakeholder engagement at a level capable of formulating positions or reporting back on outcomes. Multistakeholder internet dialogues at the regional, sub-regional or national level have shown real impact. To date, 31 national IGF initiatives and 4 African sub-regional IGFs are acknowledged on the IGF website.[8] They are an opportunity for stakeholders and governments to engage in dialogues on issues of common concern. There is also vibrant African participation in IGF youth initiatives and national and sub-regional Schools of Internet Governance (SIGs), often linked to national and sub-regional Internet Governance Forums (NRIs). The African School on Internet Governance (AfriSIG) has become a respected international SIG and leadership development event targeting middle and senior management from all stakeholder groups, with more than 400 participants in its 10 years' existence remaining part of an active and supportive AfriSIG alumni network.

The European Union (European Commission, European External Action Service, EU Member States) is actively contributing to Internet Governance institutions and involved in promoting and contributing to the improvement of the overall multistakeholder model. Even so, the need for a more robust and inclusive Internet Governance ecosystem should nonetheless continue to ensure 'the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the internet.'[9] In this sense, a partnership between the EU and Africa could be based on a common vision for a strengthened multistakeholder model, which allows for a more democratic and effective participation.

7 Tech Start-ups Key to Africa's Digital Transformation but Urgently Need Investment, World Economic Forum, 20 January 2022.
8 The IGF Secretariat maintains a list of National and Regional IGF Initiatives, https://www.intgovforum.org/en/content/igf-regional-and-ional-initiatives
9 World Summit on the Information Society internet governance definition. See ITU. 2005.

CONCLUDING REMARKS

While digitisation is an unstoppable process, the Open Internet is not and should not be taken for granted by governments and policymakers. In Africa, digital infrastructure has grown dramatically in the last decade, and one third of Africa's population has access to the Open Internet. Digital regulations and skills are developing, the digital economy is booming especially in some countries, and a growing participation in internet governance is shaping the internet according also to Africa's interests. Yet, this is clearly not enough as Africa shows considerable gaps in these areas, starting with infrastructure and a 'usage' gap – people who have access to the internet but do not use it.

In this context, renewed and strengthened EU-African digital partnerships, under the umbrella of the Global Gateway strategy, should make sure that the next push towards national digital transitions actively opts-in for comprehensive Open Internet approaches. This is the most effective way of fully harnessing digital technologies' potential for growth, development, democratisation and local empowerment. These approaches should start with practical support for the Open Internet's technical architecture but continue with developing digital regulations that respect human rights and Open Internet principles, creating Open Internet markets that stimulate local entrepreneurs, training skills that truly develop socio-economic and political online participation, and bringing more diversity and inclusion to internet governance.

1. The Open Internet and the Global Gateway

1.1 THE GLOBAL GATEWAY AND THE EU-AFRICA PARTNERSHIP POTENTIAL

The European Union's Global Gateway[1] initiative, presented in December 2021, sets the deployment of 'digital networks and infrastructure' as a key international investment priority. In the Global Gateway Joint Communication, the European Commission and the High Representative of the Union for Foreign Affairs and Security Policy stated that investment in digital infrastructure "will also be linked with standards and protocols that support network security and resilience, interoperability, and an open, plural and secure internet. The EU will also promote access to the Open Internet, given its role as a key driver of innovation, socio-political, economic, and cultural development."[2] This represents a strong commitment from the EU to leverage the role of the Open Internet in supporting sustainable development, intrinsically linking international digitisation partnerships, including with Africa, to the promotion and development of the Open Internet.

BOX 1.1

➜ THE GLOBAL GATEWAY, EUROPE'S OFFER FOR CONNECTING THE WORLD THROUGH INVESTMENTS AND PARTNERSHIPS

The Global Gateway will mobilise up to €300 billion by 2027 for developing global infrastructure and supporting the green and digital transitions around the world with investments in five priority areas: Digital, Climate and Energy, Transport, Health, Education and Research. Europe's approach is based on linking partners rather than creating dependencies.

Partnerships will be based on six principles[3]: democratic values and high standards, good governance and transparency, equal partnerships, green and clean, security focused and catalysing private spearheads:

- deploy digital networks and infrastructure
- support network security, interoperability, and an open, plural and secure internet

1 https://ec.europa.eu/info/strategy/priorities-2019-2024/stronger-europe-world/global-gateway_en

2 European Commission. 2021. "Joint Communication to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, The Global Gateway". p. 4.

3 https://ec.europa.eu/info/strategy/priorities-2019-2024/stronger-europe-world/global-gateway_en

- country-level assistance to empower local regulatory models of open and competitive markets for communication networsk and services

Global Gateway on the ground: An EU-Africa Global Gateway Digital transition package 2021-2024[4] was announced in the context of the 6th EU-AU Summit, setting ambitious targets to be achieved by 2030 to accelerate universal access to reliable internet networks safely and securely wherever they live. Team Europe Initiatives will secure digital connectivity between Europe and Africa and reinforce interconnections within Africa, including:

- the EurAfrica Gateway Cable
- building inter-regional optical fibre connections across Africa
- the African European Digital Innovation Bridge
- a satellite-based connectivity across Africa

This report will discuss the Open Internet as a prerequisite for digital inclusion and locally driven socio-economic growth in Africa. It is part of an overarching EU-funded project for the promotion and development of the Open Internet in Africa. The report explores the potential of EU-Africa partnerships to contribute to empowering local African communities to fully reap the benefits of the Open Internet.

1.2 THE OPEN INTERNET AS A DRIVER OF GROWTH AND SUSTAINABLE DEVELOPMENT IN AFRICA

The Open Internet is widely recognised as a catalyst for social, economic, political and cultural development. Its open architecture and globally accepted, consensus-driven technical standards ensure the security and resilience of the global network and further promote innovation and collaboration between different stakeholders. This, in turn, supports locally driven socioeconomic development.[5] 'Africa and Europe both have much to gain from nurturing each other's growth and prosperity. Digital development is not merely the foundation on which that prosperity will be built, it will serve as an engine that powers rapid and ongoing social and economic transformation.'[6]

Africa's digital development in the last decade has exceeded that of any other region.[7] Economic forecasts suggest that targeted investment in digital infrastructure, enabling policy and regulatory environments, human capacity development, entrepreneurship and innovation can propel Africa towards resilience and prosperity and help achieve the Sustainable Development Goals (SDGs).[8] These goals, defined in the 2030 Agenda for Sustainable Development,[9] adopted by the United Nations General Assembly in 2015, are strongly endorsed by the European Union[10] and link to the goals in the African Union's "Agenda 2063: The Africa we want".[11] Box 1.2 shows examples of how the Open Internet can contribute to achieving the SDGs.

4 https://ec.europa.eu/info/strategy/priorities-2019-2024/stronger-europe-world/global-gateway/eu-africa-global-gateway-investment-package_en#documents
5 OECD. 2014. "OECD Principles for Internet Policy Making".
6 Bogdan-Martin, Doreen, Director, ITU Telecommunication Development Bureau, at a side-event to the European Union-African Union Summit 17 February 202
7 Stuart John. 2022. "Digital Development in Africa – What is Working and What Isn't". Trade Law Centre NPC (blog). 27 February.
8 https://sdgs.un.org/goals
9 United Nations General Assembly. 2015. "A/RES/70/1 – Transforming our world: the 2030 Agenda for Sustainable Development". 25 September.
10 European Commission. 2021. "Joint Communication to the European Parliament and the Council on strengthening the EU's contribution to rules-based multilateralism". 17 November.
11 https://au.int/agenda2063/sdgs

BOX 1.2

➜ HOW DIGITAL TECHNOLOGIES CAN CONTRIBUTE TO THE FULFILMENT OF EVERY SDG[12]:

- **SDG 1:** No poverty. Access to appropriate new technology and financial services, including microfinance (1.4); digital financial services to achieve financial inclusion and digital public services to support social protection systems (1.3); internet-enabled mobilisation of resources and development cooperation (1b)
- **SDG 2:** Zero hunger. Knowledge, market opportunities and financial services can increase agricultural productivity and incomes of small-scale food producers. Data-driven and efficient agricultural practices can help farmers increase crop yields while reducing their use of energy (2.3 and 2.4).
- **SDG 3:** Good health and well-being. Universal access to sexual and reproductive healthcare services, including for family planning, information, and education (3.7)
- **SDG 4:** Quality education. Increased access to education for people in rural areas and availability of educational material and resources for people of all ages (all targets)
- **SDG 5:** Gender equality. The Open Internet enables women's participation in public life (5.5) and access to information about reproductive health and rights (5.6) and, along with other enabling technologies, promotes the empowerment of women (5b).
- **SDG 6:** Clean water and sanitation. Collaborative and integrated water resources management at all levels, including through transboundary cooperation (6.5)
- **SDG 7:** Affordable and clean energy. Enhance international cooperation to facilitate access to clean energy research and technology (7a)
- **SDG 8:** Decent work and economic growth. Higher levels of economic productivity through diversification, technological upgrading and innovation (8.2); youth employment (8b)
- **SDG 9:** Improved infrastructure: Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder, to support economic development and human well-being (9.1); enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, and encourage innovation (9.5); significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020 (9.c)
- **SDG 10:** Reduced inequalities. Open Internet enabled political inclusion – e-democracy (2.2)
- **SDG 11:** Sustainable cities and communities. Open Internet supported integrated policies and plans towards inclusion, resource efficiency, and climate change mitigation and adaptation (11b)
- **SDG 12:** Sustainable consumption and production. Ensure that people everywhere have the relevant information and awareness on sustainable development and lifestyles in harmony with nature (12.8)
- **SDG 13:** Climate change action. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (13.3);
- support effective climate change-related planning and management in least developed countries and small island developing states (13b)
- **SDG 14:** Conserve and sustainably use the oceans. Open Internet supported regulation of harvesting to end overfishing, illegal, unreported and unregulated fishing, and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible (14.4)
- **SDG 15:** Protect, restore and promote sustainable use of terrestrial ecosystems. Enhance efforts, through Open Internet information sharing, to combat poaching and trafficking of protected species (15.c)
- **SDG 16:** Peace, justice, and effective, accountable institutions. An Open Internet contributes to the promotion of the rule of law at the national and international levels and ensure equal access

12 Developed by the authors from https://sdgs.un.org. A useful resource on the internet and the SDGs is the ITU's WSIS-SDG matrix, last updated in 2021: https://www.itu.int/net4/wsis/sdg/.

to justice for all (16.3). It supports the development of effective, accountable and transparent institutions at all levels (16.6) and is designed to ensure public access to information and to help protect fundamental freedoms (16.10).

- **SDG 17:** Strengthen the means of implementation and global partnership for sustainable development. The Open Internet is an enabler of international cooperation on and access to science, technology and innovation, and a facilitator of enhanced knowledge sharing (17.6).

With close to 5 billion people connected to it, and a myriad of applications and uses, the internet evolved far beyond what was imagined at the time it was first developed. The recent global health crisis demonstrated the value of e-learning, e-health, e-meetings and of people connecting to stay in touch with family and friends. Its existing and potential value derives to a great extent from the "openness" embedded in its architecture. This begins with how its most basic building blocks – standards and protocols – are developed: in an open way 'allowing anyone to contribute, while making choices in a meritocratic way'. The 'products' of this open process – the architecture, standards, protocols and code – are in turn open to be used by all, typically without the need to pay royalties.[13] This has allowed the Open Internet to grow into the vast, global, interactive and empowering system of communication and information sharing that it is today.

1.3 CONCEPTUALISING THE OPEN INTERNET

'Open Internet' is a concept that conveys the idea of an internet that is inclusive, interoperable, and enables competition, innovation, development and human rights.[14] A 2016 report by the Organisation for Economic Co-operation and Development (OECD) described four main dimensions of internet openness – technical openness, economic openness, social openness and additional or cross-cutting elements of openness.[15] Each dimension includes further components, such as interoperability and accessibility in the case of technical openness, regulatory transparency in the case of economic openness, or the protection of human rights and fundamental freedoms in the case of social openness (see Box 1.3).

BOX 1.3

➜ ELEMENTS OF INTERNET OPENNESS

Source: OECD, "Economic and Social Benefits of Internet Openness" (2016)

Technical openness: Technical openness is at the heart of the internet's architecture as we know it today and responsible for the resilience and interoperability that enabled its rapid development and global reach. It includes the development and use of open standards and protocols, the end-to-end principle and uniform conventions for domain names.

The stable building blocks at the foundation of the internet's technical openness are the open standards and protocols developed over years of open discussions at the Internet Engineering Task Force (IETF). The result is an internet architecture that is interoperable and 'open to be used by all,

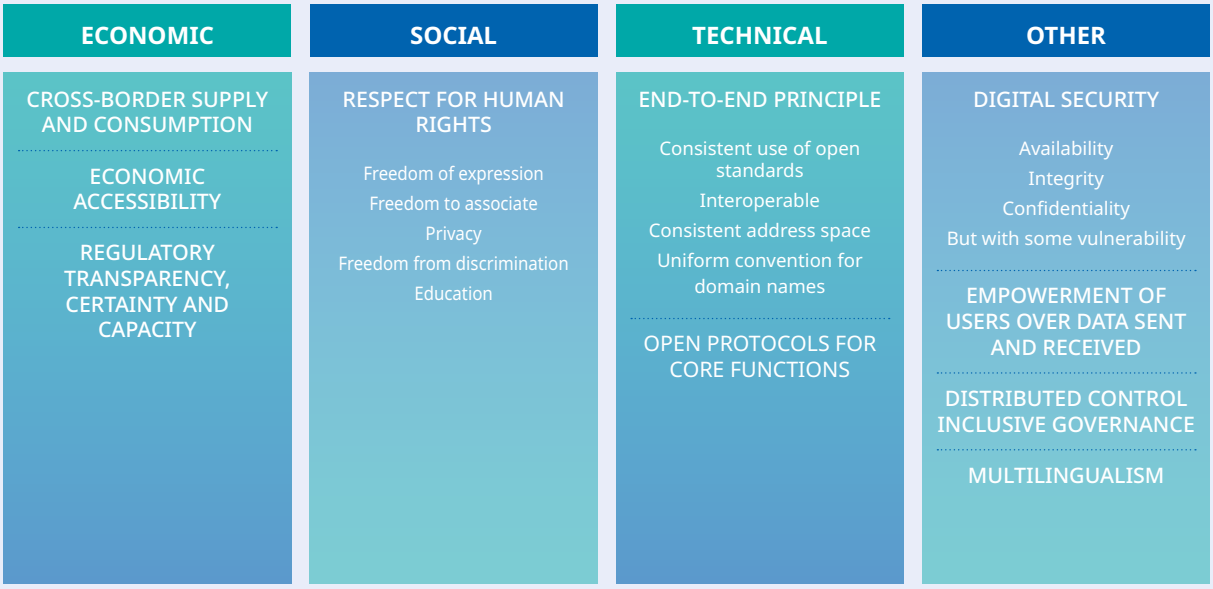
13 Kende M. Kvalbein A. Allford J. Abecassis D. 2021. "Study on the Internet's Technical Success Factors". Analysys Mason. December 2021. p.9.
14 OECD. 2016. "Economic and Social Benefits of Internet Openness". p.8.
15 Ibid. p.15-16, and "Annex B: Elements of Internet Openness". p.64-68.

typically without the need to pay any royalties.[16] This open model allows the internet to continue to evolve and to address new challenges, accommodate innovation and adapt to new usages. Economic openness involves being able to access the internet and use it to enhance economic opportunities, including on a cross-border basis. It requires pro-competitive and transparent regulation. As pointed out by the OECD, economic openness varies. It increases as internet penetration and broadband infrastructure grow but decreases when the lack of competition between access providers results in higher prices or poorer services.[17]

Social openness is provided by an approach to the internet that enables civil and political (such as freedom of expression and the right to privacy) as well as social and economic (such as the right to education and health) human rights. Social openness of the internet grows through people creating and accessing content in their own languages and when they use the internet to preserve cultural heritage and diversity. The protection, promotion, and enjoyment of all human rights are closely connected to the internet's social openness. Human rights, including freedom of opinion and expression, freedom to associate, privacy and the right to education apply online just as they do offline. Freedom of opinion and expression, for example, includes the right to hold opinions without interference and the right to seek, receive, and impart information and ideas through any media and regardless of frontiers.

Other elements of openness[18] do not fit neatly within the categories of technical, economic or social openness because of their specific nature or because they cut across some or all categories. They include digital security,[19] multilingualism, user empowerment over the use of their personal data and being able to control the information they receive online, inclusive governance shaping the way the internet is used and evolves, and the distributed control and coordination of the different components that make the internet work.

Elements of internet openness



16 Kende e.a. 2021. p.9.
17 OECD. 2016. p.16.
18 OECD. 2016. p.67-68.
19 Digital security has three main components:
- Availability: the accessibility and usability of data upon demand by an authorised entity
- Integrity: the protection of data quality in terms of accuracy and completeness
- Confidentiality: the prevention of data disclosure to unauthorised individuals, entities or persons

While all dimensions are profoundly interconnected, technical openness, the least visible of the elements, is especially relevant, as the technical architecture of the internet can have structural effects on all the other elements. The Open Internet architecture based on open standards and its uniform Domain Name System (DNS)[20] underpins the global, interactive system at the core of the Open Internet. Without technical openness, it is not possible to truly harness the potential of economic and social openness. There is wide consensus that 'actions and inactions that restrict technical openness have the capability to weaken the Internet's security, flexibility and stability, and to curtail the economic and social benefits that it can bring.'[21]

BOX 1.4

➜ A WORKING DEFINITION OF INTERNET FRAGMENTATION[22]

'The Open Internet provides a baseline approach from which fragmentation departs and against which it can be assessed. Particularly important are the notions of global reach with integrity; a unified, global and properly governed root and naming/numbering system; interoperability; universal accessibility; the reusability of capabilities; and permissionless innovation.

Technical Fragmentation: conditions in the underlying infrastructure that impede the ability of systems to fully interoperate and exchange data packets and of the Internet to function consistently at all end points

Governmental Fragmentation: Government policies and actions that constrain or prevent certain uses of the Internet to create, distribute, or access information resources

Commercial Fragmentation: Business practices that constrain or prevent certain uses of the Internet to create, distribute, or access information resources.'

The importance of the Open Internet as a driving force for society has been acknowledged in different international fora and policies. In April 2022, several global partners,[23] including the EU and its Member States endorsed 'A Declaration for the Future of the Internet', where they share a common vision for an internet that is open, free, global, interoperable, reliable and secure (see Box 1.4). The elements underlying the Open Internet have been recognised and endorsed by many stakeholders,[24] including African and European ones. For example, the EU in its Global Gateway programme explicitly promotes access to the Open Internet as a key driver of innovation and social, political, economic and cultural development.[25] African leaders have also endorsed a vision of an Open Internet as a driver for development. In February 2017, African ICT ministers committed to working together to develop 'an accessible and affordable internet, safe and reliable, so that internet remains a stable, resilient and trustworthy space, bearing a message of peace and promoting the peaceful use of internet'.[26]

20 See Section 2.2 for an explanation of internet standards and the Domain Name System (DNS).
21 OECD. 2016. p.8.
22 Drake W. Cerf V. Kleinwächter W. 2016. "Future of the Internet Initiative White Paper, Internet Fragmentation: An Overview". World Economic Forum. January. p.3-4.
23 European Commission. 2022. "EU and international partners put forward a Declaration for the Future of the Internet". Press release. 28 April.
24 Ibid.
25 European Commission. 2021. Global Gateway Communication.
26 African Union. 2017. "African Declaration on Internet Governance". 13 February.

BOX 1.5

➜ A DECLARATION FOR THE FUTURE OF THE INTERNET[27]

KEY PRINCIPLES:

Protection of Human Rights and Fundamental Freedoms in the online environment

- Protect human rights and the principles of the rule of law including effective remedies.
- Promote online safety and combat violence online.
- Reduce illegal and harmful content and online activities while promoting the right to freedom of expression.
- Oppose abuse of internet or algorithms for unlawful surveillance or oppression.
- Refrain from government-imposed internet shutdowns or degradation of internet access to lawful content and services.

A Global Internet

- Promote benefits of data flows based on shared values and trust.
- Promote cooperation in research and innovation on security threats and responsible state behaviour in cyberspace.

Inclusive and Affordable Access to the Internet

- Promote affordable, inclusive and reliable access to the internet for everyone.
- Support digital literacy skills.
- Foster greater exposure to diverse cultural and multilingual content and bolster resilience to disinformation and misinformation.

Trust in the Digital Ecosystem

- Work together to combat cybercrime and deter malicious cyber activity.
- Promote and use trustworthy network infrastructure and service suppliers.
- Base government access to personal data according to existing laws and respect for human rights.
- Refrain from using the internet to undermine voting systems, elections and political processes.
- Protect individuals' privacy and their personal data.
- Support a rules-based global digital economy fostering fair online markets.
- Promote online protection of consumers, in particular vulnerable consumers.
- Maximise the enabling effects of technology for combatting climate change and protecting the environment.

Multi-stakeholder Internet Governance

- Protect and strengthen the multistakeholder system of internet governance (i.e. United Nations, World Trade Organisation, G7, G20, etc.).
- Protect the technical infrastructure essential to the general availability and integrity of the internet.

27 On 28 April 2022, the EU, the US and several international partners proposed "a Declaration for the Future of the Internet", setting out the vision and principles of a trusted Internet. At the time of its announcement, 60 partners had endorsed the Declaration, including all EU Member States, other partners expected to follow suit in due course. The declaration is available at https://ec.europa.eu/newsroom/dae/redirection/document/86262. The list of signatories is available at https://digital-strategy.ec.europa.eu/en/library/declaration-future-internet.

2. Open Internet architecture and its governance model

The openness of the internet mostly stems from its technical architecture. The characteristics of this architecture, how it was built and maintained, and the open processes that guarantee its future development, are inextricably linked to the other dimensions of internet openness, and ultimately to maximising its potential as an enabling technology for growth, socio-economic development and prosperity. Section 2 of the report provides a basic overview of this architecture and how it is governed. This section also addresses existing challenges to the Open Internet model.

2.1 THE EVOLVING ARCHITECTURE OF THE OPEN INTERNET

The internet is constructed as one global network of individual interconnected networks that exchange data and information. There is no centralised authority that grants permission before a new network can join. Individual networks arrange their own "internetworking" to exchange traffic,[28] while they remain free to adapt the internal functioning of their network independently. The only requirement to be part of the internet is that networks connect and deliver communication to each other according to the commonly agreed way, the Internet Protocol (IP). A transport protocol is used in combination with IP to process and handle the data packets, most commonly the Transmission Control Protocol (TCP), and therefore the internet model is often referred to as TCP/IP model.

The Open Internet is a decentralised 'network of networks'. Local ecosystems do not depend on external decisions to be allowed to connect to the internet, and new networks can be deployed and connected based on local needs. Local ecosystems remain in charge of the internal organisation of their network, and local innovators, businesses and populations can adapt how they use the internet and reap the benefits of being connected to the information and opportunities of the global network.

In addition, the Open Internet's architecture allows for open innovation. The 'end-to-end' principle (briefly explained in Box 2.1) allows anyone to develop new applications and make them available on the internet. As such, how we use the internet can continuously evolve and be freely adapted, without having to change or upgrade the core architecture.

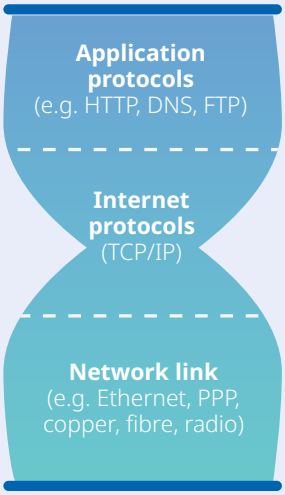
These key principles make the Open Internet a driver for growth available to local communities everywhere, provided they have the necessary access, capabilities and skills.

28 Networks can optimise how their internet connection works in function of, for example, the desired price, services available, connection bandwidth, reliability and quality. This allows the internet to be more agile, scalable and adaptable to the needs of its users.

BOX 2.1

➜ THE OPEN INTERNET ARCHITECTURE

The Open Internet is one of the most successful infrastructure systems of any kind ever developed. Within the timespan of a few decades, the internet has grown to 5 billion users today across all geographies and is at the centre of a process of digitalisation that is transforming the workplace, social and political processes, business and trade as well as people's personal lives.[29] Yet the internet has proven capable of accommodating growth, developments and innovations, largely thanks to early stage decisions on the design and structure of the internet architecture.[30]



The Internet architecture[31] is made up of separate but interconnected layers of technology, each of which does a different job.[32] At the top sits the visible functional part of the internet, **the application layer**. This contains application protocols used by programs to conduct different tasks, for example, for turning online data into videos and email or for controlling what gets onto social media feeds.

At the bottom is the layer which carries the internet traffic (copper, fibre, wireless, radio, etc.), the **physical layer**.[33] What happens in the physical layer, e.g. transmitting data over the fibre network, is controlled by network link protocols.

In the middle sits the **internet layer**, with internet protocols that make sure that data transported across the internet gets to the right place and can be understood when arrived. This layering principle separates the applications from the underlying network, with the Internet Protocol (IP) as the building block in between. A key benefit of such an arrangement is that evolutions can occur in some parts of the internet without affecting others.[34] [35]

Protocols, as it were, are small modular building blocks. The protocols in the different layers each perform a limited and simple task, for example, sending data between devices on the same network (Ethernet), or formatting data for websites and applications (HTTP).[36] These blocks can be selected and assembled in different ways, stacked or side by side in layers, to solve more complex tasks.[37] [38]

The **Internet Protocol (IP)** is the central, stable building block in the internet's architecture. Data traversing the internet is divided into smaller pieces called packets. IP information, conveying the address of

29 Esterhuysen A. Degezelle W. 2021. "When Internet Governance meets Digital Cooperation: Navigating IGF Growth and Development in the Context of an Evolving Internet Governance Ecosystem" Cyberstability Paper Series. Global Commission on the Stability of Cyberspace. December 2021. p. 61.

30 Kende e.a. 2021. p.7.

31 The hourglass depiction of the Internet Protocol suite is an adaptation by Analysys Mason of similar presentations by ResearchGate and IAB, and was included in Kende e.a. 2021. p.14.

32 For didactic purposes, we differentiate between three layers: application layer, internet layer and physical layer. Other models are more refined, for example, the 7-layered OSI model. For a description, see https://www.cloudflare.com/en-gb/learning/ddos/glossary/open-systems-interconnection-model-osi/.

33 The Internet Protocols' flexibility allows for the internet to be run over a wide range of underlying networks, most existing physical communication networks, including traditional copper telephone networks, coaxial cable TV networks, cellular mobile networks, various wireless radio networks and satellite networks.

34 Smith J. Cummins C. Krasodomski-Jones A. 2021. "Good Foundations. Why Democracies should care about the wiring of the Internet". DEMOS. March 2021. p.6.

35 Kende e.a. 2021. p.14.

36 Examples of protocols are Hypertext Transfer Protocol (HTTP) for transmitting hypermedia documents, File Transfer Protocol (FTP) for the transfer of computer files, Transport Layer Security (TLS) to facilitate privacy and data security, and Internet Protocol (IP) for routing and addressing packets of data so that they can travel over the internet and arrive at the correct destination.

37 https://www.cloudflare.com/learning/network-layer/how-does-the-internet-work/

38 Kende e.a. 2021. p.9.

the source and destination, is attached to each packet of data so that it can travel across networks and arrive at the correct destination. The IP defines how to format a packet and its address space. A transport protocol is then used in combination with IP to process and handle the data packets. The Transmission Control Protocol (TCP) is one of the most commonly used, which is why the internet model is often referred to as TCP/IP model.[39] [40] The only requirement for an individual network to be part of the internet is that it delivers communication to the networks it interconnects with according to the commonly agreed way, or more concretely, that it delivers IP packets at the interfaces with other networks.

Another important feature of the Open Internet architecture is the **end-to-end principle**, where the role of the network equipment (e.g. routers) is limited, and more complex tasks are performed in devices at the edge of the network. As a result, new applications can be installed in the end systems without requiring new software or other changes in the networks. This further facilitates innovation at the edges without requiring changes to the networks, which lowers the barrier for local innovators and entrepreneurs to develop and connect new applications.[41]

The operation of the Open Internet further relies on a stable **system of unique identifiers**, of which the most important are: the autonomous system numbers (AS)[42] – to identify networks on the internet, the IP addresses[43] – numeric addresses to identify devices attached to the internet, and the domain name system (DNS)[44] – to allow the use of easy-to-remember domain names that map to the complex IP addresses.

2.2 THE DEVELOPMENT OF STANDARDS AND PROTOCOLS FOR THE OPEN INTERNET

The development of the Open Internet's key building blocks, protocols and standards, is open and transparent. This governance model allows for continuous incremental improvement that enhances security, resilience, performance and interoperability. Innovation is accommodated without changing the core architecture.

In a network context, protocols and standards can be defined as:
Protocol: (set of) concrete rule(s) for formatting and processing data to perform a specific task.
Standard: a commonly accepted (formal or informal)[45] benchmark that provides technical specifications or defines processes.[46] Many protocols have become standards.

Standards create compatibility and interoperability by defining a common language that ensures that devices and applications can exchange data. They also help ensure quality, transparency and security. This "common language" is most valuable when it is developed and accepted at the international level. Standard developing organisations (SDOs) for digital technologies form a diverse ecosystem,[47] with different organisations and fora dedicated to different technologies or aspects of these technologies.

39 https://www.cloudflare.com/en-gb/learning/network-layer/internet-protocol/
40 Kende e.a. 2021. p.14.
41 Internet Society. 2020. "The Internet Way of Networking: Defining the critical properties of the internet". September. p.6.
42 https://www.icann.org/en/icann-acronyms-and-terms/autonomous-system-number-en
43 https://www.icann.org/en/icann-acronyms-and-terms/internet-protocol-address-en
44 https://www.cloudflare.com/en-gb/learning/dns/glossary/what-is-a-domain-name/
45 Informal or de facto, because of their widespread acceptance and use; formal or de jure, because they have been approved or recognised by a standard development organisation (SDO).
46 Teleanu S. 2021. "The geopolitics of digital standards: China's role in standard-setting organisations". DiploFoundation, Geneva Internet Platform and Multilateral Dialogue, Konrad Adenauer Foundation. December. p. 9.
47 Ranging from formal and quasi-formal standard developing organisations (SDOs) to various industry forums and consortia.

There is a wide consensus on the division of tasks of these SDOs. This consensus allows the Open Internet architecture to continue evolving and meeting current and future challenges. **Technical standards for the internet** are developed by the Internet Engineering Task Force (IETF)[48]; **standards for the World Wide Web**[49] such as HTML, XHTML, CSS, XML are developed by the World Wide Web Consortium (W3C)[50]; **industry standards for products and services in a broad range of technologies** are developed by the Institute of Electrical and Electronic Engineers Standards Association (IEEE SA)[51]; **technical standards for information and communication technologies** are developed by the Telecommunication Standardization Sector of the International Telecommunications Union (ITU-T)[52]; **technical standards for spectrum/ orbit resource and radio systems** are developed by the ITU Radiocommunication sector (ITU-R)[53]; **technical standards for cellular (mobile) telecommunication technologies** are developed by the 3rd Generation Partnership Project (3GPP)[54]; **standards for electrical, electronic and related technologies** are developed by the International Electrotechnical Commission (IEC)[55]; and the International Standards Organisation (ISO)[56] is known for its **product standards, standards for test methods, codes of practice, guideline standards and management systems standards**, and many more.

Ignoring the specialisation and division of tasks between SDOs may create competing standard developing processes that will waste resources and put at risk the interoperability between technologies. For the internet, duplicating the work done on internet standards at the IETF may lead to fragmenting the internet and undermining its stability and interoperability.

▶ INTERNET STANDARDS DEVELOPMENT AT THE INTERNET ENGINEERING TASK FORCE

Text contributed by the Internet Engineering Task Force (IETF)

Internet technical standards are notable for the open processes by which they are developed, their establishment based on technical merit, their global availability to implement, and their deployment on a voluntary basis. The Internet Engineering Task Force (IETF) is the premiere technical standards organisation responsible for core standards used for the global internet. With participation open to any interested individual, the international IETF community includes thousands of network designers, operators, vendors, and researchers.

IETF standard-setting activities are generally conducted in working groups via public email lists and meetings that include full online participation options. Records of working group discussions and decisions are freely available. Before being finalised, proposed IETF standards are subject to broad technical expert review and typically reflect lessons from multiple initial implementation and deployment. The result is practical solutions to real-world issues and opportunities.

The IETF works on a broad range of networking technologies that provide the foundation for the internet's growth and evolution. Work within the IETF is generally organised by technical areas.

48 https://www.ietf.org
49 While often used as synonyms in colloquial language, the WWW (a service on the internet) should not be confused with the internet (the network of networks). A definition of the WWW at https://www.britannica.com/topic/World-Wide-Web
50 https://www.w3.org
51 https://standards.ieee.org
52 https://www.itu.int/en/ITU-T
53 https://www.itu.int/en/ITU-R/information/Pages/default.aspx
54 https://www.3gpp.org
55 https://iec.ch
56 https://www.iso.org

››› Examples of IETF work encompasses innovations such as:

The Internet of Things: The Internet of Things is the network of physical objects or «things» embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the manufacturer, operator and/or other connected devices.[57] Security & privacy: Trust by users in security and privacy on the internet is a critical part of its success. A range of components, including the TLS protocol that provides the foundations for security in the modern internet, robust implementations, careful deployment, and appropriate use of security technologies, is required to create a trusted internet.[58] Automated network management: As the individual networks that make up the internet become larger and more complex, IETF standards help make operating and managing them easier and more efficient.[59] New transport technology: The development of new transport technologies such as QUIC in the IETF provides capabilities that improve the ability of internet applications to send data over the internet.[60]

The different SDOs historically developed their structures, membership and decision-making processes to best fit their specialised subject matter. For example, companies for which the IEEE standards are relevant can become a (paying) IEEE SA corporate member,[61] ISO membership is open to national standards bodies, and ITU-T membership is in addition to the ITU member states open to participation from industry, academia and NGOs.[62]

The IETF embraces a governance structure that reflects the fundamental nature of the internet and functions in line with the fundamental idea that technical standards and internet operating procedures should be developed and asserted through open and transparent processes, with minimal barriers to participation or access to information.[63]

▶ CYBERSECURITY STANDARDS: SOCIO-ECONOMIC BENEFITS UNDERPINNED BY THE INTERNET'S SECURITY, STABILITY, AND PREDICTABILITY

Text contributed by the EU Cyber Diplomacy Initiative – EU Cyber Direct[64]

The transformational social and economic benefits of the internet and digitalization are fundamentally underpinned by the security, stability, and predictability of cyberspace. Building cyber capacity and strengthening global resilience are thus enablers of international development. The EU develops and promotes cybersecurity policies committed to sustaining the general availability or integrity of the public core of the Open Internet,[65] while focusing on building collective capabilities to respond to major cyberattacks and supporting partners around the world to ensure international security and stability.[66] Stakeholders, including members of the private sector, academia and civil society play essential roles in achieving these aims, as reflected in current multistakeholder internet governance processes.

57 https://www.ietf.org/topics/iot/
58 https://www.ietf.org/topics/security/
59 https://www.ietf.org/topics/netmgmt/
60 https://www.ietf.org/topics/transport/
61 IEEE SA also recognises individual members who cannot represent or act on behalf of an entity but can vote and take leadership positions in working groups.
62 Teleanu S. 2021. p.68.
63 ten Oever N. Moriarty K. (editors). 2018. "The Tao of IETF. A Novice's Guide to the Internet Engineering Task Force". Online version accessed February 2022.
64 The EU Cyber Direct – EU Cyber Diplomacy Initiative supports the European Union's cyber diplomacy and international digital engagements in order to strengthen rules-based order in cyberspace and build cyber resilient societies. To that aim, EU Cyber Direct conducts research, supports capacity building in partner countries and promotes multistakeholder cooperation. The project is funded by the EU's Instrument for Cooperation with Third Countries. https://eucyberdirect.eu
65 EU Cybersecurity Act, 2019. https://eur-lex.europa.eu/eli/reg/2019/881/oj
66 EU Cybersecurity Strategy, 2020. https://digital-strategy.ec.europa.eu/en/library/eus-cybersecurity-strategy-digital-decade-0

For decades, such processes have facilitated the uninterrupted functioning of the internet, as the resilience of cyberspace is dependent on the distribution of the global network and the multiplicity of routes available to avoid disruption or blockage of internet traffic.[67] The characteristics of interoperability, end-to-end connectivity and decentralization have been essential to the development of a global "inter-network" connecting heterogeneous networks and supporting a variety of applications and services. While the internet still faces complex cybersecurity threats and challenges,[68] proposed solutions have been addressed in current networking technologies, and there has been considerable and prolonged investment in strengthening security protocols in Standards Development Organisations (SDOs) like the European Telecommunications Standards Institute (ETSI), the World Wide Web Consortium (W3C), or the 3rd Generation Partnership Project (3GPP). The Internet Engineering Task Force (IETF) for example currently addresses security in specific protocols, such as BGP Security (BGPSEC), Domain Name System Security (DNSSEC), and Resource Public Key Infrastructure (RPKI), as well as by requiring a security consideration section in a 'Request for Comments' (RFC) process that considers new research and technological developments.[69]

The multistakeholder dynamic of the Open Internet ecosystem also contributes to the peace and security of cyberspace through the development and implementation of norms of responsible behaviour. Norms such as interstate cooperation and information sharing across stakeholders strengthen global resilience, and the EU has invested in cyber diplomacy and capacity building efforts with partner countries, including African countries, in order to build confidence and reduce conflicts and promote an open, safe and secure cyberspace.

2.3 EVOLVING WITHOUT REBUILDING: THE RESILIENCE OF THE OPEN INTERNET

The Open Internet has a record of accomplishments in coping with growth and accommodating innovation.[70] Its architecture is evolving to keep up with new demand and innovations, to face challenges and to prepare for yet to be specified requirements for future uses. It allows connecting networks to optimise and tailor technical practices to the needs of their local digital environment.[71] 'Open architectures and access layers help promote competition by creating opportunities for new market entrants and rapid innovation of features and functionality.'[72] An evolving and innovative regulatory framework can empower local decision-makers and communities to govern their local digital ecosystems and to create enabling environments to fully reap the socio-economic benefits of the Open Internet.[73]

This open architecture has been repeatedly discussed and questioned,[74] yet it has always emerged as the best design solution for a growing and changing internet. Research proposals that challenge fundamental technical practices and technologies are as old as the internet. Some

67 See for example Douzet et al. 2021. https://www.researchgate.net/publication/353956643_The_geopolitics_behind_the_routes_data_travel_a_case_study_of_Iran

68 e.g. accountability vs. privacy, confidentiality & integrity, availability (DDOS attacks), etc.

69 Sharp R. Kolkman O. 2020. "Discussion Paper: An Analysis of the "New IP" proposal to the ITU-T". Internet Society. 24 April.

70 The Internet's user base has grown from an estimated 2.6 million users in 1990 to 4.9 billion in 2021. The number of devices connected to IP networks, estimated at 18.4 billion in 2018, will have increased to 29.3 billion by 2023 or more than three times the world population. (ITU, Measuring digital development: Facts and figures 2021/ Cisco Annual Internet Report (2018-2023)).

71 See Box 2.1 on the Open Internet architecture.

72 Meinrath D. Losey J. Pickard W. 2011. "Digital Feudalism: Enclosures and Erasures from Digital Rights Management to the Digital Divide". Advances in Computers, Volume 81, January 2011, Pages 237-287.

73 See Section 3.2, The Open Internet, enabling policy and regulatory environments, and e-government.

74 For example, challenged by entirely new conceptions such as the NEBULA Future Internet Architecture, Plutarch, eXpressive Internet Architecture (XIA), ChoiceNet, the Recursive InterNetwork Architecture (RINA) and other proposals, as mentioned in McCauley J. Harchol Y. Panda A. Raghavan B. Shenker S. (2019) "Enabling a Permanent Revolution in Internet Architecture".

involve updates to current protocols, some of which have been implemented over the years and helped to build a growing, stronger, more resilient and secure Open Internet.[75] The practice and opportunity to discuss proposals openly and assess them critically based on their technical merit, as is done at the IETF, have contributed to the success and strength of the Open Internet.

However, when proposers of radical changes to the internet architecture bypass the Open Internet governance framework, they also bypass the critical examination based on technical validity, compatibility and potential impact for the stability and interoperability of the internet. The open processes to discuss new ideas will also assess the cost and dependencies proposed changes may create for local digital ecosystems. As a case in point, Section 2.3.1 takes a closer look at proposals to standardise new Internet Protocols that were tabled at the ITU in 2019. Similar concerns apply to unilateral attempts to intervene in the technical operation of parts of the internet, for example, via blocking, filtering or intervening in the Domain Name System to shut down, limit access or create some kind of 'sovereign internet'.[76] Apart from stability and security risks, there are concerns that such actions could change the open, global and interoperable internet into a splinternet.[77]

2.3.1 A recent case in point: proposals to standardise new Internet Protocols in the International Telecommunication Union

Addressing internet challenges in an atypical way by bypassing the Open Internet governance framework is problematic. As a case in point, this section takes a closer look at proposals to standardise new Internet Protocols that were tabled at the ITU-T's Telecommunication Standardization Advisory Group[78] in 2019, and related and modified proposals that emerged afterwards.

The proposals describe a series of desired features to respond to envisaged challenges with the internet architecture. The suggested solution is a new, more closed architecture based on an entirely new set of standards and protocols.[79] The 'New IP' proposals provoked immediate opposition from a wide range of stakeholders, including EU Member States and stakeholders,[80] and companies and organisations, including RIPE Network Coordination Centre (RIPE NCC),[81] the European Telecommunications Network Operator's Association (ETNO),[82] Mozilla[83] and others.

The concerns related to both the substance of the proposal and the choice of the competent bodies where the proposal was discussed. There was the general concern that the proposals were presented in the wrong international venue, the ITU, and not to the technical forum historically responsible for building and maintaining the internet architecture, the IETF. Moreover, the proposals were criticised for presenting a new architecture with promising features, but without providing sufficient technical specifications that would allow an evaluation based on technical

75 For example, HTTPS, IPv6, TLS1.3, HTTP/3.

76 For example, Russia's Sovereign Internet Law from 2019 centralises state network control so that a Russian internet could be cut of from the rest of the internet and allows the government to take actions like censoring sites or hobbling social networks as all internet service providers are obliged to channel traffic through state-controlled filters.
Shankland S. 2022. "Russia's Ukraine War Raises Specter of an Online Splinternet". CNET. 3 March.
Thornhill J. 2022. "Russia's digital iron curtain will fail". Financial Times. March 2022.

77 York D. 2022. "What Is The Splinternet And Why You Should Be Paying Attention" Internet Society blog. 23 March.

78 The New IP proposals (Telecommunication Sector Advisory Group (TSAG) contribution T17-TSAG-C83 [C83], September 2019) were unveiled in the context of the Network 2030 Focus Group of ITU-T Study Group 13, "Focus Group on Technologies for Network 2030" (https://www.itu.int/en/ITU- T/focusgroups/net2030/Pages/default.aspx)

79 This New IP, amongst others, is said to support the connection of heterogenous networks (called ManyNets), allow deterministic forwarding to guarantee latency, enhance security and trust, and support ultra-high throughput. With 'deterministic forwarding' the node that will forward a data package is predetermined. With the current 'opportunistic forwarding' this decision is made on the fly.

80 Voiced for example in the contribution SG13-C1069-R1, New IP, Future Vertical Communication Networks or similar proposals, Contribution from Austria, the Czech Republic, Denmark, Estonia, ETNO, European Union, Finland, France, Germany, Greece, GSMA, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, RIPE NCC, Romania, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom, for the 7 and 17 December 2020 meeting.

81 ITU-T TSAG. 2020. Contribution TSAG-C0135.

82 ETNO. 2020. "ETNO Position paper on the New IP proposal". 5 November.

83 Knodel M. West H. 2020. "Input on Proposals and Positions for the 2020 World Telecommunication Standardization Assembly". Center for Democracy & Technology and Mozilla. Letter to the US NTIA 20 June.

merit. In other words, it was impossible to assess the feasibility of what the proposals promised to achieve.[84] Proposers[85] failed to demonstrate that the challenges they claimed to solve could not be addressed within the current internet architecture and ignored ongoing work in that direction.[86] [87] Another missing element was an assessment of the interoperability of the proposed new architecture with today's global internet.[88] Critics accused the proposers of so-called 'forum shopping',[89] with similar ideas being presented in different fora, resulting in parallel discussions. They also argued that rather than addressing a real need for new technology, New IP aimed to alter the governance structure of the internet.[90]

Due to the unprecedented opposition, including from the EU and a broad range of its partners,[91] the proposals for a New IP submitted to the ITU-T were shelved. The main objections to the proposals were: the cost of developing and deploying a new infrastructure, the lurking dependencies and limitations for local ecosystems associated with a fragmented internet, the likely impact on digital investments in ecosystems that opt for an alternative closed internet, fears of enhancing monitoring and surveillance in ways that could further encroach on individuals' rights to privacy and freedom of association online, and fears that they 'could embed a system of centralised rule enforcement into the technical fabric of the internet'.[92]

THE COST OF NEW IP

Text contributed by Analysys Mason

A group of technology companies asked TMT experts at Analysys Mason to assess the potential benefits and costs of New IP, under different scenarios. A short summary of the Analysys Mason findings is included below.

New IP would need to clear a number of critical hurdles to outweigh the costs of developing, implementing and deploying an entirely new set of standards. Internet protocols have been developed and tested over the past 50 years with the input of thousands of participants; the cost of developing New IP to the stated requirements would be significant, before even the first deployment of New IP. Delivering the stated benefits might take 10 to 15 years, so New IP would, at a minimum, have to outclass future iterations of Internet protocols and standards over that period to justify its existence. The implementation in turn would have to meet exacting performance levels with little room for error in order to deliver the promised benefits to entice the first adopters of New IP.

If developed and implemented successfully, New IP would then have to be adopted and deployed by network operators and enterprises at scale, both to deliver benefits on a sufficient scale to outweigh

84 For example, "the definition and explanations of the concept of ManyNets (...) is not detailed enough to provide a clear understanding of what it entails." Durand A. 2020. "New IP". ICANN Office of the Chief Technology Officer. 27 October. p.25.

85 New IP was driven by Huawei and its subsidiary Futurewei.

86 This ignores and duplicates ongoing efforts as most of the technical challenges pinpointed in the New IP are being tackled already by several entities including IETF, IEEE, 3GPP and ITU-T's Study Group 15: Networks, Technologies and Infrastructures for Transport, Access and Home (ITU-T SG15), among others.

87 Sharp R. Kolkman O. 2020. p.11.

88 If the proposed solution would not be fully compatible with IP, it would have to be deployed in parallel with the existing IP-based internet, forcing the use ofgateways to connect. The introduction of these gateways would mean increased operating and capital costs and add complexity to network operations. The deployment would place a very high bar for adoption. Durand A. 2020. p.28.

89 Teleanu S. 2021. p.44.

90 Hogewoning M. 2020. "Do We Need a New IP?". RIPE blog, 22 April.

91 Voiced for example in the contribution SG13-C1069-R1, "New IP, Future Vertical Communication Networks or similar proposals".

92 Murgia M. Gross A. 2020. "Inside China's controversial mission to reinvent the internet'. Financial Times. 27 March.

the large fixed costs of its development, but also to deliver the benefits it promises. These primarily stem from better management of traffic across interconnecting networks, rather than inside a given network, which constrains the scale of the benefits within an individual network. At the same time, each single network or enterprise deploying New IP would have to incur costs including new end systems, networking equipment and training. To connect with networks that have not implemented New IP will require gateways along with additional training, and to connect with others who have adopted New IP will require dedicated connections or transit providers who have also installed New IP equipment. Potential cost savings from adopting New IP will be limited unless and until many large networks have transitioned to it, since most traffic will still require IP compatibility in the meantime.

The risk associated with moving to New IP would be significant, both from a financial and operational perspective. Given that there may be little scale in the design and manufacturing of early equipment, few applications available, limited network effects, and most organisations will already have an installed base of IP equipment, the benefits would have to be significant, with a high probability of being achieved, to justify the costs and risks. As a result, New IP would have to overcome a coordination challenge – individual enterprises would be reluctant to undergo the costs for the new systems and training on their own, but unless others are willing to undergo the cost, there would be no movement to adopt.

With no guaranteed level of deployment within large established networks, the hurdles to developing and implementing New IP seem insurmountable. To meet the desired requirements in new standards requires significant development efforts, with an opportunity cost of not working on improving the existing network; likewise, there is an opportunity cost of deploying the networks, particularly in emerging markets where resources are scarce. Even if New IP meets its requirements, effective deployments will be conditional on New IP representing enough of an improvement over what IP offers at that time, to justify the cost of implementation. If that cannot be guaranteed, the investments in developing and implementing New IP would be better made on existing IP protocols, and deployment efforts would be better spent on existing networks.

2.3.2 The flaws of closed models

Proposals that radically depart from the existing Open Internet architecture, like the New IP discussed above, have generated discussion but failed to gain broad community support. Reasons for this lack of support include:

THE ROBUSTNESS OF THE CURRENT OPEN INTERNET ARCHITECTURE

With the cumulative project of decades of investment in time and resources ensuring backward compatibility, the current internet protocols have been consistently tested and refined. Any new architecture that promises the same degree of robustness with new features, such as intrinsic security and performance guarantees, will take years to develop and may fall short given the complexity of the task. Also, while a new architecture is being explored, the development of current internet protocols will continue. As a result, one cannot be sure that any new architecture, by the time it is ready to be deployed, might not be trying to address issues that have already been solved.[93] The current Open Internet is a very robust infrastructure that allows for the connecting networks to select their own technical implementation (the network-of-networks principle) and can easily accommodate innovation and new applications without the need to adapt the core of the network (end-to-end principle). A novel architecture that aims to replace the Open Internet would need to adhere to the same characteristics.

93 Kende e.a.. 2021. p.54-55.

LACK OF ADEQUATE STANDARD SETTING

There is an international consensus that because of the internet's fast and continuously evolving development, standard setting needs to be dynamic and agile. Traditional governance and standard setting models are slow and not well suited for dealing with rapidly evolving technology. Proposals regarding the core internet protocols are historically discussed openly, based on their technical merit and demonstrated need,[94] and scrutinised through broad technical expert review at the IETF. This has allowed the core architecture of the internet to evolve incrementally, based on the experiences of many stakeholders, without endangering the stability of the global infrastructure. Presenting proposals for alternative internet architectures at the ITU breaks this international consensus and is unlikely to gain broad international support. Moreover, discussing proposals at different fora creates parallel discussions and increases the risk that objectives other than need, viability and technical merit of the proposal will weigh in on the discussion.

SECURITY CONCERNS

Decentralisation has so far proven to be one major resilient feature of the Open Internet. By contrast, closed models with a more centralised architecture are more vulnerable as they are more likely to contain single points of failure, and disruptions may result in major outages and damage. Closed models also open the door to and increase the potential impact of unwarranted surveillance by those in charge of the infrastructure.

▶ THE NEW IP PROPOSALS AND RELATED SECURITY CONCERNS

Text contributed by the EU Cyber Diplomacy Initiative – EU Cyber Direct

Although the current Transmission Control Protocol (TCP/IP) suite has demonstrated a high level of resilience, scalability and adaptability, enabling the growth of the global internet and online services, the New IP proposal highlighted 'the need to enhance security and trust and support intrinsic security'.[95] Despite the ongoing cybersecurity challenges associated with TCP/IP, the still-untested New IP poses several concerns, including the inherent security challenges of 'active networking'.[96]

The process of authenticating and authorizing new addresses and data packets proposed in the New IP results in a central point in the network that could effectively cut off communication to or from a particular address.[97] Forwarding and access to the network itself would therefore be controlled from centralised authorities with the power to block a particular data flow. Such centralisation weakens network resilience by creating single points of vulnerability - while potential disruptions are limited to endpoints in a traditional client-server model, active networks risk major outages and collateral damage.

Furthermore, the fragmentation it enables increases the risk of technological splintering, not only of networks, but also standards, architecture and protocols.[98] The ability to target isolated and locally controlled intranets has implications for offensive cyber capabilities, the securitisation and predictability of cyberspace. In addition to increasing the risk of conflict, the lack of interoperability across networks may undermine agreed-upon norms of responsible state behaviour, and the multilateral and multistakeholder processes in which they are developed.

94 Sharp R. Kolkman O. 2020.
95 Sharp R. Kolkman O. 2020.
96 Durand A. 2020.
97 Hoffmann S. Lazanski D. Taylor E. 2020. "Standardising the splinternet: how China's technical standards could fragment the internet". Journal of Cyber Policy. 5:2, 239-264.
98 Ibid.

DEVELOPMENT AND DEPLOYMENT COST

Closed models pose risks for the growth of the internet in general. This is especially true as regards mobilising its potential for growth and development in developing regions like Africa. A case in point is the cost of internet shutdowns, discussed in Section 4. One of the greatest challenges currently faced is expanding the human capacity needed to drive local internet-based innovation and security. Investing time and resources in reskilling the currently under-resourced skill base of the African internet sector (see Section 4) will set back African efforts to be part of the global internet economy.

The development and deployment of a new protocol system would be hugely expensive and could adversely impact existing networks in an unpredictable manner. Massive investment has been made to support and evolve the TCP/IP protocol system, improve interoperability and avoid non-interoperable networks. The effort of developing new and untested alternatives to the TCP/IP model would ultimately be a misallocation of human and financial resources that could be better used for the further development and deployment of the Open Internet, which has proven its efficacy.[99]

A recent study[100] commissioned by the Regional Internet Registries for Asia Pacific (APNIC) and Latin America and the Caribbean (LACNIC) points out that equipment used around the world is built to function with the core internet protocols. A new technology that is not backwards compatible or, in other words, cannot work with equipment already installed and used on a global scale, has 'a large (and likely insurmountable) disadvantage', as it would require existing equipment to be replaced or adapted. These costs will be even higher if there is no competitive ecosystem of equipment, applications and network operators.[101]

There is also a cost related to the risk of fragmentation and technical lock-in. 'Technical standards create markets. If standards are applied globally, they facilitate trade and fair competition; when incompatible standards are established in different parts of the world recipients rely on suppliers that produce according to technical standards established in their country.' This – especially if it also includes technical standards for critical infrastructure – can lead to technological lock-ins and political dependency.[102]

LOST INVESTMENTS

Damaging the international consensus around the Open Internet may delay or block the flow of international digital investments. A discourse on a potential new internet architecture could generate uncertainty across the industry and thus jeopardise investments. In that sense, an envisaged deployment of a new internet architecture would bring economic burdens particularly for developing countries alongside businesses and consumers.[103] Plans for the development of an alternative to the Open Internet, might lead to the halt of major investments in telecommunication infrastructure in a country. There is a risk that the new infrastructure would need to be replaced before being fully amortised, which would decrease the return on investment in the ICT sector and put at risk its sustainability.[104] Moreover, one could expect a decrease of interest in supporting and collaborating with local developers and tech startups if there is no long-term perspective.

99 Note that the development and deployment of any new internet protocol system would necessitate an 'expensive migration effort on top of the current migration to 5G, next-generation network, and IPv6.' For this reason, alongside the challenge of compatibility with the embedded base, governments should take into account the sunken cost and investment protection challenges. (Hoffmann et al., 2020)

100 Kende e.a.. 2021.

101 Kende e.a.. 2021. p.54-55.

102 Lozada P. Rühlig T. Toner H. 2021. "Chinese Involvement in International Technical Standards: A DigiChina Forum". DigiChina. Stanford University. 6 December.

103 Teleanu S. 2021. p.44. Reference to ITU-T TSAG. 2020. Contribution SG13-C1069-R1.

104 ETNO. 2020.

2.4 THE GOVERNANCE OF THE OPEN INTERNET

"Internet governance is the development and application by governments, the private sector, and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programs that shape the evolution and use of the internet." (Working definition of internet governance adopted by the World Summit on the Information Society (WSIS))[105]

The internet was created as an open tool for sharing data between academic institutions. Its administration and management were decentralised and of a collegial nature, inspired by its interoperability and distributed networking.[106] Data could be communicated across a diversity of networks by and to anyone connected to a computer without traditional barriers and control mechanisms.[107] The creation of the World Wide Web in the mid-1990s, followed by a growing exploitation of the internet for commercial purposes, highlighted the need for the global coordination of "internet addresses" or domain names. The Internet Corporation for Assigned Names and Numbers (ICANN) was established in 1998 as a non-governmental "private sector-led"[108] not-for-profit organisation to coordinate the Domain Name System (DNS).[109] The assumption at the time – and it still largely prevails – was that a traditional intergovernmental model would be too slow to keep up with a rapidly evolving technology.[110]

BOX 2.2

➜ THE INTERNET CORPORATION FOR ASSIGNED NAMES AND NUMBERS (ICANN)

ICANN helps coordinate the Internet Assigned Numbers Authority (IANA) functions, which are key technical services critical to the continued operations of the internet's underlying address book, the Domain Name System (DNS). IANA functions include: (1) the coordination of the assignment of technical protocol parameters, including the management of the address and routing parameter area (ARPA) top-level domain; (2) the administration of certain responsibilities associated with internet DNS root zone management, such as generic (gTLD) and country code (ccTLD) top-level domains; (3) the allocation of internet numbering resources; and (4) other services such as managing large international registries like the .int TLD and the time zone database, https://www.iana.org/time-zones.[111]

Before "names" came "numbers", the backbone of the internet addressing system. Regional Internet Registries (RIRs) were established in response to a 1992 Internet Engineering Task Force (IETF) recommendation that internet number resources be managed at regional level by 'subsidiary organisations'.[112] Five RIRs were established to undertake this role, in cooperation with IANA: AFRINIC, APNIC, ARIN, LACNIC, and RIPE NCC.

105 ITU. 2005. WSIS-05/TUNIS/DOC/6(Rev.1)-E. "Tunis Agenda for the Information Society". World Summit on the Information Society (WSIS). 18 November. p.6.
106 Its history is well documented by the internet pioneers who created and developed the technology: Leiner B. Cerf V. Clark D. Kahn R. Kleinrock L. Lynch D. Postel J. Roberts L. Wolff S. 1997. "Brief History of the Internet". Internet Society. 13 September.
107 John Berry Barlows's 1996 Declaration of Independence of Cyberspace is an example of the libertarian spirit prevailing in the early days of the internet. Barlow J.P. 1996. "A Declaration of Independence of Cyberspace". Electronic Frontier Foundation. 8 February.
108 Kornfeld D. Fisher W. 2001. "The Formation of ICANN" in Domain Names. The Berkman Center for Internet & Society. Harvard Law School. June 2001.
109 The Domain Name System (DNS) is the Internet's addressing system that maps domain names to numeric (IPv4) and alphanumeric (IPv6) IP addresses.
110 Kornfeld D. Fisher W. 2001.
111 https://www.icann.org/resources/pages/welcome-2012-02-25-en
112 APNIC. "History of the Internet".

THE REGIONAL INTERNET REGISTRIES

Text contributed by RIPE NCC

The five Regional Internet Registries are also part of a global, open, bottom-up governance system – one that has evolved over the past three decades to manage the registration and distribution of internet number resources (IP addresses and Autonomous System Numbers) in a rapidly maturing industry facing challenges of scalability and efficiency.

Within this system, regional communities made up of network operators, government representatives, user groups and many other stakeholders have been able to craft and agree on policies that suit their specific needs and circumstances, while maintaining the coordination that is fundamental to a global, interoperable network of networks.

In 1998, Member States of the International Telecommunication Union (ITU) proposed a World Summit on the Information Society (WSIS).[113] The UN General Assembly endorsed the proposal in 2001, and WSIS was held in two phases: Geneva in 2003 and Tunis in 2005. Governments, in particular from developing countries, in response to the increasing importance of the internet, challenged the existing internet governance arrangements and called for the UN to play a greater role.[114] [115] At the end of the first phase of the WSIS, a regionally diverse Working Group on Internet Governance (WGIG) was convened by the UN secretary-general to explore the way forward for a more inclusive approach to the governance of the internet. The Summit in Tunis in 2005 endorsed the multistakeholder approach to internet governance and confirmed that 'existing arrangements for internet governance have worked effectively'.[116]

The aforementioned working definition of internet governance developed by the WGIG that recognises the involvement of both government and non-governmental actors such as civil society, private sector, technical experts and academic researchers, was formally adopted. This definition made it clear that internet governance goes beyond the management of the underlying technical and logical infrastructure. Internet governance also pertains to policy questions regarding the use and abuse of the internet. Thus, the WSIS Summit asked[117] the UN secretary-general to convene in an open and inclusive process a meeting for multistakeholder policy dialogue, which came to be called the Internet Governance Forum (IGF).[118]

113 ITU. 1998. "Final Acts of the Plenipotentiary Conference (Minneapolis, 1998)". Resolution 73. p.224-225.
114 Kummer M. 2016. "A Watershed Moment in Multilateral Diplomacy: Adapting Governance Models to the 21st Century". in "The Working Group on Internet Governance". APNIC, APC, CGI.br, ICANN and Internet Society. Edited by Drake W.
115 BBC. 2005. "US rejects changes to net protocol". 30 September.
116 ITU. 2005. Tunis Agenda, Art 55.
117 ITU. 2005. Tunis Agenda, Art 72.
118 https://www.intgovforum.org

BOX 2.3

➜ THE INTERNET GOVERNANCE FORUM (IGF)

The IGF serves to bring people together from various stakeholder groups as equals, in discussions on public policy issues relating to the internet. Despite its lack of binding power, the IGF informs and inspires those with policy-making power, policymakers in both the public and private sectors. During these annual meetings, delegates discuss, exchange information and share good practices with each other. The IGF facilitates a common understanding of how to maximise internet opportunities and address risks and challenges that arise.[119]

The forum is unique: while the IGF is part of the UN it is not bound by member state-driven processes in a narrow sense, which allows different stakeholder groups to table and debate policy challenges in an atmosphere of open dialogue, without the pressure and limitations presented by having to negotiate agreed outcomes.[120] In line with its mandate,[121] the IGF has no oversight function and does not replace other arrangements, mechanisms, institutions or organisations, but intends to involve them in its discussions and take advantage of their expertise. The ten-year review of WSIS, "WSIS +10", again confirmed the multistakeholder approach and extended the IGF mandate by another 10 years. The next landmark event will be WSIS+20 in 2025.

The idea of the multistakeholder approach to internet governance quickly took root, not just at global level, but regionally and nationally. All over the world, people who were invested in the potential of the internet, whether businesses, engineers or human rights defenders, wanted to be part of decisions on its development and management. In contexts with strong traditions of public participation in policymaking, the multistakeholder approach to internet governance resonated and reinforced existing consultative processes in the field of telecommunications and information policy. National and regional IGFs emerged and provided platforms for talking about policy and for concrete collaboration on implementation.

Others have argued for a multilateral approach – with a more explicit leadership role for governments in the global governance of the internet – by establishing a new mechanism in the United Nations or mandating an existing body such as the ITU to play an 'oversight' role over all global internet-related matters.[122] There is a spectrum of perspectives on the "multistakeholder vs. multilateral" approach to internet governance with some extreme views from both sides, but positions are more commonly somewhere in the middle. States that are critical of the multistakeholder approach at global level are not necessarily opposed to deploying it at national level. It is also important not to assume that opponents of the multistakeholder approach to global internet governance will consequently also oppose the Open Internet and prefer closed models. Some might, but many don't. At the root of many developing countries' preference for the multilateral approach is the fact that they feel that the United Nations system creates a level playing field for all countries, rich and poor, large and small, from the global North to the global South, and that it strengthens their position in dealing with large multinational internet platforms and tech companies. This is one of the reasons why the issue of inclusiveness, including greater involvement of developing countries, has become a key priority in recent debates around the reform of the multistakeholder model and in particular the IGF.

119 https://www.intgovforum.org/en/about

120 Esterhuysen A. Degezelle W. 2021. p.61.

121 ITU. 2005. Tunis Agenda, Art 72.

122 India proposed the establishment of such a body in 2011 and related proposals emerged again – endorsed by several other states in 2018 at the Working Group on Enhanced Cooperation (WGEC) mandated by the General Assembly to explore how to "enhance" the role of government and intergovernmental processes in internet governance. The WGEC could not achieve consensus on this matter. Kovacs A. (2013) "Is India reviving its proposal for a multilateral UN body to take over the governance of the Internet?" Internet democracy project. 14 November.

THE MULTISTAKEHOLDER APPROACH UNDERPINS THE INTERNET'S RAPID GROWTH AND SUCCESS

Text contributed by RIPE NCC

A multistakeholder approach has underpinned internet governance since its inception and has been an important factor in the internet's rapid development and success. By reflecting the basic architectural principles of the internet - a distributed system of autonomous but interoperable networks - multistakeholder governance has helped the internet to rapidly evolve and adapt in ways that could not have been foreseen only a few decades ago. As it has evolved, the internet has grown increasingly important to our societies and to individuals, and that has meant new questions and challenges for internet governance and the multistakeholder approach.

In recent years, and across a number of venues, there have been various proposals put forward for new approaches, both in technical and administrative terms. Often these proposals seek to create the possibility of more centralised control over networks and content; however, this is generally at the expense of interoperability and involves adding complexity to the core of the network, rather than at the edges (i.e. the devices that connect to the network). This interoperability and relatively simple networking architecture has been fundamental to the internet's growth and rapid development.

That doesn't mean that the internet governance system itself cannot develop or evolve - a relatively recent example of this evolution was the IANA stewardship transition that took place in 2016, which saw new accountability structures put in place for some of the internet's central administrative functions.

The focus for internet stakeholders today is how to ensure that the internet's success does not create an ever-widening digital divide, by ensuring that all people are able to gain access. That means building on the internet we currently have through active participation in multistakeholder internet governance and standardisation processes. Universal access will require us to meet many challenges, including the transition to IPv6 - an ongoing effort in the Regional Internet Registries (RIR) communities.
Working together via the multistakeholder approach, we can ensure that the internet evolves to meet all of our needs, while retaining the key features that have made it such a success.

The internet is not what it was in 2002 when the World Summit on the Information Society (WSIS) preparatory process started. Through WSIS, governments recognised the importance of the internet, and since then it has remained on the international agenda. Now, 20 years later, the internet has further evolved. The number of users has trebled, and new uses and applications have created not only new opportunities but also new challenges, for example, harmful content, cybercrime and disinformation. Some advocate for closed internet governance arrangements to confront those challenges. But, as already noted in Section 1, such models risk interfering with the Open Internet's underlying logical infrastructure and could end up limiting and fragmenting its evolution as a network of networks. Internet fragmentation is not only technical (see Box 1.4). Besides, avoiding the fragmentation of the internet is one of the key proposals in the UN secretary-general's report 'Our Common Agenda'[123] designed to accelerate the achievement of the Sustainable Development Goals.

As powerful and expansive as the potential of the Open Internet is, spanning technical, social, economic and horizontally cross-cutting spheres, so are the risks posed by closed models with intended and unintended consequences, which could result in harm not just to the Open Internet itself, but to societies and economies at large.

123 United Nations. 2021. "Our Common Agenda, Report by the Secretary-General". p.64.

3. Partnership opportunities to develop a human-centred Open Internet: The Case for Africa

Over the last decade, the Open Internet, understood broadly as an internet that is inclusive, interoperable, and that enables competition, innovation, development and human rights, has grown dramatically across both Africa and Europe – at the level of the availability of infrastructure, usage, and in the development of applications and services by governments and businesses.[124] Digital strategies and policies connected to the Open Internet are emerging rapidly, regionally and nationally – in Europe and across Africa. African voices from all stakeholder groups are present in global internet governance fora. There is, broadly speaking, recognition that the Open Internet is a catalyst for social, economic, political and cultural development both in Africa and Europe, with its open architecture and globally accepted, consensus-driven technical standards ensuring the security and resilience of the global network as well as promoting innovation and collaboration between different stakeholders. This provides fruitful soil for European and African partnership.

At the same time, significant challenges limit the full realisation of the Open Internet's potential benefit for development. Indeed, divides in access to the internet, particularly between rural and urban populations (geographic divide) and between men and women (gender divide) persist.[125] Moreover, the high cost of devices and mobile data still prevents many Africans from using the internet – even if they have access –while digital innovation is hampered by skills shortages.[126] The COVID-19 pandemic has accentuated the importance of universal access and basic connectivity to digital infrastructure and technologies, but it has also set back the human capital development needed to harness the potential of connectivity. This situation has encouraged many African governments to prioritise digital transformation, particularly access to infrastructure. Risks persist, however, that in trying to accelerate the process of digital transformation, governments support and deploy closed internet models instead of advancing policies that promote and develop multidimensional internet openness. Evidence gathered and analysed by agencies such as the OECD and the World Bank[127] over the last three decades consistently indicates that internet openness holds more potential for development than closed models do. This is particularly evident in the area of international trade, where the Open Internet and seamless flows of data make it easier for suppliers and consumers to connect across borders, process payments and delivery of products and services, and thereby widen the customer base traders can draw on. The Open Internet has served as a gateway for firms in developing countries to enter more geographic markets and become part of global value chains (GVCs). Even small and medium-sized enterprises (SMEs) have benefited as "digital platforms enable even tiny firms (micro-multinationals) to connect with global suppliers and purchasers."[128]

124 Mourdoukoutas E. 2017. "African's digital rise hooked on innovation". Africa Renewal, May-July 2017.
125 See tables and graphs in Section 3.1 for recent statistics on connectivity and the cost of connectivity
126 See tables and graphs in Section 3.3 for recent statistics on skills.
127 https://www.worldbank.org/en/topic/digitaldevelopment
128 OECD. 2016. p.18.

THE OPEN INTERNET – IDENTIFYING THE PUBLIC POLICIES THAT MAKE IT POSSIBLE

Text contributed by the Internet Society

The nature of the internet, like other ecosystems, is a changing one, because it is constantly evolving. This makes it especially complex to identify the correct public policies that protect the internet's critical attributes: we all want it to remain open, globally connected, trustworthy and secure. To achieve this, it is important to assess policy proposals, otherwise, we may implement well-intentioned decisions that have a negative impact on one of its critical attributes, harming its development. Another important aspect is to measure and promote internet resilience, to ensure that it maintains an acceptable level of service in the face of faults and challenges.

The importance of impact assessments

If we don't consider how public policy actions could impact the internet, we risk breaking what makes the internet work for everyone. It is now common practice to make Environmental Impact Assessments (EIA) to predict the environmental impacts of a project in the pre-planning stage so that decisions can be taken to reduce any adverse impacts. A similar exercise, applied on the internet, would bring enormous benefits, because we would avoid unwanted consequences or harm to its development. As the internet becomes an important tool in our daily life, governments around the world are increasingly developing policies and regulations to protect their citizens, sometime with adverse impacts. African countries can take a leadership role to protect what the Internet needs to exist and thrive by adopting the practice of conducting Internet Impact Assessments[129] to mitigate risks of harm.

Measuring the internet

It is a stark reality that many countries have under-provisioned networks and cable infrastructure, or they lack redundant interconnection systems. In these cases, the likelihood of internet outages occurring is much higher than in other countries that have appropriate infrastructure. To help support the development of an enabling environment that supports a resilient infrastructure, it is important to measure internet resilience. This should be a composite of several parameters: making accurate inventory of existing infrastructure, measuring performance and security levels, and quantifying market readiness, understanding this concept as the ability of the market to provide affordable prices to end users by maintaining a diverse and competitive market. Existing initiatives[130] are proving the benefits of tracking resiliency metrics.

Can (and should) digital access and broader Open Internet policies in Africa be reconciled, pursued in parallel rather than one taking precedence over the other? Research ICT Africa, based on their "After Access" research, emphasises the need to address both supply (availability of infrastructure) and demand (skills, services, content, openness) issues: "Until [these] demand-side issues are addressed, and there is a critical mass of people online who are able to use the Internet intensively enough for the multipliers to be felt throughout the economy, expectations of the Internet contributing directly and indirectly to economic growth and job creation will not be realised."[131]

The European approach to digital transitions has always been particularly sensitive to the way that digitalisation occurs, as this has enormous short, mid and long-term economic, social and political implications for countries and citizens. The Global Gateway builds on this "human-centric" vision of digitalisation, and proposes to partner

129 Internet Society. 2021. "The Internet Impact Assessment Toolkit – Introduction". Version 2.0. 8 November.

130 Measuring Internet Resilience in Africa (MIRA) - https://afrinic.net/research/studies/mira

131 Gillwald A. Onkokame M. 2019. "After Access 2018: A Demand-Side View Of Mobile Internet From 10 African Countries". Research ICT Africa. Policy Paper Series No. 5 After Access. p.3.

with African countries in designing, developing, and implementing projects that aim at offering an Open Internet-based option to meet Africa's digital development needs, selecting partnerships, investments and actions that are sustainable, empower local ecosystems, and do not create unwanted dependencies.[132]

What follows is an overview of the state of play of the Open Internet in Africa and suggestions for African-EU partnership opportunities based on the Open Internet as integral to the Global Gateway strategy. These are clustered in five different areas:

- Digital infrastructure for Open Internet connectivity
- Open Internet, and enabling policy and regulatory environments, and e-government
- Open Internet skills and competences
- Open Internet economy, trade, innovation and startups
- Participation in Open Internet governance.

As we have seen above, digitalisation and the Open Internet, while often confused, are not at all synonymous. Digital transitions can theoretically proceed with closed approaches to technology, the economy and society. Regulation can be designed to stifle free speech and undermine privacy and data protection. Digital skills programmes can focus on technical capacity without growing the participatory culture and social and economic openness which would increase demand for technical skills and digital infrastructure. Partnerships with a few big internet companies come at the risk of reducing market opportunities for local startups. Participation in top-down approaches to internet governance can move away from working towards a more inclusive multistakeholder system towards a state-centric model. These risks and "trade-offs" should be kept in mind while exploring the Open Internet partnership opportunities discussed below in order to ensure that digital transformation in Africa supports the social and economic transformation needed for sustainable development.

3.1 DIGITAL INFRASTRUCTURE FOR OPEN INTERNET CONNECTIVITY

3.1.1 Open Internet connectivity in Africa: State of Play

Africa's current digital infrastructure is largely based on Open Internet models. However, substantial gaps in access to connectivity limits the network's reach and openness. Globally, internet connectivity has expanded rapidly, with an additional boost during the pandemic. In 2021, 4.9 billion people were using the internet, or 63% of the global population. Africa is lagging behind with only 33% of the population using the internet. Moreover, internet use in Africa is concentrated among the young and people living in urban areas.[133] [134] Nevertheless, internet use has increased dramatically across Africa over the past two decades and continues to do so. Between 2000 and 2020, the number of people with internet access on the continent increased from 4.5 million to 590 million.[135] From 2019 to 2021, internet use increased by 23%.[136] In the next decade, the number of internet users in Africa is estimated to continue to grow by at least 11%.[137]

132 European Commission. 2021. "The Global Gateway". p.4.
133 ITU. 2021.
134 The estimate of people using the Internet in Africa was derived using modelling tools as the data was simply not available for all countries. See note on p. 21 of ITU. 2021. "Measuring digital development, Fact and Figures 2021".
135 Internet World Stats. "Internet User Statistics for Africa» https://www.internetworldstats.com/stats1.htms
136 ITU. 2021.
137 Google and IFC, a member of the World Bank Group. 2020. "e-Conomy Africa 2020: Africa's $180 Billion Internet Economy Future". p. 12.

BOX 3.1

➜ MEASURING INTERNET ACCESS IN SUB-SAHARAN AFRICA

It is worth noting that African internet statistics are notoriously challenging in terms of availability and accuracy. Gathering of statistical information on internet access and use in Africa is under-resourced. Insufficient data can impede planning and impact measurement, and strengthening Africa's capacity in this regard is a critical component for better informed policy decisions, which effect longer term growth and development efforts.

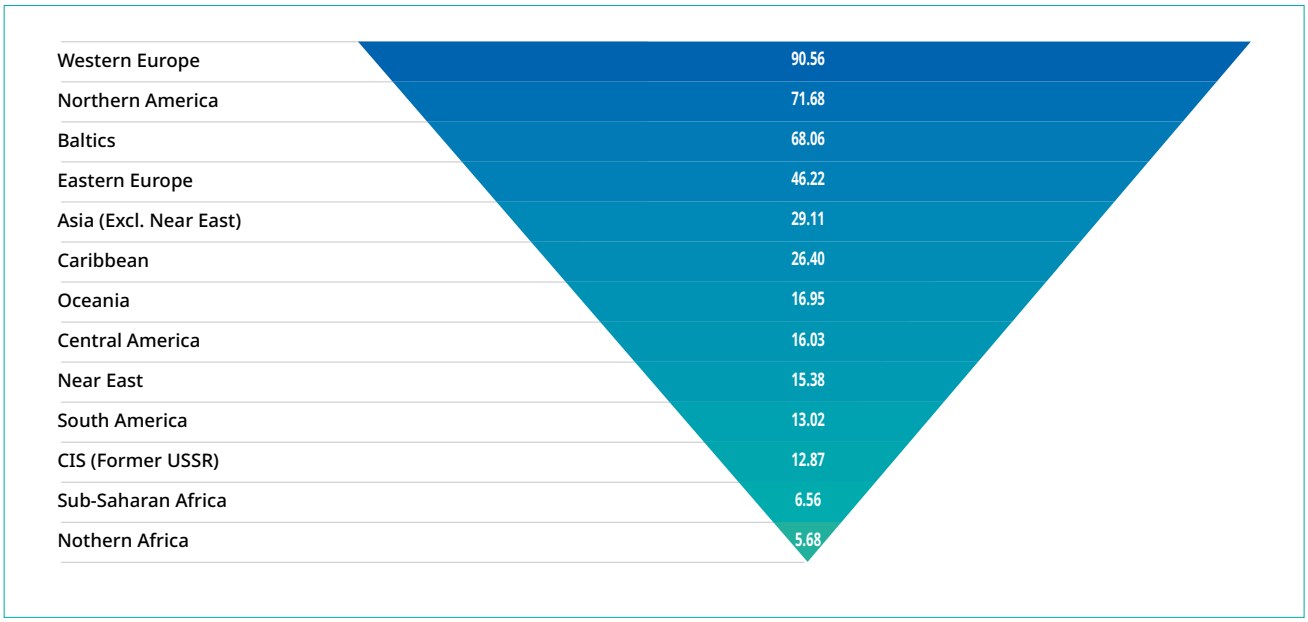
'Despite its importance, measuring and monitoring internet use over time is difficult due to the lack of consistent definitions, data sources, and details on how people connect. Discrepancies between data from supply-side sources, such as telecommunications agencies, and demand-side sources, such as household surveys, pose additional problems for monitoring internet access. For example, in Sub-Saharan Africa, consumers adapt to uneven coverage and price changes by using multiple SIM cards; however, network providers measure usage by the number of active SIM cards rather than the number of unique subscribers. In addition, it is difficult to obtain data on how people access the internet. While SDG 17.8.1 aims to track internet usage rates at any location, accessing the internet at home through a computer offers more functionality than using a mobile phone. Despite limited spatial and temporal coverage, household survey data can give a more accurate and complete picture of household internet access than supply-side indicators derived from network providers.'[138]

In spite of the positive trends, it is clear that digital divides, which persist between Africa and other parts of the world, within the continent and within countries, remain a massive challenge. Access is still not affordable for many people, even if they have some form of connectivity, and bandwidth and transmission speeds remain relatively low (see Figure 1).

Figure 1: Average broadband speeds across 13 global regions

Regional mean speed in Mbps measured in the 12 months up to 30 June 2021

Source: Worldwide broadband speed league 2021[139]



138 Frankfurter Z. Kokoszka K. Newhouse D. Silwal A.R., Tian S. 2020. "Measuring Internet Access in Sub-Saharan Africa (SSA)". World Bank Group. Poverty & Equity Notes. Number 31. August 2020. p.1.

139 Cable.co.uk. 2021. "Worldwide broadband speed league 2021". https://www.cable.co.uk/broadband/speed/worldwide-speed-league/

The Alliance for Affordable Internet (A4AI) identified four broad requirements that define meaningful connectivity: an appropriate device, regular internet access, a fast connection, and enough data.[140] The combination of these components provides the quality of access people need to use the internet in a meaningful way, for example, for online learning, video streaming, telehealth. Focusing on improving access only in numbers of people connected, and ignoring the need for meaningful connectivity, exacerbates the 'emerging new digital divide between the poorly connected (those who use a single application or website once a month) and the hyper-connected (those who watch streaming movies and work remotely every day)'.[141] The table below illustrates persisting gender, generational and urban/rural access divides.

Table 1: Percentage of people using the internet in 2020[142]

Percentage of people using the internet in 2020	By location: urban / rural	By gender	By age	Totals
World	Urban – 76%	Female – 57%	Youth* – 71%	63%
	Rural – 39%	Male – 62%	Rest of population** – 57%	
Africa	Urban – 50%	Female – 24%	Youth – 40%	33%
	Rural – 15%	Male – 35%	Rest of population – 27%	

* Individuals aged 15 to 24 using the internet as a percentage of the total population

** Individuals below 15 years old or over 24 years old as a percentage of the respective population

FROM DIGITAL CONNECTIVITY TO OPEN INTERNET CONNECTIVITY

The physical buildout of the internet infrastructure is the inevitable first step for everyone to be digitally connected and for meaningful connectivity – allowing people to use the internet every day with an appropriate device, and access to sufficient data and fast connections.[143] The digital divide is not simply a divide between those who have access, and those who don't – quality and speed, affordability, and human capacity are integral components to today's ICT "haves" and "have-nots".

Devices and data bundles must be affordable for all to avoid the creation of new digital divides being created as new, data-intensive applications and services emerge. This requires investments in broadband infrastructure – backbone infrastructure and novel solutions for remote or sparsely populated regions. Basic connectivity that is reliable and of good quality at an affordable price is essential but does not guarantee an Open Internet where those connected are not only passive consumers of content and services but internet "prosumers"; potential producers of content, applications and services that meet the needs of local communities, and that can be shared easily at low cost to compete freely with established market players.[144]

The design of the internet, based on the Open Internet architecture and its open protocols, allows the user to participate as a prosumer, it empowers end users in an active role, 'independently deciding how to use and – create apps, services and any kind of content'.[145] Connectivity investments that intrinsically strengthen and further develop the technical dimension of the Open Internet, such as IXPs, IPv6 deployment, or a more robust DNS, are necessary to allow this human-centric internet to continue to develop as an enabling tool in the hands of active end users and their communities.

140 A4AI. "Meaningful Connectivity – unlocking the full power of internet access." Alliance for Affordable Internet. https://a4ai.org/meaningful-connectivity/

141 Thakur D. Woodhouse T. Jorge S. 2020. "Meaningful Connectivity: Advancing the Open Internet during COVID 19". In The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p.37-40.

142 ITU. 2021. Table developed with data from Measuring digital development, Fact and Figures 2021. Estimates of the total number of people using the internet are for 2021 while the other figures are for 2020.

143 A4AI. "Meaningful Connectivity – unlocking the full power of internet access."

144 Belli L. Baca C. Huerta E. Velasco K. 2020. "Community Network in Latin America: Unleashing Openness through Self-determination". The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p. 114.

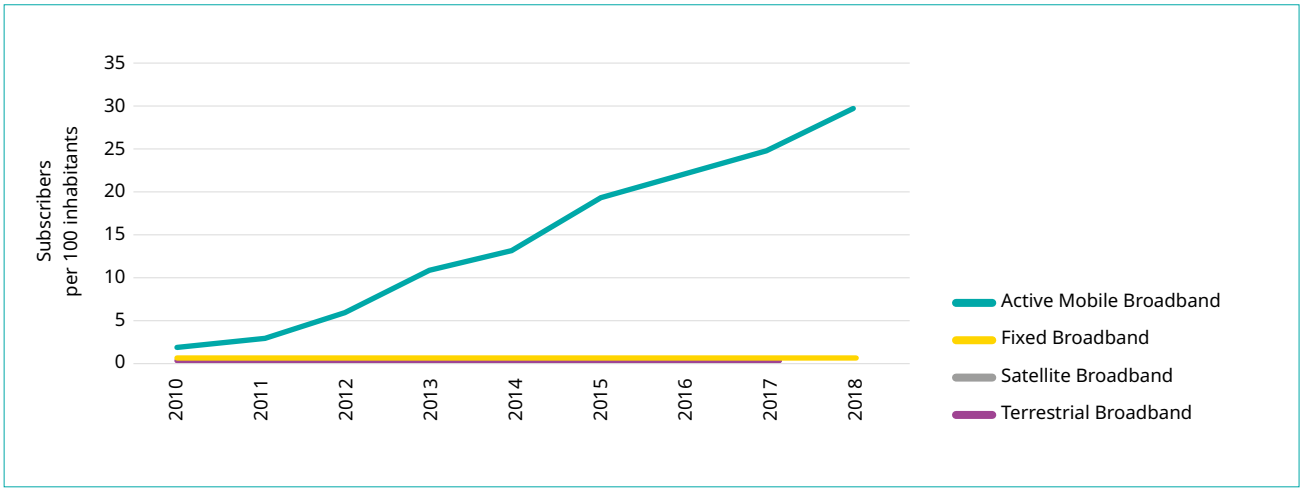
145 Belli L. Manzar O. Farooqui S. 2020. "COVID-19: A Harsh Reminder that Open Internet Access and Meaningful Connectivity are Essential". The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p.27-29.

DIGITAL CONNECTIVITY INFRASTRUCTURE

Most people in Africa access the internet through mobile phones rather than fixed broadband internet connections.[146] [147] In 2020, mobile internet was available to 81% of the African population, but only 28% were actually using the internet. 19% of the population did not have any mobile internet coverage at all.[148] While coverage and quality of mobile networks used for the internet vary extensively among countries, substantial gaps also remain between urban and rural access within countries. According to ITU data, 18% of Africa's rural population has no mobile network coverage at all, and another 11% has only 2G coverage. While broadband access is available to 89% of the urban population, almost 30% of the rural population in Africa cannot access the internet. Here too there are significant urban and rural divides.

Figure 2: Broadband Penetration[149] in African Countries by Technology 2010-2018[150]

Source: Broadband Commission for Sustainable Development



A recent World Bank Group study[151] estimated the marginal effects of expanding digital infrastructure services (internet use, mobile subscriptions and broadband subscriptions) on the level of GDP per Capita in the Middle East and North Africa and in sub-Saharan Africa. As Figure 2 shows, the cumulative gains in income per capita are higher in sub-Saharan Africa. This is due to the fact that digital infrastructure services are already accessible to a larger share of the population in the Middle East and North Africa than in sub-Saharan Africa. 'An important implication of this finding is precisely that economies starting from lower levels of digital technology penetration have a larger upside than economies in which significant portions of the population already have access to digital services. From a policy perspective, logic dictates that focusing on bringing digital services to underserved countries or even underserved regions within countries will tend to pay off more than focusing on populations that already have access to such services.'[152]

146 Granguillhome Ochoa R. Lach S. Masaki T. Rodríguez Castelán C. 2021. "Why aren't more people using mobile internet in West Africa?". World Bank Blogs. 8 December.

147 ITU. 2021. ITU estimates for 2021: The number of mobile-cellular subscriptions in Africa is estimated at 83 per 100 inhabitants; the number of active mobile-broadband subscriptions (3G or more) is 41 per 100 inhabitants.

148 GMSA. 2021. "The State of Mobile Internet Connectivity 2021". GMSA Association. Figure 1 on p. 13.

149 Fixed-broadband subscriptions refer to fixed subscriptions to high-speed access to the public internet (a TCP/IP connection), at downstream speeds equal to or greater than 256 kbit/s. These include cable modem, DSL, fibre-to-the-home/building, other fixed (wired) broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband.

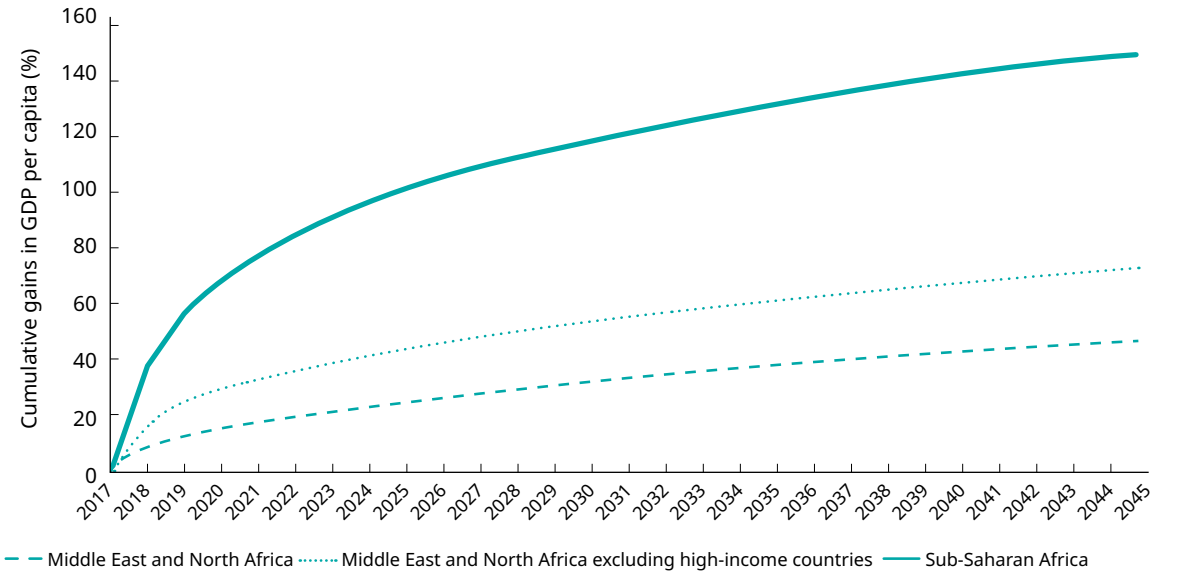
150 Broadband Commission. 2021. "Connecting Africa Through Broadband. A strategy for doubling connectivity by 2021 and reaching universal access by 2030". Broadband Commission for Sustainable Development. September. Figure 2.1. p.35.

151 Cusolito A. Gévaudan C. Lederman D. Wood C. 2022. "The Upside of Digital for the Middle East and North Africa. How Digital Technology Adoption Can Accelerate Growth and Create Jobs". World Bank Group, March 2022, p.22-23.

152 Note: The figure shows gross gains in GDP per capita under conservative assumptions, but it does not take into account the costs per user that would be required to reach universal coverage in Sub-Saharan Africa or the Middle East and North Africa, and the fact that the cost per beneficiary of digital infrastructure tends to be higher in low-density (rural) populations.

Figure 3: Cumulative gains in GDP per Capita in the Middle East and North Africa and in sub-Saharan Africa, 2017-2045

Source: World Bank Group, 2022[153]

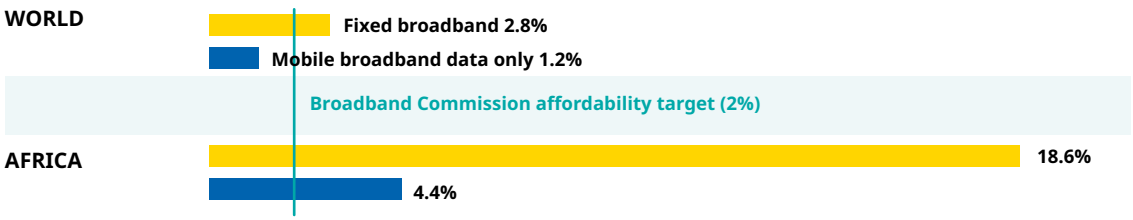


Source: Calculations based on estimates of the marginal effects of digital infrastructure on the level of GDP per capita presented in Calderon et al. 2019.
Note: The estimates of the marginal effects of expanding digital infrastructure services (internet use, mobile subscriptions, and broadband subscriptions) control for the preexisting level of GDP per capita and other indicators used in the various regression analyses. All countries are assigned the same marginal effect. The assumed adoption schedule follows the concave function discussed in the text. The data for each curve have been normalized to obtain start values of «O» in 2017.

The United Nations Broadband Commission's affordability target sets as goal that by 2025 entry-level broadband services should be made affordable in low- and middle-income countries at less than 2% of the monthly Gross National Income (GNI) per capita.[154] The price of fixed broadband and mobile data remains far above the target and stands in sharp contrast with the rest of the world.

Figure 4: Fixed broadband and mobile data basket as a % of GNI per capita., 2020

Source: ITU[155]

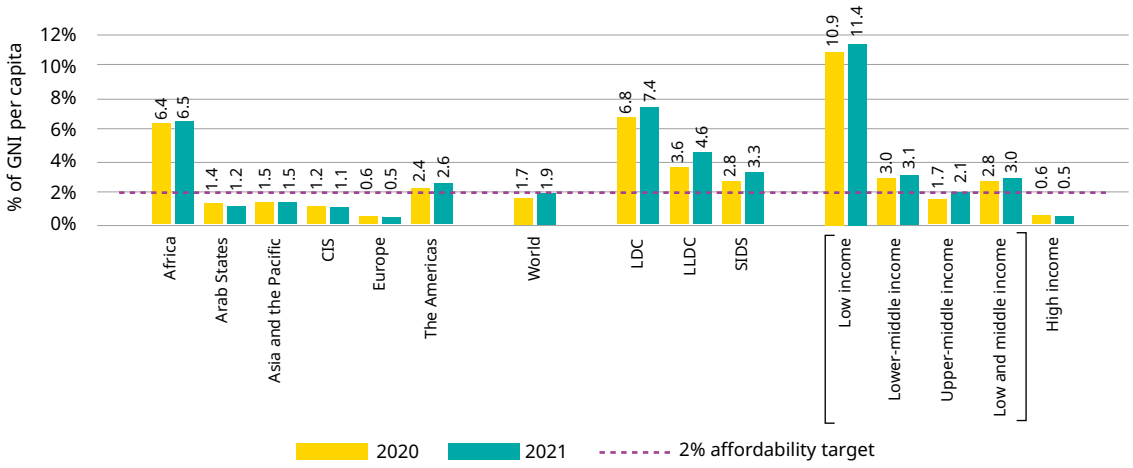


153 Cusolito A. e.a.. 2022. Figure 5.2. p.22.
154 See the Broadband Commission targets at https://www.broadbandcommission.org/advocacy-targets/
155 ITU. 2021. p.15.

In 2021, data-only mobile broadband in Africa was more than three times more expensive than the target (see Figure 5). The median for the continent, however, hides huge regional differences, for example, 3.4% of GNI per capita in Sudan versus 41% in the Central African Republic.[156] A mobile data and voice low-consumption basket (minimum 70 minutes voice, 20 SMS, 500 MB Data per month) was 12 times as expensive in Africa as in Europe, a high consumption plan (minimum 140 minutes voice, 70 SMS, 2 GB Data per month) more than 18 times.[157]

Figure 5: Data-only mobile broadband basket prices

Source: ITU[158]



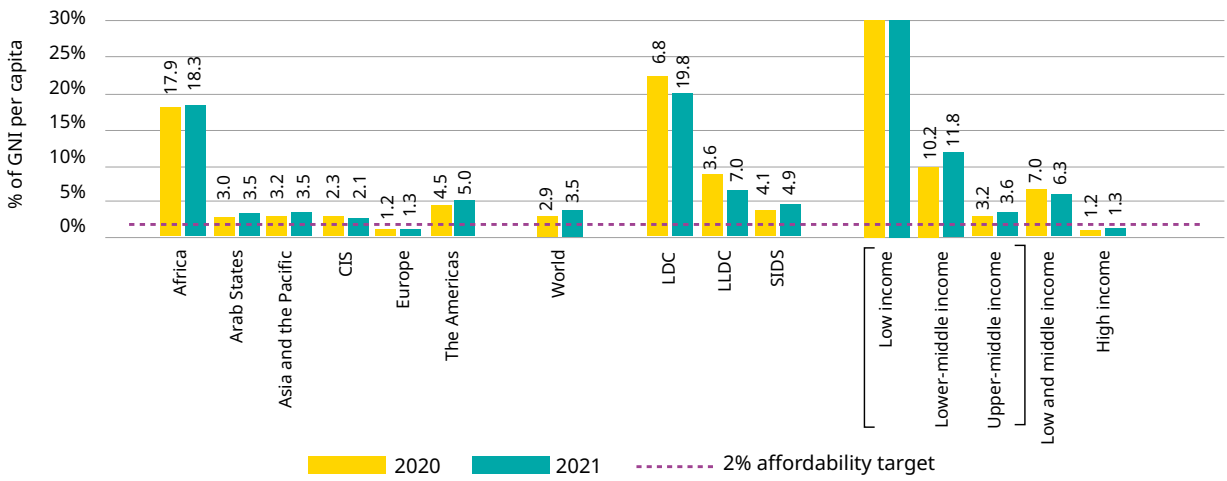
Notes : By world region and level of development, expressed as a percentage of monthly GNI per capita, 2020-2021. Medians based on the 185 economies for which data were available for both years. Economies are benchmarked according to the prince of an entry-level data-only basket, defined as the cheapest data-only mobile broadband subscription available domestically, with 3G technology or above and a minimum monthly data allowance of 1.5 GB for 2020 and 2GB for 2021.
Source: ITU and A4AI

In Africa, the average price for 5 GB fixed broadband (see Figure 6) in 2021 was 18.3% of the monthly income, five times the world median. This was 0.4 percentage points higher than the year before, mostly because of declining income levels, the real economic impact from the pandemic. It is particularly worrisome that in 15 economies in Africa, 5 GB fixed broadband costs more than 20% of GNI per capita and more than 50% in 4 economies. In Malawi in 2020, people were paying up to 80% of GNI per capita for 1 GB of data.[159] Such prices place broadband access out of reach for most of the population.[160]

156 A4AI. "2021 Affordability Report".
157 ITU. 2022. "The affordability of ICT services in 2021". ITU Policy Brief. March 2022.
158 ITU. 2022. p.5.
159 Ehl D. Grün G.-C. 2020. "Why mobile internet is so expensive in some African nations". Deutsche Welle (DW). 3 November.
160 ITU. 2022. p.8.

Figure 6: Fixed broadband basket prices

Source: ITU[161]



Notes : By world region and level of development, expressed of monthly GNI per capita, 2020-2021. Medians based on the 176 economies for which data were available for both years. Economies are benchmarked according to the prince of an entry-level data-only basket, defined as the cheapest data-only mobile broadband subscription available domestically, with a minimum of 5G monthly data allowance and advertised download speed of at least 256kbit/s of 1.5 GB for 2020 and 2GB for 2021.
Source: ITU and A4AI

Factors that contribute to the high cost of mobile broadband range from lack of infrastructure – providers use this to justify high prices, which they say is needed to cover the cost of infrastructure rollout; lack of competition – many countries only have one, two or three providers; and national policy and regulation, linked to the capacity and independence of the telecommunications regulator to regulate pricing in consumers' interest. The need for competition and effective regulation cannot be over-emphasised. Linked to this is diversifying access and infrastructure development markets. Since 2008, many African countries have relied on Chinese investment and firms for expanding their digital infrastructure.[162] Diversifying investment sources can contribute to a more competitive marketplace and help create opportunities for African companies in the infrastructure sector.

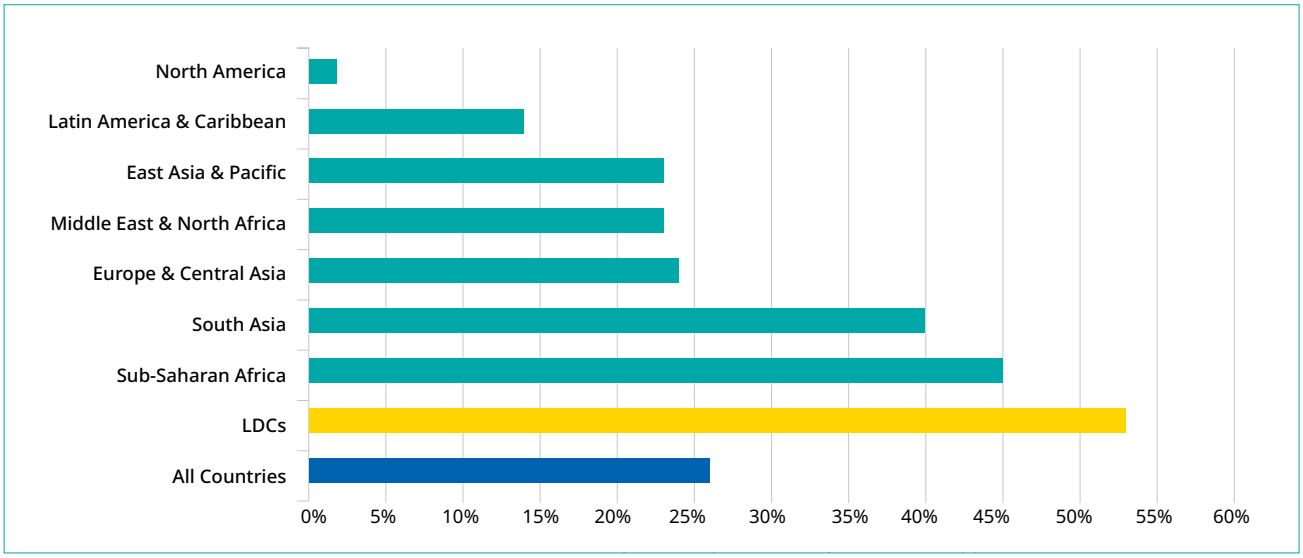
At the level of access, diversification should include financing, and other incentives and opportunities for smaller mobile data providers and local, community and municipal service providers. It is estimated that only 11% of the total offline population live in areas with no 3G/4G coverage.[163] In other words, many people have access to the internet but do not use it. The reasons for not using the internet are diverse: high cost, no interest, lack of skills, insufficient literacy or no relevant local content.

The affordability of devices has a dramatic impact on whether people can use the internet or not. The global average cost of a smartphone is around 26% of an average monthly income, US$104. However, smartphones remain inaccessible to many (see Figure 7). In the Least Developed Countries, the average person would have to spend over half of their monthly income to buy a smartphone, and in low-income countries, the cheapest available smartphone on the market costs almost 70% of the average monthly income.[164]

161 ITU. 2022. p.9.
162 Chimbelu C. 2019 "Investing in Africa's tech infrastructure. Has China won already?". Deutsche Welle (DW). 5 May.
163 ITU. 2021. p.12.
164 World Wide Web Foundation. 2021. "Device pricing 2021". 7 October.

Figure 7: Smartphone affordability by region

Source: Alliance for Affordable Internet[165]



As smartphones become increasingly important income-generating tools, device costs keep millions offline in the areas where they may be most needed. Feature phones, which are internet-capable mobile devices that resemble earlier mobile models with tactile keyboards or keypads and only support basic applications, are often affordable alternatives to smartphones to connect to the internet, especially for first-time users.[166] 'Covid-19 has exacerbated the need to advocate not just for Open Internet, but also for devices that enable realistic connectivity, and that allow users to make a meaningful use of Internet access.' A smartphone, for example, may allow to access apps but not to create them.[167] 'As policymakers look to use digital connectivity as a foundation for a post-Covid economic revival, the affordability and availability of high-quality and functional devices like smartphones need to be a key indicator for economic performance.'[168] GMSA projects a sharp increase in smartphone adoption in sub-Saharan Africa from below 50% of the population in 2020 to 64% by 2025.[169]

International internet backbone connections, which are necessary for internet data traffic and have a strong impact on costs and quality of connection, improved dramatically in the last decade, thanks to enabling regulation, public-private partnerships and massive private sector investment in subsea and terrestrial fibre optic infrastructure.[170] The submarine cable system[171] that connects African countries to the Open Internet has expanded to include numerous connections between Africa, Europe, the Americas and the Middle East. Of the 54 African countries, 38 countries have a seashore, and 37 of them have at least one submarine cable landing (see Figure 8). This has resulted in greater availability of high-speed bandwidth, which has opened new markets for online content services (such as streaming services). 'At the same time, terrestrial cross-border fibre connections remain limited on the continent. Of the total bandwidth of 8.814 Tbps available in sub-Saharan Africa as of December 2019, 8.126 Tbps, or 92.2% of the total, was delivered directly by submarine cable, while

165 A4AI. 2021. "How expensive is a smartphone in different countries?". Alliance for Affordable Internet. 7 October.

166 A4AI. 2021. "How expensive is a smartphone in different countries?".

167 Belli L. Manzar O. Farooqui S. 2020. p.28.

168 World Wide Web Foundation. 2021.

169 GMSA. 2021. "The Mobile Economy Sub-Saharan Africa 2021". GSMA Association. p.13.

170 Two major subsea cable initiatives are set to markedly improve Africa's connectivity and resiliency. The first is the 2Africa cable, an initiative of Facebook and other major tech and telecoms firms including China Mobile, Vodafone and MTN Group. The $1bn project aims to circumnavigate the continent by 2024, connecting 23 countries along a 37,000-km cable and adding 180 Tbps to design capacity. Meanwhile, Google's Equiano cable will run from Lisbon to Cape Town via Lagos, and provide up to 20 times more network capacity than the last cable laid to serve the region.' OBG. 2021. "Data Centres in Africa Focus Report". Oxford Business Group. October. p.30.
For more detailed information on investment in undersea fibre connected to Africa, see Africa Undersea Cables by Steve Song, June 2021, https://manypossibilities.net/african-undersea-cables/ .

171 Submarine Cable Networks. "Submarine Cables in Africa" https://www.submarinenetworks.com/en/africa

just 678 Gbps, or 7.8% of the total, was supplied by cross-border networks connected to submarine cables."[172]

In 2019, the Central African Republic, Eritrea and South Sudan still lacked connections to submarine cables.[173]

Figure 8: Number of subsea cable landings in African countries

Source: Oxford Business Group, October 2021[174]

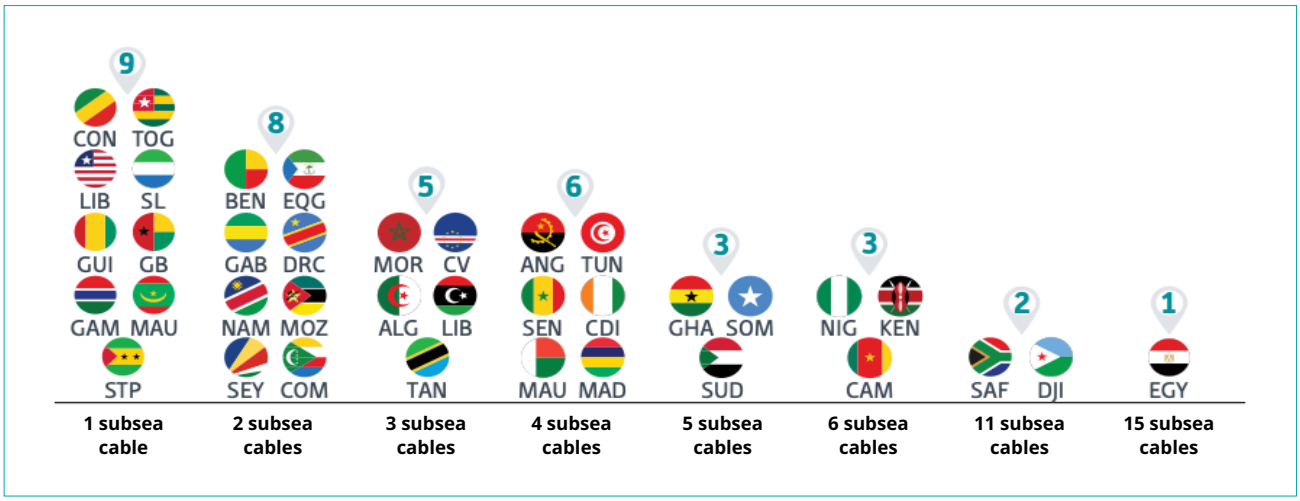
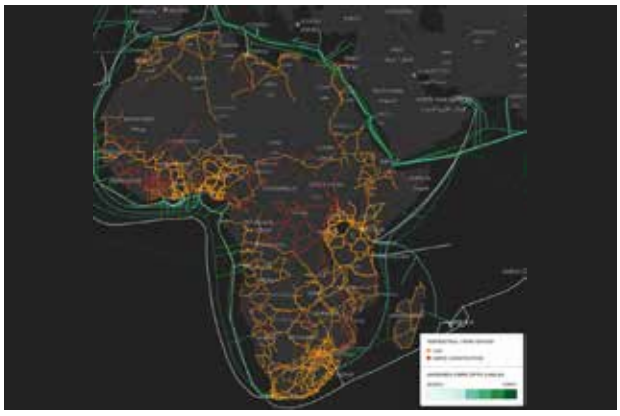


Figure 9: African undersea and terrestrial fibre optic cables

Source: Network Startup Resource Centre[175]



More recently, projects such as low earth orbit satellite solutions,[176] airships[177] and balloons[178] explore how affordable access might be provided to new users in rural and remote areas.[179] Satellite connectivity can be useful and valuable in areas where the cost of expanding cellular technology is prohibitive. The rollout of new base stations in rural and underserved areas may have an expected return from customer subscription lower than the initial capital expenditure and operating expenditure costs. The entrance of low-cost satellites and dense networks such as Telesat, OneWeb and Starlink opens a new opportunity for the continent. However, under the current scenario, the impact of space and aerial systems in terms of expanding connectivity would be rather modest; the current cost of satellite technology (~$200 per Mbps/month) are affordable for less than 1% of the uncovered and underserved population in the countries of interest.[180]

172 OBG. 2021. p.30.

173 Google and IFC, a member of the World Bank Group. 2020. p.60.

174 OBG. 2021. p.30.

175 NSRC. "African Undersea and Terrestrial Fibre Optic Cables". Network Startup Resource Center.

176 Low Earth Orbit (LEO) satellite systems may help meet the demand for connectivity by providing global access to the telecommunications infrastructure currently available only in advanced urban areas of the developed world. The configuration of these new systems allows them to provide ubiquitous coverage with relatively high throughput levels and delays that are seamlessly compatible with terrestrial networks. It is important to evaluate the potential of these solutions for the reality in Africa; from a technology perspective, LEOs may be a viable solution to address the digital divide and provide accessibility. However, the business case for their commercialisation has yet to be developed and adapted to the region. Myles. 2022. "The State and Future of LEO Satellite Internet Connectivity in Africa". Extensia. 19 January.

177 Tests are underway above the Tanzanian islands of Zanzibar and Pemba, where two helium-filled tethered balloons are providing browser and email access. The Low-Altitude Platform Stations (LAPS) float 300 metres high and use 3G and 4G frequencies to provide a signal range of about 70 kilometres (km) – enough to give basic internet coverage to most communities on the islands. Wood J. 2022. "Airships could boost internet coverage and help close the digital divide in Africa – and beyond. Here's how". World Economic Forum. 26 January.

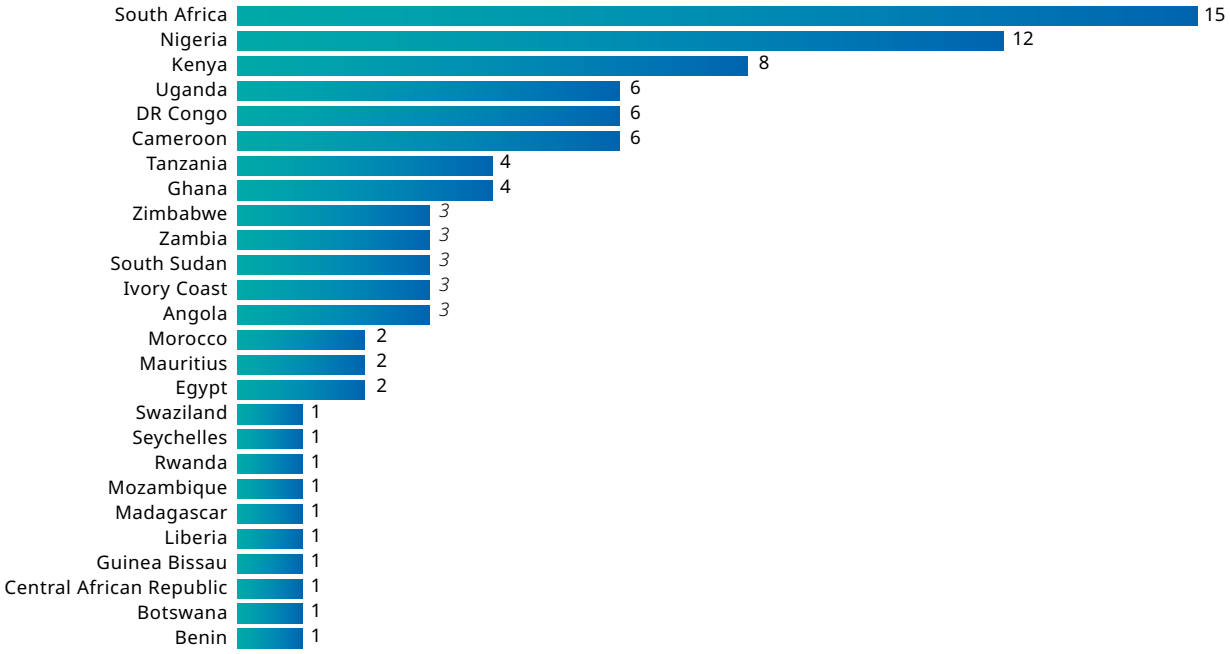
178 Toh M. 2021. 'Alphabet is shutting down Loon, its ambitious internet balloon venture'. CNN Business. 22 January.

179 Myles. 2022.

180 del Portillo I. Eiskowitz S. Crawley E. Cameron B. 2021. «Connecting the other half: Exploring options for the 50% of the population unconnected to the internet». Telecommunications Policy, Elsevier, vol. 45(3).

Figure 10: GEO satellite internet providers to African countries by numbers

Source: Space in Africa, January 2022[181]



Innovative approaches, such as diversifying local access markets through licensing small and medium service providers and community networks (see Box 3.2) are gaining recognition. Public access in schools and libraries,[182] and use of Television White Spaces (TVWS) are also helping to connect the unconnected in an affordable and sustainable manner.

BOX 3.2

➜ COMMUNITY NETWORKS

'Internet access networks that are built and operated by local citizens who want to connect their village, city, or town places technology in the hands of the people who use it, and bring new ideas, new ways of thinking and new solutions, provide a complementary solution for accessible and affordable connectivity in underserved areas. They inspire us to think differently and to solve problems together.'[183]

Community Networks are complementary connectivity solutions for low-income communities and hard to connect areas, particularly in Africa. They are decentralised networks, where internet or communication services are localised rather than monopolised by government or corporate giants. They help connect the unconnected in an affordable and sustainable manner, creating a connectivity ecosystem that brings digital skills and tools to rural, remote and underserved areas. They also give users more control over their data and privacy.[184] [185] Community networks in Africa are making excellent progress in working with national regulators on enabling regulation. For example, the Communications Authority of Kenya adopted a community networks licensing framework in November 2021,[186] paving the way for diversifying the local internet access market.

181 Space in Africa. 2022. "The State and Future of LEO Satellite Internet Connectivity in Africa". Via Satellite. 18 January.
182 African Library and Information Associations and Institutions (AfLIA) released a statement in response to the AU Digital Transformation Strategy that highlights the role of libraries in providing access and building skills. AfLIA. 2021. "AfLIA Statement in Support of African Union's Digital Transformation Strategy". African Library and Information Associations and Institutions.
183 Coffin J. 2018 "Community Networks. Switch It On". Internet Society. Community Networks ITU-D SG-1 Workshop. 17 September.
184 Harrisberg K. 2021. "Bridging Africa's digital divide: The rise of the community internet". World Economic Forum. 3 December.
185 Internet Society. 2020-2021. "Virtual Summit on Community Networks in Africa".
186 Kivuva M. 2021. "Kenya adopts community networks licencing framework". KICTANET. 9 November.

Supporting infrastructure and in particular access to reliable electricity remains a major constraint to the expansion of digital infrastructure in Africa. Supporting infrastructure drives down the cost of deploying internet infrastructures such as fibre and cell phone base stations. Electricity is needed for a range of activities, from recharging devices to powering mobile base stations. The household electrification rate in sub-Saharan Africa is the lowest in the world, averaging 44% of the population in 2017 (compared with 87% in North Africa and worldwide). There are also huge disparities in electricity access between urban (79%) and rural households (23%) in the region.[187] Investments in rural electricity mini-grids, off-grid solar and other energy sector developments have started to offer more cost-effective solutions than national grid extensions in certain areas. The effects can cascade to the general increase in internet connectivity and use. However, energy remains a key challenge to make full use of the opportunities of the digital economy.

OPEN INTERNET TECHNICAL INFRASTRUCTURE

Internet Exchange Points (IXPs)[188] are a fundamental infrastructure for Internet Protocol (IP) networking, allowing the exchange of internet traffic between local networks locally without sending domestic traffic back and forward over expensive intercontinental transfers.[189] The internet is faster, cheaper, and of better quality, as traffic is routed more directly. IXPs increase the stability, resilience and robustness of the local internet, and make local networks less dependent on third parties.

Table 2: Costs and Savings per IXP in US$ 2020 (ISOC)[190]

Country/City	IXP	IP Transit price/ Mbps/Month	Yearly IP Transit Savings	Yearly Savings per Network
Angola/Luanda	Angonix	18	4,320,000	228,350
DRC/Kinshasa	KINIX	23	3,780,000	163,233
Egypt/Cairo	CAIX	9	2,040,000	240,000
Burkina Faso/Ouagadougou	BFIX	12	1,440,000	115,800

The above table reflects data from case studies conducted by the Internet Society in the respective countries. It shows the cost of international IP transit per Mbps (in US$ and based on the cost of a Gig E connection) and the overall savings and savings-per-network of routing the traffic through an IXP rather than using an international connection.

The number of IXPs in Africa has more than doubled over a period of eight years, from 19 in 2012 to 47 in 2022.[191] Much has been achieved and more than half of African countries now have at least one IXP. In South Africa, Kenya and Nigeria, 70% to 80% of internet traffic is now exchanged locally, saving millions of USD[192] by avoiding the international transfer costs.[193] In addition to cost savings, IXPs strengthen capacity and partnerships among internet service providers and other internet-based businesses and academic networks. They also enable competition by facilitating the entry of new service providers, local data centres, DNS root server mirrors, hosting providers and content

187 The World Bank. "Access to electricity (% of population) – Sub-Saharan Africa".

188 IXPs serve as 'physical locations where different networks connect to exchange internet traffic via common switching infrastructures'. They contribute to increasing the affordability and quality of connectivity in local communities, largely by eliminating the need to exchange local traffic via international routes. Source: Internet Society. 2015. "Internet Exchange Points. An Internet Society Public policy Briefing". 30 October.

189 This situation, when traffic is sent over long distance to be exchanged and sent back to its nearby destination, is known as 'tromboning'.

190 Adapted from a table on p. 36 in Kende M. 2021. "Moving Toward an Interconnected Africa: The 80/20 initiative". Internet Society. July 2021.

191 Sourced from the Global IXP Database which is updated continuously, https://ixpdb.euro-ix.net/en/.

192 For example, the Kenya Internet Exchange Point (KIXP) grew from carrying peak traffic of 1 Gigabit per second (Gbps) in 2012 to 19 Gbps in 2020, with cost savings quadrupling to USD 6 million per year. The Internet Exchange Point of Nigeria (IXPN) grew from carrying just 300 Megabits per second (Mbps) to peak traffic of 125 Gbps in 2020, and cost savings increased 40 times to USD 40 million per year.

193 Kende M. 2021. p.36.

delivery networks (CDNs)[194] in a cost-effective[195] way.[196] However, a comparison with Europe, which has 266 IXPs, and Latin America and the Caribbean, which has 107 IXPs,[197] shows that there is a need to continue to expand IXP deployment in Africa.[198]

Map of Internet Exchange Points in Africa

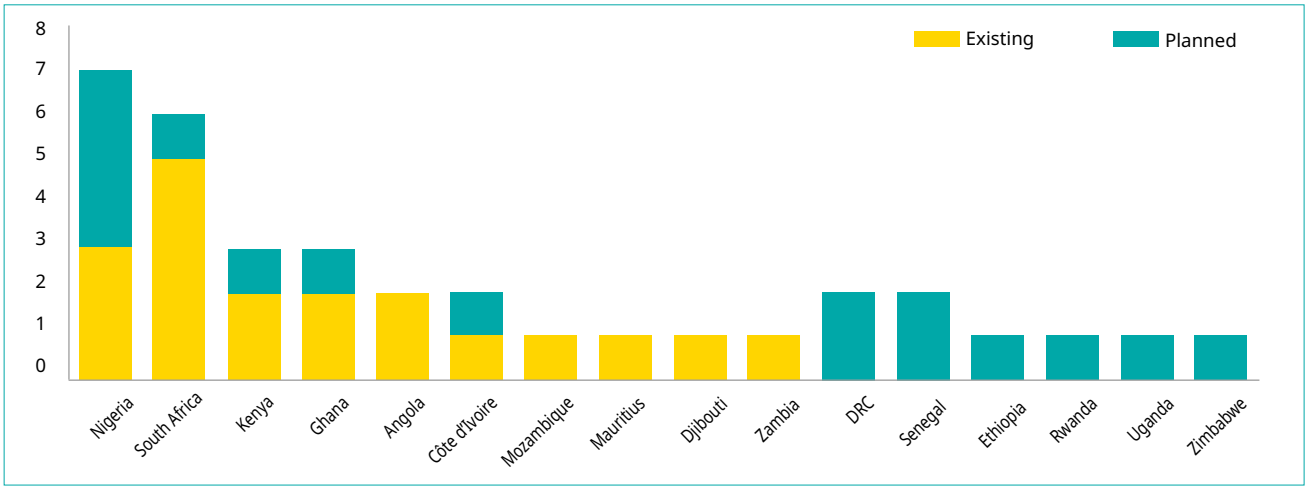
Source: The African IXP Association (https://www.af-ix.net/ixps-map / https://www.af-ix.net/ixps-list)

CARRIER NEUTRAL DATA CENTRES

Another infrastructure intrinsically linked to the IP protocol and crucial for the proper development of the Open Internet are data centres.[199] The capacity to store data locally and exchange this data with networks and service providers connected to a local IXP fosters the development of a local internet ecosystem. Since 2016, data centre capacity has doubled, but some predict that by 2030 five to six times the current capacity will be needed to bring the internet closer to the African users.[200] Africa has more internet users than the United States, a data centre capacity similar to Switzerland, all this while the demand is growing fast following rapid digitalisation and the rollout of 4G and 5G infrastructure across the continent.[201] Most of Africa's data are still stored in data centres outside the continent, relying heavily on the undersea cable system.

Figure 11: Number of carrier neutral data centres in sub-Saharan Africa, 2020

Source: Oxford Business Group[202]



194 A CDN refers to a geographically distributed group of servers which work together to provide fast delivery of internet content, by storing copies of the content (caches) closer to the user, allowing for faster access.

195 New entrants do not have to build out their networks to all the other networks that are exchanging traffic at the IXP. The IXP generally provides a neutral traffic exchange point, whereas bilateral interconnection can be expensive and include other barriers to entry.

196 IGF. 2017. "Best Practice Forum on IXPs. Contributing to the success and continued development of internet exchange points". Internet Governance Forum. January 2017. p.12.

197 Of which 33 are located in Brazil.

198 NIC.br, the national registry, operates 33 different IXPs across the country. CBI.br. 2020. "IX.br reaches mark of 10 Tb/s of peak internet traffic". 24 March.

199 Data centres can use network virtualisation to allow administrators to manage traffic to optimise performance, resources, availability and security. This can include using "virtual IP address takeover", the assignment of a virtual IP address to an existing interface, so that if one system becomes unavailable, virtual IP address takeover will automatically recover network connections between different servers. From https://www.sciencedirect.com/topics/computer-science/network-virtualization

200 Kampala. 2021. "Data centres are taking root in Africa". The Economist. 4 December.

201 OBG. 2021. p.9.

202 OBG. 2021. p.9.

INTERNET STANDARDS AND PROTOCOLS

The deployment of the most recent versions of the Open Internet's main technical protocols and standards has a major impact on the quality, security, resilience and openness of internet connectivity. As discussed before in this report, Open Internet protocols and standards are not carved in stone but remain under the scrutiny of open processes, where they are evaluated, updated, and complemented with new protocols to address changing challenges and new demands. Hence, using the latest standards has a direct impact on the quality, resilience, security and performance of the internet. Some key examples are IPv6, DNSSEC, HTTPS or the new QUIC.

Internet Society Pulse curates information about levels of IPv6 adoption in countries and networks around the world, progress being made towards an encrypted web, indicators of DNSSEC adoption by the registries for country-code domain names, and data on worldwide adoption of TLS1.3 and HTTP/3 (see Table 3).

Table 3: Protocol adoption per continent

Source: Internet Society Pulse, April 2022

	Africa	Europe	Americas	Asia	Oceania
HTTPS	77%	87%	79%	75%	72%
IPv6	6%	18%	16%	20%	9%
DNSSEC TLD	35%	86%	52%	59%	52%

IPv6 (IP version 6) brings along efficiency and assures the long-term development of the internet. Transition to IPv6 is vital for supporting the internet's continued evolution. In the global comparison (refer to Table 3), IPv6 adoption in Africa is lagging behind compared to other continents. One of the reasons for the low uptake is that there is still availability of IPv4 resources.[203] AFRINIC data indicate that the overwhelming majority of IPv6 resources have, to date, been allocated to the telecommunications and ISP industries in Africa.[204] To ensure a smooth transition, some businesses and organisations are supplementing their current IPv4 resources with IPv6 and adopting a combination of IPv4 and IPv6.[205] But much more remains to be done to also prepare public institutions, school networks and smaller ISPs and businesses.

QUIC (Quick UDP Internet Connections) is a new transport protocol for the internet, initially developed by Google and then taken to the IETF,[206] where it continued to evolve, be redefined and standardised.[207] QUIC is an example of how the Open Internet architecture allows technical components to evolve and improvements gradually deployed to build a better internet, without the need for radical changes. Since QUIC is a transport protocol and not an application, the ordinary user will not see any obvious difference, but behind the screen, the changes may have significant consequences. QUIC is a low-latency transportation protocol often used for apps and services that require speedy online service, such as gaming or streaming VoIP. QUIC is set to deliver a lot of new features designed to improve the performance and security of websites as well as other internet-based properties. [208] As QUIC is being deployed by large global players such as Facebook[209] or Uber[210] for its performance and other benefits, it is also relevant for local African developers to implement QUIC and keep up with the latest technology.

203 AFRINIC. "AFRINIC IPv4 Exhaustion statistics".
NRO. 2022. "Internet Number Resource Status Report - Q1 March 2022". The Number Resource Organization. 21 April.

204 AFRINIC. "AFRINIC IPv6 statistics".

205 This use of IPv4 and IPv6 in parallel as an interim solution is called dual stacking, explained in detail at https://www.cisco.com/c/dam/en_us/solutions/industries/docs/gov/IPV6at_a_glance_c45-625859.pdf.

206 https://quicwg.org

207 QUIC has been standardised in four IETF documents: RFC 8999, 9000, 9001 and 9002.

208 Bortzmeyer S. 2021. "The QUIC transport protocol has now been standardised". AFNIC. June 2021.
Nakutavičiūtė J. 2020. "This is what you need to know about the new QUIC protocol". NordVPN Blog. 30 September.
Ghedini A. 2018. "The Road to QUIC". The Cloudflare Blog. 26 July.

209 Joras M. Chi Y. 2022. "How Facebook Is Bringing QUIC to Billions". InfoQ. 20 January.

210 Mahindra R. Chander V. Guo E. 2019. "Employing QUIC Protocol to Optimize Uber's App Performance". Uber Engineering. 14 May.

TEST IF YOUR INTERNET IS UP TO DATE – INTERNET.NL INTERNET STANDARDS CHECKING TOOL

Text contributed by the Internet Standards Platform

The internet.nl test tool checks whether a website, email and internet connection uses modern and reliable internet standards. Users can easily check whether their internet is up to date. If not, the tool provides background information on the test results and pointers on how to update and solve the issues.

Using outdated standards that fall short of reliability is a risk not only for the individual internet user but also for the country's economy and for the world at large. The original internet standards from the 70s and 80s have been updated and new standards were developed to meet the scale and modern safety requirements.

The tool tests for the following standards:

- IPv6 (modern address)
- DNSSEC (signed domain)
- HTTPS (secure website connection)
- Website security options (such as security headers)
- STARTTLS and DANE (secure mail server connection)
- DMARC+DKIM+SPF (anti-spoofing)
- RPKI (secure routing)

Internet.nl is an initiative by the Dutch Internet Standards Platform, a collaboration of partners from the internet community and the Dutch government. The platform's mission is to jointly promote the use of modern internet standards, keeping the internet reliable and accessible for everybody. Internet.nl was made possible by using and combining other open source software.
There is also an API and dashboard of Internet.nl to scan batches with multiple domains (https://dashboard.internet.nl).

The Internet's Domain Name System (DNS)[211] allows the use of domain names to access information online instead of the complex (alpha)numeric IP addresses. The administration of DNS is structured in a hierarchy with the root zone at the very top. Root servers are DNS nameservers that operate in the root zone. These servers can directly answer queries for records stored or cached within the root zone, and they can also refer other requests to the appropriate Top-Level Domain (TLD) server.[212]

To date, the root server system consists of 1609 instances[213] operated by 12 independent root server operators.[214] (An up-to-date interactive map of root server location can be found at https://root-servers.org.) ICANN, the operator of the L-root, announced in February 2022 that it will install and manage two new ICANN Managed Root Server (IMRS) clusters in Africa. The clusters, one of which is confirmed to be in Kenya, will reduce the time it takes for a website to load, particularly when there are spikes in internet usage. This will bring immediate benefits for everyday internet users across the continent. Perhaps most important, the new IMRS clusters will reduce the impact of a potential cyberattack in the continent. Distributed

211 For an introduction to the DNS for Non-Experts: Karrenberg D. 2004. "The Internet Domain Name System Explained for Non-Experts". Internet Society. 1 March.
212 Cloudflare. "What is a DNS root server?".
213 https://root-servers.org
214 IANA. List of Root Servers.

Denial-of-Service (DDoS) cyberattacks work by overwhelming servers with a flood of queries. With two separate IMRS cluster locations and higher bandwidth and data processing capacity, the risk of the internet going down because of a cyberattack will be significantly reduced. Increased capacity lessens the impact of attacks.[215]

The African DNS address space consists of 56 top level country code ccTLDs,[216] 5 Internationalised Domain Names (IDNs)—Egypt (مصر), Algeria (الجزائر), Tunisia (تونس), Sudan (سودان) and Morocco (المغرب)—and 4 geographic TLDs (.africa, .capetown, .durban, .joburg).[217] On 22 April 2022, the African ccTLDs together counted 1.994.402 registered ccTLD domain names.[218] The global number of ccTLD registrations totalled 127.4 million at the end of fourth quarter of 2021, according to the VeriSign 'The Domain Name Industry Brief'. It should be noted that VeriSign excludes .cf, .ga, .gq and .ml from its data set and trend calculations due to a 'lack of verification from the registry operator for these TLDs'. [219] A comprehensive study of the DNS market in 2016 found links between the development of the domain name market and the presence of hosting and web developers: 'Domain name registration by African entities takes place mainly in countries where the local hosting industry and web development sector has developed sufficiently to create demand for local domains'.[220]

Table 4: The African ccTLD space

Source: DomainTools, 22 April 2022 data / ranked by size

> 1.000.000 registrations	.ga* .cf* .ml* .gq* .za (* unverifiable data according to The Domain Name Industry Brief)
> 100.000 registrations	.ng .ma (note: they are 133k and 103k)
> 50.000 registrations	.ke .tn
> 10.000 registrations	.zw .cm .re .tz .ly .st .so .dz .ci .mu
> 1.000 registrations	.bw .ug .ao .mz .dj .eg .sn .cd .rw .zm .mg .sc .sd .na .yt .gh .bi .cv .mw .sl .bj .tg .cg .ls .sz .et .bf .gm .mr
< 1.000 registrations	.ne .td .gn .lr .gw .km .er .ss

Table 5: IDN ccTLDs in Africa

Source: DomainTools, 22 April 2022 data / ranked by size

تونس (Tunisia)	604
مصر (Egypt)	116
الجزائر (Algeria)	26
المغرب (Morocco)	15
سودان (Sudan)	6

Table 6: Geographic TLDs in Africa

Source: DomainTools, 22 April 2022 data / ranked by size

.africa	48.393
.capetown	3.991
.joburg	2.758
.durban	2.202

The Domain Name System Security Extensions (DNSSEC) is a technology developed at the IETF[221] to protect the internet's Domain Name System (DNS) against unauthorised changes replacing the addresses of intended servers with addresses of machines controlled by the attackers. DNSSEC protects consumers by ensuring that DNS data

215 ICANN. 2022. "ICANN-Managed Root Server Clusters to Strengthen Africa's Internet Infrastructure". ICANN Press Release. 28 February.

216 .ao (Angola), .bf (Burkina Faso), .bi (Burundi), .bj (Benin), .bw (Botswana), .cd (Congo DRC), .cf (Central African Republic), .cg (Congo Rep.), .ci (Cote d'Ivoire), .cm (Cameroon), .cv (Cape Verde), .dj (Djibouti), .dz (Algeria), .eg (Egypt), .er (Eritrea), .et (Ethiopia), .ga (Gabon), .gh (Ghana), .gm (Gambia), .gn (Guinea), .gq (Equatorial Guinea), .gw (Guinea-Bissau), .ke (Kenya), .km (Comoros), .lr (Liberia), .ls (Lesotho), .ly (Libya), .ma (Morocco), .mg (Madagascar), .ml (Mali), .mr (Mauritania), .mu (Mauritius), .mw (Malawi), .mz (Mozambique), .na (Namibia), .ne (Niger), .ng (Nigeria), .re (Réunion), .rw (Rwanda), .sc (Seychelles), .sd (Sudan), .sl (Sierra Leone), .sn (Senegal), .so (Somalia), .ss (South Sudan), .st (Sao Tome and Principe), .sz (Swaziland), .td (Chad), .tg (Togo), .tn (Tunisia), .tz (Tanzania), .ug (Uganda), .yt (Mayotte), .za (South Africa), .zm (Zambia), .zw (Zimbabwe).

217 IANA Root Zone Database.

218 Calculated based Domain Tools Internet Statistics TLD Counts of 22 April 2022. The total does not include .cf, .ga, .gq and .ml. With these 4 ccTLDs included, the total would count 23.914.802.

219 VeriSign. 2022. "The Domain Name Industry Brief". Volume 19. Issue 1. April 2022.

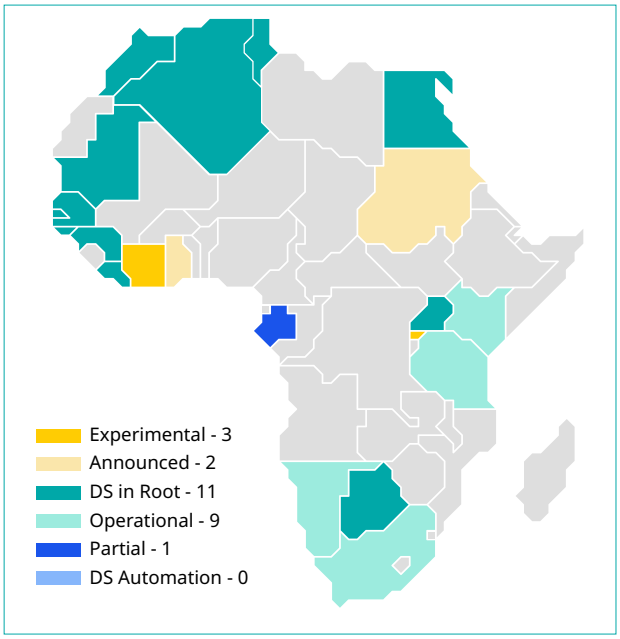
220 SACF. 2017. "ICANN - The 2016 African Domain Name System Market Study". South African communication Forum. 6 June. p.13-14.

221 IETF Datatracker. "Domain Name System Security (dnssec)".

that has been corrupted, either accidentally or maliciously, doesn't reach them.[222] In June 2021, as Figure 12 shows, 26 or roughly half of the African ccTLDs were in the process of deploying DNSSEC, with DNSSEC being operational in 9 of them.

Figure 12: DNSSEC deployment by African ccTLDs as per June 2021

Source: The Internet Society[223]



DIGITAL COMMONS

Digital commons are 'information and knowledge resources that are collectively created and owned or shared between or among a community'.[224] They are created to share among other software, databases, or digital content. Examples are wikis, such as Wikipedia,[225] OpenStreetMap,[226] or Open Food Facts,[227] open licensing organisations, such as Creative Commons,[228] open source software repositories and open software communities, such as Linux.[229] [230] Digital commons have two main characteristics: the resource is non-rival – the use of the resource by some does not limit the use by others, and the resource is non-exclusive – the right to use it is not restricted but (generally freely) available to third parties.[231] As such digital commons 'challenge the enclosure strategies pursued by some governments and major digital service providers' while contributing to the preservation of the collective control and valuation of data, and consequently the security of digital tools and innovations.[232] [233] Digital commons benefit from being shared, as this directly increases the use value of the resource and extends the community that will preserve it and inherently fights cyberbalkanization.[234] At European level, the European Commission has been active for the last few years in supporting the creation of the digital commons through different programmes and initiatives. This is especially the case with the Next Generation internet initiative,[235] where the Commission funds open source commons supporting the evolution of the internet towards the EU principles and values: data protection, security, decentralisation, openness and collaboration.

The creation of digital commons in Africa facilitates access to information, makes it possible to provide services tailored to citizens' needs, contributes to the creation of local jobs, strengthens the sovereignty of States, while avoiding the splintering of internet and balancing relations between the digital giants and governments.[236] Examples of digital commons initiatives that help to address real challenges of

222 ICANN. 2020. "Domain Name System Security Extensions Now Deployed in all Generic Top-Level Domains". 23 December. ICANN. 2019. "ICANN Calls for Full DNSSEC Deployment, Promotes Community Collaboration to Protect the Internet". 22 February.
223 Deployment status explained: Experimental - Internal experimentation announced or observed; Announced - Public commitment to deploy; Partial - Zone is signed but not in operation (no DS in root); DS in Root - Zone is signed and its DS has been published; Operational - Accepting signed delegations and DS in root; DS Automation - Automation of updates of DNSSEC keys. Source: Internet Society. "DNSSEC Deployment Maps".
224 Fuster Morell M. 2010. "Dissertation: Governance of online creation communities: Provision of infrastructure for the building of digital commons". p. 5.
225 https://www.wikipedia.org
226 https://www.openstreetmap.org
227 https://world.openfoodfacts.org
228 https://creativecommons.org
229 https://www.linux.org
230 Wigmore I. "Digital commons". Techtarget Network.
231 Alais O. 2021. "Internet and Africa: what cyberspace for tomorrow?". iD4D. 10 March, updated on 17 June.
232 France Diplomacy. 2022. "Joint statement by the Ministry for Europe and Foreign Affairs and the State secretariat for the digital transition and electronic communications. Creation of a European Initiative for Digital Commons." Ministère de L'Europe et des Affaires Etrangères 7 February. – "Declaration by the Presidency of the Council of the European Union calling for a European Initiative for Digital Commons".
233 France Diplomacy. 2020. "Barbed wire on the Internet prairie: against new enclosures, digital commons as drivers of sovereignty". Team Blog. July 2020.
234 Alais O. 2021.
235 European Commission. "The Next Generation Internet". https://www.ngi.eu/
236 Alais O. 2021.

African societies are the Ushahidi platform,[237] a not-for-profit technology company open-source software with the intent of strengthening communities and improving lives, empowering users to rapidly and purposefully gather, analyse, respond and act on data and information; and Digital Transport for Africa,[238] a collaborative digital commons and global community that scale up and support urban mobility through open data and peer-to-peer knowledge sharing. The latter aims to address transport challenges in African cities by collecting and sharing public transport data that is currently missing for planning integrated public transport, providing passenger information systems and upgrading transit services. In February 2022, Smart Africa and The Commons Project Foundation (TCP) announced a partnership for accelerating digital health across Africa to 'support and collaborate with Smart Africa member states and a variety of organizations on the design, development, deployment and operation of digital public health infrastructure for the common good. The parties will also engage on various potential digital health pilots which will benchmark the progress around digital health in Africa. The pilots will be the precursor for digital health initiatives that are aimed to strengthen Africa's health systems.'[239]

3.1.2 EU-Africa Open Internet infrastructure partnership opportunities: A multi-faceted approach

While the rate of internet connectivity, including the associated social and economic benefits, is increasingly faster in Africa compared to the global average, the continent still trails behind the rest of the world in terms of internet access and numbers of internet users,[240] coverage, quality of service, price and internet technology development. Notwithstanding broader socio-economic factors, this situation is to a great extent the result of significant challenges related to the deployment of key digital and internet infrastructures, and points towards the need for more investments and more market diversification in the provision of telecommunications services.

While much of the attention related to bridging the digital divide is focused on improving digital telecommunications infrastructure (e.g. undersea cables, telecommunications masts, satellite-powered broadband),[241] which are agnostic to the final connectivity technology, it is equally important to continue developing in parallel the Open Internet technical infrastructure (i.e. IXPs, data centres, deployment of internet protocols, improvement of the DNS). These multi-faceted and diversified investments are necessary to link the telecom infrastructure not only to improve the connectivity experience and quality but also to link the infrastructure to the global and open markets enabled by the Open Internet, while ensuring the long-term development of Africa's digital society.

EU-Africa infrastructure partnerships are already substantial, and future projects are being put in place. For example, the proposed plan for an EU space-based secure and cost-effective communication system that will also provide connectivity to Africa as part of the Global Gateway strategy.[242]

237 https://www.ushahidi.com
238 https://digitaltransport4africa.org
239 The Commons Project. 2022. "Smart Africa and The Commons Project Annouce a Partnership for Accelerating Digital Health Across Africa". 16 February.
240 ITU. 2021.
241 In 2019, the ITU estimated that to close the broadband gap in North and Sub-Saharan Africa by 2030, approx. $100 billion should be invested on the development of basic broadband infrastructure alongside supporting infrastructure such as electricity grids. (Broadband Commission. 2021.)
242 European Commission. 2022. "Space: EU initiates a satellite-based connectivity system and boosts action on management of space traffic for a more digital and resilient Europe". Press Release. 15 February.

INTERNET CONNECTIVITY EMPOWERING TODAY'S COMMUNITIES

Text contributed by the European Telecommunications Network Operators' Association (ETNO)

The members of the European Telecommunications Network Operators' Association (ETNO) deliver connectivity. They represent 70% of the network investment in Europe, but also far beyond. The members deploy telecoms infrastructure and services in the Americas, the Middle East, Africa and Asia, investing billions of Euros every year to provide fixed and mobile connectivity in these global regions. In addition to this, ETNO members are key stakeholders in major undersea cables, the backbone of intercontinental connectivity.

The key to economic growth and the empowerment of communities today is connectivity. However, internet infrastructure is not a standalone piece of the puzzle. State of the art next generation connectivity needs to be built on the foundation of a reliable and investment-friendly regulatory and legislative framework. The full benefits of connectivity can be reaped in an open internet environment, with an internet which is accessible, secure, robust and interoperable.

To bring real and tangible benefits to individuals and communities, the internet must be truly open, providing opportunities to communicate, exchange, learn and trade with other communities and partners on a global scale. A closed or restricted internet brings only limited economic and societal opportunities.

Internet ecosystems should be secure and trustworthy. An internet ecosystem that is fully centralised, closed or governed in a top-down manner is typically more vulnerable to cyberattacks and other security threats, exacerbated by the presence of a single point of failure. The economic and societal impact of cyberattacks is felt not only by the targeted entity or country, but by the entire surrounding internet ecosystem. Centralised network infrastructures are at risk to suffer from single points of failure, which makes infrastructure investment projects less attractive and less sustainable to providers.

Internet protocols are open and interoperable, and must remain so. Standards Development Organizations such as IETF, ETSI, IEEE, and 3GPP must remain inclusive as they investigate new network architectures and develop new protocols, or enhance the capabilities of current protocols. Potential development of new or improved protocols should take into account the high investments and long investment cycles typical to telecoms network infrastructure, which impact the sustainability of investment into connectivity projects and at least rely on international standardization bodies.

Finally, for the internet to remain truly open, all parts of the ecosystem must remain open. The principles to assure a level playing field, where all companies can compete on equal terms and thrive, must be equally applied to all internet actors. Largest digital platforms have become the gatekeepers of the internet, and should be prevented from restricting free competition and thus inhibiting innovation and user choice. Governments around the globe are already addressing the role of such digital gatekeepers and their dominant power by proposing regulations aimed at preventing self-preferencing and anticompetitive discriminatory approaches.

Yet, more fruitful infrastructural partnership can be established with both public and private sectors, especially bearing in mind the exponential room for growth offered by most African countries. In this sense, it needs to be pointed out that both the Global Gateway strategy and the general approach of European telecommunications companies are strongly committed to the Open Internet, thus offering African partners a solid option to diversify digital infrastructure providers and solidly increase the competition of telecom markets. In turn, this could have a much-needed effect on internet price: while internet subscription charges in Africa remain high compared to middle income countries, studies demonstrated that the adoption of broadband can be significantly boosted with relatively small (>10%) price cuts.

➜ OPEN INTERNET INFRASTRUCTURE AND ACCESS: RECOMMENDED INVESTMENT AND COOPERATION

The list below provides a broad consideration on the priorities for a multi-faceted investment in digital and internet infrastructures. Recommendations stem from the authors' research of a broad range of sources and expert studies consulted for this report.[243] Priorities must be refined and considered case-by-case in each country, and scoped in response to regional, national and subnational contexts, local demand and existing initiatives and cooperation partnerships. A stock-taking of ongoing initiatives and a dialogue with African stakeholders on what their priorities are, will contribute to a more effective cooperation.

Digital Connectivity Infrastructure:

- Extend fibre networks and broadband 4G/5G into remote and sparsely populated areas so that every country has a robust national fibre optic backbone.
- Encourage cooperation and infrastructure sharing to reduce the burden of investments and promote diversification of technologies and providers.
- Continue to improve international fibre optic capacity – including undersea cables – as demand increases, and regional terrestrial backbone infrastructure connecting countries – particularly landlocked countries.
- Invest in the deployment and affordability of alternative solutions, including satellite connectivity, in areas where the cost of expanding cellular connectivity is too complicated or expensive.
- Create public internet access facilities, such as municipal networks, public transport, school networks and in community centres and libraries.
- Provide startup capital for community, small business, and municipal ownership of small-scale communications infrastructure.

Open Internet Technical Infrastructure:

- Invest in the establishment of Internet Exchange Points (IXPs) and provide support for the community building efforts underpinning their success.
- Invest in local data centres, in particularly "green data centres", to avoid unnecessary transfer costs. Make sure that data centres are well connected to the IXPs.
- Support business and network operators to prepare for the IPv6 transition.
- Stimulate the development of a vibrant African DNS environment; invest in a robust DNS by increasing the number of Root instances and support the development of African ccTLD registries.
- Facilitate EU-Africa partnerships to share experience and solutions at sectoral level across industries and stakeholder groups, including digital commons.

243 Including Broadband commission, ITU documents, Internet Society, D4D, WSIS implementation reporting, AUC strategies, Research ICT Africa, WEF, A4AI, World Bank, OECD.

- Enabling policy and regulation remains a requirement for infrastructure development. Specific recommendations in this regard are included in the section below.
- Support the digital commons and promote the use of open source software.

Supporting infrastructure:

- Invest in "green" electricity infrastructure and in the institutional and human capacity to support and maintain it.
- Invest in new internet infrastructure powered by renewable energy resources.

Collection of data and statistics for Open Internet research and development:

- Invest in the systematic gathering and analysis of data on African's Open Internet Ecosystem. Demand and supply-side data are essential for public sector planning and private sector investment.
- Facilitate partnerships to collaborate and share methodologies for collecting and maintaining statistics among European and African institutions (from the technical community to national statistical agencies).
- Improve the capacity for statistics and data gathering, including financing regular household surveys.

3.2 THE OPEN INTERNET, ENABLING POLICY AND REGULATORY ENVIRONMENTS, AND E-GOVERNMENT

This section focuses on enabling policy and regulatory environments, and on e-government and digital public services. Both areas are led by the public sector, but they are effectively implemented only with the full participation of all other stakeholders. E-government and enabling policy and regulation are among the "action lines" agreed on by member states at the World Summit on the Information Society (WSIS) in 2003[244] and feature in existing digital development and regional integration strategies in Europe and Africa. Differences in contexts, in the extent of implementation and in lessons learned can enrich partnerships in this area in ways that can benefit citizens in both regions.

3.2.1 Open Internet-related policy, regulation and e-government in Africa and Europe: State of Play

Policy and regulation can either enable or slow down or block the availability and use of the Open Internet in all its dimensions: technical, social and economic. Efforts to put enabling policy and regulation in place in Africa at the level of both demand and supply are not new but progress has been uneven.

Many African countries first developed national information and communications strategies in the late 1990s as part of the United Nations Economic Commission for Africa's (UNECA) African Information Society Initiative[245] (AISI). The World Summit on the Information Society (WSIS) gave further impetus to these efforts, emphasising the need for policy and regulation to play an enabling role.

244 Action lines 6 and 7 respectively in the Geneva Plan of Action, 2003: 6. Enabling environment and 7. ICT applications: benefits in all aspects of life. ITU. 2003. WSIS-03/Geneva/Doc/5-E. "WSIS Geneva Plan of Action". 12 December.

245 The AISI was launched in 1996 and received support from the European Commission. United Nations. Economic Commision for Africa. 2008. "The African Information Sociaty Initiative (AISI): a decade's perspective". March.

Currently, the trend is to approach policy and regulation in Africa as part of broader digitalisation and regional integration strategies. Yet, whatever the labels used, most African states continue to face difficulties in implementing these strategies and in updating them to keep up with the fast-changing digital sector, and responding to basic digital inequality.[246] As the reach of the Open Internet expands, so does the range of policy, legislation and regulation needed to create an enabling environment for maximising its potential for socio-economic development. In a sense, African policymakers and regulators face a double burden: enabling investment and innovation in closing the digital divide through basic affordable access and responding to cutting-edge digitalisation challenges and opportunities such as digital identities, digital trade and services, data protection, artificial intelligence, disinformation and cybercrime, among others.

"The impact of technologies is determined by how they are used and managed. If new technologies are poorly introduced, they can destroy livelihoods and disrupt ecological balances. The opposite also applies. Policies in the era of the 4IR need to not only focus on economic competitiveness and employment, but must also ensure alignment with our national imperatives of social justice and redress – particularly with regards to reducing inequality and building livelihoods and inclusiveness. (...) The challenge for Africa is not whether but rather how and with what effect 4IR technologies will find systemic application. If the process is haphazard, the continent may find itself dictated to experiences that are not in tune with its social contexts."[247]

Many African states have difficulty in keeping up with new developments in the tech sector, and the African Union Commission itself has limited capacity to support these processes. At the same time, at national level, policy and regulation that impacts – often restrictively – on the Open Internet has proliferated.[248] Discussions on Africa-wide Open Internet regulatory frameworks are ongoing at regional and subregional levels, and also present opportunities for EU partnerships and sharing of experiences and expertise.

A good illustration is the regulation of online content. Several African governments have demanded that global platforms remove content and user accounts linked to criticism of government officials or practices. These disputes sometimes result in these platforms being blocked. Regulation aimed at addressing disinformation often fails to do so, instead resulting in stifling freedom of expression. Respecting human rights online is an area of vigorous debate on the continent and elsewhere, often sparked by intentional disruption of internet services initiated by states. Such disruptions also have dramatic economic and technical impacts that often go beyond national borders. According to TOP10VPN's calculation of the cost of internet shutdowns globally, Africa was the most affected region in terms of the number of hours that internet access was intentionally disrupted in 2021: 15,963 hours vs. 13,458 in Asia, a far larger region with more internet users.[249] A total of 12 African countries disrupted internet access 19 times during 2021 – three more times than in 2020. Government initiated these disruptions mostly in response to social protest or because elections were taking place.[250] See Table 7 for the estimated cost of these shutdowns.

246 Gillwald A. 2017. "From digital divide to digital inequality: The connectivity paradox". Research ICT Africa. Paper Presented at the Law and Development Research Conference: University of Antwerp, 20-22 September 2017.
247 MISTRA. 2020. "Leap 4.0: African perspectives on the fourth industrial revolution". Policy Brief from the Mapungubwe Institute for Strategic Reflection (MISTRA). December 2020. p.2.
248 Boakyz B. 2021. "Africa's open internet is at risk – its leaders must act to save it". African Business. 4 October.
249 Woodhams S. Migliano S. 2022. "Government Internet Shutdowns Cost $5.5 Billion in 2021". TOP10VPN. 4 January.
250 Access Now. 2022. "The return of digital authoritarianism. Internet shutdowns in 2021". #KeepItOn coalition. April 2022.

Table 7: The cost of internet shutdowns in Africa, 2021[251]

	Country	Total Cost	Duration (Hrs)	Internet Users Affected
1	Nigeria	$1.5BN	5040	104.4M
2	Ethiopia	$164.5M	8864	21.3M
3	Sudan	$157.4M	777	13.2M
4	Uganda	$109.7M	692	10.6M
5	Burkina Faso	$35.9M	192	10.9M
6	Eswatini	$2.9M	218	0.5M
7	Republic of Congo	$2.5M	72	1.5M
8	Zambia	$1.8M	48	2.6M
9	Chad	$1.6M	29	1.1M
10	Senegal	$0.3M	7	4.9M
11	South Sudan	$0.3M	24	0.9M

Another restrictive regulatory practice introduced in the last few years is taxing social media use, with taxes having to be paid by individual users. While African states have a legitimate concern with regard to not being able to collect sufficient tax revenue from the operation of multinational internet companies in their jurisdiction, taxing users has tended to stifle demand among low-income users. Research by Analysis Mason showed that in Uganda, 'the number of internet users declined by 15.7% in the first three months after the social media tax was implemented in July 2018'. This, in turn, reduced tax revenue from online services supported by social media platforms, such as data sales, and advertising.[252]

However, there are notable positive developments in policy and regulation, regionally and nationally. The 2019 Declaration of Principles on Freedom of Expression and Access to Information adopted by the African Commission on Human and People's Rights, an autonomous treaty body of the African Union, provides a clear and detailed soft law instrument to guide states – and non-state actors – as they make and apply internet-related content policy.[253]

BOX 3.3

➜ EXTRACT FROM THE DECLARATION OF PRINCIPLES ON FREEDOM OF EXPRESSION AND ACCESS TO INFORMATION IN AFRICA, 2019

> Part II: Right to Freedom of Expression

Principle 17. Regulatory bodies for broadcast, telecommunications and the internet

4. A multi-stakeholder model of regulation shall be encouraged to develop shared principles, rules, decision-making procedures and programmes to shape the use and evolution of the internet.

> Part IV: Freedom of Expression and Access to Information on the Internet

Principle 37. Access to the internet

3. States shall, in cooperation with all relevant stakeholders, adopt laws, policies and other measures to provide universal, equitable, affordable and meaningful access to the internet without discrimination, including by:
   a. developing independent and transparent regulatory mechanisms for effective oversight;
   b. improving information and communication technology and internet infrastructure for universal coverage;
   c. establishing mechanisms for regulating market competition to support lower pricing and encourage diversity;
   d. promoting local access initiatives such as community networks for enabling the increased connection of marginalised, unserved or underserved communities; and
   e. facilitating digital literacy skills for inclusive and autonomous use.

251 Woodhams S. Migliano S. 2022.

252 Kende M. Abecassis D. 2019. "Impact of taxation on social media in Africa". Analysys Mason. March 2019. p.2.

253 ACHPR. 2019. "Declaration of Principles on Freedom of Expression and Access to Information in Africa". African Commission on Human and People's Risghts. November 2019.

Several African countries are participating in the OECD's Inclusive Framework on Base Erosion and Profit Sharing (OECD BEPS)[254] aimed at international cooperation to end tax avoidance. This has the potential to 'elevate the discourse on the disproportional impacts of corporate tax avoidance in Africa and provide a more sustainable tax base for capital investments in critical infrastructure and social investment and protection, particularly in the context of COVID-19.'[255]

The African Union Commission (AUC) is the secretariat of the African Union. Its Infrastructure and Energy Department, led by the Commissioner for Infrastructure and Energy, is home to most of the policy and regulatory initiatives that relate to the Open Internet (see Box 3.4). Regional Economic Communities (RECs) are among the AUC's most important organs. The AU has eight officially recognised RECs that serve as the building blocks for regional integration: the Arab Maghreb Union (AMU), Community of Sahel-Saharan States (CEN-SAD), Common Market for Eastern and Southern Africa (COMESA), East African Community (EAC), Economic Community of Central African States (ECCAS), Economic Community of West African States (ECOWAS), Intergovernmental Authority on Development (IGAD), and Southern African Development Community (SADC). These bodies are not all equally effective, but they play an important role in policy and regulation. For example, model laws based on AUC guidelines would often be developed at the level of a REC. Global Gateway partnership opportunities exist across many AU organs, including treaty bodies such as the ACHPR and the RECs. Utilising these partnerships across the spectrum of both region's institutional architecture can widen the reach of the Global Gateway and the impact of investment in the Open Internet, provided sufficient coordination and information sharing are maintained.

BOX 3.4

➜ AFRICAN UNION-BASED POLICY AND REGULATION INITIATIVES TO STRENGTHEN REGIONAL INTEGRATION

How an Open Internet can support regional integration, and how to best enable this through policy and regulation, is at the heart of EU-Africa partnership opportunities. The African Union's Agenda 2063[256] is the most comprehensive vision for regional integration in Africa and includes targets for digital development. It created the impetus for establishing multiple regional policy guidelines and strategies related to digitalisation.

The Digital Transformation Strategy (DTS)[257] adopted by the AU in 2020 is aimed at harnessing innovation and digital technologies to generate inclusive economic growth, stimulate job creation and eradicate poverty. It recognises the availability, use and governance of data as essential for a digital ecosystem that will support the AU's regional integration priorities.

The African Union Digital Identity Framework[258] launched in 2021 will establish an Interoperable Digital Credential (IDC) to strengthen interoperability and trust between AU member states' different national identity systems. Models being discussed include digitally signed credentials or digital wallets to empower individuals with control over their personal data. The AUC hopes for implementation to begin in 2023, but a recent study on the adoption of ID systems in 10 African countries suggests that more time is needed and calls for collaborative multistakeholder approaches to the design, financing, implementation and governance of digital identity ecosystems.[259]

254 Base erosion and profit shifting (BEPS) refers to tax planning strategies used by multinational enterprises that exploit gaps and mismatches in tax rules to avoid paying tax. https://www.oecd.org/tax/beps/about/

255 Research ICT Africa. 2020. "Multifacted challenges of digital taxation in Africa". Research ICT Africa Policy Brief 7. November 2020. p.1.

256 African Union. "Key Transfomational Outcomes of Agenda 2063".

257 African Union. 2020. "The Digital Transformation Strategy for Africa (2020-2030)". 18 May.

258 AfricaPortal. 2021. "Event: Help the African Union Commission develop a digital ID framework for the continent". 26 July.

259 Hersey F. 2021. "Major research project examines digital identity in 10 African countries". Biometric Update.com. 9 November.

The African Data Policy Framework[260] will provide guidance to AU member states on the data governance building blocks needed for a fair, just and trusted digital environment.

The Programme for Infrastructure Development in Africa (PIDA)[261] started in 2012 to support regional integration through improved infrastructure in the transport, energy, transboundary water and telecommunication/ICT sectors. Its specific Open Internet related goal was to boost broadband connectivity on the continent by 20%. PIDA is a joint initiative of the AUC, the New Partnership for Africa's Development Planning and Coordination Agency (NPCA) and the African Development Bank (AfDB).

The Policy and Regulatory Initiative for Digital Africa (PRIDA), launched in 2020 with support from the European Union, aims to enable universally accessible and affordable broadband across the continent through harmonised and enabling legal and regulatory frameworks. Main activities are to:

- facilitate efficient and harmonised spectrum utilisation
- harmonise measurable policy, legal and regulatory frameworks
- strengthen the ability of African stakeholders to actively participate in the global internet governance debate (more on this in Section 4.5).

PRIDA activities are implemented by the AUC except for that on spectrum, which is led by the ITU. Key outputs include dedicated digital infrastructure to support the delivery of continuous online training in internet governance and ICT policy and regulation and a one-stop shop web portal for all national policies and regulation.

These digital and data policy frameworks and strategies have the ultimate goal of supporting the development of a Digital Single Market (DSM) for Africa and form part of a larger set of initiatives to support regional integration such as: The African Continental Free Trade Area (AfCFTA),[262] Pan-African Financial Institutions (AUFIs),[263] Single African Air Transport Market (SAATM)[264] and Free Movement of Persons (FMP) Protocol.[265]

All these efforts to achieve regional integration are only likely to succeed if there is a widely available and accessible technical, economic and social Open Internet environment. Sharing learning and experience on how policy and regulation can best support regional integration constitutes one of the most exciting opportunities for EU-Africa partnership.

Regarding cybersecurity, several African states have used the Budapest Convention to guide national cybercrime legislation and European Union member states have collaborated actively with African states and institutions – both at the level of national policy and in the field of international cybersecurity. A recent example is the South Africa-Netherlands Cyber Policy Dialogue that took place on 4 and 5 April 2022.[266] The Commission supports the Cyber4Dev[267] initiative which is delivering cybersecurity training in several African countries.

Much remains to be done at both national and international levels and the potential for EU-Africa

260 Research ICT Africa. 2021. "Consultation workshop: Africa Data Policy Framework, African Union Commission".
261 African Union. "Program Infrastructure Development for Africa (PIDA)". https://au.int/en/ie/pida
262 GIZ. "African Continental Free Trade Area (AfCFTA)". Project description. https://www.giz.de/en/worldwide/59611.html
263 African Union. 2018. "Pan-African Financial Institutions".
264 African Union. 2021 "The Single African Air Transport Market".
265 African Union. 2018. "Protocol tot he Threaty establishing the African Economic Community Relating to Free Movement of Persons, Right of Residence and Right of Establishment".
266 The Netherlands and you. 2022. "South-Africa – Netherlands Cyber Policy Dialogue Joint Statement". 6 April.
267 https://cyber4dev.eu

partnership in the area of cybersecurity is likely to expand in the coming years as both regions tackle the multi-faceted challenge of developing a secure and trusted Open Internet. According to the ITU Global Cybersecurity Index 2020, the number of countries with Cyber Incident Response Teams (CIRTs) in the African region has increased from 13 to 19 from 2018 to 2020. That said, cybercrime is still a major challenge to the ICT infrastructure and its development. In 2018, McAfee estimated cybercrime to have an economic impact on the global economy of over $1 trillion. In 2018, sub-Saharan Africa lost $2 billion (equivalent to 135% GDP) because of cybercrime, which targeted organisations including government and financial institutions as well as critical infrastructure. Such attacks hinder not only the recovery of the economy but also the investment in digital technologies made by African governments to mitigate the risks of the COVID-19 pandemic. In the same vein, e-commerce industry in Africa is also at risk because of cyberattacks.

The African Union Commission's Malabo Convention on Cyber Security and Personal Data Protection has a broader ambit, as it includes personal data protection, electronic transactions and cyber security. Adopted in 2014 but still not ratified, it nevertheless built capacity and encouraged many African states to introduce data protection legislation at national level.[268] Currently, 72% of Africa's 54 countries have data protection legislation in place (33 countries) or in draft form (six countries).[269] Given Europe's frontrunner legislation on data protection, the 2018 General Data Protection Regulation (GDPR), a Global Gateway partnership can assist in building a broader awareness of privacy being not only a human rights concern, but fundamental to the growth of the digital economy.

Indeed, the EU is often considered to have one of the most advanced and influential regulatory frameworks for digital societies, explicitly committed to the principles and technologies enabling the Open Internet. Box 3.5 summarises some of the key recent legislative and policy developments in the EU, covering issues that range from data protection to artificial intelligence or the empowering of European digital business, including its cultural industries. The development of such frameworks is not absent from strong debate among stakeholders, citizens and civil society, including deliberation on potential impacts on human rights, and the elaboration of a corpus of evidence (e.g. surveys, expert analyses) to assess the impact of each measure. Every legislative piece is the result of research and political compromise, aimed not only at connecting Europe to global digital markets but also making the Open Internet work for local economic and socio-political development, while keeping its global un-fragmented architecture untouched.

BOX 3.5

➜ SELECTED EU REGULATIONS AND POLICIES WITH A STRONG IMPACT ON THE OPEN INTERNET

Europe's Digital Decade: digital targets for 2030[270] This vision for Europe's digital transformation is for a secure and trusted online environment, universal digital education and skills, access to digital systems and devices that respect the environment, accessible and human-centred digital public services and administration, ethical principles for human-centred algorithms, protecting and empowering children in the online space and access to digital health services, among others.[271] It is guided by a Digital Compass[272] with four cardinal points: Skills – Government – Infrastructure – Business. The Digital Decade includes a policy programme,[273] multi-country projects,[274] international partnerships and digital citizenship development.

268 Jamil Z. 2016. "Comparative analysis of the Malabo Convention of the African Union and the Budapest Convention on Cybercrime". Council of Europe. 20 November.
269 UNCTAD. "Data Protection and Privacy Legislation Worldwide".
270 European Commission. 2021. "Shaping Europe's digital future. Europe's Digital Decade".
271 European Commission. 2021. "Europe's Digital Decade: digital targets for 2030".
272 https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#ecl-inpage-kyvdstob
273 https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#ecl-inpage-kyvdswtr
274 https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#ecl-inpage-kyvdszzf

The draft **Declaration of Digital Rights and Principles**,[275] proposed by the Commission in January 2022, aims to provide a clear reference point about the kind of digital transformation Europe promotes and defends. It will also provide a guide for policymakers and companies when dealing with new technologies. The rights and freedoms enshrined in the EU's legal framework, and the European values expressed by the principles, should be respected online as they are offline. Once jointly endorsed, the Declaration will also define the approach to the digital transformation, which the EU will promote throughout the world, providing guidance for human-centric digital transformation.

The **General Data Protection Regulation (GDPR)** of 2018 is an EU law that safeguards personal data and upholds the privacy rights of anyone in EU territory and EU citizens anywhere in the world. The regulation includes seven principles of data protection that must be implemented and eight privacy rights that must be facilitated. The GDPR[276] became recognised globally as a model of privacy and data protection law and has been used as a benchmark for other countries including Turkey, Mauritius, Chile, Japan, Brazil, South Korea, South Africa, Argentina, and Kenya. The European Data Protection Supervisor,[277] the EU's independent data protection authority, which defends and promotes the privacy of individuals and data protection, can serve as a model for similar entities in African countries.

The **Digital Services Act (DSA)** and the **Digital Markets Act (DMA)**, both proposed in 2020 and upheld in 2022, are two legislative initiatives of the European Commission to upgrade rules governing digital services in the EU. Their main goals are: 1) to create a safer and more open digital space in which the fundamental rights of all users of digital services are protected; 2) for big tech companies to curb illegal content and disinformation on their platforms; and 3) to establish a level playing field to foster innovation, growth and competitiveness, both in the European Single Market and globally.[278]

The EU's approach to artificial intelligence hinges on excellence and trust to boost research and industrial capacity while safeguarding fundamental rights. To this aim, an AI strategy was developed with a special focus on excellence in AI and trustworthy AI.[279] The proposed **EU Artificial Intelligence Act** of 2021[280] identifies horizontal rules for the development, commodification and use of AI-driven products, services and systems within the territory of the EU. The European approach to AI seeks to ensure that any AI advancements are based on rules that safeguard the functioning of markets and the public sector, and people's safety and fundamental rights. The legal framework for AI[281] proposes a clear, easy to understand approach, based on four different levels of risk: unacceptable risk, high risk, limited risk, and minimal risk.[282]

The **Directive on Copyright** in the Digital Single Market of 2019 promotes creativity and enables consumers and creators in the context of the Open Internet. It buttresses the creation and dissemination of more high-value content and allows for more digital uses in core areas of society, while safeguarding freedom of expression and other fundamental rights. The Directive promotes a better remuneration for creators and rights holders for their online work and increases transparency in their relationships with online platforms. It further provides opportunities for using copyright-protected material online and across borders for education, research and preservation of cultural heritage.[283]

275 European Commission. 2022. "Shaping Europe's Digital future. Declaration on European Digital Rights and Principles". 26 January.
276 GDPR.EU. "Complete guide to GDPR compliance". Proton Technologies 2022. https://gdpr.eu
277 European Data Protection Supervisor. https://edps.europa.eu/_en
278 European Commission. "Shaping Europe's digital future. The Digital Services Act package".
279 European Commission. "Shaping Europe's digital future. A European approach to artificial intelligence".
280 European Commission. 2021. "Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts". 21 April.
281 European Commission. 2021. "Shaping Europe's digital future. Proposal for a Regulation laying down harmonised rules on artificial intelligence". 21 April.
282 Kop. M. 2021. "EU Artificial Intelegence Act: The European Approach to AI". Vienna Transatlantic Technology Law Fo-rum, Transatlantic Antitrust and IPR Developments, Stanford University, Issue No. 2/2021.
283 European Commission. 2021. "New EU copyright rules that will benefit creators, businesses and consumers start to apply". Press realease. 4 June.

EU Regulation on Open Internet Access,[284] applicable since 2016, grants end-users the directly applicable right to access and distribute lawful content and services of their choice via their internet access service and enshrines the principle of non-discriminatory traffic management. At the same time, it allows reasonable traffic management. This approach to traffic management resonates with that practised in many countries in Africa, where limitations in available bandwidth necessitates user-centric traffic management.

The **Data Act**, published in February 2022, proposes new rules on who can use and access data generated in the EU across all economic sectors. The Data Act will ensure fairness in the digital environment, stimulate a competitive data market, open opportunities for data-driven innovation and make data more accessible for all. It will lead to new, innovative services and more competitive prices for aftermarket services and repairs of connected objects.[285]

The **EU Network Information Security Directive (NIS2)** [286] is a revision of the earlier NIS Directive (2016), which was Europe's first cybersecurity legislation. Its goal is to provide clear guidelines on requirements for all businesses on how to ensure information and network security. NIS2 addresses gaps in NIS and is currently under discussion.

The **EU Toolbox for 5G Security**, [287] published in 2021, pinpoints a common set of measures to mitigate the main cybersecurity risks of 5G networks and to provide guidance for the selection of measures. It aims at establishing a robust framework of measures with a view to ensure an adequate level of cybersecurity of 5G networks across the EU. These measures will embed standards and protocols that support network security and resilience, interoperability, and an open, plural and secure internet, given its role as a key driver of innovation, socio-political, economic and cultural development.

`E-government and digital public services in both Europe and Africa can contribute to more effective regional integration, as well as strengthen citizen-centred governance and greater transparency, and accountability. When they work well, they are at the heart of the benefits of the Open Internet. 'Effective digital public services, or eGovernment, can provide a wide variety of benefits. These include more efficiency and savings for governments and businesses, increased transparency, and greater participation of citizens in political life. ICT is already widely used by government bodies, but eGovernment involves more than just the tools: it involves rethinking organisations and processes and changing behaviour so that public services are delivered more efficiently to people. Implemented well, eGovernment enables citizens, enterprises and organisations to carry out their interactions with government more easily, more quickly and at lower cost.'[288]

The potential benefits of e-government and digital public services for citizens in Africa, where the population is often distributed thinly over large areas with poor transport infrastructure, cannot be understated. 'The reality, though, is that African countries' adoption of e-government platforms hasn't served the majority of their citizens. Services like e-taxation, e-payment and e-billing are useful for the middle class and richer people. But e-government initiatives that would support and cater to poorer people are sorely lacking. For example, e-government initiatives designed to enable skills development for poor citizens and the unemployed, or to promote

284 European Commission. "Shaping Europe's digital future. Open Internet".
285 European Commission. 2022. "Data Act: Commission proposes measures for a fair and innovative data economy". Press release. 23 February.
286 European Commission. 2020. "Shaping Europe's digital future. Proposal for directive on measures for high common level of cybersecurity across the Union". 16 December.
287 NIS Cooperation Group. 2020. "Cybersecurity of 5G networks. EU Toolbox of risk mitigating measures". January 2020.
288 European Commission. "Shaping Europe's digital future: eGovernment and digital public services".

micro enterprises, are not easy to find in most African countries.'[289] Data from the 2020 global e-government survey by the United Nations Division for Economic and Social Affairs' (UN DESA)[290] support this analysis: 'Europe has the largest proportion of countries (93 per cent) offering online services to vulnerable populations, followed by the Americas (84 per cent), Asia (80 per cent), Oceania (65 per cent) and Africa (55 per cent).'[291]

At the same time, the ranking of countries in the E-Government Development Index (EGDI) shows that African countries have made significant progress with only 7 of the region's 54 countries remaining in the lowest EGDI group. The survey praises joint initiatives, such as Smart Africa and the Digital Agenda for Europe, as 'manifestations of a growing understanding that the challenges and opportunities associated with digital transformation are best addressed through interregional and intraregional cooperation.'[292] 'At the regional level, positive changes in levels of e-government development were most apparent in Africa, where 15 countries (28 per cent) moved to a higher EGDI group. These results show that Africa is experiencing digital progress despite the persistence of the digital divide (reflected in Africa having the lowest regional EGDI average and the largest number of countries in the low EGDI group).'[293]

E-government services need to be designed, or re-designed, to ensure they are available to citizens with low-end devices or through public access points. Prioritising which services to provide, from the perspective of the Open Internet can help EU-Africa partnership achieve concrete results. The authors of a case study of e-government in Nigeria propose the following as core e-government services[294] that can contribute to socio-economic development of the masses in Africa:

- E-democracy: voter registration, actual voting and election monitoring can facilitate citizens' active participation in democratic processes
- Wealth-creation through e-government platforms for small and informal businesses: cloud platforms that provide computing infrastructure, software services, and market exposure
- Electronic payment and procurement systems for improved fiscal discipline
- E-participation for inclusive governance
- E-learning for improved education and informal learning
- Mobile learning and mobile commerce
- E-health initiatives for improved healthcare for the masses
- E-governance for peace and security.

While Africa does have very specific challenges, the UN DESA survey points out that there are areas in all regions that require attention. 'Some of the areas requiring attention in every region include the following: political will, leadership and institutional capacities; technology diffusion and connectivity; trade and the digital economy as driving forces behind digital transformation; data, data inclusiveness, and the critical importance of open data in building inclusive societies; digital skills as a cornerstone for the future in the employment, education, health and other sectors that are especially relevant to people's day-to-day lives; economic empowerment and gender divides; and smart cities and urbanization. Leadership and collaboration are increasingly being recognized as key to advancing the regional digital agenda and the role of e-government in sustainable development.'[295] This resonates with Open Internet values and potential and can provide a useful framing for EU-Africa partnerships in e-government and digital public services.

289 Olawande Daramola J. 2019. "African countries should rethink how they use e-government platforms". The Conversation. 22 January.
290 United Nations. 2020. "E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development". United Nations Department of Economic and Social Affairs.
291 Ibid p. xxvi
292 Ibid p. xxvii
293 Ibid p.40
294 Daramola O. Ayo C. 2015. "Enabling socio-economic development of the masses through e-government in developing countries". Department of Computer Science and Information Sciences, Covenant University, Ota, Nigeria. January 2015.
295 United Nations. 2020. p. xxvii

3.2.2 EU-Africa partnership opportunities for the Open Internet regulatory environment and e-government

Through the Global Gateway, 'the EU will offer digital economy packages that combine infrastructure investments with country-level assistance on ensuring the protection of personal data, cybersecurity and the right to privacy, trustworthy AI, as well as fair and open digital markets.'[296] This builds on the already existing collaboration between the EU and Africa in the area of information and communication technology policy and regulation that dates back to the European Commission's support of UNECA's African Information Society Initiative (AISI)[297] launched in 1996. Since then, EU-Africa collaboration has continued and expanded. In 2008, in a response from African communication ministers, the European Union and the International Telecommunications Union started a collaboration with regional institutions in Africa on the project "Harmonization of ICT Policies in Sub-Saharan Africa (HIPSSA)".[298] HIPSSA contributed to pan-African harmonised ICT policies and frameworks including the development of model laws by AU RECs, without which the substantial growth of regional internet backbone in the last decade would not have taken place. The collaboration through PRIDA, described above, built on these earlier initiatives. Furthermore, there are several other important areas of collaboration, such as in the field of data protection, where new digital partnerships between Africa and Europe can contribute to establishing more secure data flows between the continents. Another regulatory area with the same universal features is cybersecurity. Partnership in this field can help connect African and European digital environments by guaranteeing a secure and trusted digital infrastructure based on the Open Internet.

One of the features of the evolving EU digital regulatory framework that is most interesting from a development perspective is the potential to contribute to shaping the real socio-political and economic dynamics of the Open Internet to support local empowerment. It does so by upholding values such as competition, privacy and respect for human rights in very concrete ways. This enables the Open Internet to visibly provide opportunities for local content to thrive and local economies to grow through innovation in the digital sphere, following a strict democratic vision that puts people's empowerment at its centre.

While tried and tested EU regulations can provide inspiration for the regulatory frameworks being developed in African countries, it is important that they are not used as blueprints. They need to be properly debated and adapted to local contexts and needs. This will result in cross-regional learning policy innovations that can in turn benefit EU frameworks. Analysts have often commented on the risks of enacting laws too rapidly, without sufficient local research and consultation with local stakeholders.[299] In the end, the digital environment is still under construction everywhere – every major law continues to be a policy experiment and, as far as these can be built under common principles, there is major room for partnerships and developing a common understanding of how to shape the Open Internet so that its benefits revert directly to people.

➜ OPEN INTERNET REGULATION AND POLICIES AND E-GOVERNMENT: RECOMMENDED COOPERATION PRIORITIES

The current European and African contexts present well-defined cooperation opportunities to develop enabling policy and regulatory frameworks. Recommended priorities are listed below. It is particularly important to note that priorities must be refined and scoped in response to regional, national and subnational contexts, as well as local demand and existing initiatives and cooperation partnerships. In this sense, the EU and Africa can also collaborate to develop a proper local evidence-

296 European Commission. 2021. "The Global Gateway". p.4.

297 United Nations. Economic Commission for Africa. "What is the African Information Society Initiative (AISI)?". Knowledge Repository.

298 ITU. HIPSSA Project. "Support for harmonization of ICT Policies in Sub-Saharan Africa".

299 Sewe N. 2021. "Multi-stakeholder collaboration: Achieving digital inclusion in Africa". World Benchmarking Alliance. Blog. 27 June. OECD. 2000. "Reducing the risk of policy failure: challenges for regulatory compliance".

based policy-making background (e.g. impact assessment) on access and Open Internet connectivity, as recommended in the previous section.

Data governance:

- Building a digital environment that ensures the protection of personal data, the right to privacy and allows for trustworthy AI
- Good data protection practices in data centres to ensure trust

Cybersecurity and cybercrime:

- Participation from all stakeholder groups in global cybercrime and cybersecurity responses
- Monitoring of norm implementation and uptake of confidence building measures and capacity building, including through the Programme of Action to Advance Responsible State Behaviour in Cyberspace, a proposal made by France and Egypt and 58 additional co-sponsors in the context of the discussions on the use of ICTs in the context of international security[300]
- Elaboration of mitigating measures to address security risks related to the rollout of the fifth generation of mobile networks (5G)

Fair and open digital markets:

- Enable regulatory models that ensure open and competitive markets for communications networks and services.
- Sharing experience and impacts of regulatory responses to large multinational internet-based companies, including platforms
- Policy and regulation to enable competitive and diversified access markets by, for example, licensing small, medium enterprises and community owned networks[301]; regulation to incentivise infrastructure-sharing between operators to ensure utilisation of new infrastructure is optimised[302]; policy and regulation to incentivise use of solar energy to extend access in "off-grid" areas
- Reducing taxes on ICT goods and services
- Collaborative approaches to fair tax payment by global internet companies
- Dynamic spectrum regulation and allowing innovative use of spectrum and new dynamic spectrum-sharing techniques, such as TV whitespace (TVWS)

Local culture and content:

- Policy and regulation as well as soft law guidelines and self-regulation that contribute to the protection and promotion of African knowledge, culture, and artifacts
- Business models that ensure fair remuneration for content creators while also expanding open access publishing models – in particular, in the area of Open Educational Resources (OERs)[303]

Open Internet regulation:

- Building understanding of the various dimensions of network neutrality into internet policy and regulation
- Putting into place user-centric regulation that also creates more transparency and predictability around traffic management in bandwidth constrained contexts

300 One example would be through the Programme of Action, a joint proposal submitted by France and Egypt to the United Nations First Committee. Digwatch. 2020. "France and partners propose a programme of action for advancing responsible state behaviour in cyberspace". Geneva Internet Platform. 8 October.

301 APC. 2016. "Ending digital exclusion: Why the access divider persists and how to close it". Association for Progressive Communications. Position Papers. April 2016.

302 Infrastructure sharing here refers to regulations that require mobile and terrestrial broadband infrastructure being made available to operators or public sector entities other than those that initially built the infrastructure.

303 https://www.oerafrica.org/

Protection and promotion of human rights:

- Building evidence and raising awareness of the links between a digital environment that safeguards human rights and one that enables economic growth
- Addressing internet shutdowns, censorship and mass surveillance; discussing alternative, democratic solutions to the problems apparently tackled by these tools with African countries

E-government and digital public services:

- Focus partnerships in areas explicitly linked to social and economic development opportunities and that reflect Open Internet values and benefits, such as:
  - E-democracy e.g. voter registration and election monitoring
  - E-government platforms for small and informal businesses
  - E-government platforms for tech startups
  - E-participation for inclusive governance
  - Electronic payment and procurement for improved fiscal discipline
  - E-learning for improved education and informal learning
  - Mobile learning and mobile commerce
  - E-health initiatives for improved healthcare for the masses
  - E-governance for peace and security.
- Partnerships that facilitate leadership and collaboration in areas relevant to e-government and governance in all parts of the world:
  - Political will
  - Leadership and institutional capacities
  - Technology diffusion and connectivity
  - Trade and the digital economy as driving forces behind digital transformation
  - Data and data inclusiveness, and the critical importance of open data in building inclusive societies
  - Digital skills as a cornerstone for the future in the employment, education, health and other sectors that are especially relevant to people's day-to-day lives
  - Economic empowerment and gender divides
  - Smart cities and urbanisation.

3.3 OPEN INTERNET SKILLS AND COMPETENCES

What do we mean by Open Internet skills and competences? They are best described as a broad range of skills and competences needed to realise the potential of the Open Internet for economic and social growth and development. They link to all four main dimensions of the Open Internet previously discussed (see Section 1.3): technical openness, economic openness, social openness, and the horizontal aspects of openness: digital security, multilingualism, user empowerment, inclusive governance, and the distributed control and coordination of the different components that make the internet work. Strategies to build these skills and competences should consider supply-side factors (e.g. rollout and maintenance of infrastructure and equipment[304]) and demand-side factors (e.g. content creation, e-government applications and services, digital and media literacy, digital safety skills).

'Evidence from the 2017 Research ICT Africa (RIA) After Access Survey, a nationally representative survey conducted in 10 African countries – Ghana, Kenya, Lesotho, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania and Uganda – shows that supply-side issues such as ICT infrastructure

304 Internet connectivity as well as supporting infrastructure such as electricity. See Section 3.1.

development and coverage do not necessarily ensure digital beneficiation, but demand-side factors such as digital skills, education and affordability are equally critical elements to ensure a sustainable and a welfare-enhancing ICT sector.'[305] Entry level skills, such as digital literacy, are as important as high-end and specialised technical skills. Media literacy, including the ability to recognise mis- and disinformation, is as important as understanding how to be safe online.

A lifelong learning approach that integrates the development of Open Internet skills and competences into formal education, from primary school to tertiary level and into formal and informal adult and vocational education programmes, is necessary. Also needed are competences in policy and regulation, project planning and design, management and implementation of large-scale projects including e-governance and government projects, and monitoring and evaluation for the purpose of learning and improvement. In the context of the Open Internet and a multistakeholder approach to inclusive governance, it is also important to actively build the capacity – and associated confidence – of people from all walks of life and all stakeholder groups to participate in policy processes.

3.3.1 Digital and Open Internet skills and competences: State of Play

Human capital – made up of accumulated knowledge, skills and health – in Africa grew significantly in the decade before the pandemic, but it remains low relative to other parts of the world.[306] According to the World Bank's Human Capital Index 2020 report, sub-Saharan Africa is the lowest ranking region.

Table 8: Human Capital Index 2020, averages by World Bank region[307]

Indicator	East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	North America	South Asia	Sub-Saharan Africa
HCI Component 1: Survival							
Probability of Survival to Age 5	0.98	0.99	0.98	0.98	0.99	0.96	0.93
HCI Component 2: School							
Expected Years of School	11.9	13.1	12.1	11.6	13.3	10.8	8.3
Harmonised Test Scores	432	479	405	407	523	374	374
HCI Component 3: Health							
Survival Rate from Age 15 to 60	0.86	0.90	0.86	0.91	0.91	0.84	0.74
Fraction of Children Under 5 Not Stunted	0.76	0.90	0.85	0.82	—	0.69	0.69
Human Capital Index (HCI) 2020	**0.59**	**0.69**	**0.56**	**0.57**	**0.75**	**0.48**	**0.40**

Source: World Bank calculations based on the 2020 update of the Human Capital Index (HCI)
Note: The table reports averages of the index components and the overall Human Capital Index (HCI) by World Bank Group regions. — = not available.

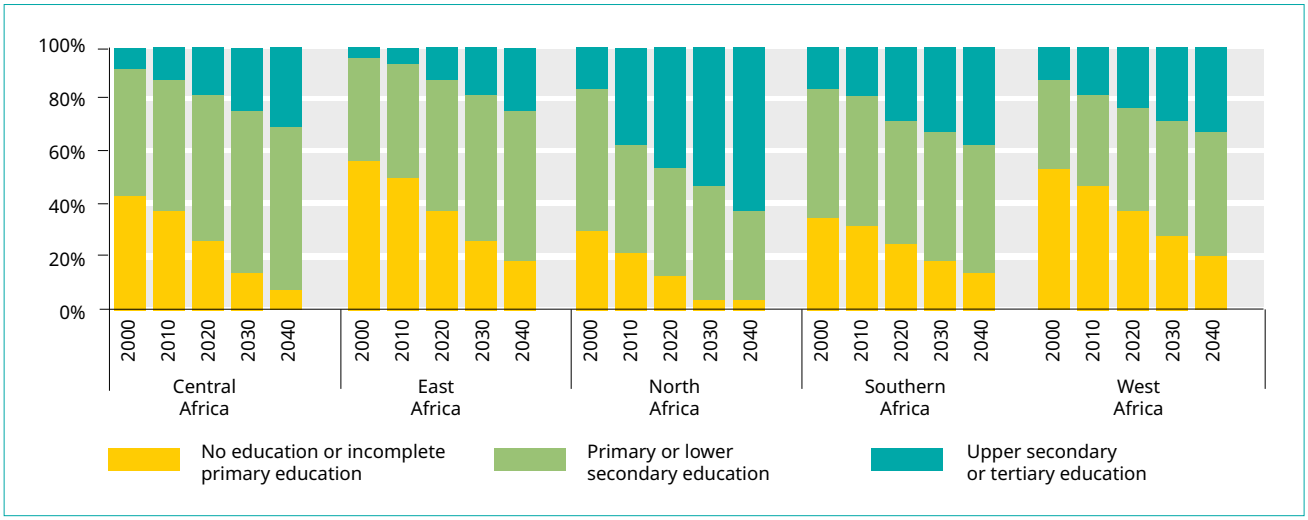
Africa still trails behind most other parts of the world in overall levels of education and unemployment.[308] In 2020, more than 20% of Africans between the age of 15 and 29 had not had any primary education at all (see Figure 13).[309] According to the International Labour Organisation in 2019, more than one in five African youth were 'Not in Education, Employment or Training' or NEET. Youth

305 Gillwald A. Onkokame M. 2019.
306 The World Bank. 2021. "Investing in people for a resilient and inclusive recovery: Africa Human Capital Plan year two progress report". June 2021.
307 World Bank Group. 2020. "The Human Capital Index 2020 update: Human Capital in the Time of Covid 19". p.18.
308 EIB. 2021. "The rise of Africa's digital economy - The European Investment Bank's activities to support Africa's transition to a digital economy". European Investment Bank. February 2021, p. 35.
309 Donkor A. 2021. "Africa's Youth Unemployment Crisis Is a Global Problem". Foreign Policy. 19 October.

joblessness has been steadily growing since 2012, and more young women than young men fall into the NEET category.[310] South Africa is at the extreme end of the youth unemployment spectrum with a rate of 66.5% in the last quarter of 2021.[311]

Figure 13: Profile of Africa's youth (aged 15-29) by educational attainment and region, 2000-2040

Source: OECD[312]



Open Internet skills extend beyond technical skills, but technical skills and general STEM (science, technology, engineering and mathematics) competences are important for African digital development and innovation. Less than 25% of African students in tertiary education pursue STEM careers.[313] This is not much lower than the percentage in Europe,[314] but as Africa has a smaller existing human resource pool, its impact is greater. 'The fact that only a few young Africans choose to pursue STEM-related career fields is a big issue. It potentially means that regardless of Africa's talent pool, public and private institutions would have to source workers in those fields from outside of the continent consequently leading to a limited domestic STEM workforce.'[315] Increasing the size of the STEM human resource pool matters for the Open Internet, but this pool also needs to be more inclusive. Between 18% and 31% of science researchers in sub-Saharan Africa are women, compared to 49% in Southeast Europe. 'Getting girls and women into STEM is not only a matter of human rights but also makes economic sense. Adopting diversity and gender inclusion in STEM is critical for increasing creativity, innovation, gender-sensitive perspective for products, and productivity, considering that women make up half of the world's population.'[316]

The relatively low levels of formal education make strengthening Open Internet skills and competences more challenging, particularly high-end technical and STEM skills. On the other hand, the flexibility of the Open Internet, through customised applications and services designed to meet people's specific needs, presents a multitude of new opportunities for human capital development. At the same time, the cross-border character of the Open Internet means that Africa needs not only to develop talent but also to retain it. Linking skill building initiatives to opportunities for employment, internships, further education opportunities, access to startup capital and participation in policy processes can help achieve this.

310 ILO. 2021. "Global Employment Trends for Youth 2020: Africa". International Labour Organization.

311 Trading Economics. "South African Youth Unemployment Rate".

312 AUC/OECD. 2021. «Profile of Africa's youth (aged 15-29) by educational attainment and region, 2000-40», in Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs, OECD Publishing.

313 AIMS. 2021. "Promoting STEM Education in Africa". African Institute for Mathematical Sciences. Next Einstein Initiative. 5 October.

314 'Eurostat data from 2019 says that 25.8% of university graduates graduated in STEM subjects in the 27 countries of the European Union as a whole.' Alvarez M. 2022. "In which European countries are STEM graduates most highly recognised?". CYD Foundation. Multirank. 23 February.

315 AIMS. 2021.

316 Ekine A. Aremu A. 2022. "Making the future of African STEM female". Brookings Institute. 10 February.

3.3.2 EU-Africa partnership opportunities: Open Internet skills and competences as part of a broader educational policy

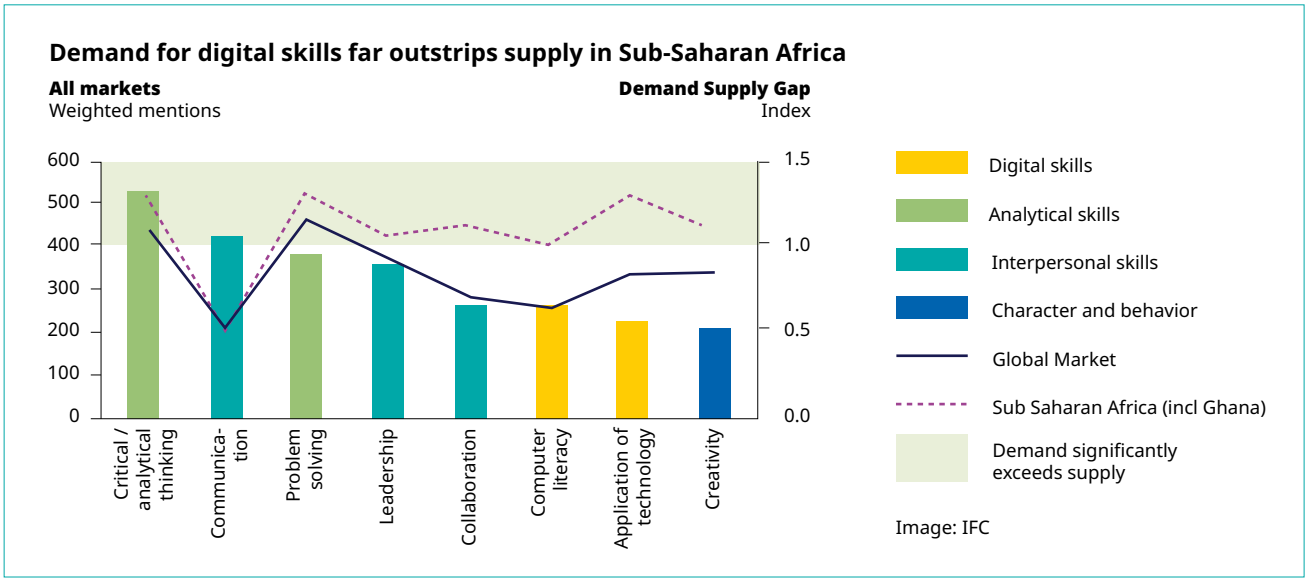
A multi-pronged approach is needed to effectively support the development of Open Internet skills and competences as part of a broader educational policy.

Firstly, Open Internet skills should be incorporated into standard educational curricula, from primary school to tertiary levels. Learning has to include not only STEM but also entry-level digital literacy and media literacy. It should also include skills in online safety and online citizenship as well as understanding of individual human rights and how to exercise them responsibly on the Open Internet. Providing a basic yet solid insight into the Open Internet's technical architecture and basic principles and exposing the more technically inclined to the development processes of Open Internet standards could encourage future African engineers to play a significant role in the evolution of the internet. Initiatives like the Internet Protocol Security (IPSec), a course for university students from the Democratic Republic of Congo (DRC), Ethiopia, Kenya and Ghana, provide insights into Open Internet standards and create the next generation of Open Internet Standards Experts in Africa.[317]

Secondly, those who are already outside the educational system, or who never had access to it, should be reached with digital literacy and media literacy programmes, including efforts focused on how to use e-government services. Open Internet "social skills" are part of this, particularly in the context of using, for example, social media that can be harmful to specific individuals or groups of people. 'The skills the digital economy needs range from the ability to use a mobile phone, the internet and social media to advanced skills in data analytics, app development and network management.
Currently, African countries are lagging behind: ITU data suggests that only 2% of Kenyans are using the internet to find and apply for jobs, against a global average of 17%. In Sudan and Zimbabwe, only 4% of adults are able to copy and paste files. Effectively developing these skills in African countries will require a targeted approach, addressing both supply- and demand-side challenges.'[318] It is important to emphasise that these general Open Internet skills are needed by workers in all sectors of the economy, not just by those in the digital sphere. Increased digitisation means that all jobs in all sectors will need such skills.[319]

Figure 14: Supply and demand for most important workforce skills

Source: World Bank/IFC



317 Chege K. 2020. "In Africa, An Open Internet Standards Course for Universities". Internet Society. 17 July.
318 Karishma B. 2021. "Why skills development is key for digital transformation in Africa", ODI, 2021.
319 Caballero A. Bashir S. 2020. «Africa needs digital skills across the economy - not just the tech sector». World Economic Forum. 22 October.

Thirdly, a range of specialised Open Internet skills can improve Africa's influence on the internet. This would include competences in research, in developing internet protocols, and in emerging fields such as digital trust, machine learning, renewable energy and quantum computing. Also part of these specialised Open Internet skills are competences in extending infrastructure through tech innovations and redesigning business models. Skill building for startups, discussed in the chapter below, can also be considered here together with some of the overarching skills mentioned above: project management, monitoring and evaluation, policymaking and regulation, participating in policy processes, and understanding and navigating the multistakeholder approach.

The inclusion of women and girls is important in all three areas. Barriers to access, affordability, lack of education and 'inherent biases and socio-cultural norms' limit women and girls from benefiting from digital transformation. Greater inclusion of women 'in the digital economy and increased diversity bring value, both social and economic. For instance, inventions arising out of mixed teams are more economically valuable and have higher impact than those in which only men are involved'.[320]

Recognition of the need to prioritise building Open Internet-related skills and competences is widespread on the continent, with many states having dedicated strategies for introducing ICTs into education and building digital literacy. At regional level, it is included in the African Union's Digital Transformation Strategy.

BOX 3.6

➜ SKILLS AND HUMAN CAPACITY IN THE AU DIGITAL TRANSFORMATION STRATEGY[321]

The African Digital Transformation Strategy addresses skills and competences and can contribute to the conceptualisation of future EU-Africa partnerships. Two of the Strategy's objectives focus on skills:

- 'Build inclusive digital skills and human capacity across the digital sciences, judiciary, and education, both technical and vocational, to lead and power digital transformation including coding, programming, analysis, security, block chain, machine learning, artificial intelligence, robotics, engineering, innovation, entrepreneurship, and technology policy & regulation.
- Offer a massive online e-skills development program to provide basic knowledge and skills in security and privacy in digital environment to 100 million Africans a year by 2021 and 300 million per year by 2025.'

Section D is dedicated to digital skills and human capacity and includes specific **POLICY RECOMMENDATIONS AND PROPOSED ACTIONS** under the following headings:

Review education curricula in accordance with the evolving needs and trends in the digital economy and society.

Provide schools and other educational institutions with technology equipment and, where possible, broadband internet connection. More advanced equipment will need to be provided by companies in work-based learning systems. In parallel, ensure that teachers access digital training and promote the development of train-the-teachers programmes, both for their own professional development and for educating students on the use of technology to help create a scale-up and multiplier effect.

Develop partnerships through a multistakeholder African Alliance for Digital Skills and Jobs.

Mainstream digital skills and responsible online behaviour among all citizens to enable them to be active and successful participants in the digital society and raise awareness of risks in terms of digital rights, online safety and security.

Facilitate digital skills development across all sectors of the economy that use technology with a specific focus on governments, administrations, service providers and civil society.

320 OECD. 2018. "Briding the digital gender divide: Include, upskill, innovate." p5.
321 African Union. 2020. "The Digital Transformation Strategy for Africa (2020-2030)".

`The European skills agenda and digital education platform could inform and contribute to similar existing and new action plans tailored to African needs'.[322] Targets in the European skills agenda and the digital education action plan[323] foresee that 70% of adults should have basic digital skills by 2025. These initiatives aim to reduce the level of 13 to 14-year-olds who underperform in computing and digital literacy from 30% (2019) to 15% in 2030. In this vein, the European Digital Skills and Jobs Platform was launched to offer information and resources on digital skills, as well as training and funding opportunities.

➜ OPEN INTERNET SKILLS AND COMPETENCES: RECOMMENDED PARTNERSHIP PRIORITIES

The current African context presents well-defined investment needs and cooperation opportunities to support the population in building Open Internet skills and competences. Recommended priorities must be refined and scoped in response to regional, national and subnational contexts, local demand and existing initiatives and cooperation partnerships, such as the African Union's Digital Transformation Strategy, which includes concrete recommendations.

Open Internet skills integrated in existing educational institutions and curricula:

- Use the "broad" definition of Open Internet skills and competences that includes technical, social (which includes human rights), economic and horizontal dimensions such as digital security, multilingualism, user empowerment, inclusive governance, and distributed control and coordination of the different components that make the internet work.
- Start at primary school level and where possible in early childhood education all the way through to tertiary level.
- Include a focus on STEM and in doing so, focus on the inclusion of women and girls.
- Expose all learners to media literacy, digital literacy, awareness of digital rights, consumer rights and how to be safe online. This can include developing the ability to identify mis- and disinformation.
- Skills in the use of devices and tools is important, but a broader more conceptual 'technology neutral' approach can be more sustainable over the longer term.

Open Internet skills for the general population:

- Introduce digital literacy and media literacy programmes in the workplace, in partnership with civil society organisations, libraries and community information centres, community organisations, trade unions, etc.
- Build capacity and raise awareness among the population on the use of e-government services.
- Build basic knowledge and understanding of data-intensive technologies, such as artificial intelligence.
- Include Open Internet "social skills" in public awareness and digital and media literacy programmes that can include, for example, how to avoid using social media in a way that can be harmful to specific individuals or groups of people.
- Enhance the population's awareness of online safety and potential risks, general principles of data protection, and the protection of personal privacy.
- Share do's and don'ts and general skills on device maintenance and security.
- Aim, when addressing the above recommendations, to be as inclusive as possible and diversify programmes and initiatives according to the needs of people and groups with different social and cultural backgrounds, different levels of literacy and education, etc.

322 Existing initiatives such as SIFA - Skills Initiative For Africa (AUC and German Gov) (https://skillsafrica.org/) or Google Digital Skills for Africa (https://learndigital.withgoogle.com/digitalskills/).

323 European Commission. "European Education Area. Digital Education Action Plan (2021-2027)".

Specialised Open Internet skills that can improve Africa's influence and presence on the internet:

- Developing internet protocols and contributing to emerging fields such as digital trust, machine learning and quantum computing
- Renewable "green" energy solutions applied to the internet industry, e.g. data centres
- Extending infrastructure through innovative technologies and business models; skill building for startups (discussed in the chapter below)
- Content creation
- Building institutional capacity and partnerships
- Provide schools and other educational institutions with technology equipment and, where possible, broadband internet connection.
- Facilitate partnerships in skills development between stakeholder groups (civil society, government, business, and the technical community) and across countries and regions.
- Link skills acquisition to opportunities (job, financing, further education) to retain skills.

3.4 OPEN INTERNET ECONOMY, LOCAL INNOVATION, AND LOCAL STARTUPS

'Internet openness benefits innovation and entrepreneurship by cementing the Internet as a venue for creativity. It does this in a number of ways – by boosting knowledge flows that support innovation, by underpinning the Internet as a platform on which entrepreneurs can construct new businesses and commercialise their ideas, and by enabling new avenues for business to obtain inputs, thereby lowering barriers and freeing up resources that were previously not possible, with benefits for collaborative research, public service delivery and activities. The Internet's end-to-end design principle makes it open to new applications and, combined with a competitive marker and absence of gatekeeping, means lawful new services can bubble up. This dynamism makes the Internet crucial for innovation, which is nourished by the availability of finance, business services and marketplaces online.'[324]

3.4.1 Digital economy, local innovation and startups in Africa and Europe: State of Play

The African continent represents a tremendous untapped market opportunity for tech startups to develop services and products and gather a consumer base and grow, before conquering markets elsewhere in the world.[325] African nations that are committed to becoming creators and not just users of technology will fully benefit from the tech revolution. Africa's commitment to developing the African Continental Free Trade Area (AfCFTA) brings the creation of a continent-wide single digital market (SDM) within reach and will further accelerate the growth of the African internet economy.[326] 'A well-functioning digital economy is required to achieve faster economic growth, offer innovative products and services, as well as create more job opportunities. Assessing where strategic investments and interventions need to be made is a critical first step to enabling growth in the digital economy.'[327] Kenya's Digital Economy Blueprint, for example, identified five pillars of the digital economy – ubiquitous access to infrastructure, digital government, digital business, a thriving innovative and entrepreneurial ecosystem, and a new set of digital economy skills and values – and four crosscutting themes that are

324 OECD. 2016. "Economic and Social Benefits of Internet Openness". p.9-10.
325 Denis B. 2020. "Development solutions: There's an app for that". European Investment Bank, June 2020.
326 Bayuo B. Bamford R. e.a. 2022. "Supercharging Africa's Startups: The Continent's Path to Tech Excellence". Tony Blair Institute For Global Change. February 2022. p.7.
327 Govender M. 2022. "Can development finance accelerate Africa's drive towards a digital economy?". Business Day. January 2022.

resident in every pillar – legal and policy frameworks, emerging technologies, interoperability and data.[328] Evolutions and observation already discussed in the Report build an economic and social fabric favourable for developing the African digital economy. More affordable technology and connectivity provide access to communication, news and information, as well as to microloans and e-insurance. Internet penetration contributes to macroeconomic performance in sub-Saharan Africa. Research shows that a one percentage point increase in internet penetration leads to 0.37 percentage point increase in real per capita GDP growth, and that higher internet penetration increases labour productivity, particularly in sectors such as utilities, trade and transportation.[329] Others conclude that a 10% increase in mobile internet penetration raises GDP per capita by 2.5% in Africa and project that increasing internet penetration from 40% today to 75% by 2025 would create 44 million new jobs.[330] The total downstream economic benefits of achieving universal internet access in sub-Saharan Africa is estimated to be 15-fold greater than the cost of implementing universal access in the region.[331] The potential of Africa's vibrant and growing young entrepreneurial ecosystem and innovative startups has a projected value of US$ 180 billion.[332]

Creators of new technologies that are close to the challenges they address, are likely to be more effective than ones located on the other side of the world.[333] 'Africa is already home to a growing cohort of dynamic e-commerce businesses.[334] They are adapting their services to address the specific challenges of the African market: unbanked customers, the lack of reliable identity credentials and last mile delivery issues.[335] Meanwhile, local specialist digital content companies[336] are competing with global giants to meet the huge demand from Africans for local entertainment content.'[337]

The growing number and diversity of digital platforms in Africa are opening up new livelihood opportunities to young workers. A pre-pandemic analysis in eight African countries (South Africa, Nigeria, Kenya, Ghana, Uganda, Tanzania, Zambia, Rwanda) recorded a robust 37% year on year growth in digital platforms in 2019. Of the total of 365 unique operating digital platforms, a majority was active in online shopping (98), freelance (91) and e-hailing (81) activities. 64% of the total platforms in operation were intermediate place-based activities, thereby contributing directly to the absorption of local labour capacity.[338] Platforms originating in Africa accounted for the largest number of platforms in operation (82%). However, scale-of-usage data suggest that the average number of users per platform is three times larger on platforms originating from outside of Africa's borders than on homegrown platforms.[339]

A stronger digital startup ecosystem that enhances innovation and the viability of African digital platforms is needed to meet youth employment needs. 'Gig-matching[340] and job-matching platforms offer young people flexibility, low barriers to entry into the job market and an alternative to informal employment, though job quantity often prevails over job quality. The pervasive effects of Covid-19 have exposed the urgent need for platforms and governments to provide gig workers with basic job and social protection.'[341] The informal sector – the part of the economy that is neither taxed

328 Kenya Digital Economy. 2019. "Digital Economy Blueprint, Powering Kenya's Transformation". p. 26-29. See also the 'country checklist for development of digital economy' in Annex 1.

329 Simione F. Li. Y. 2021. "The Macroeconomic Impacts of Digitalization in Sub-Saharan Africa: Evidence from Submarine Cables". IMF Working Paper. April 2021, p.26-27.

330 Google and IFC, a member of the World Bank Group. 2020.

331 Bamford R. Hutchinson G. Macon-Cooney B. 2021. "The Progressive case for Universal Internet Access: How to Close the Digital Divide by 2030". Tony Blair Institute For Global Change. March 2021.

332 Pimenta S. Gajria N. 2020. "Understanding Africa's $180 billion internet economy future". Google blog. 11 November.

333 Bayuo B. Bamford R. e.a. 2022. p.8.

334 For example: Jumia, one of the larget pan-African e-commerce platforms with 23.3 million monthly visits; Takealot.com, a South African e-commerce platform with 10.5 million monthly visits; Konga, a Lagos-based e-commerce platform with 2.3 million monthly website visits; Bidorbuy.co.za, a South African e-commerce company with 1.9 million monthly visitors; or zando.co.za with 570,000 visits, also based in South Africa. Data as reported by Statistica for 2021. Araba Benson E. 2022. "Top 5 biggest eCommerce startups in Sub-Saharan Africa". Business Insider Africa, 20 March.

335 For example, due to the lack of postal addresses.

336 A report by Disrupt Africa revealed that digital content startups raised $13.9 million in 2020, almost 19 times the total for 2019. Disrupt Africa. 2022. "The African Tech Startups Funding Report 2021". January 2022.

337 Mobile World Live. 2022. p.17.

338 Johnson C. Bester H. van Vuuren P.J. Dunn M. 2020. "Emerging trends from Africa's digital platforms". CENFRI. April 2020. p.2.

339 Ibid. p.5.

340 Gig-work can be defined as work that consists of temporary, part-time, or project-based income-earning activities often mediated through a digital platform.

341 Ngene G. Pinet M. Maclay C. e.a. 2021. "Strengthening youth livelihoods and enterprise innovation in Africa's digital era". ODI Working paper.

nor overseen by the government – is of considerable size[342] in many African countries. Some of the most successful ventures in the African internet economy address challenges faced by businesses or workers in the informal sector. The vast majority of workers in the informal sector own a mobile phone, which they use for both private and business purposes. Mobile phone ownership in the informal sector is broadly correlated with access to digital connectivity at the national level.

Local innovation and startups have flourished along with increased connectivity. Funding for startups in Africa increased six-fold from 2015 to 2020, when it amounted to $1.2 billion. But this still represented less than 1% of the amount raised by US startups, and Africa's overall research and development (R&D) investment was a quarter of the global average.[343] A survey conducted by Deloitte found that fewer than 10% of 188 government incentive programmes for business across 32 African countries provided support for initiatives using new technologies.[344]

The Global Startup Ecosystem Index 2021[345] lists 14 African countries in the top 100 of best performing startup ecosystems in the world (see Table 9). At 48th place, South Africa ranks the highest among African countries on the list, while 21 of the EU countries are ranked within the top 50. In the list of cities, the Nigerian city of Lagos was ranked as the top African startup ecosystem (no. 122), closely followed by Nairobi and Kenya at 136th place.

Table 9: Global Startup Ecosystem Index 2021 – African countries in the Top 100

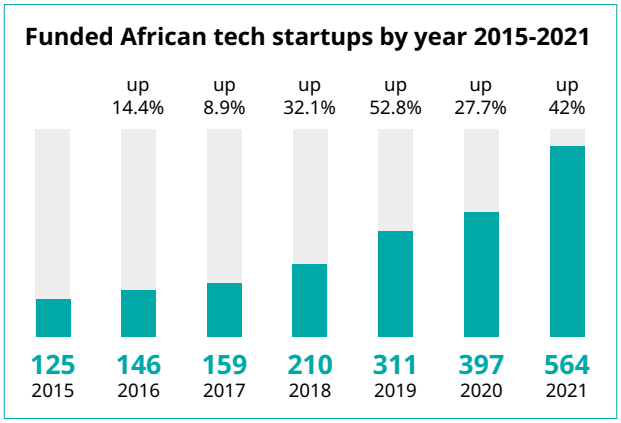
Source: https://www.startupblink.com/startupecosystemreport.pdf

48. South Africa	73. Mauritius	95. Morocco
61. Kenya	81. Ghana	97. Uganda
63. Nigeria	82. Tunisia	99. Namibia
69. Rwanda	87. Cape Verde	100. Ethiopia
70. Egypt	94. Somalia	

According to Disrupt Africa's *African Tech Startups Funding Report 2021*, 2021 was a record year for funding activity in the African tech startup ecosystem, with total investment passing US$2 billion raised by 564 startups. The total annual funding flowing into African tech startups has grown by 1000% since 2015. 'Though the bulk of funding activity continues to take place in the "big four" markets of Nigeria, Egypt, South Africa and Kenya, there is growth in activity across many other ecosystems, while acquisitions are becoming a regular feature of the ecosystem.'[346]

Figure 15: Funded African tech startups by year 2015-2021

Source: Disrupt Africa's African Tech Startups Funding Report 2021



Partech, an investment platform for tech and digital companies, tracked that, in 2021, 640 African tech startups raised a total of US$ 5.2 billion across 681 equity rounds, 3.6 times more than the year before. This makes Africa's tech startup ecosystem the fastest growing in the world. 73% of the total funding went to the top 4 countries – Nigeria, South Africa, Egypt and Kenya – with half of it going to Nigeria alone.[347] [348]

Africa's record of sustaining and scaling up startups, unfortunately, is another story. The entire continent has only three "unicorns" – privately held tech companies valued at more than $1 billion – the most recent being Nigerian fintech Flutterwave. By contrast, there are more than 50 unicorns in the EU, 100 in China and 200 in the US.[349]

342 Source estimates Africa's informal sector to account for 80% and more of the jobs.
Guven M. Karlen R. 2020. "Supporting Africa's urban informal sector: Coordinated policies with social protection at the core". World Bank Blogs. 3 December.
343 World Economic Forum. 2022. "Tech Start-ups Key to Africa's Digital Transformation but Urgently Need Investment". 20 January.
344 Deloitte. 2020. "Survey of Global Investment and Innovation incentives 2020". 31 October.
345 StartupBlink. 2021. 'Global Startup Ecosystem Index 2021'.
346 Disrupt Africa. 2022.
347 Partech. 2022. "2021 Africa Tech Venture Capital Report". February 2022.
348 Afadhali J.-P. 2022. "Africa's tech startups ecosystem fastest growing with rising investments". IOL. 7 March.
349 Maher H. Laabi A. Ivers L. Ngambeket G. 2021. "Overcoming Africa's Tech Startup Obstacles". BCG. 12 April.

BOX 3.7

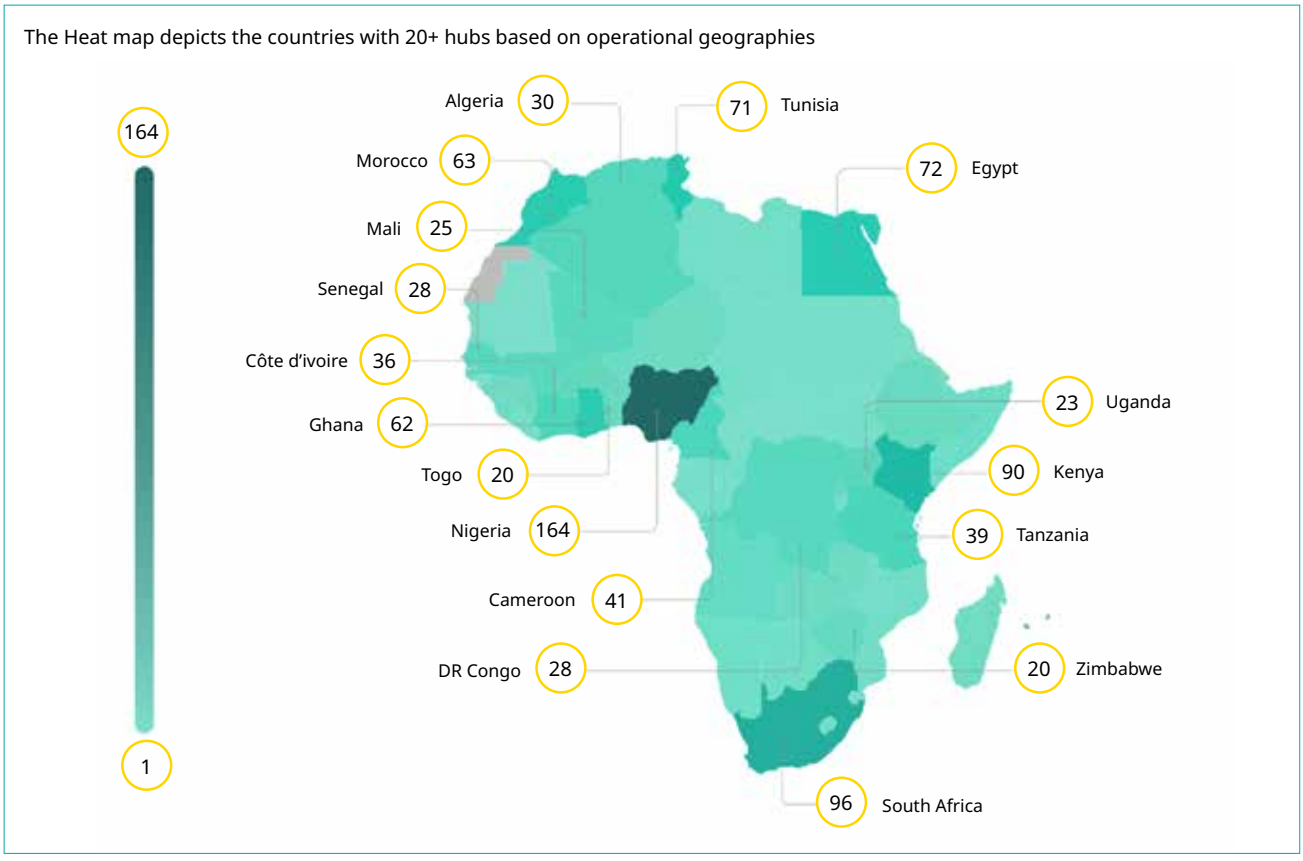
➜ STARTUP EUROPE

Startup Europe[350] strengthens networking opportunities for deep tech scaleups and ecosystem builders to accelerate the growth of the European startup scene. Aiming at creating a digital ecosystem that multiplies jobs, reinforces growth and stimulates investment, Startup Europe ramps up the connected Digital Single Market through a set of EU initiatives to increase networking opportunities for startups, investors, and accelerators. It is designed to connect startups, investors, accelerators, entrepreneurs, corporate networks, universities and the media through an array of networks. Furthermore, it intends to connect local startup ecosystems around Europe and enhance their capacity to invest in other markets outside Europe, such as Silicon Valley, India, Africa and the United Arab Emirates.

In October 2021, 1,031 tech hubs operated in 53 countries in Africa and in over 200 cities across the continent.[351] Innovation hubs play a vital role in supporting entrepreneurs and small businesses. They provide safe spaces to launch new ideas, scale their companies, and network. Hubs are concentrated in key cities, but also emerging in non-capital cities. The African countries with the highest number of hubs are Nigeria (164), South Africa (100) and Kenya (90). They are followed by two countries in the North of Africa: Egypt with 72 hubs and Tunisia with 71 hubs.

Figure 16: Africa's Tech Hub Landscape

Source: 'Bolstering innovators in Africa, Innovation hubs' Briter Bridges and AfriLabs, October 2021



350 European Commission. "Shaping Europe's digital future. Startup Europe".

351 Briter Bridges. 2021. "Bolstering innovators in Africa, Innovation hubs' catalytic role as ecosystem support organisations". Briter Bridges and AfriLabs, October 2021.

Notwithstanding the positive signs, many hubs remain 'fragile and heavily reliant on grant funding from international donor partners'.[352] A survey among 103 hubs revealed that 78% of the hubs were forced to shut down their premises at one point during the pandemic, but now seem to be gradually going back to business. Only 16% of the hubs remained open and operational throughout the entire period.'[353]

The financial technology or fintech sector has evolved rapidly in African countries and offers a range of new-mobile money services including savings, lending, insurance and money transfers. 'As devices have become more affordable and data costs continue to fall, more sophisticated products have emerged serving new customer bases – such as small and medium-sized enterprises – often ignored by traditional lenders.' (...) 'Low market penetration by traditional banks combined with increasing connectivity and smartphone use mean the African fintech market is ripe for further growth.' [354] 'The relentless growth of Africa's fintech space should not, however, detract from positive developments elsewhere. Non-fintech start-ups still raised over US$1 billion between them in 2021, with many sectors more than doubling the amount of funding secured the previous year.'[355]

Several countries in Africa are exploring the possibility of adopting a central bank digital currency (CBDC). Nigeria has already moved forward by launching the eNaira.[356] The CBDC is expected to offer several benefits, for example, by enhancing financial inclusion, lowering the cost of remittances and reducing the reliance on private crypto currencies that may hinder monetary transmission and facilitate illicit flows. Yet, the IMF also warns that CBDCs present new challenges and risks. They are complex and evolving, where the balance between benefits and risks depends on country characteristics. The IMF advises that countries, to harness the potential benefits of CBDCs, should invest in digital infrastructure, build expertise within central banks, and confront cybersecurity risks.[357]

BOX 3.8

➜ TOGO: REWEAVING SAFETY NETS USING ARTIFICIAL INTELLIGENCE

From 'Investing in People for a Resilient and Inclusive Recovery: Africa Human Capital Plan Year Two Progress Report', The World Bank, June 2021[358]

The Government of Togo launched a project called Novissi in April 2020 with support from the World Bank to provide cash transfers to informal workers in regions most impacted by lockdown restrictions. By September 2020, Novissi had provided cash transfers to over 570,000 informal sector workers in Togo's urban areas, but it wanted to add rural citizens. Novissi partnered with GiveDirectly in its second phase to cover 57,000 new beneficiaries in the poorest 100 rural cantons, identified using a combination of high-resolution satellite images, a phone survey and data on mobile phone use.

Satellite images revealed distinguishing features of lower income communities, such as roofing material and road quality. A large-scale phone survey further provided "ground truth" on the living conditions of roughly 10,000 people, who were then matched to their mobile phone metadata obtained from telecom operators in Togo. This formed the basis of a machine learning algorithm that was used to generate a consumption estimate for each of the 5.7 million mobile subscribers in

352 World Economic Forum. 2022. "Attracting Investment and Accelerating Fourth Industrial Revolution Adoption in Africa". January 2022, p. 13.
353 Briter Bridges. 2021. p.11.
354 Bayuo B. Bamford R. e.a. 2022. p.20-21.
355 Disrupt Africa. 2022. p.11.
356 https://enaira.gov.ng
357 IMF. 2022. "Regional Economic Outlook Sub-Saharan Africa". International Monetary Fund, April 2022, p.viii, p.17, box p.22.
358 The World Bank. 2021. "Investing in People for a Resilient and Inclusive Recovery: Africa Human Capital Plan Year Two Progress Report", p.21

the country, 70 percent of the population. Novissi's innovative use of artificial intelligence, geospatial analytics and mobile phone technology has allowed it to identify vulnerable communities like Anfoin Avele, pinpoint at-risk individuals like Eric Dossekpli, and transfer cash to them quickly and safely. By January 2021, Novissi had created over 170,000 new mobile money accounts, a 7 percent increase in the penetration of mobile money in Togo. The government is looking to Novissi's unique approach as it considers an integrated social information system to support multiple social protection programs.

3.4.2 EU-Africa partnership opportunities: empowering local ecosystems by promoting innovation and local startups

Internet openness provides a space for innovation and entrepreneurship. The end-to-end principle, one of the basic principles of the Open Internet technical architecture, combined with creativity, available funding and access to an online marketplace creates a dynamism in which ideas can thrive, develop, compete and eventually become success stories. Moreover, the internet's global interconnected network makes it possible to enter new geographic markets to sell services, cooperate, secure funding and trade.

Africa's internet capacity is growing, becoming faster, denser and more local, a shift that attracts global infrastructure investors and has profound implications for the continent's economies.[359] Initiatives such as the African Continental Free Trade Area[360] and the African Union Data Policy Framework[361] are contributing to an enabling policy environment in which local initiative and innovation can thrive. However, existing social and economic inequality continues to stifle internet-enabled growth, a factor that investment in the digital economy needs to take into account. Income levels are directly linked to smart device ownership and the ability to pay for data, and as a result, to individuals benefiting from the power of the Open Internet.[362] The data on startups presented above show that there is no lack of ideas and initiatives and underscore the potential of the African continent. However, for ideas to become success stories, support over the longer term that allows scaling up is crucial.

The previously mentioned World Economic Forum report on accelerating the fourth industrial revolution in Africa identified the following two policy enablers:

- Legislation such as "Startup Acts" designed to spur private sector innovation, reduce the burden of regulation and promote entrepreneurship
- Embed incentives for startups in legislation, such as startup grants, rebates on efficiency gains through technology implementation, co-investment of critical infrastructure, tax-free operations for the early years and incentives for research and development[363]

Investment in partnerships, people, infrastructure and in financing for development is essential. This represents a challenge, but evidence shows that it produces positive results. The Open Internet promotes innovation and entrepreneurship in the local industry, which in turn contributes to effectively overcoming key social and economic development challenges. In that sense, the Open Internet espouses the development of online marketplaces that are supportive of micro, small and medium enterprises and startups to reach their full potential, which in turn can stimulate economic progress and multiply the social benefits. This is because technology and innovation enhance the performance of the digital economy through overcoming key policy challenges and improving public service delivery. That said, alongside the

359 Cotterill J. 2021. "Cabling Africa: the great data race to serve the last billion". Financial Times. 31 January.
360 https://au.int/en/cfta
361 Research ICT Africa. 2021.
362 Gillwald A. 2020. "Measuring Digital Inclusion". Research ICT Africa/University of Cape Town. December 2020.
363 World Economic Forum. 2022.

development of ICT infrastructure, it is crucial to spur innovation and productivity in the digital economy. A robust startup ecosystem with opportunities to secure funding can provide international access to African talent and entrepreneurship. 'Compared to the Single Digital Gateway in the EU, the US Small Business Administration and the Start-up India Portal, Africa does not have reliable and comparable public information on tech start-ups.' [364]

Research[365] on whether e-commerce platforms support women entrepreneurs, or whether such tools remain stymied by women's low access to the internet, mobile phone, and other fundamental tools of the digital economy concluded that 'closing gender gaps in this arena could add nearly $15 billion to the value of Africa's e-commerce industry between 2025-2030 alone—putting billions in the hands of women entrepreneurs.'[366]

BOX 3.9

➜ DIGITAL FOR DEVELOPMENT HUB

The Digital for Development (D4D) Hub[367] is a new form of global digital cooperation between the EU and developing countries. The strategic multistakeholder platform promotes new international partnerships on digital transformation between the EU and partner countries in Africa, Asia, Latin America, the Caribbean and the EU's Eastern Neighbourhood. Central to its mission is a human-centric approach to digital transformation: Facilitating multistakeholder dialogues, sharing digital expertise and fostering investments of diverse European and global partners. The Digital for Development Hub presented eight innovative projects:

The African Union - European Union Digital4Development Hub[368] (AU-EU D4D Hub) is a multidonor action to help operationalise digital cooperation for a sustainable and inclusive digital future globally. The EU and five D4D Hub members (Belgium, Estonia, France, Germany and Luxembourg) support African institutions to lay the groundwork for an inclusive digital transformation. It offers a comprehensive package of services, products and activities aimed at creating an enabling environment for Africa to seize digitalisation opportunities.

- Providing technical assistance to national and regional institutions that request analysis and expertise to develop digital transformation plans and support the implementation of digital projects
- Facilitating capacity building and exchanges of knowledge among African and European actors
- Organising dialogues and consultations to promote collaboration between governments, civil society, private sector and academia in Europe and Africa

The African European Digital Innovation Bridge (AEDIB)[369] establishes a network of African and European Digital Innovation Hubs (DIHs) to create and strengthen a common African-European digital innovation ecosystem, where national, pan-African and intercontinental innovation partnerships between stakeholders in innovation clusters are created along thematic, technological and entrepreneurial challenges (i.e. Climate Smart Agriculture, Digital Trade/E-Commerce and Smart Cities) and joint solution development is facilitated. Initiated by EU Member States (France, Belgium and Germany) and the European Commission, the AEDIB brings together 14 partners from Europe and Africa which are experienced in building innovation ecosystems on both continents.

364 Bayuo B. Bamford R. e.a. 2022. p.12.
365 IFC. 2021. "Women and E-commerce in Africa". International Finance Cooperation.
366 Roscoe A. Kabugi A.N. 2022. "Women and e-commerce in Africa: The $15 billion opportunity". Foresight Africa series. Brookings. 7 March.
367 https://d4dhub.eu/
368 https://d4dhub.eu/au-eu-project
369 https://aedibnet.eu/

The EU-AU Data Flagship[370] supports the development of an EU/AU joint and non-binding data framework based on shared values and principles and with the objectives of protecting citizens' rights, assuring data sovereignty and supporting the creation of the African Single Digital Market. The Flagship project is initiated by EU Member States (France, Belgium and Germany) and the African Union Commission, European Commission, Smart Africa and Germany.

The Innovation Dialogue Europe Africa (IDEA) will enable civil society organisations and academia to take up a role in promoting digital rights by strengthening their capacities and facilitating their active participation in multistakeholder dialogues. It is a planned future action by the European Commission and Germany and implemented by Smart Africa, Betterplace.Lab, Enabel, Expertise France and GIZ.

Four additional Digital Actions focus on tackling the challenges caused by the COVID-19 pandemic in Eastern and Southern Africa, the IGAD Region, ACP countries, and the establishment of a #SmartDevelopmentFund.

➜ EMPOWERING LOCAL OPEN INTERNET ECONOMY ECOSYSTEMS THROUGH PROMOTING LOCAL INNOVATION AND STARTUPS

The current context presents well-defined investment and cooperation opportunities to promote and enable local innovation and startups. A non-exhaustive list of priorities is presented below. Priorities must be refined and scoped in response to regional, national and subnational contexts, local demand and existing initiatives and cooperation partnerships. In addition, it should be clear that progress on other priorities discussed in this report (infrastructure, skills, enabling legal and regulatory measures) is essential as they underpin the internet economy, and make or break chances for innovative startups.

Africa-based digital platforms:

- Conduct research to learn how African digital platforms can compete more effectively with global platforms.
- Create initiatives to incentivise the use of African digital e-commerce platforms.
- Invest in research and data collection on Africa's digital economies, existing gaps and challenges to inform policy and decision makers.

Digital entrepreneurship and job-matching to activate the African potential:

- Private and public sectors need to acknowledge the unused potential of women, offer them training on entrepreneurship and digital skills, and open up funding opportunities to allow them to create, formalise, and grow their online businesses.
- Governments and dedicated platforms can collaborate for a better gig and job-matching to improve the quality of jobs and provide basic social protection.

Fintech innovation:

- Encourage partnerships on establishing consumer protection in financial services provided by mobile operators.
- Facilitate partnerships between fintech entrepreneurs in Europe and Africa.

370 European Commission. 2020. "Digital 4 Development Hub Forum. The EU-AU Data Flagship".

Strengthening the African startup ecosystem:

- Strengthen institutions that support startups, such as universities, digital innovation hubs and labs.
- Support the establishment of tech entrepreneur networks and associations and promote partnerships with their EU counterparts.

Support tech startups and innovators:

- Financing and skills development programmes for local startups
- Support and advice for local innovators and startups to protect and market their creations in a local, cross-border or global context (e.g. negotiate patents, IP rights)
- Sharing good practices on policies that spur digital innovation and productivity in the digital economy
- Cooperate with African stakeholders in Startup Europe initiatives, and support the collaboration between African and European players in promising market segments.

Create and support tech hubs :

- Continue supporting African digital hubs, as many are reliant on donors and sponsorships. However, distribute the efforts between hubs in capital cities and smaller initiatives at the regional level.
- Facilitate peer learning and skill sharing between local innovators in Europe and Africa, through hub partnerships.
- Select target countries and target sectors that lag behind in existing indices.

3.5 PARTICIPATION OF AFRICAN STAKEHOLDERS IN INTERNET GOVERNANCE PROCESSES

3.5.1 Participation of African stakeholders in internet governance: State of Play

Participating in global internet governance discussions can be challenging for African stakeholders. The global Internet Governance Forum (IGF) has succeeded in bringing people and stakeholder groups from different backgrounds and all parts of the world to the table.[371] African stakeholders participate in ICANN[372] and the IETF, but this participation needs to be strengthened to be more influential. African governments are relatively active in multilateral institutions with an indirect relation to internet governance, such as ITU, and follow intergovernmental processes addressing trade and development. What is often lacking however is national multistakeholder engagement at the level of formulating positions or reporting back on outcomes.

371 IGF. 2021. "IGF 2021 Participation and Programme Statistics". Internet Governance Forum. December 2021.
IGF. 2021. "IGF 2021 by the numbers". Internet Governance Forum. December 2021.

372 Tomasso N. 2021. "ICANN72 Participation Metrics Preview". ICANN blog. 1 November.

IETF HACKATHONS – IETF PARTICIPATION AROUND THE WORLD

Text contributed by the Internet Engineering Task Force (IETF)

IETF participants come from around the world and can participate online in most of the IETF activities. One example is a developer group based in Mauritius made up of a wide range of people from different backgrounds: high school students, university students, professional engineers, and advisors to the minister of ICT who participated in an IETF Hackathon.[373]

Because of the IETF's open approach, implementation and use of IETF protocols can be undertaken by anyone, without permission. Hackathons independently organised at Africa Internet Summits, for instance, have aimed to support open standards development and increase involvement by individuals in work done at the IETF.[374]

ICANN's Africa Regional Plan for Fiscal Years 2021-2025[375] is cognisant of the many challenges Africa faces, including lack of DNS industry awareness, capacities, skills, and limited local and regional resources. It emphasises capacity development to empower African governments and internet stakeholders especially the business sector to address these challenges by leveraging ICANN's technical expertise and resources, with the African community's support.

Attending international meetings is costly and there are limited financial resources available to cover travel and accommodation. Online participation options are improving fast, but it is nonetheless difficult to deny the comparative advantage of those attending in-situ, and employees of stakeholder organisations and governments who can dedicate working hours to internet governance discussions have an advantage over those who can only offer a part of their free time.

Multistakeholder internet dialogues at the regional, sub-regional or national level have increased dramatically over the last five years and have shown real impact. They are an opportunity for stakeholders and governments to engage in dialogues on issues of common concern. The regional African IGF was first convened in 2012 in Cairo, building on the success of the global IGF held in Nairobi and hosted by the government of Kenya in 2011. Since then, the African IGF has taken place every year in different parts of the continent, creating legitimacy for the multistakeholder approach to internet governance.

Table 10: Regional African Internet Governance Forums (IGFs)[376] since 2012

Year	Host country	Host city
2012	Egypt	Cairo
2013	Kenya	Nairobi
2014	Nigeria	Abuja
2015	Ethiopia	Addis Ababa
2016	South Africa	Durban
2017	Egypt	Sharm el-Sheikh
2018	Sudan	Khartoum
2019	Chad	N'Djamena
2020	Virtual	
2021	Virtual	
2022	Malawi	Lilongwe (Hybrid)

To date, 31 national IGF initiatives and 4 African sub-regional IGFs (e.g. the West African IGF) are acknowledged on the IGF website.[377] There is also vibrant African participation in IGF youth initiatives.

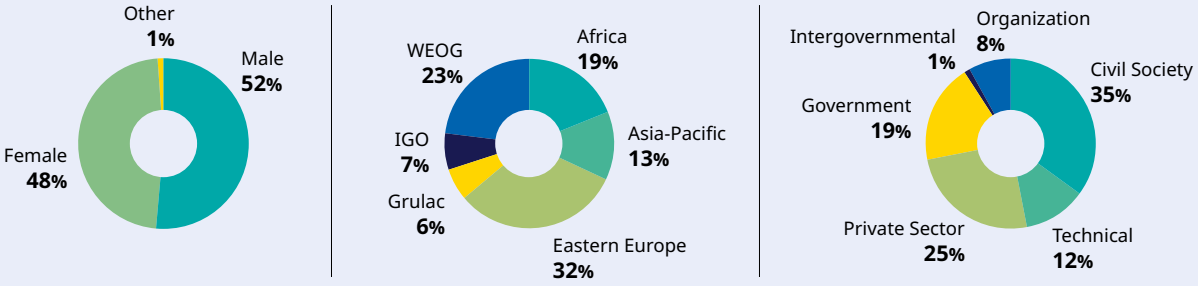
373 Participating in the IETF Hackathon from Mauritius: https://www.ietf.org/blog/participating-ietf-hackathon-mauritius/ .
374 Hackathon @ Africa Internet Summit 2019: https://www.ietf.org/blog/participating-ietf-hackathon-mauritius/ .
375 ICANN. 2020. "ICANN Africa Regional Plan for Fiscal Years 2021-2025". 1 July.
376 https://www.afigf.africa/?q=past_events#
377 The IGF Secretariat maintains a list of National and Regional IGF Initiatives, https://www.intgovforum.org/en/content/igf-regional-and-national-initiatives

BOX 3.10

➜ PARTICIPANT REGISTRATION - HYBRID IGF 2021

African participation in 2021 IGF[378]

- 19% of the 10,371 stakeholders from 175 countries participated in the 16th IGF
- 59% of the remote hubs organised around the world to participate at IGF 2021 were located in Africa
- 31 African National IGF initiatives and 4 African sub-regional IGF initiatives
- 7 individuals from Africa appointed to the UN Secretary General's IGF 2022 Multistakeholder Advisory Group (MAG)[379]



The African School on Internet Governance (AfriSIG), a partnership between the African Union Commission, the Association for Progressive Communications and Research ICT Africa, has had significant impact. Launched in 2013, this intensive multistakeholder leadership development and learning event is now in its 10th year. AfriSIG participants – close to 400 to date - have played a leading role in launching national IGFs and Schools on Internet Governance (SIGs), and contributing as African and global IGF MAG members.[380]

▶ INTERNET GOVERNANCE AND THE POLICY AND REGULATORY INITIATIVE FOR DIGITAL AFRICA

Text contributed by The Policy and Regulation Initiative for Digital Africa (PRIDA)

It is a joint initiative of the African Union, the European Union and the International Telecommunication Union that enables the African continent to reap the benefits of digitalisation. Its strategic objectives regarding Internet Governance (IG) are as follows:

1. Increase the number of countries having multistakeholder processes on IG through the establishment of national IGFs.
   - In 2020, 9 of the 23 countries (Botswana, Eswatini, Madagascar, Cape Verde, Comoros, Liberia, Egypt, Mauritania and Morocco) were supported to hold their first School on Internet Governance, and 5 countries (Eswatini, Madagascar, Botswana, Liberia and Cape Verde) received support to hold their national IGF.
   - In 2021, 7 of the 23 countries (Ethiopia, Guinea, Seychelles, the Central African Republic, Djibouti, Lesotho and Somalia) were supported to hold their first SIG while 2 (Lesotho and Somalia) subsequently held their IGF.

2. Streamline and coordinate IG processes at national, regional and continental levels. Improve synergies and feedback mechanism between these components.

378 IGF. 2021. "IGF 2021 Participation and Programme Statistics".
379 IGF MAG 2022 Members: https://www.intgovforum.org/en/content/mag-2022-members
380 https://afrisig.org. For a research study on the impact of AfriSIG from 2013 to 2019, see: Budlender D. 2018. "The African School on Internet Governance: Tracer study of four rounds of AfriSIG (2013-2016)". Association for Progressive Communications.

- At African continental level, PRIDA took an active role in the planning and organisation of the continental IGFs in 2019, 2020 and 2021.
- At global level, PRIDA supported the participation of African countries in the Global IGF in 2020 and 2021 as well as the organisation of a workshop on cyber diplomacy in Africa and digital transformation.

3. Develop the capacity of various internet stakeholder groups from governments, civil society, private sector, and the technical community on IG issues relevant to their context.
   - PRIDA developed toolkits to assist stakeholders to establish their national and regional IGFs.
   - PRIDA is currently developing an online training course for a wider group of stakeholders that will be delivered through the Pan African University.

Aside from annual IGFs, several African states have been using a uniquely empowering multistakeholder mechanism to not only engage in policy dialogue but also to collaboratively conduct an assessment of the state of "internet universality" at national level: the UNESCO Internet Universality Indicators.[381] These voluntary assessments present a comprehensive and substantive understanding of the national internet environment and policies, assess their alignment to the principles of an Open Internet and their contribution to sustainable development, and help develop policy recommendations and practical initiatives to improve a country's internet ecosystem. Six countries in Africa used this process during 2021: Benin, Ethiopia, Ghana, Kenya, Niger and Senegal.[382]

BOX 3.11

➜ UNESCO'S ROAM-X INTERNET UNIVERSALITY INDICATORS

UNESCO's ROAM-X Internet Universality Indicators[383] are designed to help countries assess the Open Internet environment at national level. The indicators are organised in five clusters based on UNESCO's four ROAM principles with a cluster added for cross-cutting factors:

R – Rights
O – Openness
A – Accessibility to all
M – Multistakeholder
X – Cross-cutting[384]

Examples of what the indicators measure

Rights indicators focus on freedom of expression, rights of access to information, freedom of association and the right to take part in public affairs, the right to privacy, and social and economic rights. Accessibility indicators address equitable access, affordability, local content and language, and access for disabled people. Openness indicators look at the Open Internet in terms of protocols and standards for accessibility, IPv6 adoption, and regulation to ensure open and competitive markets.

381 UNESCO. "ROAM-X Indicators". https://en.unesco.org/internet-universality-indicators/roamx-indicators
382 UNESCO. "National assessments". https://en.unesco.org/internet-universality-indicators/national-assessments
383 UNESCO. "Internet Universality Indicators". https://en.unesco.org/internet-universality-indicators
384 The cross-cutting indicators are related to gender, children, sustainable development, trust and security, and legal and ethical aspects of the internet.

3.5.2 EU-Africa partnership opportunities: Fostering effective participation in internet governance

The European Union (European Commission, EEAS, EU Member States) is already one of the principal actors in internet governance institutions, actively involved in promoting and contributing to the improvement of the overall multistakeholder model. Even so, the need for a more robust and inclusive internet governance ecosystem should nonetheless continue to ensure 'the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the internet'.[385] In this sense, a partnership between the EU and Africa could be based on a common vision for a progressive and effective reform of the multistakeholder model, so that it becomes more effective, inclusive and democratic.

Key actors of this process could be universities, which are among the most critical institutions for building bridges between academia and policymakers, providing opportunities for African researchers, educators and students to collaborate locally and compete internationally. National Research and Education Networks (NRENs) enable universities and the research community to grow a dedicated network, and many countries have prioritised NRENs to boost the connectivity of universities. There has been a rapid increase in NRENs across Africa, many supported by the World Bank. NRENs are becoming more robust in Northern, Eastern and Southern Africa, while in Central and Western Africa, they still need to pick up speed.[386] The government of Senegal has equipped all universities with a fibre optic network directly linked to the government's ICT agency.

➜ **OPEN INTERNET: FOSTERING EFFECTIVE AFRICAN PARTICIPATION IN INTERNET GOVERNANCE**

Effective participation in internet governance at the local, regional and global levels needs to include African stakeholder voices in the debates. Priorities are listed below. The list should be considered as incomplete. Priorities must be refined and scoped in response to regional, national, and subnational contexts, local demand and existing initiatives and cooperation partnerships.

Maintain and strengthen African participation in global multistakeholder processes:

- Create opportunities for African voices in Europe-led internet governance dialogues.
- Financial support for African participation in global intergovernmental and multistakeholder processes including the global IGF
- Partnership to ensure African voices and priorities are reflected in the Global Digital Compact and the Summit of the Future
- Facilitate dialogue between African and Europeans from all stakeholder groups on current and emerging global internet governance issues.

Increase European participation in African IG processes:

- Support for European participation – from all stakeholder groups – in African internet governance events and processes including in AfriSIG
- Strengthen regional and national multistakeholder internet governance in Africa.
- Support for regional, sub-regional and national IGFs through mechanisms such as PRIDA, the IGF Secretariat and the IGF Support Association

385 World Summit on the Information Society internet governance definition. See ITU. 2005.
386 Bashir S. 2021. "Africa's universities can jumpstart the end of the digital divide". World Bank Blogs, 18 March 2021.

- Support for national, regional and continental Schools on Internet Governance
- Research partnerships with African universities and research institutions and networks (e.g. NRENs) in the area of global, regional and national internet governance

Foster existing and build new collaborations in technical internet governance:

- Support the training, preparation and participation of African specialists in technical open internet fora and discussions.
- Strengthen current and build new partnerships between technical organisations in Europe and Africa (e.g. RIPE NCC and AfriNIC).

Open Internet assessments at national level:

- Support for country-level multistakeholder assessments using the UNESCO Internet Universality Indicators

4. Concluding Remarks

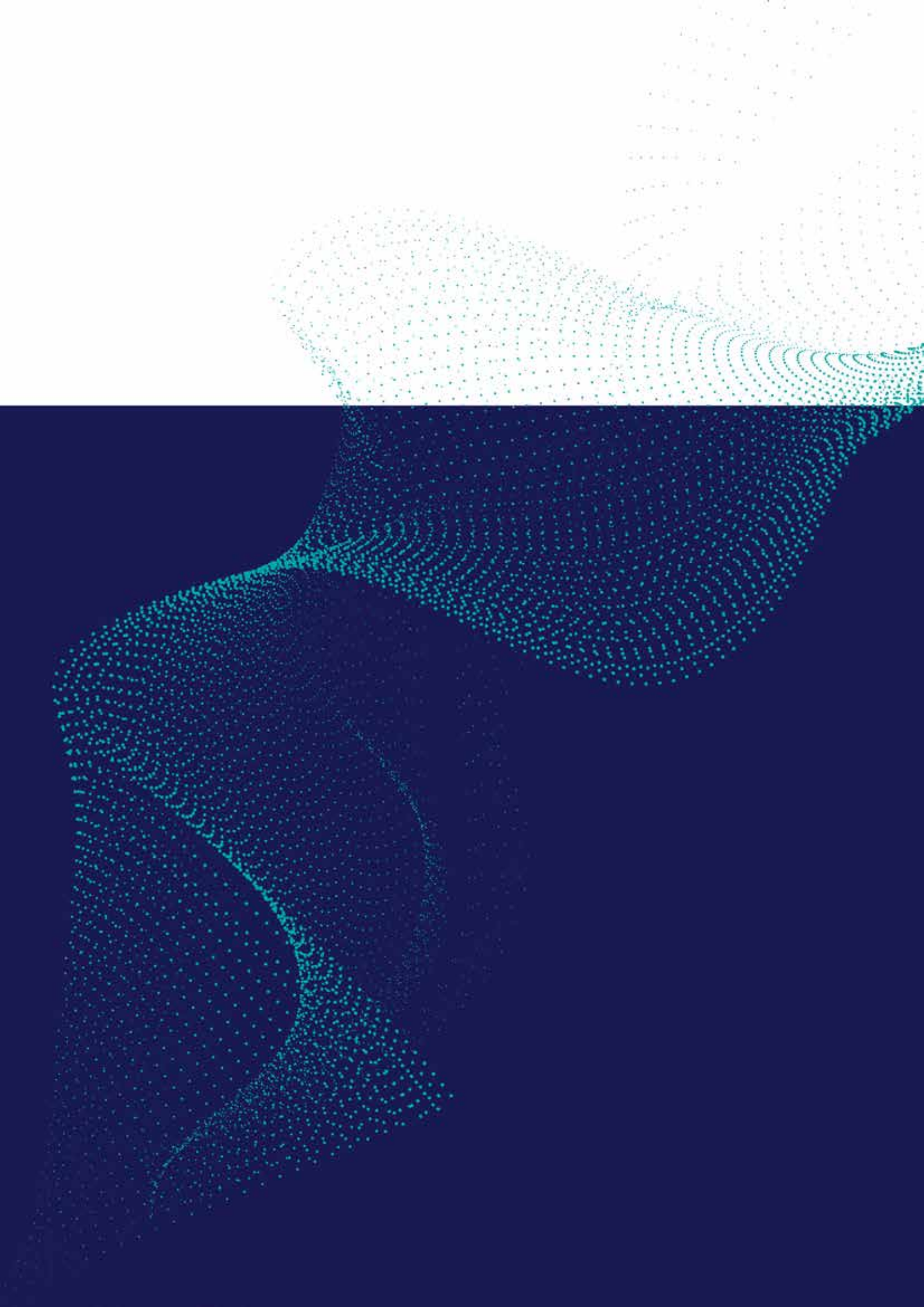
There is, globally, a recognition that the Open Internet is a catalyst for growth, empowering local communities to nurture social, economic, political and cultural development. The Open Internet's decentralised architecture, built on stable standards and protocols that are developed in open and consensus-driven processes ensures the security and resilience of the global network. At the same time, these processes allow the protocols and standards to adapt to new and future challenges and accommodate innovation and the growing number of users.

While digitisation is an unstoppable process, the Open Internet is not, and should not be taken for granted by governments and policymakers. In Africa, digital infrastructure has grown dramatically in the last decade, and one third of Africa's population has access to the Open Internet. Digital regulations and skills are developing, the digital economy is booming, especially in some countries, and a growing participation in internet governance is shaping the internet according also to Africa's interests. Yet, this is clearly not enough, as Africa shows considerable gaps in these areas, starting with infrastructure and 'usage' gap – people who have access but who do not use the internet.

In this context, renewed and strengthened EU-African digital partnerships, under the umbrella of the Global Gateway, should make sure that the next push towards national digital transitions actively opts in for comprehensive Open Internet approaches. This is the most effective way of fully harnessing digital technologies' potential for growth, development, democratisation and local empowerment. These approaches should start with practical support for the Open Internet's technical architecture and continue with developing digital regulations that are respectful of Human Rights and Open Internet principles, creating Open Internet markets that stimulate local entrepreneurs, enhancing skills that truly develop socio-economic and political online participation, and bringing more diversity and inclusion in internet governance.

The Report identified concrete opportunities for EU-Africa partnerships and cooperation for each of the five key areas. The fact that there are existing initiatives in both regions forms a sound basis for peer learning and sharing of solutions, sequencing and prioritisation.

A comprehensive approach to the Open Internet based on a strong human-centric vision on digitalisation is consistent with strategies in both regions. The opportunities for EU-Africa partnerships proposed in the Report are not exhaustive but form the basis for such a holistic approach. They aim to strengthen the Open Internet in Africa, harness its potential for growth and socio-economic development, and nurture a more inclusive multistakeholder internet governance model.



List of reference documents and links

Araba Benson E. 2022. "Top 5 biggest eCommerce startups in Sub-Saharan Africa". Business Insider Africa, 20 March. https://africa.businessinsider.com/local/markets/top-5-biggest-ecommerce-startups-in-africa/em7kc41

Access Now. 2022. "The return of digital authoritarianism. Internet shutdowns in 2021". #KeepItOn coalition. April 2022. https://www.accessnow.org/cms/assets/uploads/2022/04/2021-KeepItOn-Report-1.pdf

ACHPR. 2019. "Declaration of Principles on Freedom of Expression and Access to Information in Africa". African Commission on Human and People's Risghts. November 2019. https://www.achpr.org/public/Document/file/English/Declaration%20of%20Principles%20on%20Freedom%20of%20Expression_ENG_2019.pdf https://www.achpr.org/legalinstruments/detail?id=69

Afadhali J.-P. 2022. "Africa's tech startups ecosystem fastest growing with rising investments". IOL. 7 March. https://www.iol.co.za/technology/software-and-internet/africas-tech-startups-ecosystem-fastest-growing-with-rising-investments-d5ddc392-a4e8-524e-ba60-04fb8d07d905

AfLIA. 2021. "AfLIA Statement in Support of African Union's Digital Transformation Strategy". African Library and Information Associations and Institutions. https://web.aflia.net/wp-content/uploads/2021/03/AfLIA-Statement-in-Support-of-African-Union-Digital-Transformation.pdf

African Union. 2021 "The Single African Air Transport Market". https://au.int/en/articles/single-african-air-transport-market
African Union. 2020 "Key Transfomational Outcomes of Agenda 2063". https://au.int/agenda2063/outcomes

African Union. 2020. "The Digital Transformation Strategy for Africa (2020-2030)". 18 May. https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf

African Union. 2018. "Pan-African Financial Institutions". https://au.int/en/documents/20180918/pan-african-financial-institutions

African Union. 2018. "Protocol tot he Threaty establishing the African Economic Community Relating to Free Movement of Persons, Right of Residence and Right of Establishment". https://au.int/sites/default/files/treaties/36403-treaty-protocol_on_free_movement_of_persons_in_africa_e.pdf

African Union. 2017. "African Declaration on Internet Governance. (unofficial translation)". 13 February. https://au.int/sites/default/files/newsevents/workingdocuments/33025-wd-african_declaration_on_internet_governance_en_0.pdf

African Union. "Program Infrastructure Development for Africa (PIDA)". https://au.int/en/ie/pida

AFRINIC. "AFRINIC IPv4 Exhaustion statistics". https://stats.afrinic.net/ipv4/exhaustion/ipv4_available

AFRINIC. "AFRINIC IPv6 statistics". https://stats.afrinic.net/ipv6/

AfricaPortal. 2021. "Event: Help the African Union Commission develop a digital ID framework for the continent". 26 July. https://www.africaportal.org/features/event-help-african-union-commission-develop-digital-id-framework-continent/

AIMS. 2021. "Promoting STEM Education in Africa". African Institute for Mathematical Sciences. Next Einstein Initiative. 5 October. https://nexteinstein.org/promoting-stem-education-in-africa/

Alais O. 2021. "Internet and Africa: what cyberspace for tomorrow?". iD4D. 10 March, updated on 17 June. https://ideas4development.org/en/africa-internet-cyberspace/

Alvarez M. 2022. "In which European countries are STEM graduates most highly recognised?". CYD Foundation. Multirank. 23 February. https://www.umultirank.org/blog/In-which-European-countries-are-STEM-graduates-most-highly-recognised/

APC. 2016. "Ending digital exclusion: Why the access divider persists and how to close it". Association for Progressive Communications. Position Papers. April 2016. https://www.apc.org/sites/default/files/EndingDigitalExclusion_dig.pdf

APNIC. "History of the Internet". https://www.apnic.net/about-apnic/organization/history-of-apnic/history-of-the-internet/

AUC/OECD. 2021. «Profile of Africa's youth (aged 15-29) by educational attainment and region, 2000-40», in Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs, OECD Publishing, https://doi.org/10.1787/16c7e570-en.

A4AI. "2021 Affordability Report". https://a4ai.org/affordability-report/report/2021/#despite_the_impact_of_icts_vast_digital_inequalities_persist_throughout_the_globe

A4AI. 2021. "How expensive is a smartphone in different countries?". Alliance for Affordable Internet. 7 October. https://a4ai.org/how-expensive-is-a-smartphone-in-different-countries/

A4AI. "Meaningful Connectivity – unlocking the full power of internet access. Alliance for Affordable Internet. https://a4ai.org/meaningful-connectivity/ .

A4AI. 2020. "Meaningful Connectivity: A New Target to Raise the Bar for Internet Access." Alliance for Affordable Internet. https://docs.google.com/document/d/1qydsmTY4hln3pP4dWJbCSRFna8SfDYAtGfacKYwhVk8/edit

Bamford R. Hutchinson G. Macon-Cooney B. 2021. "The Progressive case for Universal Internet Access: How to Close the Digital Divide by 2030". Tony Blair Institute For Global Change. March 2021. https://institute.global/sites/default/files/articles/The-Progressive-Case-for-Universal-Internet-Access-How-to-Close-the-Digital-Divide-by-2030.pdf

Barlow J.P. 1996. "A Declaration of Independence of Cyberspace". Electronic Frontier Foundation. 8 February. https://www.eff.org/cyberspace-independence

Bashir S. 2021. "Africa's universities can jumpstart the end of the digital divide". World Bank Blogs, 18 March 2021. https://blogs.worldbank.org/digital-development/africas-universities-can-jumpstart-end-digital-divide

Bayuo B. Bamford R. e.a. 2022. "Supercharging Africa's Startups: The Continent's Path to Tech Excellence". Tony Blair Institute For Global Change. February 2022. https://institute.global/sites/default/files/articles/Supercharging-Africa-s-Startups-The-Continent-s-Path-to-Tech-Excellence.pdf

BBC. 2005. "US rejects changes to net protocol". 30 September. http://news.bbc.co.uk/2/hi/technology/4296646.stm

Belli L. Baca C. Huerta E. Velasco K. 2020. "Community Network in Latin America: Unleashing Openness through Self-determination". The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p. 109-120. https://www.intgovforum.org/multilingual/filedepot_download/6114/2375

Belli L. Manzar O. Farooqui S. 2020. "COVID-19: A Harsh Reminder that Open Internet Access and Meaningful Connectivity are Essential". The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p.27-36. https://www.intgovforum.org/multilingual/filedepot_download/6114/2375

Boakyz B. 2021. "Africa's open internet is at risk – its leaders must act to save it". African Business. 4 October. https://african.business/2021/10/technology-information/africas-open-internet-is-at-risk-its-leaders-must-act-to-save-it/

Bortzmeyer S. 2021. "The QUIC transport protocol has now been standardised". AFNIC. June 2021, https://www.afnic.fr/en/observatory-and-resources/expert-papers/the-quic-transport-protocol-has-now-been-standardised/

Briter Bridges. 2021. "Bolstering innovators in Africa, Innovation hubs' catalytic role as ecosystem support organisations". Briter Bridges and AfriLabs, October 2021. https://briterbridges.com/reports

Broadband Commission. 2021. "Connecting Africa Through Broadband. A strategy for doubling connectivity by 2021 and reaching universal access by 2030". Broadband Commission for Sustainable Development. September. https://broadbandcommission.org/wp-content/uploads/2021/09/WGDigitalMoonshotforAfrica_Report2020-1.pdf

Broadband Commission. "Achieving the 2025 Advocacy Targets. Universal connectivity, affordability, skills access, equality and use. https://www.broadbandcommission.org/advocacy-targets/

Budlender D. 2018. "The African School on Internet Governance: Tracer study of four rounds of AfriSIG (2013-2016)". Association for Progressive Communications. https://www.apc.org/en/node/34578

Caballero A. Bashir S. 2020. «Africa needs digital skills across the economy - not just the tech sector». World Economic Forum. 22 October. https://www.weforum.org/agenda/2020/10/africa-needs-digital-skills-across-the-economy-not-just-tech-sector/

Cable.co.uk. 2021. "Worldwide broadband speed league 2021". https://www.cable.co.uk/broadband/speed/worldwide-speed-league/

Caeiro C. Jones K. Taylor E. 2021. "Technical Standards and Human Rights: The Case of New IP". Unedited draft, to be published by Chatham House and Brookings Institution Press in the course of 2022. https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID4012782_code4796510.pdf?abstractid=3907165&mirid=1

CBI.br. 2020. "IX.br reaches mark of 10 Tb/s of peak internet traffic". 24 March. https://www.cgi.br/noticia/releases/ix-br-reaches-mark-of-10-tb-s-of-peak-internet-traffic/

Chege K. 2020. "In Africa, An Open Internet Standards Course for Universities". Internet Society. 17 July. https://www.internetsociety.org/blog/2020/07/in-africa-an-open-internet-standards-course-for-universities-2/

Chimbelu C. 2019 "Investing in Africa's tech infrastructure. Has China won already?". Deutsche Welle (DW). 5 May. https://www.dw.com/en/investing-in-africas-tech-infrastructure-has-china-won-already/a-48540426

Cisco. 2020. "Cisco Annual Internet Report (2018-2023)". Updated 9 March 2020. https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.pdf

Cloudflare. "What is a DNS root server?" https://www.cloudflare.com/en-gb/learning/dns/glossary/dns-root-server/

Coffin J. 2018 "Community Networks. Switch It On". Internet Society.

Community Networks ITU-D SG-1 Workshop. 17 September. https://www.itu.int/dms_pub/itu-d/oth/07/0d/D070D00000B0001PDFE.pdf

Cusolito A. Gévaudan C. Lederman D. Wood C. 2022. "The Upside of Digital for the Middle East and North Africa. How Digital Technology Adoption Can Accelerate Growth and Create Jobs". World Bank Group. March. https://openknowledge.worldbank.org/bitstream/handle/10986/37058/9781464816635.pdf

Cotterill J. 2021. "Cabling Africa: the great data race to serve the last billion". Financial Times. 31 January. https://www.ft.com/content/adb1130e-2844-4051-b1df-a691fc8a19b8

Daramola O. Ayo C. 2015. "Enabling socio-economic development of the masses through e-government in developing countries".Department of Computer Science and Information Sciences, Covenant University, Ota, Nigeria. January 2015 https://www.researchgate.net/publication/283780380_Enabling_socio-economic_development_of_the_masses_through_e-government_in_developing_countries

del Portillo I. Eiskowitz S. Crawley E. Cameron B. 2021. «Connecting the other half: Exploring options for the 50% of the population unconnected to the internet». Telecommunications Policy, Elsevier, vol. 45(3). https://ideas.repec.org/a/eee/telpol/v45y2021i3s0308596120301828.html

Deloitte. 2020. "Survey of Global Investment and Innovation incentives 2020". 31 October. https://www2.deloitte.com/global/en/pages/tax/articles/global-investment-and-innovation-incentives-survey.html.

Denis B. 2020. "Development solutions: There's an app for that". European Investment Bank, June 2020. https://www.eib.org/en/essays/developing-countries-digitalisation

Digwatch. 2020. "France and partners propose a programme of action for advancing responsible state behaviour in cyberspace". Geneva Internet Platform. 8 October. https://dig.watch/updates/france-and-partners-propose-programme-action-advancing-responsible-state-behaviour

Disrupt Africa. 2022. "The African Tech Startups Funding Report 2021". January 2022. https://disruptafrica.gumroad.com/l/hheig
Domain Tools Internet Statistics. "TLD Counts". https://research.domaintools.com/statistics/tld-counts/

Donkor A. 2021. "Africa's Youth Unemployment Crisis Is a Global Problem". Foreign Policy. 19 October. https://foreignpolicy.com/2021/10/19/africa-youth-unemployment-crisis-global-problem/

Durand A. 2020. "New IP". ICANN Office of the Chief Technology Officer. 27 October. https://www.icann.org/en/system/files/files/octo-017-27oct20-en.pdf

Drake W. Cerf V. Kleinwächter W. 2016. "Future of the Internet

Initiative White Paper, Internet Fragmentation: An Overview". World Economic Forum. January. https://www3.weforum.org/docs/WEF_FII_Internet_Fragmentation_An_Overview_2016.pdf

Ehl D. Grün G.-C. 2020. "Why mobile internet is so expensive in some African nations". Deutsche Welle (DW). 3 November. https://www.dw.com/en/why-mobile-internet-is-so-expensive-in-some-african-nations/a-55483976

EIB. 2021. "The rise of Africa's digital economy - The European Investment Bank's activities to support Africa's transition to a digital economy". European Investment Bank. February 2021. https://www.eib.org/attachments/thematic/study_the_rise_of_africa_s_digital_economy_en.pdf

Ekine A. Aremu A. 2022. "Making the future of African STEM female". Brookings Institute. 10 February. https://www.brookings.edu/blog/africa-in-focus/2022/02/10/making-the-future-of-african-stem-female/

Esterhuysen A. Degezelle W. 2021. "When Internet Governance meets Digital Cooperation: Navigating IGF Growth and Development in the Context of an Evolving Internet Governance Ecosystem" Cyberstability Paper Series. Global Commission on the Stability of Cyberspace. December 2021. https://cyberstability.org/wp-content/uploads/2021/12/Cyberstability-Paper-Series.pdf

ETNO. 2020. "ETNO Position paper on the New IP proposal". 5 November. https://www.etno.eu/library/positionpapers/417-new-ip.html

European Commission. 2022. "EU and international partners put forward a Declaration for the Future of the Internet". Press release. 28 April. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2695

European Commission. 2022. "Data Act: Commission proposes measures for a fair and innovative data economy". Press release. 23 February. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1113

European Commission. 2022. "Space: EU initiates a satellite-based connectivity system and boosts action on management of space traffic for a more digital and resilient Europe". Press Release. 15 February. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_921

European Commission. 2022. "Shaping Europe's Digital future. Declaration on European Digital Rights and Principles". 26 January. https://digital-strategy.ec.europa.eu/en/library/declaration-european-digital-rights-and-principles

European Commission. 2021. "New EU copyright rules that will benefit creators, businesses and consumers start to apply". Press realease. 4 June https://ec.europa.eu/commission/presscorner/detail/en/IP_21_1807

European Commission. "Shaping Europe's digital future. Open Internet". https://digital-strategy.ec.europa.eu/en/policies/open-internet

European Commission. "Shaping Europe's digital future: eGovernment and digital public services". https://digital-strategy.ec.europa.eu/en/policies/egovernment

European Commission. "Shaping Europe's digital future. The Digital Services Act package". https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package

European Commission. "Shaping Europe's digital future. A European approach to artificial intelligence". https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

European Commission. 2021. "Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts". 21 April. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0206

European Commission. 2021. "Shaping Europe's digital future. Proposal for a Regulation laying down harmonised rules on artificial intelligence". 21 April. https://digital-strategy.ec.europa.eu/news-redirect/709090

European Commission. 2021. "Joint Communication to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, The Global Gateway". https://ec.europa.eu/info/sites/default/files/joint_communication_global_gateway.pdf

European Commission. 2021. "Joint Communication tot he European Parliament and the Council on strengthening the EU's contribution to rules-based multilateralism". 17 November. https://eeas.europa.eu/sites/default/files/en_strategy_on_strengthening_the_eus_contribution_to_rules-based_multilateralism.pdf

European Commission. 2021. "Europe's Digital Decade: digital targets for 2030". https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

European Commission. 2021. "Shaping Europe's digital future. Europe's Digital Decade". https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#ecl-inpage-kyvdstob

European Commission. 2020. "Joint Communication to the European Parliament and the Council. The EU's Cybersecurity Strategy for the Digital Decade". 16 December. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=72164

European Commission. 2020. "Shaping Europe's digital future. Proposal for directive on measures for high common level of cybersecurity across the Union". 16 December. https://digital-strategy.ec.europa.eu/en/library/proposal-directive-measures-high-common-level-cybersecurity-across-union

European Commission. 2020. "Digital 4 Development Hub Forum. The EU-AU Data Flagship". https://futurium.ec.europa.eu/en/Digital4Development/discussion/eu-au-data-flagship?language=fr

European Union. 2019. Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act). https://eur-lex.europa.eu/eli/reg/2019/881/oj

European Commission. "The Next Generation Internet". https://www.ngi.eu/

European Commission. "European Education Area. Digital Education Action Plan (2021-2027)". https://education.ec.europa.eu/focus-topics/digital-education/about/digital-education-action-plan

European Commission. "Shaping Europe's digital future. Startup Europe".https://digital-strategy.ec.europa.eu/en/policies/startup-europe

European Data Protection Supervisor. https://edps.europa.eu/_en
Frankfurter Z. Kokoszka K. Newhouse D. Silwal A.R., Tian S. 2020. "Measuring Internet Access in Sub-Saharan Africa (SSA)". World Bank Group. Poverty & Equity Notes. Number 31. August 2020. https://openknowledge.worldbank.org/bitstream/handle/10986/34302/Measuring-Internet-in-Access-in-Sub-Saharan-Africa-SSA.pdf?sequence=1

France Diplomacy. 2022. "Joint statement by the Ministry for Europe and Foreign Affairs and the State secretariat for the digital transition and electronic communications. Creation of a European Initiative for Digital Commons." Ministère de L'Europe et des Affaires Etrangères. 7 February. https://www.diplomatie.gouv.fr/en/french-foreign-policy/digital-diplomacy/news/article/joint-statement-by-the-ministry-for-europe-and-foreign-affairs-and-the-state

France Diplomacy. 2022. "Declaration by the Presidency of the Council of the European Union calling for a European Initiative for Digital Commons", https://www.diplomatie.gouv.fr/IMG/pdf/declaration_of_the_presidency_european_initiative_for_digital_commons_cle894d85.pdf

France Diplomacy. 2020. "Barbed wire on the Internet prairie: against new enclosures, digital commons as drivers of sovereignty". Team Blog. July 2020, https://www.diplomatie.gouv.fr/en/french-foreign-policy/digital-diplomacy/team-blog/digital-commons

Fuster Morell M. 2010. "Dissertation: Governance of online creation communities: Provision of infrastructure for the building of digital commons". https://www.onlinecreation.info/digital-commons/

GDPR.EU. "Complete guide to GDPR compliance". Proton Technologies 2022. https://gdpr.eu

Ghedini A. 2018. "The Road to QUIC". The Cloudflare Blog. 26 July. https://blog.cloudflare.com/the-road-to-quic/

Gillwald A. 2020. "Measuring Digital Inclusion". Research ICT Africa/University of Cape Town. December 2020. https://researchictafrica.net/wp/wp-content/uploads/2020/12/Measuring_Digital_Inclusion-Digital_Inclusion_or_Digital_Inequality-WTIS.pdf

Gillwald A. Onkokame M. 2019. "After Access 2018: A Demand-Side View Of Mobile Internet From 10 African Countries". Research ICT Africa. Policy Paper Series No. 5 After Access. https://researchictafrica.net/wp/wp-content/uploads/2019/05/2019_After-Access_Africa-Comparative-report.pdf

Gillwald A. 2017. "From digital divide to digital inequality: The connectivity paradox". Research ICT Africa. Paper Presented at the Law and Development Research Conference: University of Antwerp, 20-22 September 2017. https://researchictafrica.net/publications/Other_publications/2017_Gillwald_From_digital_divide_to_digital_inequality.pdf

GIZ. "African Continental Free Trade Area (AfCFTA)". Project description. https://www.giz.de/en/worldwide/59611.html

GMSA. 2021. "The Mobile Economy Sub-Saharan Africa 2021". GSMA Association. https://www.gsma.com/mobileeconomy/sub-saharan-africa/

GMSA. 2021. "The State of Mobile Internet Connectivity 2021". GMSA Association. Figure 1 on p. 13. https://www.gsma.com/r/wp-content/uploads/2021/09/The-State-of-Mobile-Internet-Connectivity-Report-2021.pdf

Google and IFC, a member of the World Bank Group. 2020. "e-Conomy Africa 2020: Africa's $180 Billion Internet Economy Future". https://www.ifc.org/wps/wcm/connect/publications_ext_content/ifc_external_publication_site/publications_listing_page/google-e-conomy

Govender M. 2022. "Can development finance accelerate Africa's drive towards a digital economy?". Business Day. January 2022, https://www.businesslive.co.za/bd/opinion/2022-01-26-melissa-govender-can-development-finance-accelerate-africas-drive-towards-a-digital-economy/

Granguillhome Ochoa R. Lach S. Masaki T. Rodríguez Castelán C. 2021. "Why aren't more people using mobile internet in West Africa?". World Bank Blogs. 8 December. https://blogs.worldbank.org/digital-development/why-arent-more-people-using-mobile-internet-west-africa

Guven M. Karlen R. 2020. "Supporting Africa's urban informal sector: Coordinated policies with social protection at the core". World Bank Blogs. 3 December. https://blogs.worldbank.org/africacan/supporting-africas-urban-informal-sector-coordinated-policies-social-protection-core

Harrisberg K. 2021. "Bridging Africa's digital divide: The rise of the community internet". World Economic Forum. 3 December. https://www.weforum.org/agenda/2021/12/bridging-africas-digital-divide-the-rise-of-community-internet/

Hersey F. 2021. "Major research project examines digital identity in 10 African countries". Biometric Update.com. 9 November. https://www.biometricupdate.com/202111/major-research-project-examines-digital-identity-in-10-african-countries

Hoffmann S. Lazanski D. Taylor E. 2020. "Standardising the splinternet: how China's technical standards could fragment the internet". Journal of Cyber Policy. 5:2, 239-264. https://doi.org/1.1080/23738871.2020.1805482

Hogewoning M. 2020. "Update on WTSA-20 Preparations and New IP". RIPE blog, 10 November. https://labs.ripe.net/author/marco_hogewoning/update-on-wtsa-20-preparations-and-new-ip/

Hogewoning M. 2020. "Do We Need a New IP?". RIPE blog, 22 April. https://labs.ripe.net/author/marco_hogewoning/do-we-need-a-new-ip/

IANA Root Zone Database: https://www.iana.org/domains/root/db.

IANA. List of Root Servers. https://www.iana.org/domains/root/servers

ICANN. 2022. "ICANN-Managed Root Server Clusters to Strengthen Africa's Internet Infrastructure". ICANN Press Release. 28 February. https://www.icann.org/resources/press-material/release-2022-02-28-en

ICANN. 2020. "ICANN Africa Regional Plan for Fiscal Years 2021-2025". 1 July. https://www.icann.org/en/system/files/files/africa-regional-plan-fy21-25-01jul20-en.pdf

ICANN. 2020. "Domain Name System Security Extensions Now Deployed in all Generic Top-Level Domains". 23 December. https://www.icann.org/en/announcements/details/domain-name-system-security-extensions-now-deployed-in-all-generic-top-level-domains-23-12-2020-en

ICANN. 2019. "ICANN Calls for Full DNSSEC Deployment, Promotes Community Collaboration to Protect the Internet". 22 February. https://www.icann.org/en/announcements/details/icann-calls-for-full-dnssec-deployment-promotes-community-collaboration-to-protect-the-internet-22-2-2019-en

IETF Datatracker. "Domain Name System Security (dnssec)". https://datatracker.ietf.org/wg/dnssec/documents/

IFC. 2021. "Women and E-commerce in Africa". International Finance Cooperation. https://www.ifc.org/wps/wcm/connect/47361305-6ebe-431a-8dd9-db2290919823/202105-digital2equal-women-and-e-commerce-africa.pdf?MOD=AJPERES&CVID=nCGRGTr

IGF. 2021. "IGF 2021 Participation and Programme Statistics". Internet Governance Forum. December 2021. https://www.intgovforum.org/en/content/igf-2021-participation-and-programme-statistics.

IGF. 2021. "IGF 2021 by the numbers". Internet Governance Forum. December 2021. https://www.intgovforum.org/en/filedepot_download/223/20513

IGF. 2017. "Best Practice Forum on IXPs. Contributing to the success and continued development of internet exchange points". Internet Governance Forum. January 2017. https://www.intgovforum.org/en/filedepot_download/3408/442

IGF. "IGF Regional and National Initiatives". https://www.intgovforum.org/en/content/national-and-regional-igf-initiatives

ILO. 2021. "Global Employment Trends for Youth 2020: Africa".

International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_737670.pdf

IMF. 2022. "Regional Economic Outlook Sub-Saharan Africa". International Monetary Fund, April 2022. https://www.imf.org/en/Publications/REO/SSA/Issues/2022/04/28/regional-economic-outlook-for-sub-saharan-africa-april-2022

Internet Society. 2021. "The Internet Impact Assessment Toolkit – Introduction". Version 2.0. 8 November. https://www.internetsociety.org/wp-content/uploads/2021/11/Introduction-IIAT_EN.pdf

Internet Society. 2020-2021. "Virtual Summit on Community Networks in Africa". https://www.internetsociety.org/events/summit-community-networks-africa/

Internet Society. 2020. "The Internet Way of Networking: Defining the critical properties of the internet". September. p.6. https://www.internetsociety.org/wp-content/uploads/2020/09/IWN-IIAT-Defining-the-critical-properties-of-the-Internet.pdf

Internet Society. 2015. "Internet Exchange Points. An Internet Society Public policy Briefing". 30 October. https://www.internetsociety.org/wp-content/uploads/2015/10/ISOC-PolicyBrief-IXPs-20151030_nb.pdf

Internet Society. "DNSSEC Deployment Maps". https://www.internetsociety.org/deploy360/dnssec/maps/

ITU. 2022. "The affordability of ICT services in 2021". ITU Policy Brief. March 2022. https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2021/ITU_A4AI_Price_Brief_2021.pdf

ITU. 2021. "Measuring digital development. Facts and figures 2021". Interneational Telecommunication Union Development Sector. December. https://www.itu.int/itu-d/reports/statistics/facts-figures-2021/

ITU. 2005. WSIS-05/TUNIS/DOC/6(Rev.1)-E. "Tunis Agenda for the Information Society". World Summit on the Information Society (WSIS). 18 November. https://www.itu.int/net/wsis/docs2/tunis/off/6rev1.pdf

ITU. 2003. WSIS-03/Geneva/Doc/5-E. "WSIS Geneva Plan of Action". 12 December. https://www.itu.int/net/wsis/docs/geneva/official/poa.html

ITU. 1998. "Final Acts of the Plenipotentiary Conference (Minneapolis, 1998)" https://search.itu.int/history/HistoryDigitalCollectionDocLibrary/4.16.43.en.100.pdf

ITU. HIPSSA Project. "Support for harmonization of ICT Policies in Sub-Saharan Africa". https://www.itu.int/en/ITU-D/Projects/ITU-EC-ACP/HIPSSA/Pages/default.aspx

ITU-T TSAG. 2020. Contribution SG13-C1069-R1. "New IP, Future Communication Networks or similar proposals". 18 November. https://www.itu.int/md/T17-SG13-C-1069 . (copy at https://www.ripe.net/participate/internet-governance/multi-stakeholder-engagement/t17-sg13-c-1069-r1-msw-e.pdf)

ITU-T TSAG. 2020. Contribution TSAG-C0135. "Response to "New IP, Shaping Future Network" proposal. 28 January. https://www.itu.int/md/T17-TSAG-C-0135 . (copy at https://www.ripe.net/participate/internet-governance/multi-stakeholder-engagement/ripe-ncc_tsag_new-ip.pdf)

ITU-T TSAG. 2019. TSAG-TD598. "Tutorial on C83 – New IP: Shaping the Future Network". 18 September. https://www.itu.int/md/T17-TSAG-190923-TD-GEN-0598/en

ITU-T TSAG. 2019. Contribution T17-TSAG-C83 [C83]. ""New IP, Shaping Future Network": Propose to initiate the discussion of strategy transformation for ITU-T". 10 September. https://www.itu.int/md/T17-TSAG-C-0083

Jamil Z. 2016. "Comparative analysis of the Malabo Convention of the African Union and the Budapest Convention on Cybercrime". Council of Europe. 20 November. https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016806bf0f8

Johnson C. Bester H. van Vuuren P.J. Dunn M. 2020. "Emerging trends from Africa's digital platforms". CENFRI. April 2020. https://cenfri.org/wp-content/uploads/Africas-digital-platforms-trends-report.pdf

Joras M. Chi Y. 2022. "How Facebook Is Bringing QUIC to Billions". InfoQ. 20 January. https://www.infoq.com/presentations/facebook-quic-http3/

Kampala. 2021. "Data centres are taking root in Africa". the Economist. 4 December. https://www.economist.com/middle-east-and-africa/2021/12/04/data-centres-are-taking-root-in-africa

Karishma B. 2021. "Why skills development is key for digital transformation in Africa", ODI, 2021. https://odi.org/en/insights/why-skills-development-is-key-for-digital-transformation-in-africa/

Karrenberg D. 2004. "The Internet Domain Name System Explained for Non-Experts". Internet Society. 1 March. https://

www.internetsociety.org/resources/doc/2004/the-internet-domain-name-system-explained-for-non-experts-by-daniel-karrenberg/

Kende M. Kvalbein A. Allford J. Abecassis D. 2021. "Study on the Internet's Technical Success Factors". Analysys Mason. December 2021. https://report.analysysmason.com/internet_success_factors/MKGRA669%20%20Report%20for%20APNIC%20LACNIC%20V3.pdf

Kende M. 2021. "Moving Toward an Interconnected Africa: The 80/20 initiative". Internet Society. July 2021. https://www.internetsociety.org/wp-content/uploads/2021/07/2021-Moving-toward-an-Interconnected-Africa-EN.pdf

Kende M. Abecassis D. 2019. "Impact of taxation on social media in Africa". Analysys Mason. March 2019. p.2. https://www.analysysmason.com/consulting-redirect/reports/impact-of-taxation-on-social-media-africa-may2019/
Kenya Digital Economy. 2019. "Digital Economy Blueprint, Powering Kenya's Transformation". https://www.ict.go.ke/wp-content/uploads/2019/05/Kenya-Digital-Economy-2019.pdf

Kivuva M. 2021. "Kenya adopts community networks licencing framework". KICTANET. 9 November. https://www.kictanet.or.ke/kenya-ratifies-the-community-networks-licensing-framework/

Knodel M. West H. 2020. "Input on Proposals and Positions for the 2020 World Telecommunication Standardization Assembly". Center for Democracy & Technology and Mozilla. Letter to the US NTIA 20 June. https://blog.mozilla.org/netpolicy/files/2020/06/2020-06-08-NTIA-filing-CDT-Mozilla.pdf

Kop. M. 2021. "EU Artificial Intelegence Act: The European Approach to AI". Vienna Transatlantic Technology Law Forum, Transatlantic Antitrust and IPR Developments, Stanford University, Issue No. 2/2021. https://law.stanford.edu/publications/eu- artificial-intelligence-act-the-european-approach-to-ai/

Kornfeld D. Fisher W. 2001. "Domain Names". The Berkman Center for Internet & Society. Harvard Law School. June 2001. https://cyber.harvard.edu/ilaw/DomainNames/ https://cyber.harvard.edu/ilaw/DomainNames/FormationofICANN.htm

Kovacs A. (2013) "Is India reviving its proposal for a multilateral UN body to take over the governance of the Internet?". Internet democracy project. 14 November. https://internetdemocracy.in/2013/11/is-india-reviving-its-un-cirp-proposal

Kummer M. 2016. "A Watershed Moment in Multilateral Diplomacy: Adapting Governance Models to the 21st Century". in "The Working Group on Internet Governance". APNIC, APC, CGI.br, ICANN and Internet Society. Edited by Drake W. https://www.apc.org/en/WGIG10

Leiner B. Cerf V. Clark D. Kahn R. Kleinrock L. Lynch D. Postel J. Roberts L. Wolff S. 1997. "Brief History of the Internet". Internet Society. 13 September. https://www.internetsociety.org/internet/history-internet/brief-history-internet/

Lozada P. Rühlig T. Toner H. 2021. "Chinese Involvement in International Technical Standards: A DigiChina Forum". DigiChina. Stanford University. 6 December. https://digichina.stanford.edu/work/chinese-involvement-in-international-technical-standards-a-digichina-forum/

Maher H. Laabi A. Ivers L. Ngambeket G. 2021. "Overcoming Africa's Tech Startup Obstacles". BCG. 12 April. https://www.bcg.com/publications/2021/new-strategies-needed-to-help-tech-startups-in-africa

Mahindra R. Chander V. Guo E. 2019. "Employing QUIC Protocol to Optimize Uber's App Performance". Uber Engineering. 14 May. https://eng.uber.com/employing-quic-protocol/

MISTRA. 2020. "Leap 4.0: African perspectives on the fourth industrial revolution". Policy Brief from the Mapungubwe Institute for Strategic Reflection (MISTRA). December 2020. https://mistra.org.za/wp-content/uploads/2020/12/Leap-4.0-African-Perspectives-on-the-Fourth-Industrial-Revolution-Policy-Brief.pdf

McCauley J. Harchol Y. Panda A. Raghavan B. Shenker S. (2019) "Enabling a Permanent Revolution in Internet Architecture". SIGCOMM '19: Proceedings of the ACM Special Interest Group on Data Communication. August 2019. https://doi.org/10.1145/3341302.3342075

Meinrath D. Losey J. Pickard W. 2011. "Digital Feudalism: Enclosures and Erasures from Digital Rights Management to the Digital Divide". Advances in Computers, Volume 81, January 2011, Pages 237-287. https://www.researchgate.net/profile/Victor-Pickard/publication/220662581_Digital_Feudalism_Enclosures_and_Erasures_from_Digital_Rights_Management_to_the_Digital_Divide/links/55f9898f08aeba1d9f1e87b2/Digital-Feudalism-Enclosures-and-Erasures-from-Digital-Rights-Management-to-the-Digital-Divide.pdf?origin=publication_detail

Mourdoukoutas E. 2017. "African's digital rise hooked on innovation". Africa Renewal, May-July 2017. https://www.un.org/africarenewal/magazine/may-july-2017/africa%E2%80%99s-digital-rise-hooked-innovation

Mobile World Live. 2022. "Towards a flourishing digital economy

for all – a spotlight on Africa". February 2022. https://www.mobileworldlive.com/wp-content/uploads/2022/02/MWL-DIT-whitepaper-Towards-a-flourishing-digital-economy-for-all-–-a-spotlight-on-Africa.pdf

Multiple signatories. 2022. "A Declaration for the Future of the Internet". 28 April. https://ec.europa.eu/newsroom/dae/redirection/document/86262

Murgia M. Gross A. 2020. "Inside China's controversial mission to reinvent the internet'. Financial Times. 27 March. https://www.ft.com/content/ba94c2bc-6e27-11ea-9bca-bf503995cd6f

Myles. 2022. "The State and Future of LEO Satellite Internet Connectivity in Africa". Extensia. 19 January. https://extensia-ltd.com/2022/01/19/the-state-and-future-of-leo-satellite-internet-connectivity-in-africa/

Nakutavičiūtė J. 2020. "This is what you need to know about the new QUIC protocol". NordVPN Blog. 30 September. https://nordvpn.com/blog/what-is-quic-protocol/

Ngene G. Pinet M. Maclay C. e.a. 2021. "Strengthening youth livelihoods and enterprise innovation in Africa's digital era". ODI Working paper. www.odi.org/ publications/strengthening-youth-livelihoods-and-enterprise-innovation-in-africas-digital-era

NIS Cooperation Group. 2020. "Cybersecurity of 5G networks. EU Toolbox of risk mitigating measures". January 2020. https://ccdcoe.org/uploads/2020/01/EU-200129-Cybersecurity-of-5G-networks-EU-Toolbox-of-risk-mitigating-measures.pdf

NRO. 2022. "Internet Number Resource Status Report - Q1 March 2022". The Number Resource Organization. 21 April. https://www.nro.net/wp-content/uploads/NRO-Statistics-2022-Q1-FINAL.pdf

NSRC. "African Undersea and Terrestrial Fibre Optic Cables". Network Startup Resource Center. https://afterfibre.nsrc.org

OBG. 2021. "Data Centres in Africa Focus Report". Oxford Business Group. October. https://www.leconomiste.com/sites/default/files/eco7/public/data_centres_in_africa_report.pdf

OECD. 2018. "Briding the digital gender divide: Include, upskill, innovate." https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf

OECD. 2016. "Economic and Social Benefits of Internet Openness". OECD Digital Economy Papers, No. 257. OECD Publishing. https://www.oecd-ilibrary.org/science-and-technology/oecd-digital-economy-papers_20716826

OECD. 2014. "OECD Principles for Internet Policy Making". https://www.oecd.org/sti/ieconomy/oecd-principles-for-internet-policy-making.pdf

OECD. 2000. "Reducing the risk of policy failure: challenges for regulatory compliance". https://www.oecd.org/regreform/regulatory-policy/1910833.pdf

OECD. "What is BEPS?". Inclusive Framework for Base Erosion and Profit Shifting. https://www.oecd.org/tax/beps/about/
Olawande Daramola J. 2019. "African countries should rethink how they use e-government platforms". The Conversation. 22 January. https://theconversation.com/african-countries-should-rethink-how-they-use-e-government-platforms-108689

Partech. 2022. "2021 Africa Tech Venture Capital Report". February 2022. https://partechpartners.com/2021-africa-tech-venture-capital-report/

Pimenta S. Gajria N. 2020. "Understanding Africa's $180 billion internet economy future". Google blog. 11 November. https://blog.google/around-the-globe/google-africa/understanding-africas-180b-internet-economy-future/

Research ICT Africa. 2021. "Consultation workshop: Africa Data Policy Framework, African Union Commission". 5 August. https://researchictafrica.net/2021/08/05/consultation-workshop-africa-data-policy-framework-african-union-commission/

Research ICT Africa. 2020. "Multifacted challenges of digital taxation in Africa". Research ICT Africa Policy Brief 7. November 2020. p.1. https://media.africaportal.org/documents/Final-Tax-PB_30112020.pdf

Roscoe A. Kabugi A.N. 2022. "Women and e-commerce in Africa: The $15 billion opportunity". Foresight Africa series. Brookings. 7 March. https://www.brookings.edu/blog/africa-in-focus/2022/03/07/women-and-e-commerce-in-africa-the-15-billion-opportunity/

SACF. 2017. "ICANN - The 2016 African Domain Name System Market Study". South African communication Forum. 6 June. https://www.icann.org/en/system/files/files/africa-dns-market-study-final-06jun17-en.pdf

Shankland S. 2022. "Russia's Ukraine War Raises Specter of an Online Splinternet". CNET. 3 March. https://www.cnet.com/news/politics/russias-ukraine-war-raises-specter-of-an-online-splinternet/

Sharp R. Kolkman O. 2020. "Discussion Paper: An Analysis of the "New IP" proposal to the ITU-T". Internet Society. 24 April.

https://www.internetsociety.org/wp-content/uploads/2020/04/ISOC-Discussion-Paper-NewIP-analysis-29April2020.pdf

Simione F. Li. Y. 2021. "The Macroeconomic Impacts of Digitalization in Sub-Saharan Africa: Evidence from Submarine Cables". IMF Working Paper. April 2021. https://ssrn.com/abstract=4026284

Sewe N. 2021. "Multi-stakeholder collaboration: Achieving digital inclusion in Africa". World Benchmarking Alliance. Blog. 27 June. https://www.worldbenchmarkingalliance.org/news/multi-stakeholder-collaboration-achieving-digital-inclusion-in-africa/
Smith J. Cummins C. Krasodomski-Jones A. 2021. "Good Foundations. Why Democracies should care about the wiring of the Internet". DEMOS. March 2021. https://demos.co.uk/wp-content/uploads/2021/03/Good-Foundations-Report-.pdf

Space in Africa. 2022. "The State and Future of LEO Satellite Internet Connectivity in Africa". Via Satellite. 18 January. https://interactive.satellitetoday.com/via/january-february-2022/the-state-and-future-of-leo-satellite-internet-connectivity-in-africa/

StartupBlink. 2021. 'Global Startup Ecosystem Index 2021'. https://www.startupblink.com/startupecosystemreport.pdf

Stuart John. 2022. "Digital Development in Africa – What is Working and What Isn't". Trade Law Centre NPC (blog). 27 February. https://www.tralac.org/blog/article/15532-digital-development-in-africa-what-is-working-and-what-isn-t.html

Submarine Cable Networks. "Submarine Cables in Africa" https://www.submarinenetworks.com/en/africa

Thakur D. Woodhouse T. Jorge S. 2020. "Meaningful Connectivity: Advancing the Open Internet during COVID 19". In The Value of internet openness in times of crisis, Official outcome of the UN IGF Coalitions on Net Neutrality and on Community Connectivity. p.37-40. https://www.intgovforum.org/multilingual/filedepot_download/6114/2375

Teleanu S. 2021. "The geopolitics of digital standards: China's role in standard-setting organisations". DiploFoundation, Geneva Internet Platform and Multilateral Dialogue, Konrad Adenauer Foundation. December. https://www.diplomacy.edu/wp-content/uploads/2021/12/Geopolitics-of-digital-standards-Dec-2021.pdf

ten Oever N. Moriarty K. (editors). 2018. "The Tao of IETF. A Novice's Guide to the Internet Engineering Task Force". Online version accessed February 2022. https://www.ietf.org/about/participate/tao/

The Commons Project. 2022. "Smart Africa and The Commons Project Annouce a Partnership for Accelerating Digital Health Across Africa". 16 February. https://www.thecommonsproject.org/newsroom/smart-africa-and-the-commons-project-announce-a-partnership-for-accelerating-digital-health-across-africa

The Netherlands and you. 2022. "South-Africa – Netherlands Cyber Policy Dialogue Joint Statement". 6 April. https://www.netherlandsandyou.nl/latest-news/news/2022/04/07/joint-statement-south-africa-netherlands-cyber-policy-dialogue

The World Bank. 2021. "Investing in people for a resilient and inclusive recovery: Africa Human Capital Plan year two progress report". June 2021. https://documents1.worldbank.org/curated/en/155781629273393266/pdf/Africa-Human-Capital-Plan-Year-Two-Progress-Report-Investing-in-People-for-a-Resilient-and-Inclusive-Recovery.pdf

The World Bank. "Access to electricity (% of population) – Sub-Saharan Africa. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ZG

Thornhill J. 2022. "Russia's digital iron curtain will fail". Financial Times. March 2022. https://www.ft.com/content/26e88a2b-c7ba-46c7-8191-490188f4757b

Toh M. 2021. "Alphabet is shutting down Loon, its ambitious internet balloon venture'. CNN Business. 22 January. https://edition.cnn.com/2021/01/22/tech/loon-project-alphabet-google-intl-hnk/index.html

Tomasso N. 2021. "ICANN72 Participation Metrics Preview". ICANN blog. 1 November. https://www.icann.org/en/blogs/details/icann72-participation-metrics-preview-1-11-2021-en

Trading Economics. "South African Youth Unemployment Rate". https://tradingeconomics.com/south-africa/youth-unemployment-rate

UNESCO. "Internet Universality Indicators". https://en.unesco.org/internet-universality-indicators

UNESCO. "ROAM-X Indicators". https://en.unesco.org/internet-universality-indicators/roamx-indicators

UNESCO. "National assessments". https://en.unesco.org/internet-universality-indicators/national-assessments

UNCTAD. "Data Protection and Privavcy Legislation Worldwide". https://unctad.org/page/data-protection-and-privacy-legislation-worldwide

United Nations. 2021. "Our Common Agenda, Report by the

Secretary-General". https://www.un.org/en/content/common-agenda-report/assets/pdf/Common_Agenda_Report_English.pdf

United Nations. 2020. "E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development".

United Nations Department of Economic and Social Affairs. https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf

United Nations General Assembly. 2015. "A/RES/70/1 – Transforming our world: the 2030 Agenda for Sustainable Development". 25 September. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

United Nations. Economic Commission for Africa. "What is the African Information Society Initiative (AISI)?". Knowledge Repository. https://repository.uneca.org/handle/10855/4195

United Nations. Economic Commision for Africa. 2008. "The African Information Sociaty Initiative (AISI): a decade's perspective". March. https://repository.uneca.org/handle/10855/14949

VeriSign. 2022. "The Domain Name Industry Brief". Volume 19. Issue 1. April 2022, https://www.verisign.com/assets/domain-name-report-Q42021.pdf

Wigmore I. "Digital commons". Techtarget Network. https://www.techtarget.com/whatis/definition/digital-commons

Wood J. 2022. "Airships could boost internet coverage and help close the digital divide in Africa – and beyond. Here's how". World Economic Forum. 26 January. https://www.weforum.org/agenda/2022/01/airships-could-solve-digital-divide-internet/

Woodhams S. Migliano S. 2022. "Government Internet Shutdowns Cost $5.5 Billion in 2021". TOP10VPN. 4 January. https://www.top10vpn.com/research/cost-of-internet-shutdowns/2021/

World Bank Group. 2020. "The Human Capital Index 2020 update: Human Capital in the Time of Covid 19". https://openknowledge.worldbank.org/bitstream/handle/10986/34432/9781464815522.pdf?sequence=4&isAllowed=y

World Economic Forum. 2022. "Attracting Investment and Accelerating Fourth Industrial Revolution Adoption in Africa". January 2022. https://www3.weforum.org/docs/WEF_Attracting_Investment_and_Accelerating_Fourth_Industrial_Revolution_Adoption_in_Africa_2022.pdf

World Economic Forum. 2022. "Tech Start-ups Key to Africa's Digital Transformation but Urgently Need Investment". 20 January. https://www.weforum.org/press/2022/01/tech-start-ups-key-to-africa-s-digital-transformation-but-urgently-need-investment/

World Wide Web Foundation. 2021. "Device pricing 2021". 7 October. https://webfoundation.org/research/device-pricing-2021/

York D. 2022. "What Is The Splinternet And Why You Should Be Paying Attention" Internet Society blog. 23 March. https://www.internetsociety.org/blog/2022/03/what-is-the-splinternet-and-why-you-should-be-paying-attention/