European Commission

DIGITALISATION FOR DEVELOPMENT. A TOOLKIT FOR DEVELOPMENT COOPERATION PRACTITIONERS

INTERNATIONAL PARTNERSHIPS (INTPA)

Connectivity & Digital Infrastructure

InfoSheet nº11

This InfoSheet is part of a series on digitalisation and relevance to EU International Partnerships and development cooperation programmes. The Toolkit is designed to provide key definitions, main opportunities and challenges for global development presented by digital transformation, case studies and suggested further reading. Learn more on Cap4Dev

What is Digital Connectivity?

Digital connectivity refers to people's **ability to connect to the internet** and to access information and services relevant to our everyday lives. Connectivity allows us to reach and connect with others from and to any place worldwide, offering new opportunities like learning skills and taking online classes; accessing the most up-to-date news whenever and wherever required; browsing online markets looking for or offering products and services regardless of where we are in the world[1].

Digital connectivity is an essential building block for economic and social development. The expansion of digital networks enables the deployment of digital technologies and services, which are key drivers of **sustainable growth** and the achievement of the United Nations Sustainable Development Goals (SDG). From the delivery of public services to applications in industry, energy, agriculture and research, the digital transformation permeates all sectors of the economy and society[2].

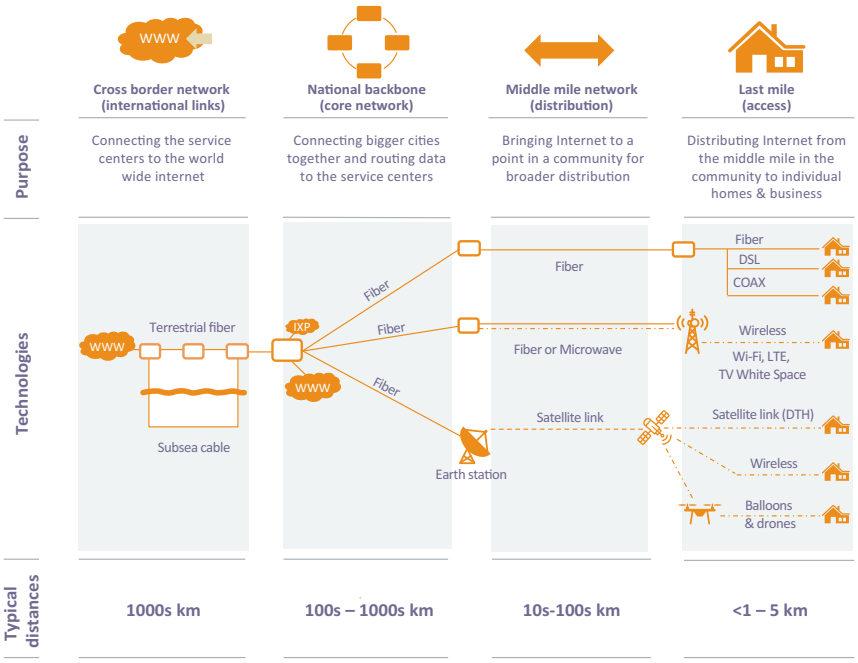
As globalization continues to drive the world's economies, the importance of infrastructure for international connectivity cannot be overstated. There are four main pillars of connectivity infrastructure.

1. **Submarine cables** are the backbone of global communications, connecting continents and facilitating the transfer of vast amounts of data across the world. These cables are essential for global businesses, governments, and individuals who require reliable and fast data transfer. By investing in submarine cables, countries can increase their access to information, enhance their trade opportunities, and improve their citizens' quality of life[3].
2. **Terrestrial cables**, such as fibre-optic networks, are essential for national and regional connectivity. By connecting cities, towns, and rural areas, these cables enable businesses to operate more efficiently, individuals to access information more quickly, and governments to provide better services to their citizens. Investing in terrestrial backbones can help to close the digital divide, improve economic opportunities, and increase social cohesion.
3. **Data centres** play a critical role in storing and processing the vast amounts of data generated by individuals, businesses, and governments. By providing reliable and secure storage and processing services, data centres enable businesses to operate globally, governments to deliver more efficient services, and individuals to access the information they need. Investing in data centres can help to spur economic growth, create jobs, and improve the quality of life for citizens[4].
4. **Satellite** connectivity is essential for connecting remote and underdeveloped areas that lack terrestrial infrastructure. Satellites can provide high-speed internet, telecommunication, and other services that are critical for businesses, governments, and individuals in these areas. By investing in satellite connectivity, countries can improve education, healthcare, and economic opportunities in remote and underdeveloped regions[5].

In conclusion, investing in infrastructure for international connectivity can have a significant impact on a country's economy, society, and overall well-being. By developing and maintaining robust submarine cables, terrestrial cables, data centres, and satellite connectivity, countries can improve their global competitiveness, increase access to information, and enhance the quality of life for their citizens.

[1] European Commission, Communication (2021)118 final, 9 March 2021, 2030 Digital Compass: the European way for the Digital Decade.
[2] T. Lynn, et alia, "Infrastructure for Digital Connectivity", in: Digital Towns, 2022, Palgrave Macmillan.
[3] Dan Swinhoe, "What is a submarine cable? Subsea fiber explained", 2021, Data Center Dynamics (DCD).
[4] "Data centers and connectivity", in "Data Centers ensure connectivity in our digital society", 2020, Smartdc.
[5] P. Shankar, et alia, "How satellite connectivity combats the digital divide", 2021, EY.

Digital Infrastructure at Different Level of Connectivity
Source: World Bank, Innovative Business Models for Expanding Fibre Optics Networks and Closing the Access Gap.



There are various means of connectivity, including first mile, middle mile, and last mile connections. **First-mile connectivity** refers to the initial link between the **user and the larger network infrastructure.** This can be achieved through different technologies such as fibre-optic cables, wireless connections, or satellite connections. For example, in rural areas where laying fibre-optic cables may not be feasible, satellite connections can provide internet access to remote communities.

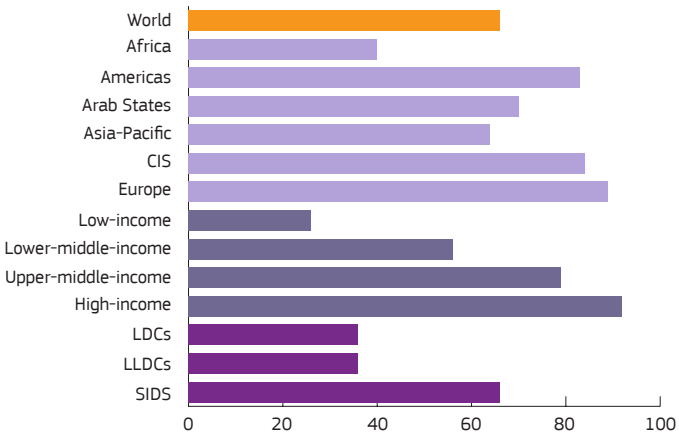
Middle-mile connectivity involves the **transmission of data between local and regional networks,** ensuring the flow of information across different areas. This is typically facilitated by submarine cables, which span vast distances underwater, connecting continents and enabling global data transfer. More than 400 of such cables play a crucial role in carrying over 95% of global internet traffic.[6]

Last-mile connectivity, by contrast, refers to the **connection between the local network infrastructure and individual end-users,** such as households or businesses. This can be achieved through fixed connections, such as Digital Subscriber Line (DSL), cable, fibre-optic connections, or through mobile networks using wireless technologies like 4G or 5G.

It is important to note that digital connectivity is not evenly distributed worldwide, leading to what is known as the **digital divide**. The digital divide refers to the gap between those who have access to digital technologies and those who do not, often due to factors such as lack of infrastructure, affordability issues, and social or geographical disparities. This divide can exacerbate existing inequalities and hinder social and economic development, making it crucial to address and bridge this gap. This persistent **asymmetrical growth of digital connectivity** excludes citizens of many low- and middle-income countries from the global digital economy. Most of the time, the **digital divide** is **intersectional** and can be caused by lack of infrastructure due to cost barriers, affordability (of both connection and equipment), and rural and gender gaps.

The availability of digital connectivity significantly varies between world regions, with an estimated 2.7 billion people still lacking access to the internet[7]. For instance, while in Europe and the Americas around 80-90% of people use the internet, this figure stands at only 64% in the Asia-Pacific region and 40% in Africa. In 29 out of 48 countries in Sub-Saharan Africa, internet penetration remains below 25%. In high-income countries, internet usage stands at 92%, whereas in low-income countries, only 26% of people have access to the internet[8].

Percentage of individuals using the Internet, by region
Source: Measuring digital development: Facts and figures, 2022, ITU



Universal access to the internet is crucial for achieving the goals of the 2030 Agenda for Sustainable Development, accelerating **social, economic, and environmentally sustainable growth** and the uptake of the green transition. For this reason, connectivity should be **sustainable, comprehensive, and rules-based** to ensure **fair access, security, and resilience**[9]. In our digital age, it is impossible to fight global inequalities without addressing the digital divide; the integration of partner countries into the global internet will contribute to fostering businesses and innovations both in partner countries and Europe.

This info sheet will dive deeper into: 1) the EU policy approach to Digital Connectivity; 2) A global approach EU's Global Gateway 3) Cross-cutting issues 4) a brief case study: the BELLA Programme.

[6] J. Brock, "U.S. and China wage war beneath the waves – over internet cables", 2023, a Reuters special report, Reuters.
[7] D. Hirsch, M. Albertini, "Internet surge slows, leaving 2.7 billion people offline in 2022", 2022, ITU.
[8] "Measuring digital development: Facts and Figures 2022", 2022, ITU – Development Sector.
[9] Council Conclusions, 12720/18, 15 October 2018, Connecting Europe and Asia – Building blocks for an EU strategy.

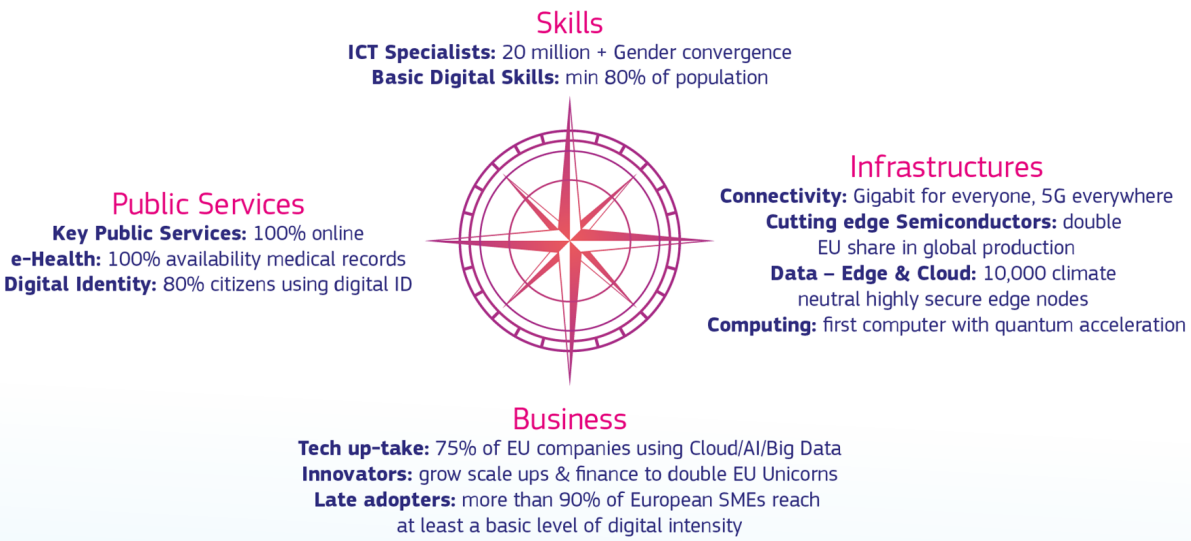
Closing the Digital Divide

Source: Adapted from infographic in Facebook 2016, with recent ITU data.

Digital connectivity: the EU internal policy approach

The **European Union's Digital Decade**, outlined in the "Path to the Digital Decade" initiative, is a comprehensive strategy aimed at advancing Europe's digital capabilities and technologies. It emphasizes strengthening digital sovereignty, enhancing cybersecurity, and ensuring reliable digital infrastructures. Collaboration between member states facilitates the development and deployment of cutting-edge technologies like Artificial Intelligence (AI), cloud computing, and 5G networks. The European Commission's declaration on digital rights and principles further reinforces the EU's commitment to protecting fundamental rights, including privacy, data protection, and freedom of expression, and to fostering inclusivity and fairness in the digital era.

Additionally, the Connectivity 5G toolbox plays a crucial role in the Digital Decade strategy. It provides a comprehensive framework to address the security challenges associated with the deployment of 5G networks.



The Communication 'Digital Compass: The European Way for the Digital Decade' set out digital ambitions for the next decade in the form of clear, concrete targets. The digital compass uses the 4 points of the compass to identify the main goals to reach over the next decade. The four core objectives are the furthering of 1) digitally skilled citizens and highly skilled digital professionals; 2) to secure effective and sustainable digital infrastructures; 3) the digital transformation of businesses; and 4) the digitalisation of public services.

By setting out common criteria, risk assessments, and mitigation measures, the toolbox aims to safeguard the integrity and resilience of 5G infrastructure across the EU. The Connectivity 5G toolbox is a key instrument in enabling the EU to achieve its digital ambitions while ensuring the security and trustworthiness of its digital infrastructure.

Human-centred digitalization lies at the core of the EU's Digital Decade strategy. It recognizes that technology should serve the needs and aspirations of individuals, society, and the planet. The EU strives to ensure that the digital transformation enhances **inclusivity, fairness, and sustainability**. Human-centred digitalization emphasizes the importance of empowering citizens with digital skills, ensuring equal access to digital services, and safeguarding privacy and data protection rights.

Digital sovereignty is of paramount importance not only for the European Union but also for third and partner countries outside of the EU. It entails the ability to control a nation's own digital infrastructures, technologies, and data, reducing dependence on foreign entities. This enhances **autonomy, economic resilience, and the ability to protect the rights and privacy of citizens**. It also enhances mutually beneficial collaborations and partnerships with the EU, facilitating the exchange of knowledge, technologies, and best practices for a sustainable and inclusive digital transformation.

Additionally, the EU's approach to digital transformation is firmly grounded in **high standards of social and environmental protection**. It places great importance on **safeguarding individual rights**, both online and offline, to create a digital environment that respects privacy, freedom of expression, and other fundamental rights[10]. Moreover, the EU promotes a vision of a **free, open, transparent, and secure internet landscape** within and beyond its borders. By reducing the risks of internet fragmentation, the EU seeks to maintain a cohesive digital ecosystem, ensuring interoperability and promoting global digital cooperation.

Finally, with its holistic approach to digital connectivity, the EU aims to enhance strategic international investments. As the lending arm of the European Union, the **European Investment Bank (EIB)** plays a crucial role in financing digital and connectivity infrastructure projects with a high developmental impact[11]. By providing long-term loans and leveraging private investments, the EIB catalyses economic development, job creation, and the improvement of living standards in the EU and partner countries. Along with European Development Finance Institutions (DFIs), the EIB is a strategic partner of the EU for the lending component of blending operations for projects in third countries.

A global approach: EU's Global Gateway

At Digital Day 2021, EU Member States (MS), together with Iceland and Norway, pledged to strengthen internet connectivity between Europe and its partners in **Africa, Asia, as well as the European neighbourhood, the Western Balkans and Latin America**. With the Data Gateways Declaration, EU MS committed to aligning their national initiatives for international connectivity and work closely with industry, civil society, and development institutions to promote stronger EU engagement in international digital partnerships[12]. Thus, EU partner countries will benefit from secure data processing thanks to the EU's strong data protection standards.

Hence, the **Global Gateway (GG)** is the EU strategy for value-added international partnerships. Overall, the aim of the GG is to provide an **alternative policy instrument** to finance the development of **infrastructure** in the Global South. Specifically, in words of the President of the European Commission, Ursula von der Leyen, the EU aims to "take a values-based approach, offering transparency and good governance to our partners"[13]. The GG ambition is to assert the strategic autonomy of the EU and ensure the digital sovereignty of partner countries. This comprehensive strategy will address the following policy issues:

- Promoting a human-centred digital transformation by boosting universal, meaningful, and safe access to the internet.
- Bridging the global digital divide between and within regions.
- Strengthening the resilience and security of digital connections between the EU and partners and transitioning to secure digital government.
- Safeguarding Europe's digital sovereignty and supporting partner countries in asserting their digital sovereignty.
- Promoting an open, secure, and interoperable internet through investments in digital infrastructures.
- Embracing the Twin Transition by investing in green digital infrastructures and leveraging digital technologies against climate change.

Certainly, the EU does not operate in a vacuum. Over the past few years, China has developed a comprehensive geostrategic approach to promote its interests in digital connectivity. China's Belt and Road Initiative (BRI) is the massive, geopolitically influential network of infrastructure and transport investments that Beijing uses to link its exporters to western markets. Embedded within BRI, the Digital Silk Road (DSR) is "an umbrella branding effort and a narrative for Beijing to promote its global vision across a range of technology areas and projects"[14]. Similar to others, Chinese investments in digital infrastructure can enhance connectivity, boost economic growth, and facilitate trade and investment. Chinese DSR investments often involve technology transfer and knowledge sharing. Hence, by providing technological assistance, China aims to bridge the digital divide and facilitate digital transformation in developing countries. Chinese tech companies have been involved in deploying digital infrastructure and offering services such as 5G networks and cloud computing in various countries[15]. Indeed, the flexibility and dynamism of the private sector, paired with significant policy and financial backing, has proven to be exceptionally effective in promoting China's interests abroad. However, dependence on Chinese digital infrastructure and services may pose challenges to the digital sovereignty of third countries. Reliance on Chinese technology providers might limit their ability to regulate and control digital operations within their borders[16].

Nowadays, the roll-out of digital infrastructures is driven almost entirely by the private sector. Until recently, telecommunication providers were the main market forces in developing and operating international cables. European companies such as Orange, Deutsche Telekom, and Telecom Italia are among the leading providers of the international internet backbone. Yet, the dominance of telecommunications companies is being increasingly displaced by the rise of content providers, i.e., Meta, Alphabet, Amazon, Microsoft, and Apple (MAAMA). Between 2012 and 2022, their share of submarine cable capacity jumped from 10% to 66%, positioning Alphabet's Google among the top three cable owners[17]. The steep growth of content providers' market share leads to a concentration of global internet capacity in the hands of a few companies. This has significant implications for global resilience and security, as international communications increasingly depend on infrastructures run by an oligopoly of tech companies. These implications account for considerable cross-cutting issues in the domain of digital connectivity, and it is important to address them in order to ensure a holistic approach to connectivity.

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[10] Council Conclusions, 12720/18, 15 October 2018, Connecting Europe and Asia – Building blocks for an EU strategy.
[11] Council Conclusions, 10234/21, 12 July 2021, A Globally Connected Europe.
[12] European Commission, Communication (2021)118 final, 9 March 2021, 2030 Digital Compass: the European way for the Digital Decade.
[13] See: Council Conclusions, 10234/21, 12 July 2021, A Globally Connected Europe; M. A. Kuo, "Global Gateway: The EU Alternative to China's BRI", 2021, The Diplomat ; European Commission, Working Document SWD(2021)247 final, 15 September 2021, accompanying the document Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme "Path to the Digital Decade".
[14] D. Gordon, M. Nouwens, "The Digital Silk Road: China's Technological Rise and the Geopolitics of Cyberspace", 2022, IISS.
[15] K. Shi-Kupfer, M. Ohlberg, "China's digital rise: Challenges for Europe", 2019, Mercator Institute for China Studies.
[16] T. Murphy, M. Tanchum, "The EU's Global Gateway and a new foundation for partnerships in Africa", 2021, ECFR.
[17] R. Csernatoni, "The Geopolitics of Submarine Cables, the Infrastructure of the Digital Age", 2022, ISPI.

Special considerations on financing connectivity

The EU's ambitions for itself and partner countries are to be digitally sovereign in an open and interconnected world and to pursue digital policies that empower people and businesses to seize a human-centred, inclusive, and sustainable digital future. This includes addressing vulnerabilities and dependencies as well as accelerating investment[18].

The role of market forces

Market forces play a crucial role in driving international connectivity, since they dictate the development and deployment of digital infrastructure[19]. Private companies and service providers invest in network expansion, submarine cables, data centres, and other infrastructure based on anticipated demand and potential profitability. Secondly, market competition encourages innovation and efficiency. In a competitive market, companies strive to offer superior connectivity services to attract and retain customers. This drives them to invest in cutting-edge technologies, improve network performance, and enhance security measures. Market competition fosters a continuous cycle of improvement and drives the industry towards more reliable and secure connectivity solutions. Moreover, increased competition leads to lower prices, making digital connectivity more accessible to individuals, businesses, and institutions. Lower costs enable broader adoption of digital technologies, thereby benefiting the economy, education, healthcare, and social progress.

Market failure, high risks, and political uncertainties tend to drive away private sector investments because of limited commercial value. Nevertheless, in its digital connectivity initiatives, the EU GG operates projects with a long-term investment approach. It aims to introduce slow, robust, and healthy competition in highly monopolised markets, lowering prices and bringing down the overall costs of accessing the internet by end-users.

Partnering with trusted vendors

Trusted vendors play a crucial role in ensuring the security, reliability, and integrity of the networks that underpin digital connectivity, thereby promoting a safer and more resilient digital ecosystem worldwide. Leveraging the expertise of trusted vendors enhances the EU's ability to establish resilient and highly performing digital networks. Trusted vendors adhere to regulatory frameworks, understand the legal landscape governing digital connectivity, and ensure adherence to privacy, data protection, and security regulations. Finally, trusted vendors have established a reputation for delivering reliable and secure digital infrastructure solutions.

The EU can build on a strong domestic ecosystem of cable manufacturers like Alcatel Submarine Networks (ASN) and advanced equipment vendors for mobile networks with both Nokia and Ericsson. These trusted equipment providers and telecommunication operators will play an important role in international digital connectivity investments under the GG. Many of the EU's partner countries face challenges exercising control over their cyber-jurisdictions and ensuring resilient connectivity. As such, the EU positions itself as a strategic partner to strengthen digital sovereignty by offering investments that are characterised by secure and trusted technology and the development of local capacities.

Resilient, open, cybersecure digitalization

With the rise of cyber-attacks against governments and critical infrastructures, enhancing the security of international digital networks becomes paramount for both the EU and its partner countries. This will require the development of cyber ecosystems, global coordination as well as the application of the latest cybersecurity and privacy-enhancing standards in digital infrastructures.

The resilience and security of the internet's global infrastructure require a foresightful, preventive approach as a core element of ensuring Europe's and partner countries' strategic autonomy in the cyberspace. Key potential risks include sabotage and damage of submarine cables, technical flaws in cable systems that compromise data security, as well as an overreliance on a limited number of companies for transporting data traffic. To increase digital resilience, the GG will invest in the diversification of its international digital links, working closely with trusted equipment providers and telecommunication operators. For its planned partnerships, the EU's Toolbox for 5G Security will be consistently applied in investments for increased cybersecurity.

Coordination among public and private sectors

The EU digital strategy places significant emphasis on coordination between the public and private sectors, particularly in two key areas: the deployment of hard infrastructure and the development of a robust regulatory ecosystem. Collaboration is vital for the efficient and widespread deployment of digital infrastructure, such as high-speed broadband networks and 5G connectivity. Public and private entities must work together to overcome challenges related to investment, infrastructure planning, and resource allocation. Public and private sectors should collaborate to establish clear and adaptable regulations that encourage technological advancements while safeguarding privacy, cybersecurity, and data protection. This involves aligning policies, sharing best practices, and engaging in ongoing dialogue to address emerging challenges. By fostering coordination, the EU digital strategy aims to create an enabling environment that encourages investment, nurtures entrepreneurship, and establishes a level playing field for businesses operating in the digital realm.

Twin Transition (green & digital)

The GG aims to embrace the Twin Transition by investing in green digital infrastructures and leveraging digital technologies against climate change. It will foster the development of green data centres around the world in order to lower the growing environmental footprint of digital connectivity. It can draw on the EU's extensive expertise and technological solutions in the design and operation of green data infrastructures. The GG involves the world's leading producers of energy-efficient systems and green ICT equipment. Investments in renewable energies and data centres will be complemented to boost clean energy sources. The reuse and recycling of hardware equipment and material will be essential to alleviate the global e-Waste issue, building on circular economy principles. The EU will strengthen collaboration with partner countries, also with a view to improving earth observation, with the Copernicus programme, to enhance the overall quality of global service delivery.

[18] European Commission, DG Connect, "Study to Monitor Connectivity. Final Study Report", 2022.
[19] F. Blanc-Brude et alia, "Infrastructure Strategy 2022: A Pivot to the Digital Frontier", 2022, BCG.

CASE STUDY

Today, the internet consists of a web of 1.3 million kilometres of submarine cables that enable data to flow across the world, transporting more than 95% of global traffic[20]. By investing in submarine cables, countries can increase their access to information, enhance their trade opportunities, and improve their citizens' quality of life. New, secure submarine cable infrastructures such as the Ellalink system (please see BELLA Programme below), co-financed by the EU, can serve the growing data flows of Africa, Asia, and Latin America and strengthen the EU Data Gateway Platforms. These types of transformational infrastructural projects are prime examples of what the GG aims to deliver[21].

The BELLA Programme

The BELLA Programme (Building the Europe Link with Latin America) provides for the long-term interconnectivity needs of European and Latin American research and education communities, enhancing the collaboration of researchers and academics between the two regions. This is achieved through the EllaLink, a 6,000 km submarine fibre-optic cable linking both continents. This cable provides a direct high-speed and secure data connection between the EU and Latin America and the Caribbean.

The overall objective is to **reduce the digital divide** with and within Latin America, improving international cooperation, regional development, and security, as well as to **enhance cooperation on research and innovation** between the EU and Latin America. Specifically, some of the benefits expected from long-term connectivity are the following:

- Promote **business exchanges** and enable companies in Europe and Latin America to further develop existing cooperation with high levels of data privacy, thanks to the direct link between the two continents without intermediate connection points.
- Provide capacity to connect European and Latin American research and education communities, **supporting open science and knowledge-sharing**.
- Sharing **Earth Observation** data and information at higher speed, promoting the use and uptake of the Copernicus Programme by users on both continents.
- Improving digital **interconnectivity between Latin American countries**, promoting **regional and inter-regional integration** and cooperation on interconnectivity, science, research, innovation, and technology, as well as in higher education.

The **BELLA consortium** is composed of 11 European and Latin American research and education networks from Brazil, Chile, Colombia, Ecuador, Germany, Italy, Portugal and Spain, together with the regional networks RedCLARA and GÉANT. The EU is the largest investor in the initiative, which is funded through a public-private partnership of stakeholders on both sides of the Atlantic.

[20] C. Wall, P. Morcos, "Invisible and Vital: Undersea Cables and Transatlantic Security", 2021, CSIS.
[21] European Commission, Communication (2021)118 final, 9 March 2021, 2030 Digital Compass: the European way for the Digital Decade.

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