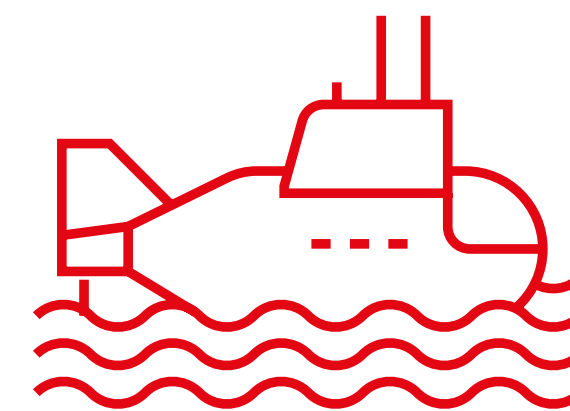


# How submarine cable connectivity can drive economic recovery



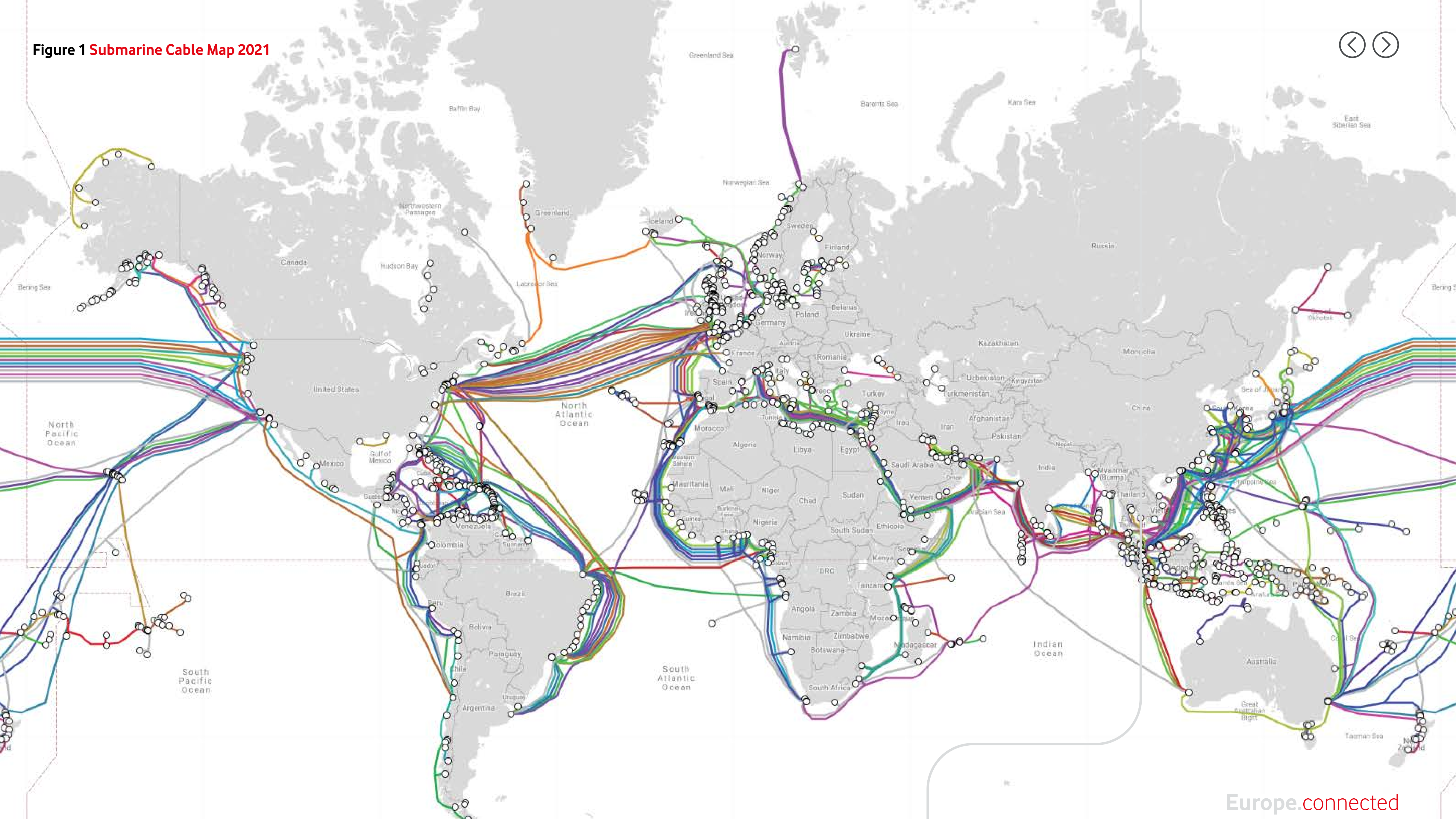
Europe has long been the global nexus of submarine cable connectivity, providing essential nodes in global voice and data networks – connecting the Eastern and Western Hemispheres, and the Northern and Southern Hemispheres alike.

Where once these cables were focused primarily on voice communication, they now underpin global internet connectivity, and are the essential infrastructure without which global data networks would be unable to function. Yet as Europe's submarine cable infrastructure ages, investment is being made in newer technologies on alternative global routes, some of which bypass Europe entirely. Europe's historically pre-eminent position is at risk.

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Figure 1 Submarine Cable Map 2021



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Submarine cable connectivity

Supporting EU strategic objectives

Submarine cables

International connectivity

The impact in Europe

This reduction in Europe's comparative advantage in submarine cable connectivity comes at a time when the data economy is expected to double between 2000 and 2025, **accounting for 6.3% of EU GDP**. There is significant potential for this market to grow further, although this will be dependent on Europe keeping pace with investments in the underlying infrastructure.

High quality connectivity between EU member states, and between the EU and the rest of the world, will be essential to ensuring that European businesses have access to the cost effective low-latency connectivity that will underpin opportunities presented by international data exchange and data hosting.



**Vodafone is developing the 2Africa cable between Europe, Africa and the Middle East. This 37,000km cable, with 16 fibre pairs, will connect France, Spain, Portugal and Italy with 18 countries across Africa and the Middle East, greatly increasing data capacity between Europe and Africa.**



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# Digital connectivity drives economic growth

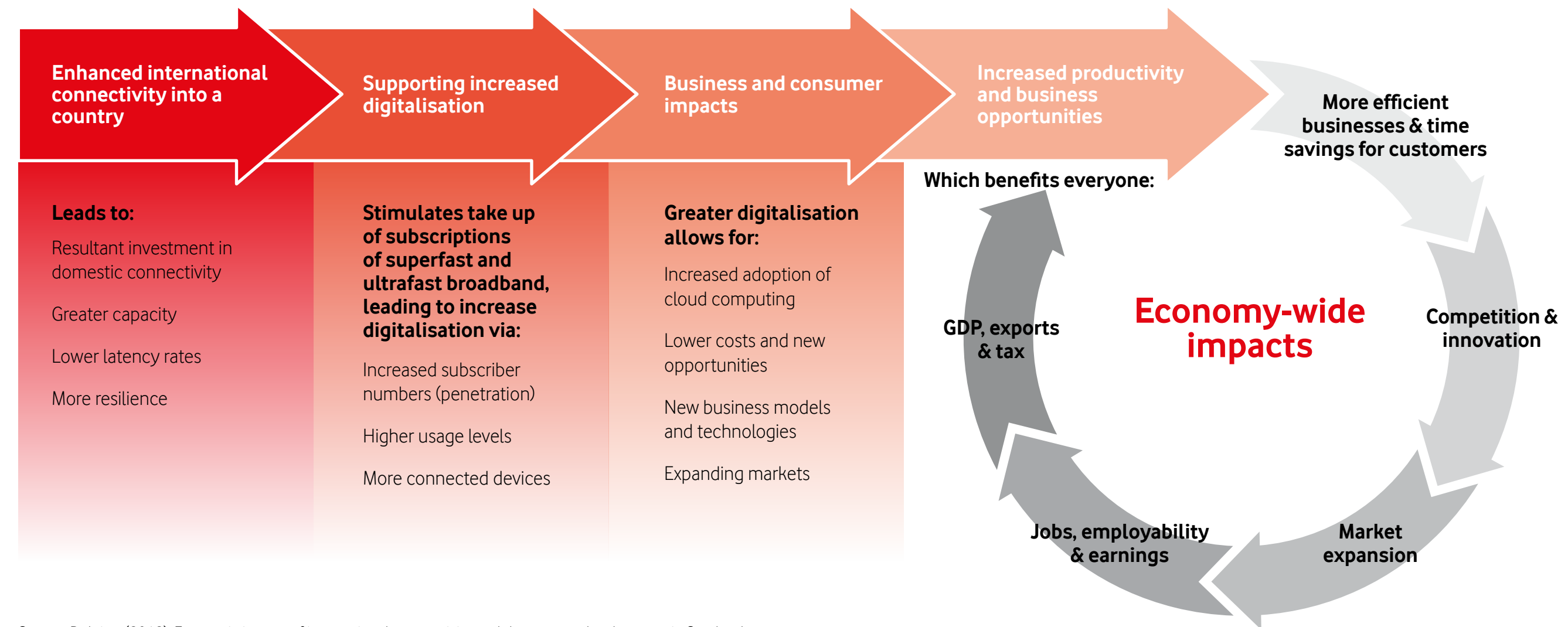
Investments in submarine cables, and in the connectivity between costal landing stations and the places where citizens live and work, will improve the overall digital connectivity of Europe.

Digital connectivity is an irreplaceable part of the value chain of almost every industry in the modern economy. Many companies rely heavily on operating online, especially since the outbreak of COVID-19, with **nearly half of EU employees working from home in July 2020**.

Access to fast, reliable, digital connectivity also allows businesses to take advantage of new technologies that offer cost savings, to exploit opportunities to bring new products to market and to access new customer channels and markets.

As a driver of productivity, digital connectivity can also help reduce barriers to entry/expansion in markets, increasing competition, and creating incentives to innovate. A World Bank study found that across 66 developed countries, a **10% rise in broadband penetration could lift GDP growth rates by 1.2 % points**. The figure below illustrates how international connectivity impacts the wider economy.

Figure 2: Impact framework of international connectivity

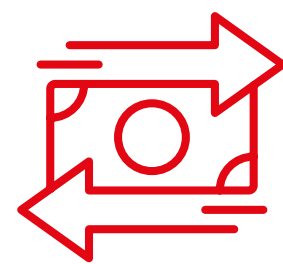


Source: Deloitte (2018): Economic impact of international connectivity and data centre development in Scotland

# Development of low-latency digital sectors

Newer and more direct cable routes can improve latency - the time between a signal being sent and being received.

Latency is critical for several important sectors including manufacturing, e-health and financial services:



The ECB found that the large number of international cables landing in the UK increased the number of financial transactions in London by as much as one third, strengthening its position as a financial centre.<sup>1</sup>



In the e-health sector, latencies beyond 200ms affect the performance of the surgeon, limiting the potential for remote surgeries.<sup>2</sup>

Reducing latency and promoting these high-value sectors can lead to the development of high-productivity jobs as well as further societal benefits, including improved health outcomes.



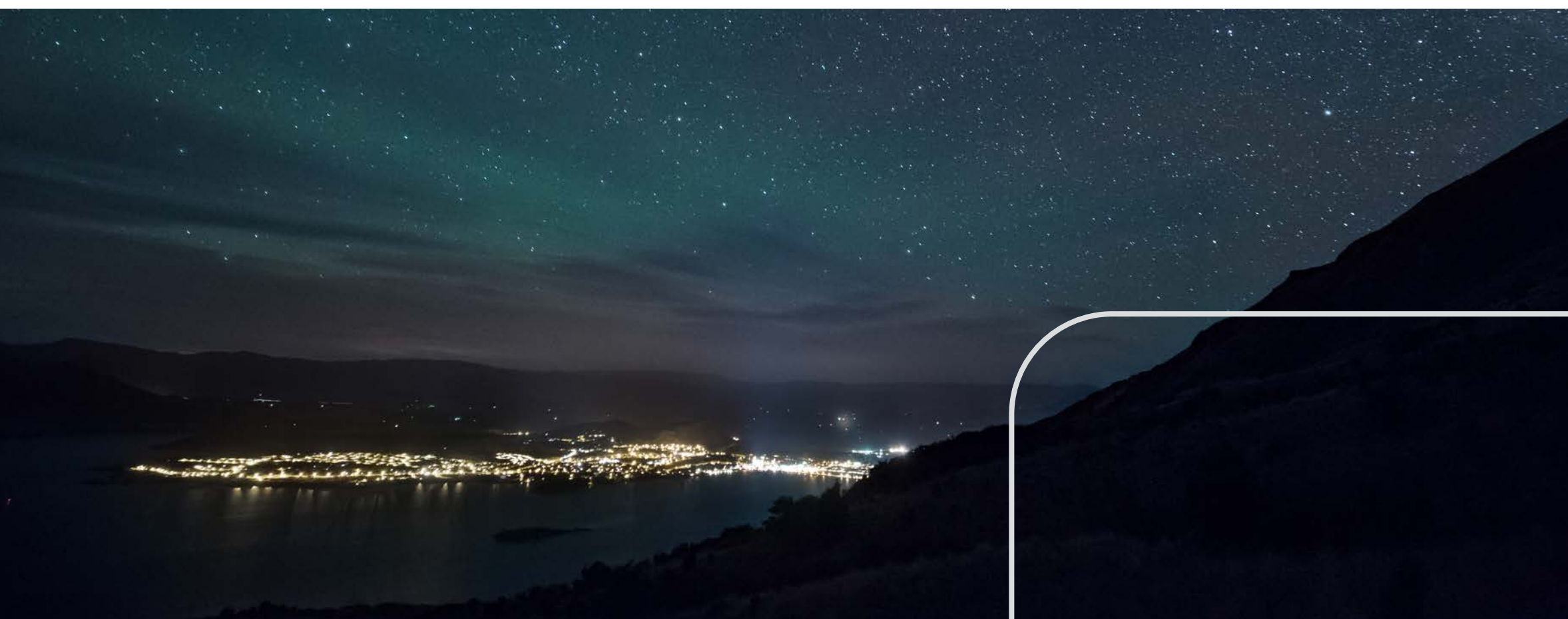
## The development of data centres

Improved connectivity, and improved latency as a result of better international connectivity, are also important factors in the location of data centres. Data centres have been shown to generate enabling and 'ripple' effects across the economy, supporting digital transformation and low-latency digital services, IoT, big data, artificial intelligence, and virtual reality.

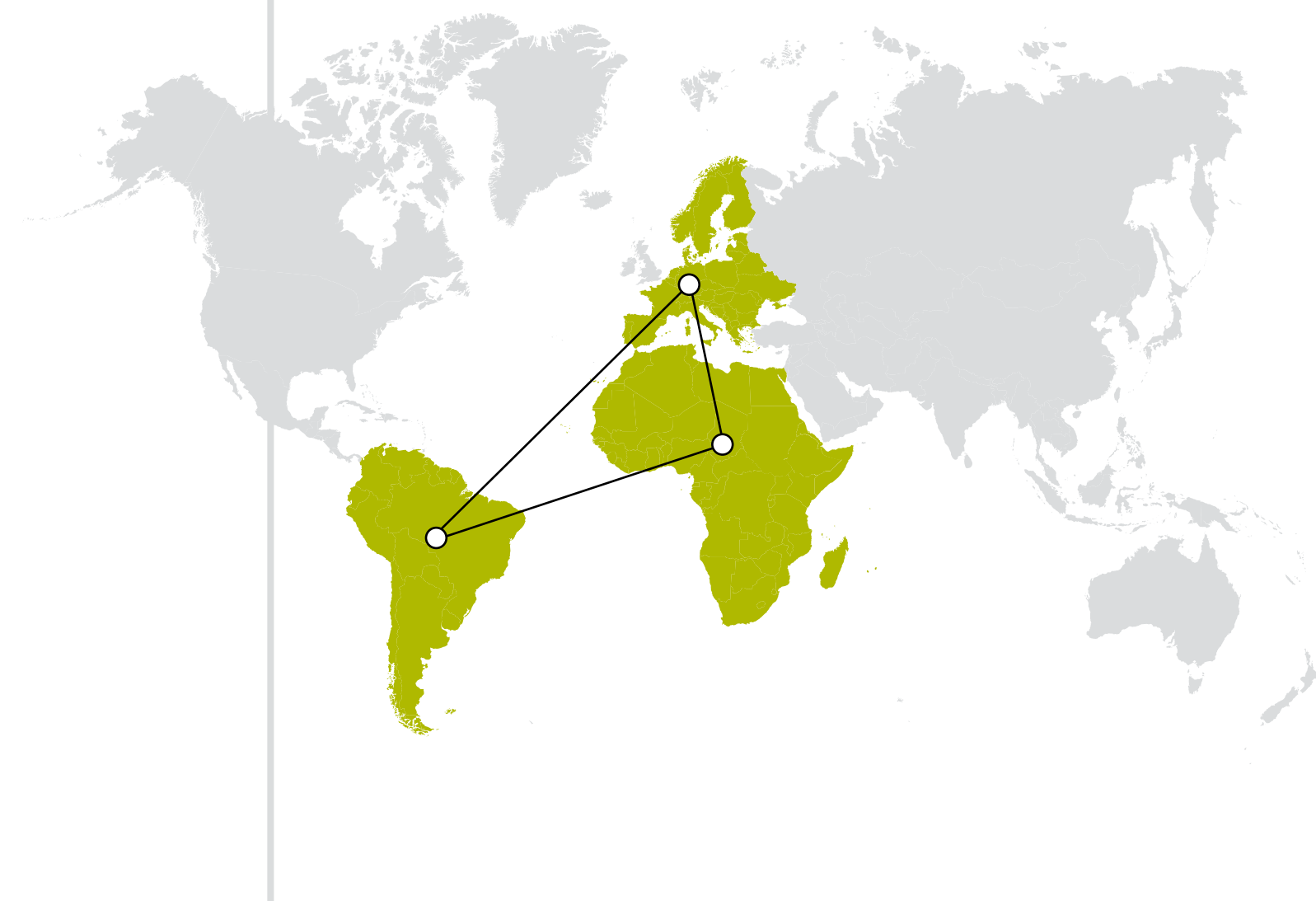
A single hyper-scale data centre in Finland has been estimated to generate over **€660m in economic benefits over a period of six years (2009-2015) and support 1,600 jobs annually**. Many of these jobs are in high-productivity sectors such as data science, the legal and professional services sectors, and energy, engineering and telecommunications more widely.

<sup>1</sup> ECB (2016), Cables, Sharks and Servers: Technology and the Geography of the Foreign Exchange Market.

<sup>2</sup> 5G Infrastructure Association (2015); 5G and e-Health.



# Supporting EU strategic objectives



Submarine cables are essential for international connectivity, in both connecting EU member states together and connecting the EU to key foreign trading partners, enabling Europe's leadership and digital autonomy on the global stage. As emphasised by the Portuguese Presidency of the Council of the European Union, submarine cables – in particular for links between **Europe, Africa** and **South America** – are a priority for the Union as they contribute to greater European digital autonomy, linking infrastructures and data.<sup>3</sup> There are several strategic benefits to the EU of investment in submarine cables.

<sup>3</sup> Programme for the Portuguese Presidency of the Council of the European Union, 1 January to 30 June 2021.

# Ensuring intra-connectivity within the EU

Developed intra-EU connectivity facilitates fast and secure data exchanges (within the EU). For instance, Ireland has become a hub for data centres, with investment forecast to reach **€10bn by 2022**. Submarine cables between Ireland and continental Europe ensure secure and low latency connections between EU citizens and businesses all over Europe and the host data in Ireland.

Strong intra-connectivity between EU member states will enable the sharing of key data-infrastructure, including access to strategic resources such as the **high performance super computers** that will underpin the data-intensive critical applications of tomorrow. Access to this infrastructure will allow for a range of sectors across the whole of the EU to benefit, including environment, energy, agriculture, and health.

**Submarine cables can also be used to connect rural coastal regions at a lower cost than traditional overland fibre networks. This can help ensure remote regions are not left behind by the digital transformation.**



New submarine cables, with more fibre strands and utilising the latest transmission technologies, are more efficient on a per Gbps basis than legacy cables. Over the past decade unit costs have fallen 10-fold: compounded annually from 2016 to 2020, weighted median 10 Gbps and 100 Gbps prices fell an average of **14% and 23% across critical global routes**.

Submarine cable access prices are typically higher in more remote areas of the EU. However, they are not sufficiently high to attract the level of investment required to expand submarine connectivity. As a result, the market has failed to deliver the redundancy and wider connectivity benefits that would help overcome broader barriers to digital connectivity in those areas.<sup>4</sup> Public support for investment in new submarine cables and its supporting terrestrial infrastructure can address these issues, thereby reducing the price to access submarine cables and encouraging digital connectivity take-up.

However, currently several geographically separate regions and extremities of the EU do not have direct connections to much of continental Europe. For instance, Ireland only has one submarine cable connected directly to continental Europe: the Celtic Norse cable to Norway. Similarly, Iceland only has two submarine cables connected to continental Europe.

<sup>4</sup> Digital draft orientations towards an implantation roadmap – Connecting Europe Facility (CEF2)



# Providing resilience through redundancy

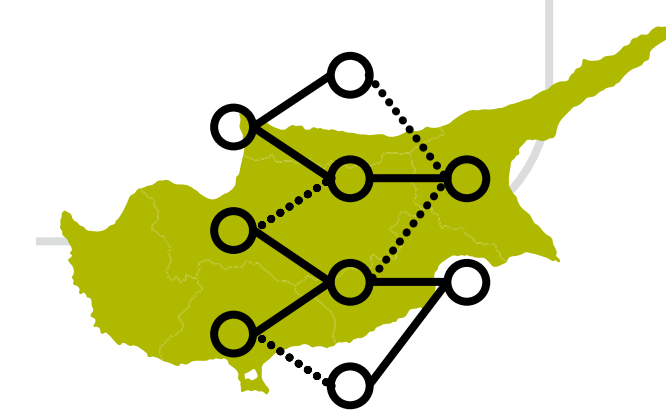
There are over **100 cable breaks per year** which can threaten the resilience of international networks. Without redundancy in the network, damage to cables from natural factors, marine traffic or terrorism can have significant consequences as services, trade and communications are disrupted. For example, Somalia suffered **three weeks of internet outage at a cost of \$10m a day** after its only international cable was severed by an anchor in 2017. Similarly, the 2006 Taiwanese earthquake resulted in 4,000m of undersea cabling being disrupted, affecting 98% of communications with Japan, Singapore, Malaysia and Korea.

Submarine cables have traditionally been funded by consortia of telecommunications network operators and other partners who then sell bandwidth. Recently however, content providers have been investing heavily in private submarine cables, targeting routes that are essential for the provision of their own services. Increased investment in submarine cables by EU member states, would help ensure sufficient redundancy in the network, improve the diversity of ownership and strengthen the EU's digital sovereignty – allowing greater control over the information flowing on cables into the EU. More generally, the private ownership of, and therefore publicly available, information on submarine cables, has been highlighted as a concern to security by **NATO** as it increases the potential for malicious attacks to the networks.

# Ensuring integration and cohesiveness within the EU

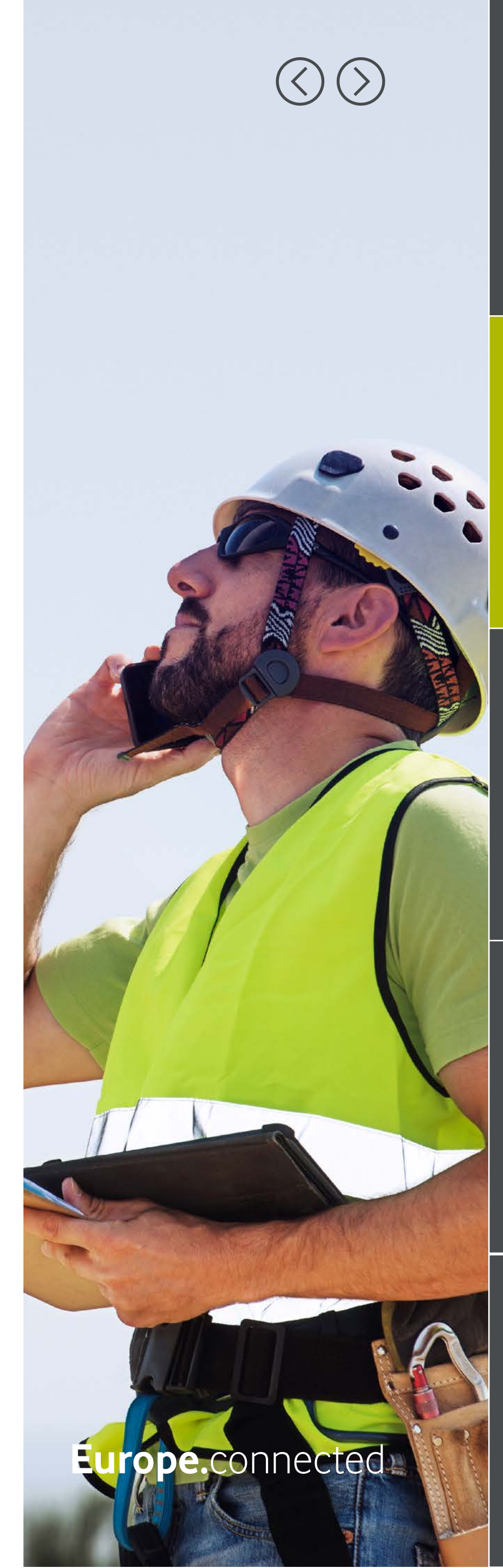
As discussed above, the provision of resilient, high bandwidth international connectivity can support the EU's economic recovery by promoting productive industries and innovation, as well as sharing key digital infrastructure between member states. As improvements in international connectivity enhance the business case for investing in domestic connectivity, these benefits are particularly important in member states that would otherwise risk falling behind on key connectivity metrics.

For instance, Cyprus, which only has one direct submarine cable to continental Europe, has the second lowest connectivity score on the Digital Economy and Society Index (DESI) for 2020.



Improving the connectivity between Cyprus and continental Europe, could promote improvements in domestic connectivity and increased digitalisation, ensuring it is not left behind by the continent's digital transformation.

The development of strong networks across Europe can also promote integration and cohesion between markets. For example, increased digital connectivity can reduce barriers to digital trade; increasing cross-border e-commerce which, in 2015, added **0.14% to EU GDP**.



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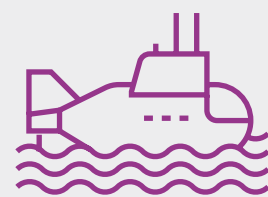
# Submarine cables – as important to the next wave of digital transformation as they were to the first

When the first submarine cables were laid in the late 19th century, they were transformative in enabling communications to travel large distances in short periods of time, and were essential for the eventual development of the World Wide Web. Now, submarine cables are essential in allowing for international digital exchanges. As of 2019, it is estimated globally, that there are more than **378 undersea cables in service, and they total more than 1.2 million kilometres, carry around 99% of international data traffic**, at much lower latency and cost than satellites.

The demand for data and submarine cables is continuing to grow:



The volume of data crossing borders is increasing exponentially and rose **64 times between 2004 and 2019**.



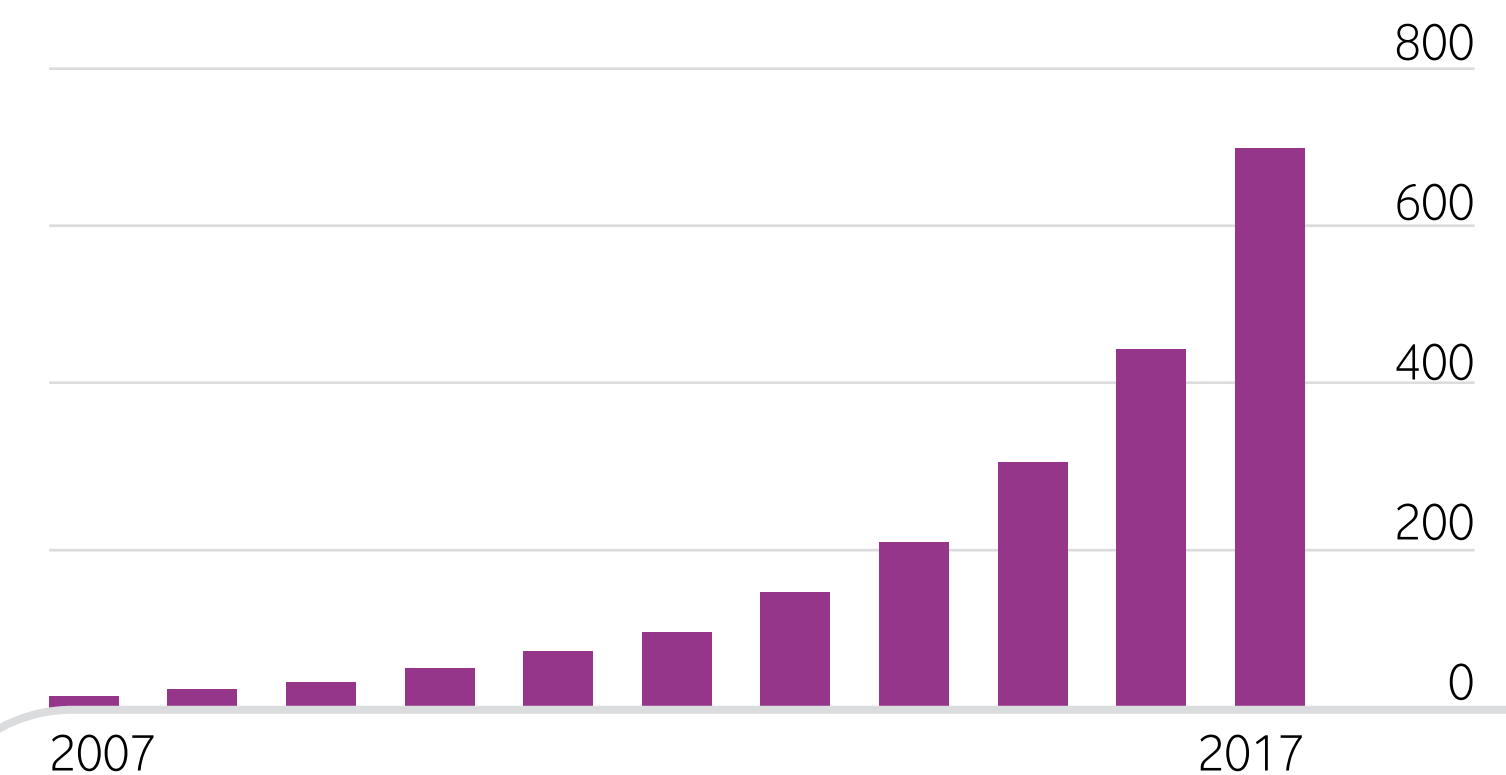
The European Subsea Cable Association estimates that capacity on submarine cables may be reached in 5 to 8 years<sup>5</sup>



In some European countries, Vodafone customers, internet usage rose by **50% during the COVID-19 pandemic**.

<sup>5</sup> ESCA (2019): Introduction to Subsea Cables around the UK and North Western Europe

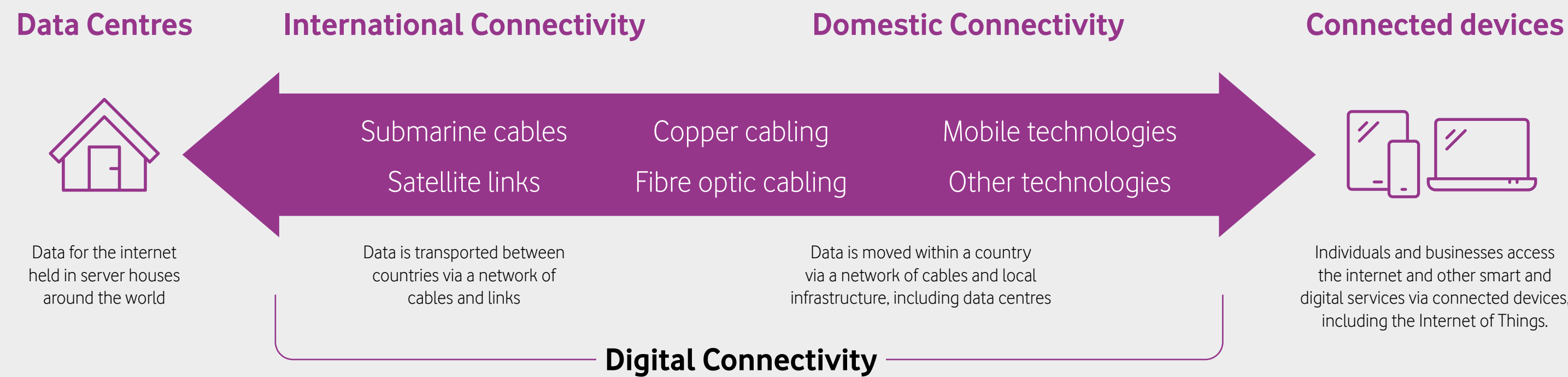
Figure 4: The exponential growth in international data exchanges



Source: The Economist, Globalisation has faltered, 2019.

Cross-border data flows have continued to expand, driven by two factors. Primarily the development of digital technologies and services have increased the amount of online activities, ranging from increased teleworking, online purchases, social media, and the downloading and streaming of music and videos. This has been accelerated by the Covid-19 crisis, which led to restrictions on physical movement, and an increase in the rate of teleworking, use of online communication platforms and video-streaming. As international travel restrictions were introduced, robust submarine cable connectivity enabled European companies to stay at the heart of the global data economy.

**Figure 5: The interaction between international and domestic connectivity**



Source: Deloitte (2018); Economic impact of international connectivity and data centre development in Scotland

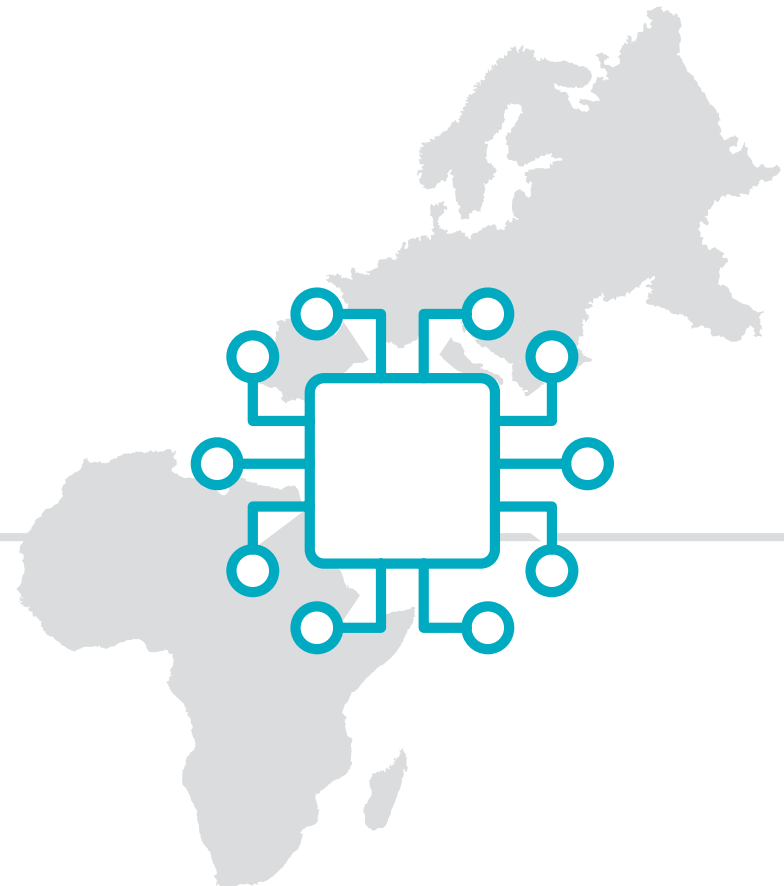
**There has been a lack of investment in these connections, with much of the EU's terrestrial infrastructure no longer fit for purpose and with insufficient resilience. Prioritised investment in these connections could complement the funding offered under the Connecting Europe Facility (CEF2) Digital programme to invest in cross-border cables.**

Submarine cables need to also be supported by onshore connectivity between landing stations and member states' core connectivity networks. This requires high bandwidth and high security terrestrial connectivity in what can otherwise be remote geographic locations.

# Continuing investment in international connectivity

As a global telecommunications provider, Vodafone is one of the largest investors in submarine cables, owning or being a partner in submarine cables that reach 100 countries, including the Europe India Gateway and the Apollo Submarine Cable System. This extensive state-of-the-art submarine and terrestrial cable network is made up of some of the world's most advanced cable systems that carry multiple terabytes per second of capacity. They form the backbone for the data centres enabling connectivity and access to the internet and World Wide Web.

The increasing quantity of data exchanges between Europe and Africa requires the development of more data centres. Given the relative advantages, including cheaper, reliable electricity, more developed domestic networks and cooler temperatures, it is likely many of these data centres could be placed within the EU. As mentioned above, data centres have been shown to generate enabling and 'ripple' effects across the economy, supporting other digital services and creating new high productivity jobs.



As part of a consortium, Vodafone is developing the 2Africa cable between Europe, Africa and the Middle East. This 37,000km cable, with 16 fibre pairs, will connect France, Spain, Portugal and Italy with 16 countries in Africa and two in the Middle East, greatly increasing the data capacity between Europe and Africa. The 2Africa cable will enable millions of people across the African continent to access higher speed 4G and 5G internet, allowing them to reap the benefits of improved digital connectivity.

As part of the **Connecting Europe Facility (CEF2) Digital programme**, funding is expected to be available for the deployment of new submarine cables, or the significant upgrade of existing cables. CEF2 Digital would allocate grants for up to 50% of the project cost for cross-border cables and 70% for projects in outermost regions. This funding would only be available for infrastructure where, as a result of the market issues in some areas outlined earlier, it is not economic for private providers to invest alone, meaning no relevant infrastructure of the same characteristics exists or is planned in the near future. However, given the strategic benefits of digital sovereignty, as well as the wider economic effects and spillovers of digital connectivity, the EU could benefit from additional investment in submarine cables, to address the existing market failures that may limit access to connectivity, or that provide insufficient redundancy, even where prior networks infrastructure exists.<sup>6</sup>

<sup>6</sup> Examples include: backhaul from Kilmore Quay in support of 'Solus' submarine cable (RFS 1999), with landing points in Kilmore Quay (IE) and Oxwich Bay (UK); Lannion (FR) to Paris (FR), in support to the Apollo submarine cable (RFS 2003) landing in Lannion (FR).

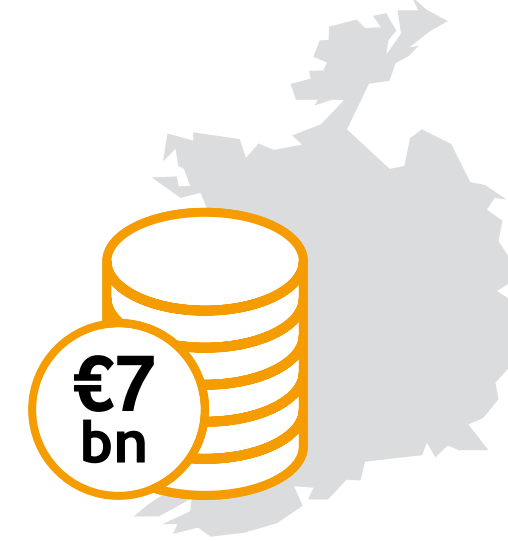
# The impact in Europe

Enhancing international connectivity and the accompanying development of data centre industries, has been shown to drive significant economic value for European countries of the order of billions of Euros per annum:



Finland's domestic data centre industry is enabled by the C-Lion1 submarine cable between Helsinki and Rostock, Germany (also known as the Northern Digital Highway). This investment of €100m, of which the Finnish state contributed €20m, has the potential to enable an **annual economic contribution of €2.3bn and support 33,000 jobs**, through its data centre industry and supply chain impacts.

Data centres in Ireland are supported by an array of submarine cables providing high-speed, low-latency connectivity to mainland Europe, the UK and North America. Enabled by this international connectivity, Ireland's data centre industry generated **over €7bn between 2010 and 2018 and supported 5,700 jobs** in construction and ongoing operation of its data centres.



Enhancing international connectivity in Scotland by **investing c. €50m** in increasing submarine cable capacity, has the potential to generate **up to €0.45bn annually** in the long-term, through growth of the local data centre industry and increased digitalisation. This may also support **3,100 jobs** in the long-term.

As the world becomes more digitalised and international data exchange becomes more important to the European economy, investment in resilient international connectivity between member states, and beyond, is essential. However, investment in submarine cables has been described as **“the missing pillar”** of the EU's digital strategy. European governments will need to coordinate with telecommunications providers to ensure that these networks are sufficient to meet the current needs of member states, and allow for the potential expansion of the digital sector across all member states and regions.

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