5

The Transatlantic Digital Economy

More data was generated over the last two years than in the entirety of human history.

69%
of EU firms have implemented advanced digital technologies since 2022

The digital jet stream is still flowing fast. More data was generated over the last two years than in the entirety of human history. By 2027, global data creation is projected to grow to more than 260 zettabytes. That is 260 followed by 21 zeros – about 3 billion times the Internet's size in 1997. Only about 2% of that data survives year-to-year. Still, 2% of 260 zettabytes is huge. By 2026, monthly global data traffic is expected to surge to 780 exabytes – more than three times data usage rates in 2020.[1] Global internet bandwidth has nearly tripled since 2019, even as growth slowed from a torrid pandemic-driven surge of 34% in 2020 to a more "normal" pace of 23% in 2023. According to Telegeography, total international bandwidth in mid-2023 stood at 1,217 Tbps (Terabits/one trillion bits per second).[2]

5.4 billion people – 67% of the world's population – were using the internet at the end of 2023, typically spending more than 40% of their waking life online. 95% of those users use a mobile phone to go online at least some of the time, and 93.5% use social media every month. 5.16 billion people own a smartphone. Mobile phones now account for roughly 57% of our online time and 53% of the world's web traffic.[3] In 2022, mobile technologies and services generated $5.2 trillion of economic value (5% of global GDP) and supported 28 million jobs. 5G will underpin future mobile innovation and services, building on ongoing deployments and adoption. 5G adoption is estimated to have reached 17% this year and projected to rise to 54% (5.3 billion connections) by 2030. The technology is on track to add almost $1 trillion to the global economy in 2030, with benefits spread across many industries.[4]

Over 60% of global GDP is now linked to digital transactions, according to the European Commission. More than 2 billion digital payments are made every day, and 1 of every 2 companies generates more than 40% of its revenues from digital products and services.[5] GSMA Intelligence forecasts that more than 38 billion devices will be connected to the internet by 2030, up from 15.1 billion in 2021.[6] The global Internet of Things (IoT) market, valued at $690.3 billion in 2021, is projected to grow to $1.5 trillion in 2026 and $1.85 trillion in 2028.[7]

Over the next three years, global spending on digital transformation is forecast to reach $3.9 trillion, with a five-year CAGR of 16.1%. The United States is the largest market for such spending, accounting for nearly 36% of the worldwide total. Western Europe will account for another 23% of all spending on digital transformation.[8] The World Economic Forum estimates that 70% of the new value created in the global economy over the next ten years will be digitally enabled.[9]

Digital Divides: Persistent, But Narrowing

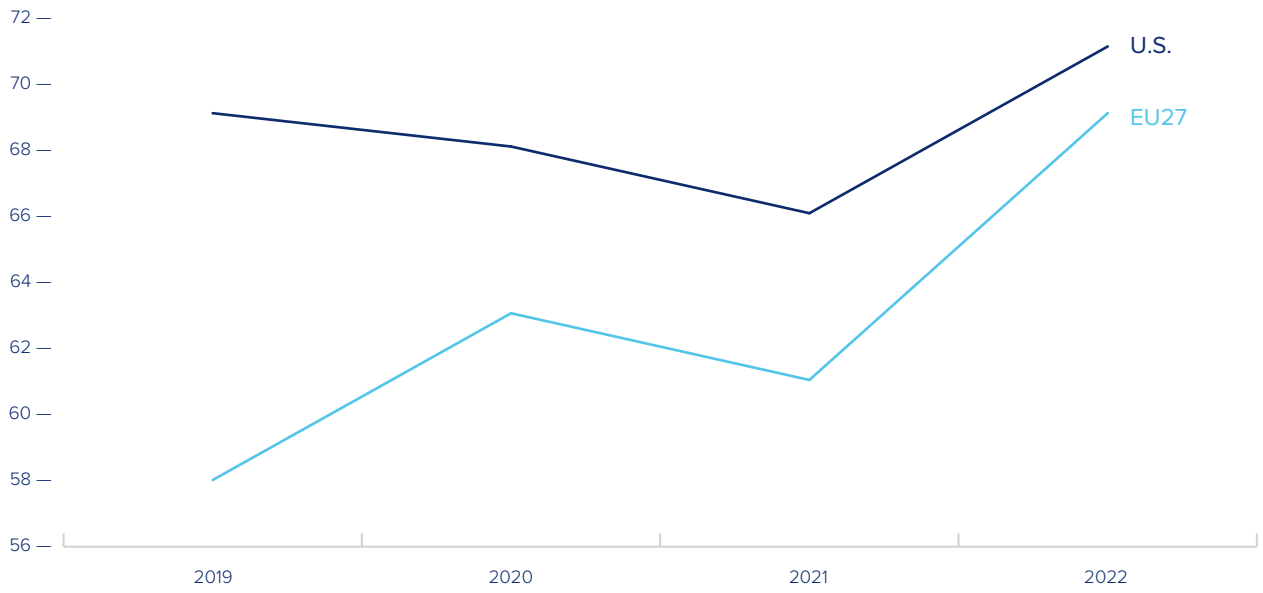
One unheralded consequence of the COVID-19 pandemic is that digital divides have narrowed across the transatlantic space, both within the United States and within Europe as well as between the two sides of the North Atlantic. The pandemic pushed many digital laggards – geographic regions, industrial sectors, and individual firms – to expand their digital operations and to extend their access. All told, digitalization increased by an average of 6% across advanced economies, according to the International Monetary Fund (IMF).

The pandemic narrowed the digital divide between European countries. For example, in 2019 more than four-fifths of workers in Sweden had computers with internet access, while Greece had less than two-fifths. By the time the pandemic subsided, the Greek share had surged almost 8 percentage points, to 45%, narrowing the gap with Sweden. Similar changes were evident across other European laggard countries.[10]

U.S. rural areas also closed the digital gap with urban metros. In 2016, only 63% of rural residents reported having home broadband. By 2021 that figure had risen 9 percentage points, to 72%, compared to 77% of adults living in urban areas and 79% in suburban areas. These and other critical disparities continue – by age, income, education, and racialized groups.[11] Overall, however, digital divides are narrowing across the country, spurred by a $42 billion initiative to help U.S. states accelerate broadband infrastructure deployment.

European companies are also closing the digital adoption gap with their U.S. counterparts. The share of EU firms implementing advanced digital technologies reached 69% in 2022, compared with 71% of U.S. enterprises, according to the European Investment Bank (EIB). The gap in the adoption of Internet of Things (IoT) technologies

Table 1. **Closing the Gap: Adoption of Advanced Digital Technologies by EU and U.S. Firms** (% of Total Firms, 2019-2022)



Source: EIBIS 2019-2022

between EU and U.S. firms also narrowed, from 18 percentage points in 2021 to 12 percentage points in 2022.[12]

A look beyond this broad comparison reveals wide disparities among EU countries when it comes to the adoption of advanced digital technologies. More than 75% of firms report using advanced digital technologies in Sweden, Austria, Slovenia, Czechia, Denmark, Belgium, Luxembourg, and Spain. The share was 66-75% for firms in Germany, Finland, Estonia, Poland, Italy, Croatia, the Netherlands and Romania, and fell to 50-65% for companies in France, Bulgaria, Ireland, Latvia, Portugal, Lithuania, Slovakia, and Greece.[13]

Digital transformations affecting the transatlantic economy

Opportunities for SMEs

Evolution of 3D printing

Development of the metaverse

Digital twinning technology

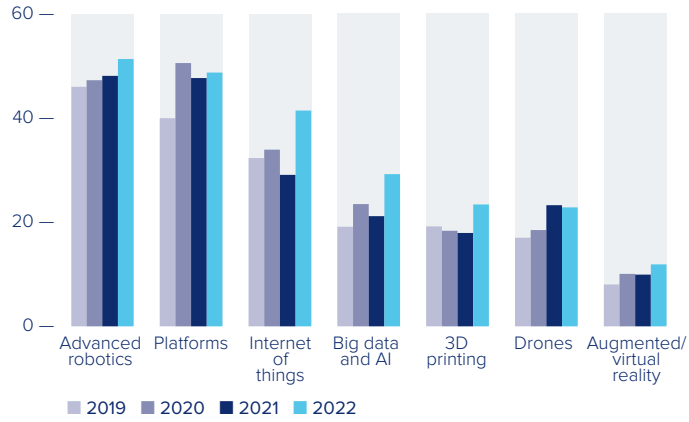
Emergence of Web3

Promise of the connected factory

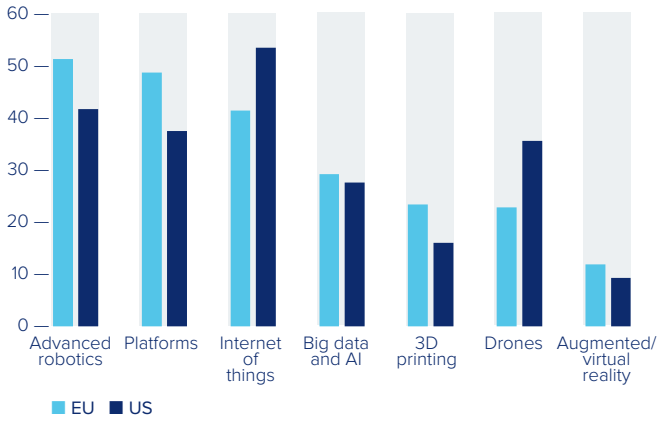
Advent of digital currencies

Table 2. Adoption of Specific Digital Technologies (% of firms)

a) European Union, 2019-2022

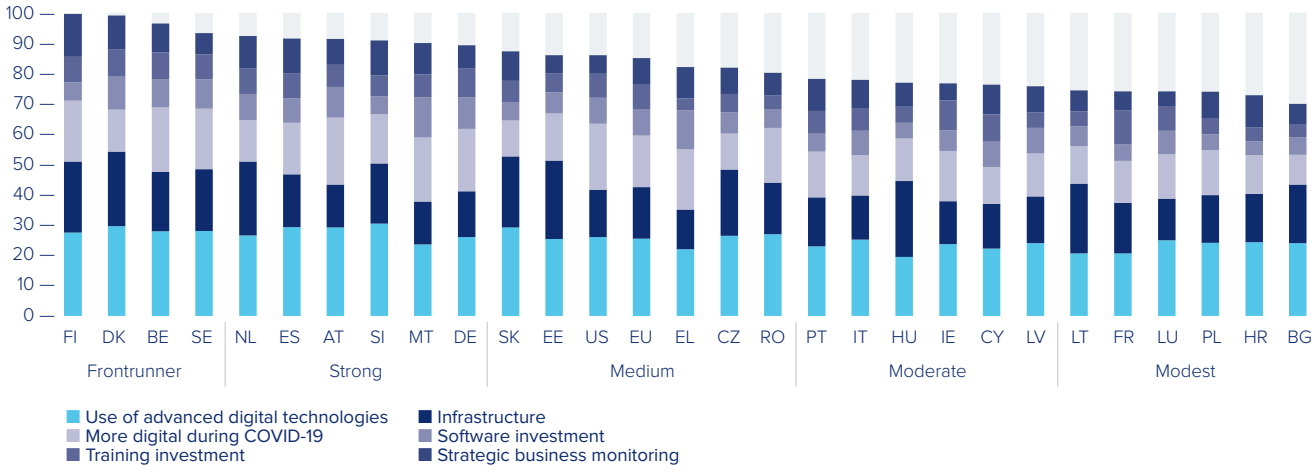


b) European Union vs. the United States, 2022



Source: European Investment Bank.

Table 3. Corporate Digitalization in the United States and EU Member States (EIBIS Index, by country)



Source: European Investment Bank.

Digital disparities continue within Europe and across the Atlantic. Several European countries outperform the United States (Table 3). The European Investment Bank ranks Finland and Denmark as the EU's top two digital countries, followed by Belgium and Sweden. Slovenia leads for the use of advanced digital technologies, Austria for boosting digitalization during the pandemic, Estonia for digital infrastructure, Malta for investment in software and data, France for investment in employee training, and Finland for the use of formal strategic business monitoring.

The Influencer Economy, Digital Finance, and Generative AI

For the transatlantic economy, several digital transformations bear watching. In previous surveys we have discussed opportunities for small- and medium-sized enterprises, the evolution of 3-D printing, the metaverse, digital twinning, the emergence of Web3, the promise of the connected factory, and the advent of digital currencies. Each of these developments remains significant.

Perhaps one of the most intriguing digital phenomena of recent years has been the rise of the "influencer" or "creator" economy, which Goldman Sachs estimates is now a $250 billion global industry with tens of millions of workers creating online content for hundreds of millions of customers.[14] YouTube estimates that its creators' work supported roughly 390,000 full-time jobs in the United States in 2022 – four times the number of people employed by General Motors. Linktree analysts expect the market to more than double to $480 billion by 2027, ahead of global revenue from video games, which PwC estimates will reach $312 billion by 2027. The *Washington Post* notes that an industry once "dismissed as a frivolous craze for tweens and teens" has "reshaped American culture, transformed how we get information, rewritten the rules for modern fame and amassed huge levels of wealth and influence."[15] Yet despite the creator economy's size and importance to the labor force, official records have yet to classify "social media" as an industry worth tracking.

Conflicting digital developments are whipsawing the financial world. On the one hand, digital transformation is rippling through the industry. Nine out of ten of the world's central banks are exploring digital versions of their own currencies. Digital payments accounted for 75% of all transactions in the U.S. in 2021, and even higher percentages in Finland, Sweden, and the UK, as the global share of cash-based payments continues to fall. McKinsey estimates that the global banking industry could boost productivity by up to 4.7% and generate up to $340 billion in additional annual revenues by embracing generative AI. And more developing countries searching for relevant digital models are turning from closed systems such as China's Alipay, and looking instead at India's Unified Payments Interface (UPI), an open platform that processed over $1 trillion in transactions in 2022, equivalent to a third of India's GDP.[16]

Even though "digital globalization" evokes the image of a seamless global marketplace, digital connections are "thicker" between some continents and "thinner" between others – and they are "thickest" between North America and Europe.

At the same time, concerns are growing that financial volatility can be triggered by taps on an app. On March 9, 2023, in what has been called "the first Twitter-fueled bank run," Silicon Valley Bank's panicked customers used their apps to pull an unprecedented $42 billion from their accounts – more than $1 million per second – for ten straight hours, and were on track to withdraw another $100 billion the next day before the bank was seized by federal regulators.[17]

The digital health market is projected to reach $612.4 billion by 2028

Relatedly, booming cryptocurrency and fintechs boosted their share of the global market capitalization of large listed and private payment firms, including banks and card networks, from about 9% in 2019 to 15% in autumn 2021, and then imploded in 2022. Their share has now fallen back to around 10%. Central banks warn that digital platforms that enable crypto investors to transact with each other, without oversight by central intermediaries, enables money-laundering and can generate greater financial volatility. And central bank digital currencies (CBDCs) already in circulation – such as China's e-cny, the Bahamas sand dollar, and Nigeria's e-naira, have thus far failed to take hold, as the U.S. Federal Reserve and a number of European central banks now question the need for CBDCs.[18]

As digital transformations envelop these fields, the buzz continues to center around generative AI, which promises to be more transformative than the smartphone. Open AI's ChatGPT broke all records by reaching 100 million monthly active users just six weeks after its debut – far faster than Instagram (2.5 years), WhatsApp (3.5 years), YouTube or Facebook (each 4 years). McKinsey estimates that generative AI could add up to $4.4 trillion annually to the global economy (the UK's entire GDP in 2021 was $3.1 trillion).[19] Hundreds of start-ups are engaged in the field, and venture capital is pouring in, despite ongoing concerns

related to bias, safety, mis- and disinformation, intellectual property, and the potential for massive labor displacements.[20] Generative AI tools can already churn out original prose, images, sounds and even code in response to human prompts. Companies are now tailoring new applications to more customized needs for specific industries. Gartner projects that by 2026, generative design AI will automate 60% of the design effort for new websites and mobile apps. Morgan Stanley foresees that 40% of all professions will be affected by generative AI by 2026, while research firm Valoir estimates that AI has the potential to automate 40% of the average work day.[21]

What's more, generative AI is integrating with predictive analytics into a form of predictive AI that is already affecting whole economic sectors.[22] In late 2023, for instance, the GraphCast AI model demonstrated that it was more consistently accurate – and at far less cost – than the world's leading weather forecasting system, although less so for sudden weather events.[23] In life sciences, predictive AI is poised to reshape clinical trials, genomic sequencing, therapeutics and preventive medical practice; enable drug discover; and facilitate more effective antibody treatments.[24] In 2022 the medical field led the way in AI investment, drawing just more than $6 billion, ahead of data management, processing and cloud ($5.86 billion) and fintech ($5.52 billion).[25] The overall global digital health market, valued at $276.36 billion in 2023, is projected to reach $612.40 billion by 2028.[26]

The Onrushing Bio-Cognitive Age

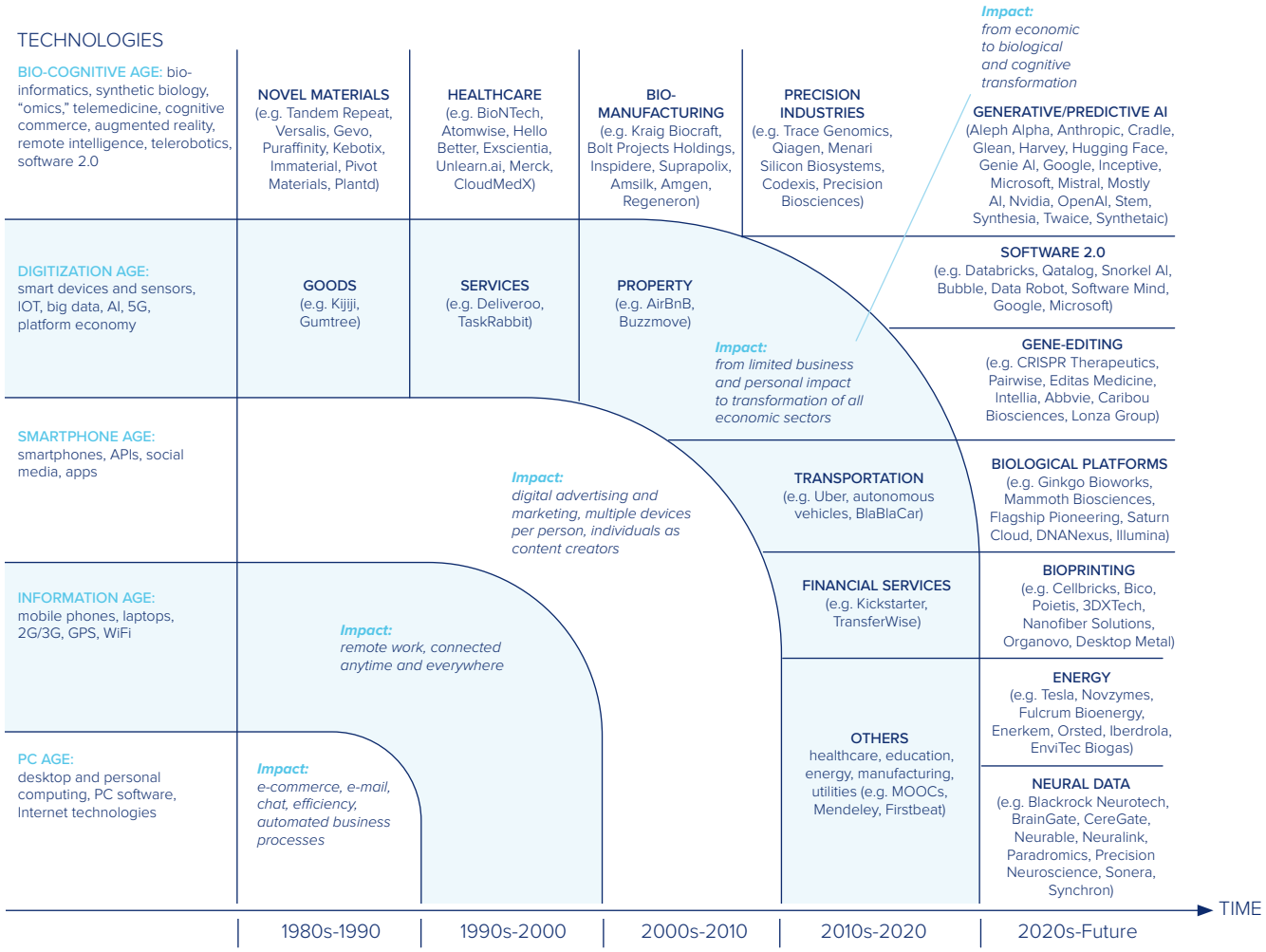
Breakthrough advances in the cognitive and biological sciences are further evidence that companies on both sides of the Atlantic are pioneering a new Bio-Cognitive Age.[27] Table 4 offers our updated view of this digital frontier, which showcases fields ranging from novel materials and bio-engineering to gene editing, bio-printing, and more.

Advances across these many fields continue to astound. MRNA tools, which were critical to tackling the COVID-19 pandemic, are now being applied to deal with malaria, tuberculosis, HIV, Zika, and RSV, and are opening a whole new world of weight-loss drugs. Spatial omics, which combine advanced imaging techniques with DNA sequencing, are being used to map a new generation of molecular-level "cell atlases" that could help doctors customize tumor treatments and unravel the complexities behind Alzheimer's disease and rheumatoid arthritis.[28] Scientists have now compiled a "pan-genome," a greatly expanded database that gives a more accurate representation of the genome of people from around the world, and that should eventually improve diagnosis and treatment of genetic diseases, aid drug discovery and bolster personalized medicine.[29] In 2023 several countries approved a therapy based on Crispr gene editing, by authorizing a treatment for sickle cell disease and beta thalassemia that could be used to replace bone marrow transplants. Even the stethoscope, which has not been redesigned for 200 years, is now being equipped with AI to detect heart disease instantly.[30]

Major breakthroughs have also been recorded in computational biology. Meta AI created a public atlas of 617 million predicted proteins, and DeepMind announced it could now predict the three-dimensional structure of nearly all proteins known to science, essentially solving a problem that researchers had been trying to crack for the past 50 years.[31] And while much commentary focuses on the potential for many routine medical decisions may be made by AI alone, healthcare is more likely to be influenced by highly-trained human medical professionals teamed with advanced generative and predictive AI tools – a phenomenon characterized as "centaur AI" or "centaur doctors."[32]

A next frontier is neural data and what scientists call "organoid intelligence." Stunning strides in neurotechnology are giving neurobiologists the ability to access brain activity. Brain-computer interfaces are being developed that can record data from brain cells and turn that information into applications that can help impaired individuals restore communicative and motor functions. Neuralink announced its first human brain chip implant in January. Wearable brain sensing devices coming to market could improve cognitive functions, diagnose mood disorders, even enable touch-free typing. These advances will further enhance the value of personal data, and are reviving debates about the importance of "cognitive liberty," which bioethicist Nita Farahany defines as "the right to control our thoughts and the data generated by our brains."[33]

Table 4 **The Expanding Digital Frontier**



Sources: GSMA Intelligence; McKinsey Global Institute; Author's own estimates.

Digital Apples and Oranges

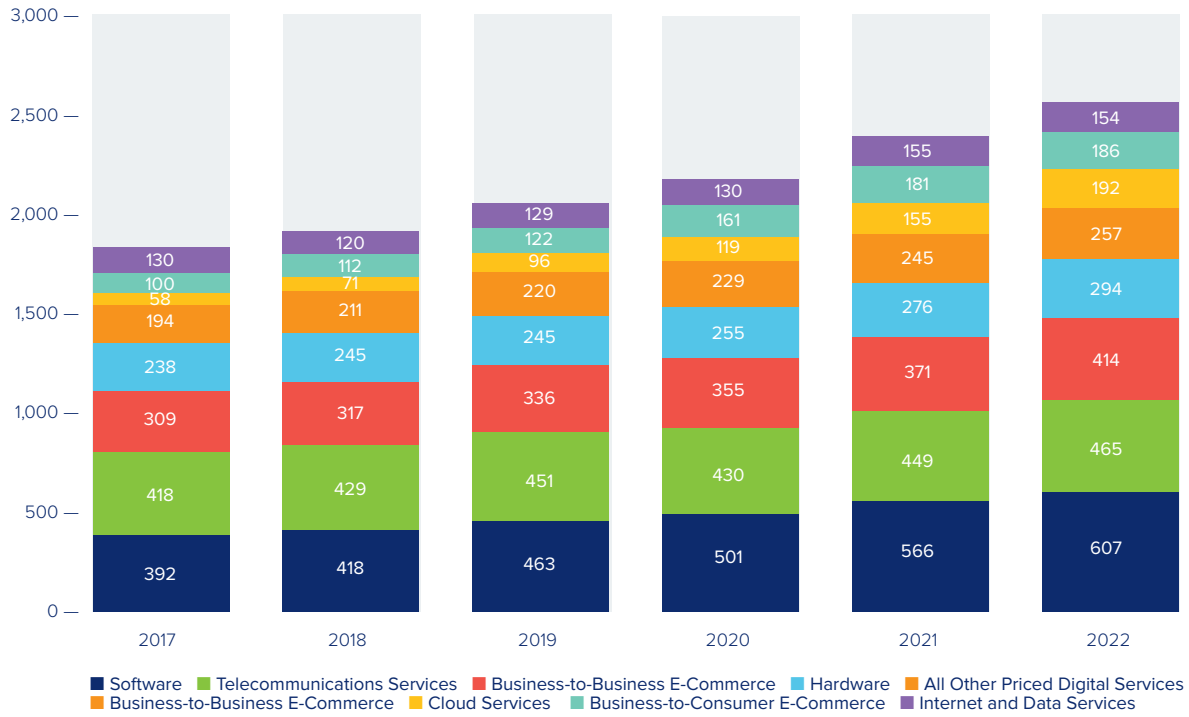
Given data's peculiar qualities, economists and governments have struggled to devise quality metrics to measure the digital economy. Some recent efforts are relevant to this year's survey.

The U.S. Bureau of Economic Analysis (BEA) now defines the digital economy to include four major types of goods and services: supportive and enabling infrastructure; electronic commerce; priced digital services charged to customers; and the annual budget of U.S. federal nondefense agencies whose services are directly related to supporting the digital economy. This definition begs many questions, including why the sizable, digitally-intense U.S. defense sector would be excluded. Nonetheless, based on these metrics, BEA estimates that real value-added growth of the U.S. digital economy (6.3%) far outpaced real GDP growth of the overall economy (1.9%) in 2022, accounting for $2.6 trillion of value added (10% of U.S. GDP), $1.3 trillion in compensation, and 8.9 million jobs.[34]

In 2022, software represented the largest share of value added in the U.S. digital economy (24%), followed by telecommunication services (18%) and business-to-business e-commerce (16%) (Table 5). Cloud services are growing the fastest (232.1% between 2017 and 2022) with an annual average growth rate of 27.2%.

The European Union takes a different tack. Its member states have not agreed on an official definition of what constitutes the digital economy. Instead, between 2014 and 2022 it published a flagship annual assessment, the Digital Economy and Society Index (DESI), that tracked the digital progress of EU member states according to four metrics: human capital; connectivity; integration of digital technology; and digital public services. Based on this assessment, Finland, Denmark, the Netherlands and Sweden had the most advanced

Table 5. U.S. Digital Economy Value Added by Detailed Activity Type, 2017-2022 ($Billions)



Source: U.S. Bureau of Economic Analysis.

digital economies in the EU, followed by Ireland, Malta and Spain. Romania, Bulgaria and Greece had the lowest DESI scores.

In 2023 DESI was transformed into a dashboard of indicators summarizing EU and member state progress toward four key goals set out in the EU's Digital Decade. According to the first EU digital target, at least 80% of all adults should have minimum basic digital skills by 2030. In 2021 only 54% had reached this level. The second digital target states that at least 20 million ICT specialists should be employed in the EU by 2030; in 2022, around 9 million people were so employed. According to the third digital target, more than 90% of SMEs should reach at least a basic level of digital intensity, and 75% of EU companies should use cloud computing services, perform big data analysis, or use artificial intelligence. In 2022, the SME share was 69%, around 20 percentage points below the target, and in 2021, 41% of businesses in the EU bought cloud computing services – 34 percentage points below the target. The fourth EU digital decade target states that all key public services for businesses and citizens should be fully online by 2030. In 2022, 42% of EU people used the internet to obtain information from public authorities' websites.[35]

Europe and the U.S. remain each other's main commercial trading partners in digitally-deliverable services.

How Prepared are Europe and the United States for the Digital Transformation?

A global assessment is offered by the 2023 Network Readiness Index, which measures how prepared countries are to leverage opportunities offered by technological innovation. It does so by looking at the state of technology infrastructure, the ability of individuals, businesses, and governments to use ICT productively, how conducive the national environment is for a country's participation in the network economy, and the economic, social, and human impact of a country's participation in the network economy. Based on these metrics, Europe and North America represent 8 of the top 10 countries, and 17 of the top 25, when it comes to technology readiness and adoption (Table 6). Singapore and South Korea were the lone Asian countries in the top ten.[36]

Table 6. Top Ten Network-Ready Countries, 2023

Country	NRI Rank	Technology	People	Governance	Impact
United States	1	1	4	7	23
Singapore	2	5	6	10	1
Finland	3	10	7	1	1
Netherlands	4	4	15	2	5
Sweden	5	9	9	5	4
Switzerland	6	2	14	13	6
Republic of Korea	7	17	1	18	11
Denmark	8	11	11	3	8
Germany	9	6	8	14	10
United Kingdom	10	8	10	16	9

Source: Soumitra Dutta and Bruno Lanvin, eds., The Network Readiness Index 2023 (Washington, DC: Portulans Institute, 2023), https://networkreadinessindex.org.[37]

Five Lenses on the Evolving Transatlantic Digital Economy

Due to these apples-and-oranges approaches, it is difficult to come up with a clear estimate of the overall size or value of the transatlantic digital economy. Our interest in this annual survey, however, is more on how North America and Europe connect, rather than on how they compare. With that in mind, we present five ways to look at the transatlantic digital economy. These metrics are not mutually exclusive; they are best understood as different lenses through which one can better understand the importance of transatlantic digital connections.

Together, these five metrics convey one clear message: even though "digital globalization" evokes the image of a seamless global marketplace, digital connections are "thicker" between some continents and "thinner" between others – and they are "thickest" between North America and Europe.

1. Cross-Border Trade and Investment in Digital Services and Digitally-Deliverable Services

Digitalization is changing the scale, scope, and speed of trade. It has blurred the distinction between goods and services. It has lowered shipping and customs processing times. It offers alternative means of payment and finance. It can boost growth, reduce costs, foster innovation, and promote resilience to disruptive shocks. At a time when trade in many traditional goods and services has flagged, digital trade is booming.

Cross-border digitally delivered services are the fastest growing segment of international trade, registering an almost fourfold increase in value since 2005, with an 8.1% average annual growth rate for almost two decades. This has outpaced growth in goods exports (5.6%) and other services exports (4.2%) (Table 7). The value of global trade in digitally delivered services rose to $3.82 trillion in 2022, accounting for a record 54% share of overall services trade.[38]

Europe and North America accounted for two-thirds of global exports of digitally delivered services in 2021 (Table 8). The EU is the global leader, with a 37% share, followed by the U.S. (16%), the UK (9%), Canada and other European countries.[39]

In 2022, U.S exports of digital services totaled $93.3 billion, while U.S. digital services imports were $51.2 billion, resulting in a U.S. digital services trade surplus of $30.2 billion. U.S. trade in digitally-deliverable services was much higher: exports of $626.0 billion and U.S. imports of $370.0 billion. The result: a digitally-deliverable trade surplus of $256.0 billion.[40]

The UK was the U.S.' top overall trading partner in digitally-deliverable services, and its largest source of digitally-deliverable services imports. Ireland maintained its position as the top recipient country for U.S. exports of digitally-deliverable services for the fourth year in a row.[41]

In terms of world regions, Europe and the U.S. remain each other's main commercial trading partners in digitally-deliverable services. In 2022

Digitally-enabled services exports (2021)

$244.2 billion

U.S. exports to the EU

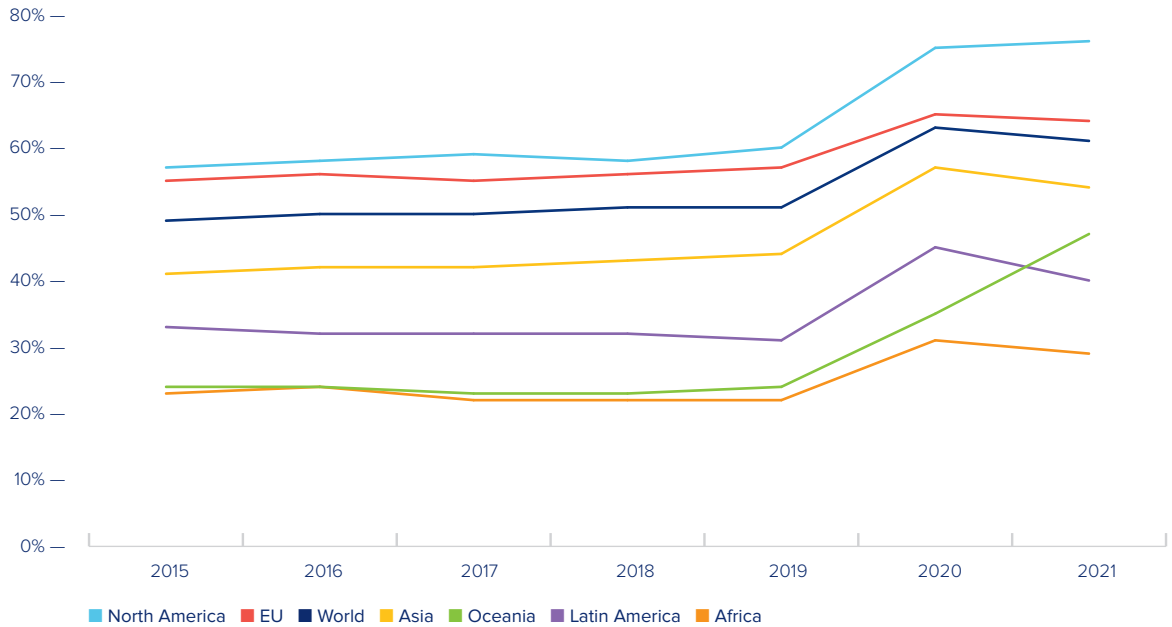
$208.4 billion

EU exports to the U.S.

Table 7. Digitally Delivered Services: The Fastest Growing Segment of International Trade
Export Growth Index (2005=100)

Source: IMF, OECD, UNCTAD, World Bank, WTO, Handbook on Measuring Digital Trade, 2nd Edition, 2023, https://www.oecd-ilibrary.org/docserver/ac99e6d3-en.pdf.

Table 8. Digitally Deliverable Services Exports by Region (Share in total services exports)



Source: UNCTAD;WTO; OECD.

the United States exported $307 billion in digitally-deliverable services to Europe – more than double what it exported to the entire Asia-Pacific region ($141 billion), and more than combined U.S. exports of digitally-deliverable services to the Asia-Pacific, Latin America and other Western Hemisphere, Africa and the Middle East. Europe accounted for 49% of all U.S. digitally-deliverable exports to the world. Within Europe, the EU accounted for 61%, and the EU+UK+Switzerland accounted for 97%, of U.S. digitally-deliverable exports. The U.S. had a $103 billion trade surplus with the EU in digitally-deliverable services in 2022.[42]

In 2021, EU member states exported about $1.52 trillion in digitally-enabled services. 46% went other EU member states. The United States was the largest customer for EU digitally-enabled services exports, accounting for 25% ($208.4 billion) of the EU's digitally-enabled services exports to non-EU countries.[43] The EU exported about the same to the U.S. alone as to the entire region of Asia and Oceania ($210.9 billion) (Table 9).

In 2021, EU member states imported about $1.45 trillion in digitally-enabled services. 44% originated from other EU member states. Another 17% ($244.2 billion) came from the United States, making it the largest single-country supplier of these services. EU imports of these services from the U.S. were 30% more than EU imports from the UK ($169.8 billion) and more than twice EU imports from the entire region of Asia and Oceania ($119.7 billion) (Table 10).

Digitally-Enabled Services Supplied Through Foreign Affiliates

The digital economy has transformed the way trade in both goods and services is conducted across the Atlantic and around the world. Even more important, however, is the delivery of digital services by U.S. and European foreign affiliates – another indicator reinforcing the importance of foreign direct investment, rather than trade, as the major driver of transatlantic commerce.

In 2021, U.S. services supplied by affiliates abroad were $1.95 trillion, roughly 2.4 times U.S. global services exports of $801.14 billion. Half of all services supplied by U.S. affiliates abroad are digitally-enabled – also larger than U.S. global services exports.[44]

Table 9. Destination of EU27 Exports of Digitally-Enabled Services, 2021 ($Billions)

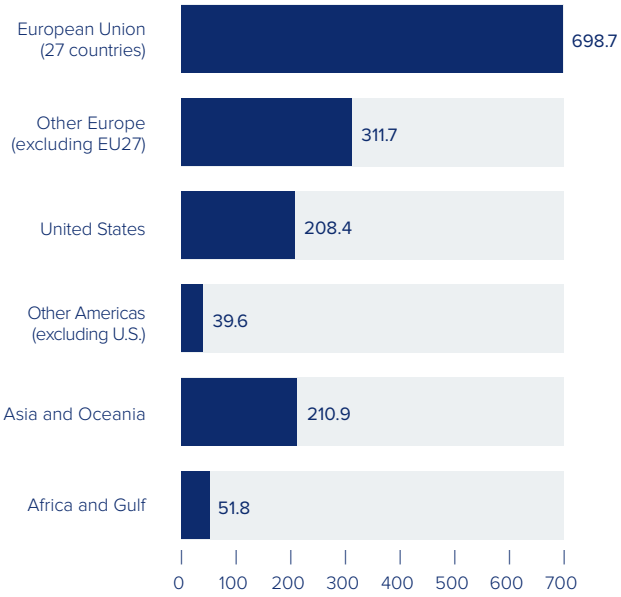
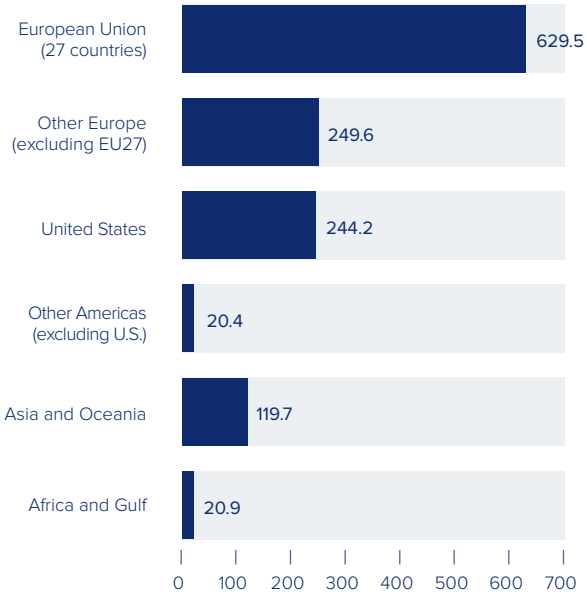


Table 10. Origin of EU27 Imports of Digitally-Enabled Services, 2021 ($Billions)



Note: Digitally-enabled services includes finance; insurance; IP charges; telecommunications, computer, information services; R&D services; professional and management services; architectural, engineering, scientific and other technical services; trade-related services; audiovisual services; and other personal, cultural, and recreational services.
Source: Authors' own calculations based on OECD, Eurostat.

Transatlantic data flows account for more than half of Europe's data flows and about half of U.S. data flows globally.

EU-based firms transferring data to and from the U.S. (2020)

Over 90%

The significant presence of leading U.S. service and technology leaders in Europe underscores Europe's position as the major market for U.S. digital goods and services. In 2021, Europe accounted for 67% of the $434 billion in total global information services supplied abroad by U.S. multinational corporations through their majority-owned foreign affiliates. This is not surprising given the massive in-country presence of U.S. firms throughout Europe, with outward U.S. FDI stock in information overwhelmingly positioned in Europe. U.S. overseas direct investment in the "information" industry in the UK alone, for instance, was triple U.S. information industry investment in the entire Western Hemisphere outside the United States, and 15 times more than such investment in China. Equivalent U.S. investment in Germany was 3.8 times more than in China.

2. E-Commerce

Electronic commerce (e-commerce), which refers to transactions in which goods or services are ordered over a computer network (usually over the Internet), offers a second window into transatlantic digital connections.[45] Here again we run into some definitional and data challenges. Most estimates of e-commerce do not distinguish whether such commerce is domestic or international. Many metrics do not make it clear whether they cover all modes of e-commerce or only the leading indicators of business-to-business (B2B) and business-to-consumer (B2C) e-commerce. Finally, in most economies, there are simply no national statistics on the value of e-commerce, and those that do exist vary in terms of definitions, data sources and methods, and approaches to e-commerce value. Many are based on surveys rather than on real data.[46]

Nevertheless, we can evaluate and compare many different estimates and surveys that have been conducted. B2B and B2C global e-commerce revenue reached an estimated $32.5 trillion in 2023. Projections indicate a rise to $40 trillion in 2025 and to over $79 trillion by 2030.[47]

When most people hear the term 'e-commerce,' they think of consumers buying things from businesses via websites, social networks, crowdsourcing platforms, or mobile apps. These business-to-consumer transactions (B2C), however, pale in comparison to business-to-business (B2B) e-commerce, which accounts for most global e-commerce. In 2023 B2B e-commerce was valued at $26.2 trillion, over four times that of the B2C e-commerce market ($6.3 trillion). Projections indicate the B2B e-commerce market will grow to $56.9 trillion in 2028.[48]

Official estimates of the value of combined B2B and B2C e-commerce sales indicate that the United States has the largest overall e-commerce marketplace.[49] China has the largest B2C e-commerce market, reflecting its billion-plus population. China is underweight, however, when it comes to B2B e-commerce, whereas the U.S. B2B e-commerce marketplace is significant.

In the U.S., 74.9% of e-commerce is B2B and 25.1% is B2C. The U.S. B2B e-commerce market was valued at $3.6 trillion in 2023; projections indicate it will grow to $6.6 trillion in 2028. The U.S. accounted for 13.8% of global B2B ecommerce in 2023. North America's B2B e-commerce market was worth $3.9 trillion in 2023, equivalent to 15% of the global market. Europe's B2B e-commerce was worth $1.8 trillion in 2023, 6.3% of the global market.[50]

Global B2C e-commerce reached an estimated $6.3 trillion in 2023, up 10.4% from 2022 ($5.7 trillion). Projections indicate that value will increase to $8 trillion in 2027. China accounts for 52.1% of global B2C e-commerce sales, followed by the U.S. (19%) and the UK (4.8%). Japan, South Korea, and Germany rank 4th, 5th, and 6th, respectively. U.S. B2C e-commerce sales reached $1.21 trillion in 2023, up 16.3% from 2022. Projections indicate that U.S. retail e-commerce sales will exceed $2 trillion in 2027. B2C e-commerce accounts for 14.4% of all U.S. retail sales.[51]

21% of all e-commerce purchases made in Europe crosses a border. 25% of EU consumers purchase from e-commerce sellers from non-EU countries. The European B2C e-commerce market generated $465.4 billion in revenue in 2021.[52]

While B2B e-commerce accounts for the bulk of global e-commerce, most B2B e-commerce does not cross a border. Most B2B e-commerce

users are manufacturers or wholesalers who are dependent on physically moving goods, and often heavy freight; the lack of freight digitalization ultimately poses a barrier to cross-border B2B e-commerce. The sheer volume of B2B e-commerce, however, means it still is the most important component of cross-border e-commerce sales.[53]

There are 2.64 billion online shoppers worldwide, or one-third of the global population. The American shopping event Black Friday has gone global to become the world's biggest online shopping day.[54] Global e-commerce retail sales are predicted to reach $9.4 trillion by 2026. Around 22% of all B2C e-commerce sales worldwide are cross-border sales. Cross-border B2C e-commerce sales were an estimated $992.92 billion in 2022, up 25.1% from their 2021 total of $793.7 billion. The global cross-border B2C e-commerce market is expected to reach $3 trillion by 2028.[55]

56% of online shoppers in Canada, and 52% of online shoppers in Spain, purchased items from other countries in the past year. Next was Italy at 47%, followed by France (46%), UK (43%), and Germany (33%). 32% of U.S. online shoppers purchased from a foreign online retailer in the past year.[56]

More than 75% of European internet users buy goods or services online.[57] In 2022, the total cross-border B2C e-commerce market in Europe, including the UK, Switzerland and Norway, amounted to a turnover of $292 billion (excluding travel). Among 16 prominent European e-commerce markets, 27.3% of total B2C turnover was cross-border in 2022. Cross-border turnover accounted for 35% or more of total ecommerce turnover for Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, Norway, Portugal, Sweden, and Switzerland.[58]

3. The Platform Economy

Platform companies that connect individuals and companies directly to each other to trade products and services continue to reshape the U.S. and European economies, as well as the commercial connections between them. Platforms have swiftly become a prominent business model in the transatlantic and global economy, both by matching supply and demand in real time and at unprecedented scale, and by connecting code and content producers to develop applications and software such as operating systems or technology standards.[59] Seven of the world's ten most valuable firms currently operate using a platform business model.[60] In 2020 a team at MIT found that the top 43 publicly-listed platform companies had nearly twice the operating profits, growth rates and market capitalizations of the 100 largest firms in the same businesses over a 20-year period – with half the workers.[61] By 2025, platform models are projected to expand to around $60 trillion, or nearly one-third of all global commerce.[62]

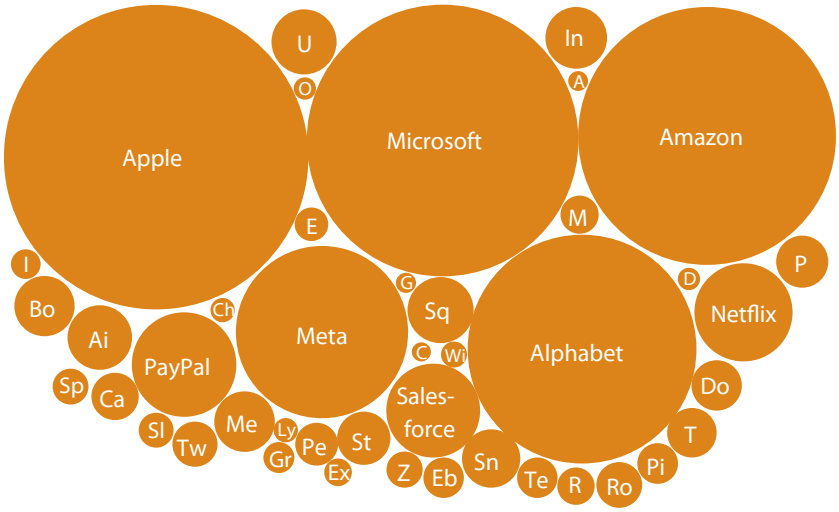
Size matters in the platform economy. The biggest are U.S. companies, which account for about two-thirds of the global platform economy. According to a study by DinarStandard, a consultancy, U.S.-based companies accounted for 90% of the 371 billion average monthly users of digital platforms in 2022.[63] Next come Chinese companies. European platform companies on average are markedly smaller than their U.S. and Chinese counterparts, and together represent only 3% of global market value (Table 11).

The dramatic rise of U.S. and Chinese platform companies has generated considerable concern among Europeans that they may be missing out on a major economic transformation. Europe certainly faces some challenges. However, size is not everything. Platform economics have rewarded entrepreneurship and the adoption of new business models. Those who can develop both their digital and their entrepreneurial ecosystems stand to profit greatly from the platform revolution.

The Digital Platform Power Index (Table 12) explores which countries could best gain from this transformation. It compares the current economic influence of countries' current platforms, the degree to which countries offer a supportive enabling environment for further platform development, and the readiness of countries to spawn next-generation platforms. According to this Index, North America and Europe account for 16 of the top 25 countries.

Table 11. Geographical Distribution of the Top Global Platforms. Based on MarketCap/last-known venture round valuation. (December 2021)

America



Airbnb
Alteryx
Booking
Carvana
Chegg
Doordash
Dropbox
Ebay
Etsy
Expedia
Grainger
Grubhub
Instacart
Intuit
Lyft
Match
MercadoLibre
Opendoor
Palantir
Peloton
Pinterest
Roblox
Roku
Slack
Snap
Splunk
Square
Stripe
Teladoc
Twilio
Twitter
Uber
Wish
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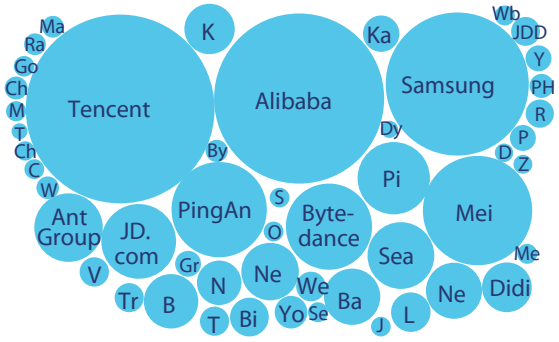
Asia-Pacific



Baidu
Beike
Bilibili
BYJU
Chehaoduo
Coupang
Dada Nexus
Didi Chuxing
Go-Jek
Grab
JD Digits
Kakao
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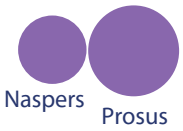


Share in total value, by region (%)

Number of top 100 platforms, by region

Source: Holger Schmidt, available at www.netzoekonom.de/vortraege/#tab-id-1 (data as of December 2021).

Table 12. Global Digital Platform Power Index

Rank	Country	Economic Influence of Domestic Platforms	Enabling Environment	Readiness for Next Gen Platforms
1.	U.S.	7.0	8.7	9.1
2.	China	5.0	6.9	6.4
3.	Japan	3.0	9.0	7.7
4.	Netherlands	2.0	8.9	8.7
5.	South Korea	2.5	8.6	7.7
6.	Singapore	2.0	8.8	8.3
7.	Germany	1.5	9.5	8.4
8.	Russia	3.9	7.5	6.1
9.	Canada	2.0	8.4	8.7
10.	UK	1.5	8.9	8.3
11.	Sweden	1.0	9.3	8.6
12.	Spain	1.0	8.7	7.3
13.	Switzerland	<0.5	9.2	8.7
14.	Denmark	<0.5	9.4	8.4
15.	Israel	1.0	8.0	7.4
16.	Australia	0.5	8.0	8.0
17.	Belgium	<0.5	9.1	7.7
18.	France	<0.5	8.9	7.9
19.	Norway	<0.5	8.5	8.0
20.	Poland	0.5	8.3	6.6
21.	Hong Kong	<0.5	8.1	7.7
22.	Czechia	0.5	7.7	7.0
23.	Italy	0.5	7.8	6.9
24.	Estonia	<0.5	8.0	7.1
25.	Taiwan	1.0	6.9	5.9

Ranking on scale of 10. Source: DinarStandard, "Global Digital Platform Power Index 2023," https://2feea378-8f71-46c9-9424-36229a900f86.usrfiles.com/ugd/2feea3_b69dbe6fa1ea49548d3768008b168446.pdf.

In the end, it is Europe's larger ecosystem that is like to shape its future in the platform economy. This underscores the importance of a true European Single Market, including a more integrated Digital Single Market, that would transcend fragmentation of languages, consumer preferences, rules and regulations to facilitate cross-border research, development and commercialization that could introduce new technologies and fresh business models to reach the kind of scale that platform companies have achieved in the large continental markets of the United States or China.[64]

4. Cross-Border Data Flows

Another lens through which we can better understand transatlantic digital connections is to appreciate the role of cross-border data flows, which not only contribute more to global growth than trade in goods, they underpin and enable virtually every other kind of cross-border flow.[65]

Transatlantic data flows are critical to enabling the $8.7 trillion EU-U.S. economic relationship. They account for more than half of Europe's data flows and about half of U.S. data flows globally. Over 90% of EU-based firms transfer data to and from the United States.[66]

However, despite the broad recognition of its value, and the need to develop appropriate policy frameworks, there is still no consensus method for empirically determining the value of data.[67] One reason is that data is a special resource different than goods and services. UNCTAD calls cross-border data flows "a new kind of international economic flow, which lead to a new form of global interdependence."[68] Data flows are not necessarily a proxy for commercial links, since data traffic is not always related to commercial transactions.[69] Knowing the volume of data flows does not necessarily provide insight on the economic value of their content. The Bureau of Economic Analysis puts it succinctly: "Streaming

a video might be of relatively little monetary value but use several gigabytes of data, while a financial transaction could be worth millions of dollars but use little data."[70]

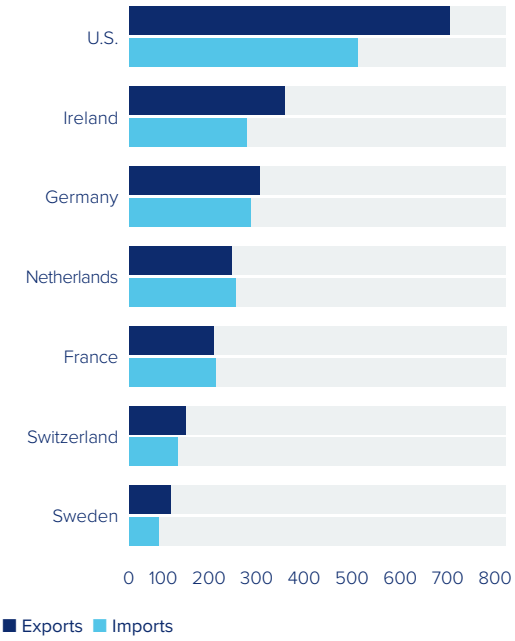
In addition, commercial transactions do not always accompany data, and data do not always accompany commercial transactions. For instance, multinational companies often send valuable, but non-monetized, data to their affiliates.[71] User-generated content on blogs and on YouTube drives very high volumes of internet traffic both within countries and across borders, but consumers pay for very little of this content. Since it does not involve a monetary transaction, the significant value that this content generates does not show up in economic or trade statistics.[72]

In short, data flows are commercially significant, yet their extent, as well as their commercial value, are hard to measure and are in constant flux.

Cross-Region Data Flows

Globally, the most intense and valuable cross-region data flows continue to run between North America and Europe. They are also almost certainly the most valuable, even if their worth is difficult to measure. The OECD devised metrics to determine the most active countries when it comes to delivering products across borders through data flows, as opposed to considering all transactions facilitated through data flows. It determined that the United States is a major hub for international trade in products delivered through data flows, and that France, Germany, India, Ireland, the Netherlands, Switzerland, and the United Kingdom also feature heavily in trade underpinned by data, all ahead of China (Table 13).[73]

Table 13. International Trade Underpinned by Data Flows, Top Countries ($Billions)



Note: Trade underpinned by data flows includes four categories: (1) "ISIC J production", or trade in products produced by firms classified in ISIC section J (Information and Communication); (2) "ISIC J products," or trade in the products mainly associated with firms classified in ISIC section J but including production by firms classified in other sectors; (3) "Digitally deliverable services," or "potentially ICT-enabled products" per UNCTAD (2015); and (4) "Digitisable products," or products within the WTO HS commodity classification per Banga (2019).
Source: OECD, Perpectives on the Value of Data and Data Flows, December 2020.
Data as of October 2020.

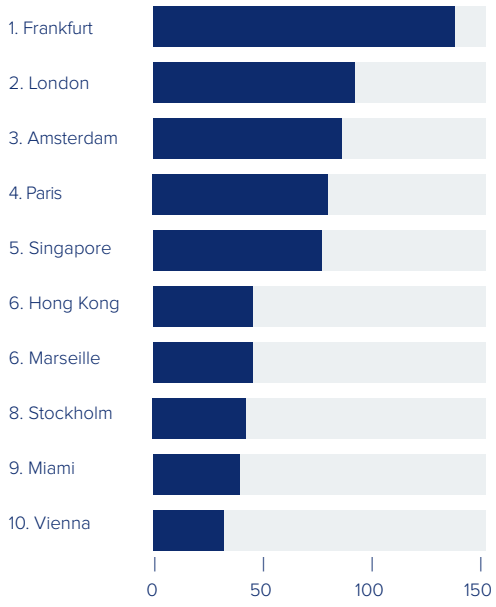
5. Digital Wiring: Land-Based Hubs and Sea-Based Spokes

The Digital Landscape: Hubs and Hyperscalers

The United States and Europe host key land-based hubs and sea-based spokes of the global digital economy.

European and U.S. cities are major hubs of cross-border digital connectivity. Europe is the global leader, with tremendous connected international capacity. Frankfurt, London, Amsterdam, and Paris – together known as FLAP – substantially outpace North American and Asian cities (Table 17). Frankfurt is home to the largest Internet node in the northern hemisphere. Frankfurt's connected capacity is over four times greater than that of New York and almost double that of Singapore, the Asian leader.[74]

Table 14. Top 10 Highest Capacity International Internet Hub Cities (Tbps)



Domestic routes omitted.
Source: Telegeography, Global Internet Map 2022.

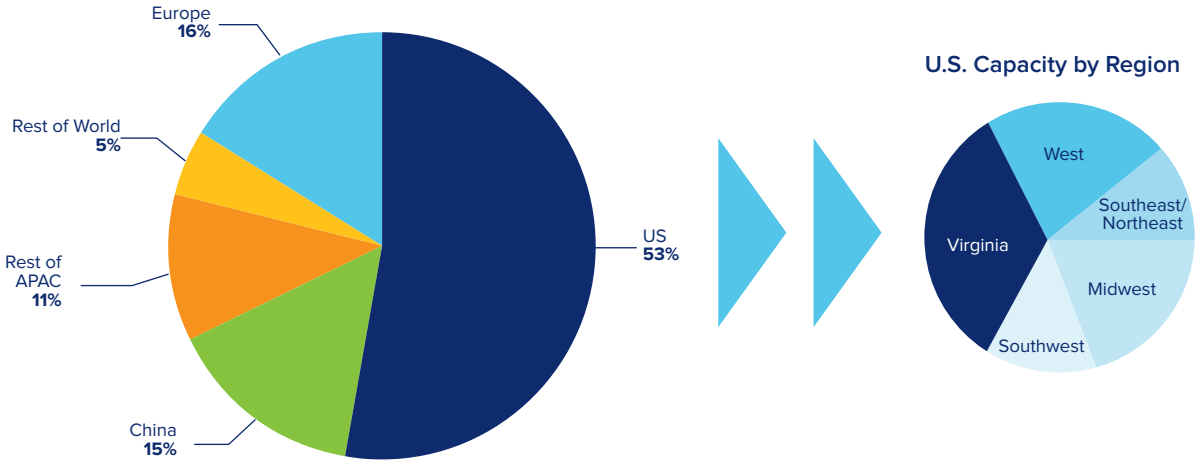
The role of the United States and Europe as critical digital hubs is also underscored by looking at interregional connections and capacity. Over 80% of global interregional bandwidth is connected to the U.S and close to 60% is connected to Europe, compared to less than 40% for Asia. Almost all of Latin America's interregional bandwidth is U.S.-connected, and most interregional bandwidth of Africa and the Middle East is connected to Europe.[75]

The hard-wiring of the transatlantic digital landscape continues to evolve. One key development, which we discussed in more detail in last year's survey, is the shift in providers of data centers and cloud-like services from European and U.S. telecommunication companies and related data-center management enterprises to "hyperscalers," mainly from the United States. Many commentators simplify the term "hyperscalers" to refer to the three largest providers: Amazon Web Services (AWS), Microsoft Azure, and Google Cloud. These three firms account for about two-thirds of hyperscale data market share. Nonetheless, other hyperscalers include Meta, Oracle, Apple, IBM, Scaleway, Switch, Alibaba, Huawei, QTS, Digital Realty Trust, Equinix and SAP.[76]

The average capacity of hyperscale data centers to be opened over the next six years will soon be more than double that of current ones. Total capacity of all operational hyperscale data centers will grow almost threefold in the next six years. Large data centers operated by hyperscale providers account for 37% of the worldwide capacity of all data centers and will account for over half of all capacity in the next five years. The hyperscale data center market is projected to be worth $413.1 billion by 2030.[77]

The United States accounts for over 53% of the world's operational hyperscale infrastructure, measured by critical IT load.[78] More than one-third of U.S. hyperscale capacity is in one state – Virginia.[79] Virginia has far more hyperscale data center capacity than either China or all of Europe. Much of that is in Northern Virginia, along the border with Washington, DC. The second-largest concentration of hyperscale infrastructure is in the western United States, primarily Oregon and California. The U.S. Midwest follows, with large concentrations of hyperscale infrastructure in Iowa and Ohio (Table 15).[80]

Table 15. Hyperscale Data Center Capacity (Q2 2022)



Source: Synergy Research Group. APAC: Asia-Pacific.

The other half of global hyperscale infrastructure is relatively evenly split between China, Europe, and the rest of the world.

Europe's hyperscale data center market is expected to grow from $28.42 billion in 2022 to $39.69 billion by 2028. Nordic and Western Europe remain attractive for hyperscale investments, while Spain and Portugal have emerged as new destinations for hyperscale data center development.[81]

While many U.S. and European regions have embraced these investments, others have raised concerns about data centers' size and heavy energy and water use. By 2030, data centers are projected to account for 3.2% of electricity demand within the EU – an 18.5% jump from 2018, at a time when Europe is under severe pressure to cut its energy demand. The Netherlands has tightened permitting for hyperscale site development. Authorities in the Netherlands, Ireland and Germany, as well as in Loudon County, Virginia have introduced restrictions on new centers to comply with more stringent environmental requirements.[82]

These concerns are amplified by related European anxieties about U.S. dominance, which could inhibit some possible avenues for deeper transatlantic cooperation. In last year's survey we discussed in more detail how two other trends – migration to the "edge" and the evolution of "cloud-as-a-service" to "cloud-as-a-product" – have the potential to mitigate such concerns, depending on how they unfold.

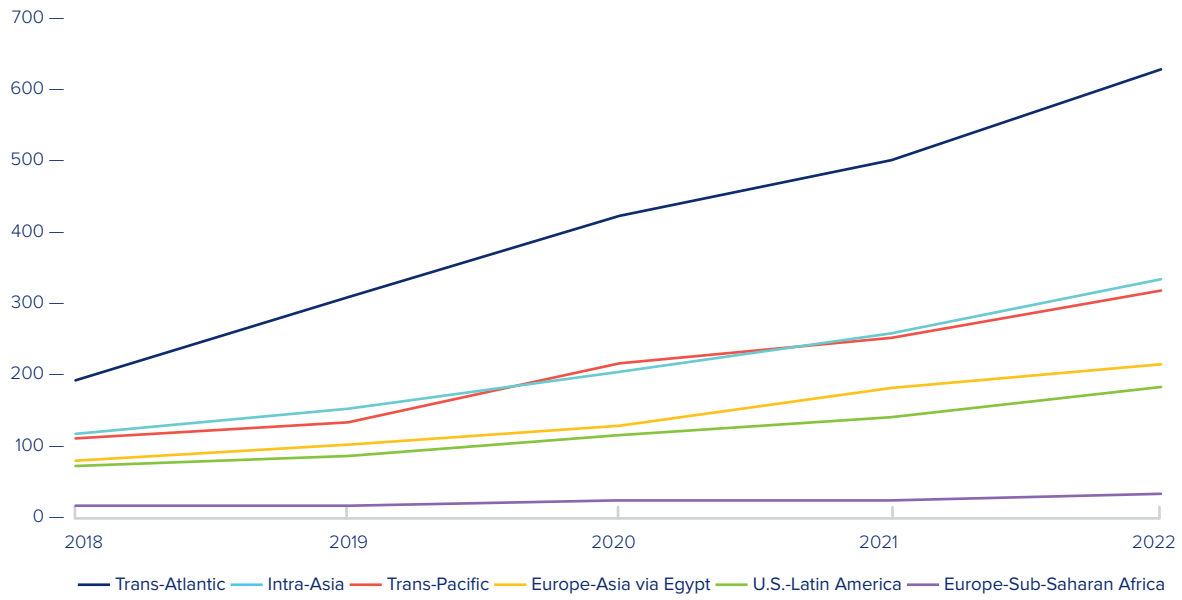
The Digital Atlantic Seascape

Land-based digital hubs are connected to sea-based digital spokes – roughly 500 undersea fiber optic cables that span over 870 million miles and transmit over 99% of all intercontinental data traffic, carry more than $10 trillion of financial transactions every day, and serve as the backbone for the global internet. Elon Musk's Starlink and Amazon's Project Kuiper may have popularized the idea of satellite internet, but the digital world is connected by sea, not by air. Satellites cannot compete with submarine cables when it comes to digital communication capacity, cost, speed, or transaction time (latency). They transmit less than one-half of one percent of such traffic.[83]

Globally, demand for international bandwidth is nearly doubling every two years. The market for submarine fiber optic cables, estimated at $18.2 billion in 2022, is slated to reach $48 billion by 2030, growing at a compound annual rate of 12.9%.[84]

Subsea cables serve as an additional proxy for the ties that bind continents. The transatlantic data seaway is the busiest and most competitive in the world. Submarine cables in the Atlantic carry more than twice the traffic of transpacific routes and intra-Asian routes. In recent years the trans-Atlantic route has also registered the most rapid pace of growth: between 2018 and 2022, trans-Atlantic lit capacity – the amount of capacity actually running over a cable – increased over 3-fold (Table 16).[85]

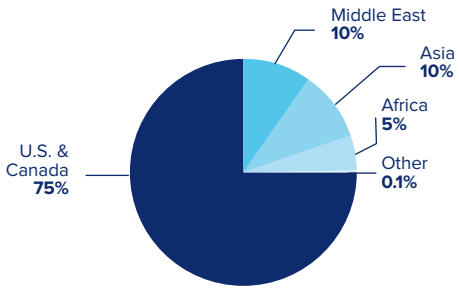
Table 16. Lit Submarine Cable Supply by Route (Lit Capacity, Tbps)



Lit capacity means the amount of capacity actually running over a cable. Trans-Atlantic capacity refers to the North Atlantic. Trans-Pacific capacity refers to the North Pacific. Intra-Asian capacity only includes cables with landings in both Hong Kong and Japan.
Source: Telegeography, "Transport Networks Forecast Service," 2023.

The trans-Atlantic route accounted for 75% of Europe's total interregional bandwidth in 2021. The Middle East and Asia each accounted for 10%, Africa 5%, and other regions for 1%. There are land-based networks that link Europe to Asia, but they boast far less capacity than subsea cables – and all of them go through Russia.[86]

Table 17. Share of European Interregional Bandwidth by Region



Data for 2021. Source: Telegeography.

North America and Europe are connected via 17 subsea cables. The extend from the U.S. East Coast, primarily from New York, New Jersey, Massachusetts, and Virginia. They land in the UK, France, Denmark, Norway, Ireland, Spain and Portugal. Transatlantic subsea routes are building out fast, as capacity demands grow. In 2022, total transatlantic capacity was boosted 70% just by two new powerful transatlantic cables: Grace Hopper, which now extends over 3,800 miles from New York to the Cornish seaside resort town of Bude in the UK and over 3,900 miles from New York to Bilbao in Spain; and Amitié, which now connects Massachusetts with Bude and with Le Porge in France across 4,100 miles of subsea terrain.[87]

Myrtle Beach, South Carolina, is quickly emerging as a new Atlantic cable hub. In 2024, it will be home to two new cables: Google's Firmina, stretching 8,700 miles to Las Toninas, Argentina, with landing points in Praia Grande, Brazil and Punta del Este, Uruguay; and Meta's Anjana, stretching 4,400 miles to Santander, Spain. In 2026 another new cable, dubbed Nuvem – Portuguese for "cloud" – will connect South Carolina with Portugal via Bermuda.[88]

The digital Atlantic continues to build out to the south and to the north. 2Africa, the world's longest subsea cable project covering 28,000 miles, is slated in 2024 to connect Europe and the Middle East with 21 landing sites in 16 African countries. The cable is expected to provide more than the total combined capacity of all subsea

Submarine cables in the Atlantic carry more than twice the traffic of transpacific routes and intra-Asian routes.

cables serving Africa at present. In the northern Atlantic, the Leif Erikson Cable System, the first transatlantic cable to be powered with 100% renewable energy, is slated to run 2,600 miles from southern Norway to Goose Bay, Canada, and then on Montreal. The Digital Arctic may also become reality. The Far North Fiber project, led by Alaskan company Far North Digital, Finland's Cinia, and Japan's Arteria Networks, would extend 8,700 miles to connect Scandinavia and Ireland to Japan, passing via the Arctic Northwest Passage, with landings in Greenland, Canada and Alaska. The cable would be the first to be laid on the Arctic seabed and the first to connect Europe to Asia without passing via the Suez Channel.

Security Concerns

Subsea cables are relatively fragile. On average, 2-4 cables break somewhere in the world every week. Most incidents are caused by shipping or environmental damage. In 2012, for instance, Hurricane Sandy cut 11 of the 12 high-capacity cables that connected the U.S. and Europe at that time.[89] More recently, concerns about intentional sabotage have been sparked by disruptions in the Norwegian Ocean and on Norway's Svalbard; explosive damage to the Nord Stream pipelines in the Baltic Sea; and damage to Swedish-Estonian communications cables and a Finland-Estonian natural gas pipeline.

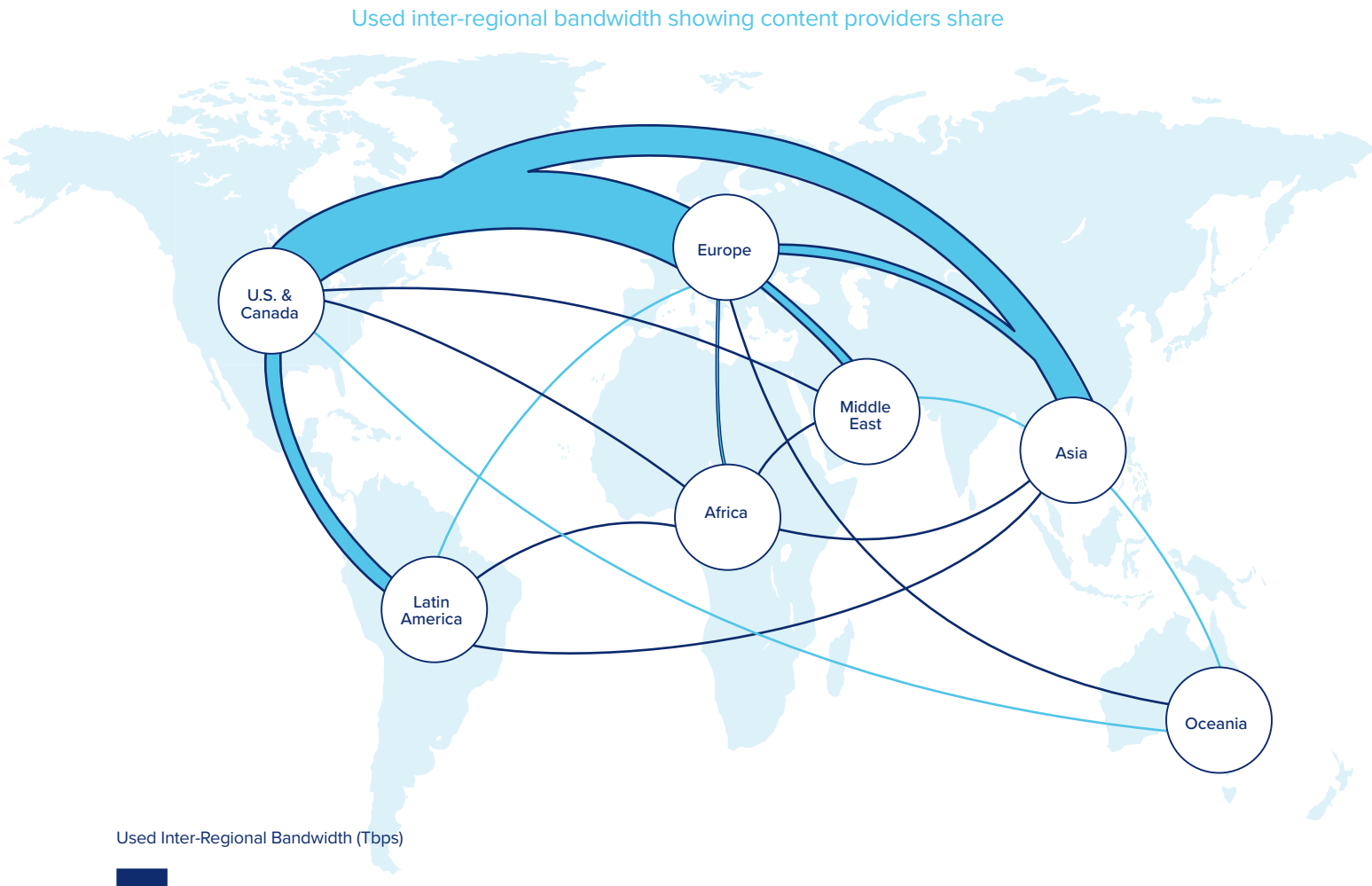
In response, NATO governments are ramping up their own surveillance and deep-sea defensive capabilities to protect maritime infrastructure. NATO leaders have said that "the threat to critical undersea infrastructure is real and it is developing," and have committed the Alliance to protect that infrastructure. Concerns about subsea cable fragility has also prompted subsea cable providers to generate greater redundancy and diversification across their own networks.

Such concerns are not limited to northern Europe. The "most vital bottleneck for the EU," according to a European Parliament study, is the passage between the Mediterranean and the Indian Ocean, where sixteen subsea cables, responsible for 90% of all Europe-Asia capacity, converge in Egypt and the Red Sea.[90] The fragility of this major chokepoint has been highlighted by repeated Yemeni Houthi rebel attacks against commercial shipping vessels. A foretaste of what such disruption could mean came in 2022, when the Asia-Africa-Europe-1 Internet cable connecting Hong Kong to Marseille was severed where it briefly crosses across land in Egypt. Millions were plunged offline; Ethiopia lost 90% of its connectivity; Somalia lost 85%. Several cable providers had planned to generate cable connections that would cross Israel, bypassing Egypt and the Suez Canal, but the Israel-Hamas conflict has cast doubt on the feasibility of those initiatives.[91]

The Hyper-Providers

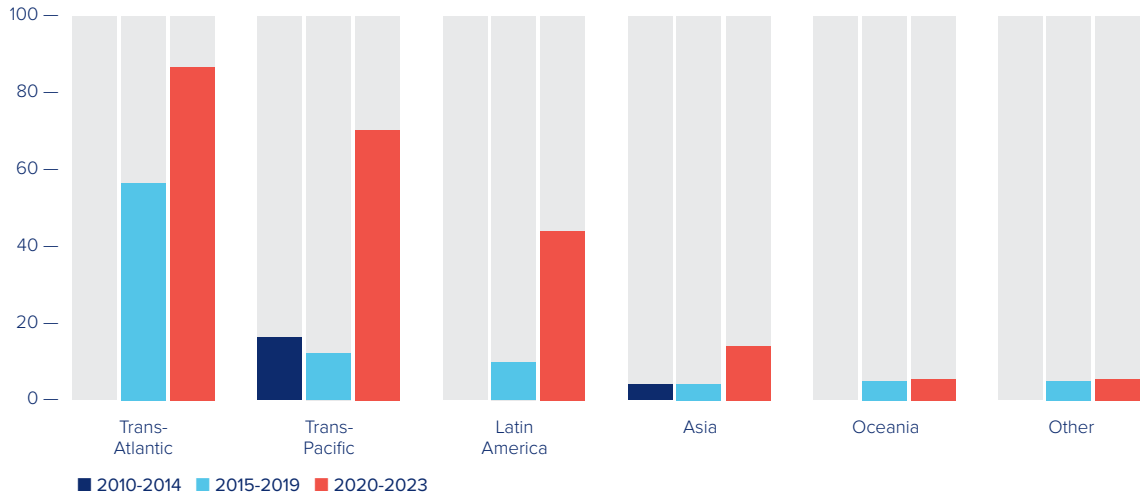
In 2010, most international cable capacity was used by telecommunications companies, governments, and research-educational networks. Only 6.3% was consumed by private network providers of content and cloud services. By 2022, the numbers had flipped: content providers accounted for 71% of used international bandwidth globally and for 92% of used capacity on transatlantic routes. Moreover, the content providers now build and either wholly or partially own those cables themselves. They are largely responsible for the new surge in global subsea digital capacity, and their densest connections are between North America and Europe (Tables 18 and 19).[92]

Table 18. Inter-Regional Capacity and the Cloud



Source: Telegeography.

Table 19. Content Provider Investments Share as % of CAPEX on New Submarine Cables



Source: Telegeography.

Bypassing the Internet

The rise of private content providers as drivers of submarine cable traffic is related to yet another significant yet little understood phenomenon shaping the transatlantic digital economy: more and more companies are working to bypass the public internet as a place to do business in favor of private channels that can facilitate the direct electronic exchange of data among companies.[93]

This move is exponentially increasing demand for "interconnection" – direct, private digital data exchanges that bypasses the public internet – and is another fundamental driver behind the proliferation of transatlantic cable systems. According to Equinix, private interconnection bandwidth is not only distinct from public internet traffic, it is already 20 times the size and is growing twice as fast.[94]

The public internet will remain a pervasive force in most people's lives and a key to digitally-delivered services, e-commerce and the platform economy.[95] Yet private interconnection rivals, and in many cases exceeds, the public internet as a powerful vehicle for business. And as we have shown here, its deepest links are across the Atlantic.

Notes

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