4

The Digital Acceleration

Florida

Spain

The COVID-19 pandemic has further accelerated the digitalization of the transatlantic and global economies, even as it has upended the world's way of living, working and playing. Some industries have been devasted while others have grown more resilient by fast-tracking their digital transformation. Many digital pioneers experienced a gold rush as online spending surged and virtual conferencing, learning and gaming all skyrocketed. Analysts estimate the crisis has sped up the adoption of a wide range of digital technologies by at least two years.[1]

Digital tools powered an unprecedented worldwide sharing of gene sequencing data to track and treat SARS-CoV-2, the virus that causes the COVID-19 disease. The first breakthrough vaccine was a triumph of transatlantic collaboration between Germany's BioNTech and U.S.-based Pfizer. The speed at which the vaccine was developed was an amazing feat of science that was reliant on barrier-breaking synergies between digital and medical advances, and not possible for any previous pandemic.[2]

When the pandemic subsides, more government services will be online and more people will work and learn more flexibly. Digital shopping, virtual fitness, and online courses are all likely to become regular fixtures of societies across the Atlantic and beyond. Digital companies will grow into new areas of business and play an even larger role in our lives than they do now. Between 2020 and 2023 companies are expected to spend $6.8 trillion on digital transformation. By the end of 2021, 60% of global GDP will be digitized.[3]

The numbers continue to astound. This year, humans will generate 74 zettabytes of data – 840 million times the Internet's size in 1997.[4] More than 5.22 billion people now use mobile phones. 4.66 billion are now online. We now spend almost as much time online as we do asleep. Nearly half a billion people began to use social media in 2020, taking the global total to 4.2. billion people who will spend a total of 3.7 trillion hours on social media in 2021 – equivalent to more than 420 million years of combined human existence.[5]

The digital economy is not just connecting billions of people to each other, it is connecting them to billions of things, and it is connecting those billions of things to each other as well.[6] Cisco estimates that 500 billion devices will be connected to the Internet by 2030.[7] This has prompted former Cisco Chairman John Chambers to predict that the globe is already moving beyond the Internet of Things (IoT) to what he calls "the Internet of Everything: the penetration of the World Wide Web into the everyday aspects of our lives."[8]

For the transatlantic economy a number of digital transformations bear watching.

First, as companies and countries in North America and Europe have become more digitized and connected, they have also become more vulnerable to cyberattack and disruption. Cyberattacks spiked during COVID-19, including surreptitious efforts to gain data from scientific and medical research organizations, the World Health Organization, the European Medicines Agency, along with companies, contact-tracing applications, and hospitals in North America, Europe and around the world.[9] Data theft, cyber-espionage, supply-chain attacks, ransomware efforts and spear-phishing scams all rose sharply over the past year. This growing threat landscape has added additional burdens to organizations grappling with business continuity, travel lockdowns, remote working, and generally struggling to stay afloat. It is fueling a cybersecurity market that is expected to grow to nearly $250 billion by 2023.[10]

Second, the pandemic has spurred the further digitalization and internationalization of small- and medium-sized enterprises (SMEs). While in general SMEs tend to lag behind larger firms in terms of digital

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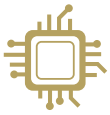
60%

of global GDP will be digitized by the end of 2021

Digital transformations impacting the transatlantic economy

Rise of cyberattacks

Growth of online payments and shopping



Digitization and internationalization of SMEs

Advent of the connected factory

adoption, many SMEs turned to online platforms during COVID-19 to gain efficiencies and access to new markets, sourcing channels and a multitude of digital networks offering e-commerce sales, teleworking capabilities and more. Digital platforms have been a lifeline to restaurant owners who saw their non-delivery sales vanish during lockdowns. Market estimates suggest that the food delivery industry is set to double its 2018 value of $85 billion by 2025. Moreover, the OECD reports that digitalization is "the key strategic means" for SMEs to reach international markets by lowering trade costs and easing access across borders. There is substantial opportunity through further internationalization. According to Eurostat, less than half of small businesses with e-commerce sales sell in other EU countries and an even lower share sell outside of the EU. A similar trend can be observed for medium-sized firms selling via e-commerce: half sell in other EU countries and less than a third sell outside of the EU.[11]

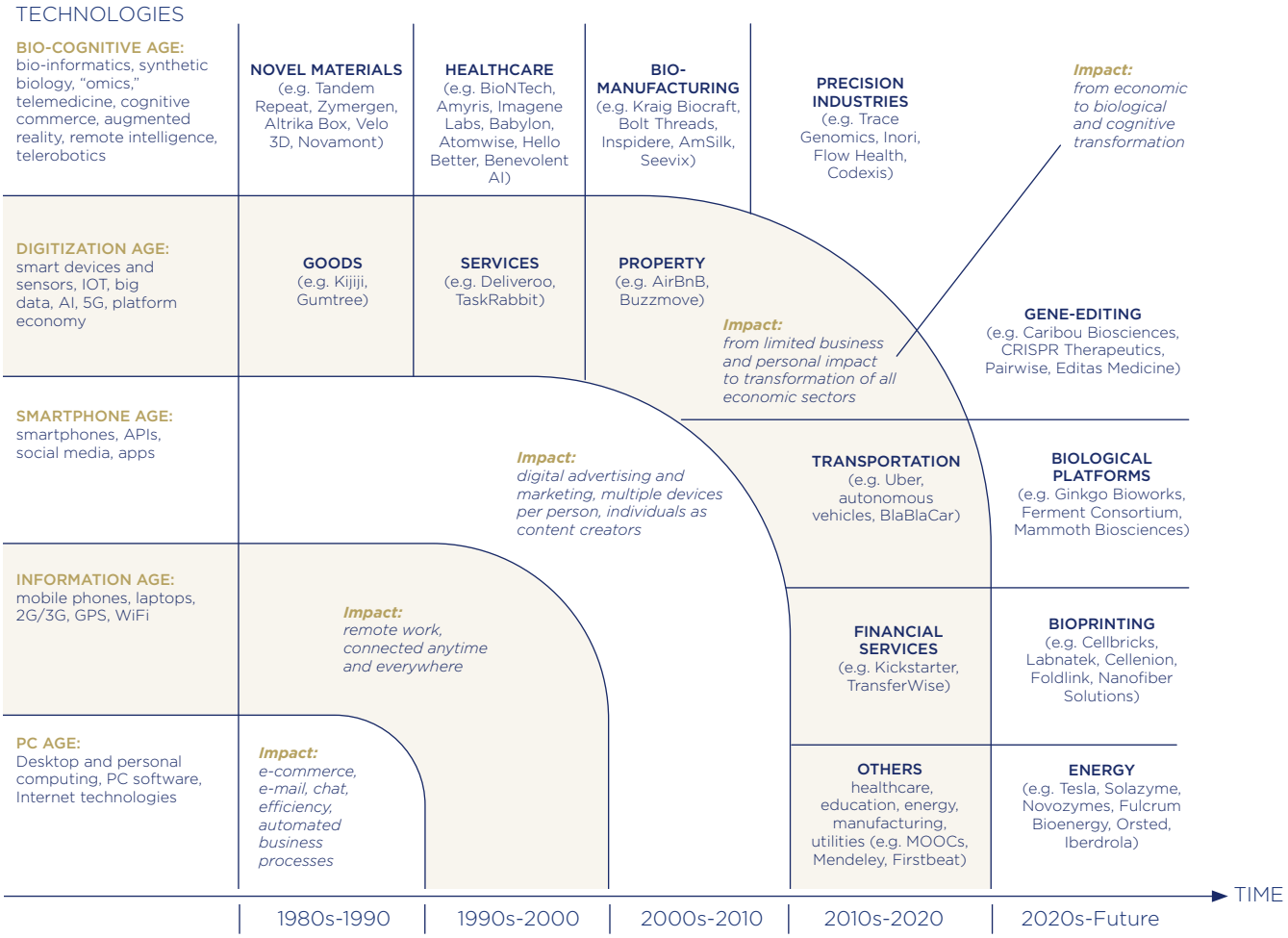
Third, the pandemic accelerated an ongoing transformation in the way people spend and move their money. More than 40% of the world's adult population uses the Internet to pay bills or shop online.[12] FinTech, a combination of technology and financial services, holds promise for deploying funds more nimbly to places and people in need. The consumer-oriented FinTech market alone is expected to reach $11.2 trillion in transaction value by 2024. Digital payments account for the largest segment of that market, with a transaction value of $4.9 trillion in 2020 that is expected to reach $8.4 trillion by 2024. China and the United States lead this market, with Europe struggling. For instance, while cash is still king in Germany, mobile payments in China (such as Alipay and WeChat Pay) have already all but replaced cash.[13]

Germany and other advanced manufacturing countries are likely to fare much better when it comes to another new frontier: the advent of the connected factory. It is estimated that smart factories will have delivered over $500 billion in value, and increased overall manufacturing productivity by a factor of seven, over the past five years. Their potential is enhanced by 3D technologies such as 3D printing, 3D visualization and 3D configuration. These digital innovations are changing how products are designed, manufactured, used and serviced. Mass production is shifting to mass customization. Product-based manufacturing models are increasingly complemented by product-as-a-service models. Extended trade-in-task supply chains are evolving into smarter, connected and more resilient systems. Lower-cost countries, such as China, are no longer the automatic first choice for manufacturing facilities, as producers build capacities closer to their customers and seek to avoid bottlenecks and chokepoints.[14]

Entering the Bio-Cognitive Age

Even as we grapple with the advances and challenges of the "Digital Age," some pathfinders are already charting new revolutionary advances in quantum physics, biology, nanotechnology, behavioral and cognitive sciences and artificial intelligence (AI).[15] In previous surveys we used Table 1 to herald the possibilities. Now we are able to give this chart greater detail, as this new age has already arrived, due to scientific breakthroughs and to the cascading changes wrought by the pandemic. New industries are appearing, led by pioneering companies on both sides of the Atlantic.

Table 1 The Expanding Digital Frontier



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

The pandemic has been a major accelerant of the biological revolution. The pace of scientific research into SARS-CoV-2 has been extraordinary, even when compared to the work that accompanied the SARS epidemic in 2002–03. Scientists mapped the virus genome in weeks rather than months. Less than six months after the discovery of the virus, 161 vaccine and therapy candidates were in the research-and-development pipeline. Now multiple vaccines are available and many more are in development. The breakthrough of successful mRNA vaccines promises to pave the way for a new generation of products.[16]

By 2025, 40% of the datasphere will be in health – the largest of any sector or industry. This explosion of genetic and health data – and increasing abilities to process it – hold significant potential for scientific and medical achievement worldwide. Telemedicine, telepresence, and telesurgery are transforming medical techniques and generating greater cross-border trade in healthcare services.[17]

Synthetic biology, a field that uses biology as a manufacturing platform, has emerged as a foundational element of the $4 trillion bioeconomy. The market for goods and services related to synthetic biology is expected to reach $15 billion by 2025. McKinsey estimates that insights derived from biological data could account for more than half of economic potential in the next decade. Looking farther out, it suggests that as much as 60% of the physical inputs to the global economy could, in principle, be produced biologically. Attaining that full potential is a long way off, yet even modest progress could transform economies, societies, and our lives, including what we eat and wear, the medicines we take, the fuels we use, and how we construct our physical world.[18]

Changing the Nature of Trade

Digitalization is not just changing the scale, scope and speed of trade, it is changing its very nature.

Many services sectors that were once non-tradable – because they had to be delivered face-to-face – have become highly tradable – because they can now be delivered over long distances.[19] Digitalization even blurs the distinction between trade in goods and services. Automakers are now also services providers; online retailers are now also manufacturers. 3D-printing generates products that are a mix of goods and services.[20] Digitalization increases the importance of data flows and intellectual property. It has boosted trade in software design over trade in final products.[21] It offers alternative means of payment and finance. It has lowered shipping and customs processing times and reduced the cost of creating, copying and accessing text, video content and music, while enhancing our ability to access goods and services without owning them.[22]

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

The 2020 Network Readiness Index measures how prepared countries are to leverage the 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 information and communications technologies (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 the United States represent nine of the top ten countries in the world when it comes to technology readiness and adoption (Table 2). Singapore was the lone Asian country in the top ten. The Republic of Korea ranked 14th, Japan 15th, and China 40th.[23]

Digital Globalization: Still Uneven

"Digital globalization" evokes the image of a seamless global marketplace in which unbridled data flows drive goods, services and money across national boundaries without friction. Reality is different. Digital connections are "thicker" between some continents and "thinner" between others – and they are "thickest" between the United States and Europe. Researchers and firms on each side of the Atlantic have been the vanguard of the digital economy. The transatlantic region is the fulcrum of global digital connectivity. North America and Europe generate approximately 75% of digital content for internet users worldwide. U.S. and European cities (Frankfurt, London, Amsterdam, Paris, Stockholm, Miami, Marseille, New York) represent the world's foremost hubs for international communication and data exchange.[24]

Our understanding of the full impact of the digital economy is limited by our inability to measure it. Not only is there is no widely accepted definition of the digital economy, governments simply don't have good data about data. In addition, while many digital services are considered "free," they clearly have value to both producer and consumer. This value is difficult to calculate and none of this is counted in official economic measures.[25]

Failing standard measurements, we have devised five metrics through which we can see more clearly the importance of transatlantic digital connections. These metrics are not mutually exclusive; they are better understood as different lenses through which one can better understand the transatlantic digital economy.

Table 2. **Top Ten Network-Ready Countries, 2020**

Country	NRI Rank	Technology	People	Governance	Impact
Sweden	1	2	4	4	3
Denmark	2	5	1	2	5
Singapore	3	10	5	13	1
Netherlands	4	3	9	3	4
Switzerland	5	1	13	10	2
Finland	6	9	3	5	9
Norway	7	11	8	1	6
United States	8	4	7	8	14
Germany	9	7	12	12	7
United Kingdom	10	8	14	14	10

Source: Soumitra Dutta and Bruno Lanvin, eds., The Network Readiness Index 2020: Accelerating Digital Transformation in a post-COVID Global Economy (Washington, DC: Portulans Institute, 2020), https://networkreadinessindex.org/wp-content/uploads/2020/10/NRI-2020-Final-Report-October2020.pdf.

1. Digital Services and Digitally-Enabled Services

The digital economy is dominated by services, which accounted for over 90% of total U.S. digital economy current-dollar value added in 2017.[26] Two metrics offer us a clearer picture of transatlantic connections in digital services. A narrow view can be had by looking at cross-border ICT services, or digital services as shorthand, which are services used to facilitate information processing and communication.[27] A broader view can be taken by looking at digitally-enabled services: services that can be, but not necessarily are, delivered remotely over ICT networks. These include digital services as well as "activities that can be specified, performed, delivered, evaluated and consumed electronically."[28] Identifying potentially ICT-enabled services does not tell us with certainty whether the services are actually traded digitally.[29] But the U.S. Commerce Department notes that "these service categories are the ones in which digital technologies present the most opportunity to transform the relationship between buyer and seller from the traditional in-person delivery mode to a digital one,"[30] which means a digital transaction is likely and thus can offer a rough indication of the potential for digital trade.[31]

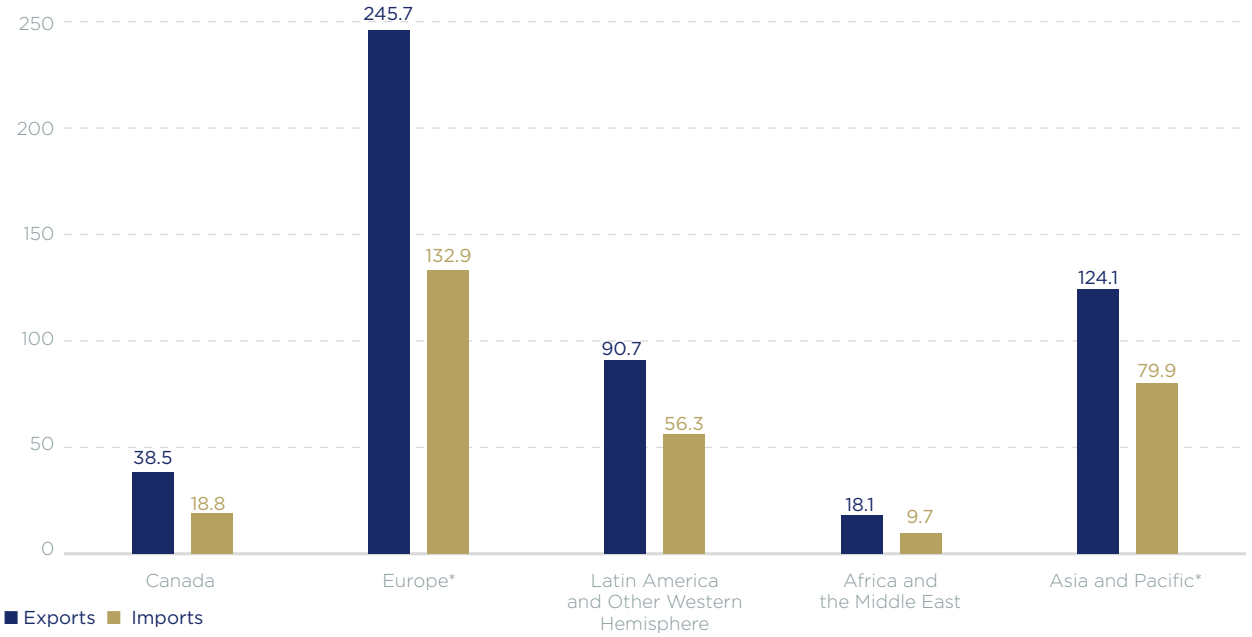
In 2018, the latest year of available data, digitally-enabled services exports amounted to $2.9 trillion, half of total global services exports. Business services exports were by far the largest category, with a global value of $1.2 trillion.[32]

Digitally-enabled services are not just exported directly, they are used in manufacturing and to produce goods and services for export. Over half of digitally-enabled services imported by the United States from the European Union is used to produce U.S. products for export, and vice versa, thus generating an additional value-added effect on trade that is not easily captured in standard metrics.[33] According to the OECD, the top global hubs for imports and exports of digitally deliverable services are the United States, Germany, Ireland, the Netherlands, France and the UK.[34]

In 2019, digitally-enabled services accounted for 59% of all U.S. services exports, 50% of all services imports, and 76% of the U.S. global surplus in trade in services (Table 7).

In 2019 the United States registered a $219.9 billion trade surplus in digitally-enabled services with the world. Its main commercial partner was Europe, to which it exported over $245 billion in digitally-enabled services and from which it imported an estimated $133 billion, generating a trade surplus with Europe in this area of over $112 billion. U.S. exports of digitally-enabled services to Europe were about 2.7 times greater than U.S. digitally-enabled services exports to Latin America, and roughly double U.S. digitally-enabled services exports to the entire Asia-Pacific region (Table 3).

Table 3 U.S. Trade in Digitally-Enabled Services by Major Area, 2019 ($Billions)



**Europe imports of ICT are author's estimates. Actual data for ICT imports in 2019 have been suppressed to avoid disclosure of individual company data.*
Source: Bureau of Economic Analysis, Trade in Potentially ICT-Enabled Services Database.
Data as of July 2020.

The 27 EU member states collectively exported €1.1 trillion in digitally-enabled services to countries both inside and outside the EU in 2019.[35] EU27 imports of digitally-enabled services were also €1.1 trillion in 2019. Excluding intra-EU trade, EU member states exported €585 billion and imported €622 billion in digitally-enabled services, resulting in a deficit of €37 billion for these services (See Table 3 and Table 4).

Digitally-enabled services represented 55% of all EU services exports to non-EU countries and 63% of all EU services imports from non-EU countries.

In 2019 the United States accounted for 22% of the EU27's digitally-enabled services exports to non-EU countries, and 27% of EU digitally-enabled services imports from non-EU countries.[36] The United States purchased €130 billion, according to Eurostat data for 2019, making it one of the largest consumers of EU digitally-enabled services exports.

European countries with the largest estimated value of digitally-enabled services exports were the UK (€261 billion), Ireland (€177 billion), Germany (€173 billion), and the Netherlands (€160 billion).

On the other side of the equation, EU27 member states imported €1.1 trillion in digitally-enabled services, according to 2019 data from Eurostat. 42% originated from other EU27 member states (See Table 4). Another 16% (€167 billion) came from the United States – making it the largest supplier of these services – and 11% came from the UK.

Table 4 Destination of EU27 Exports of Digitally-Enabled Services, 2019 (€Billions)

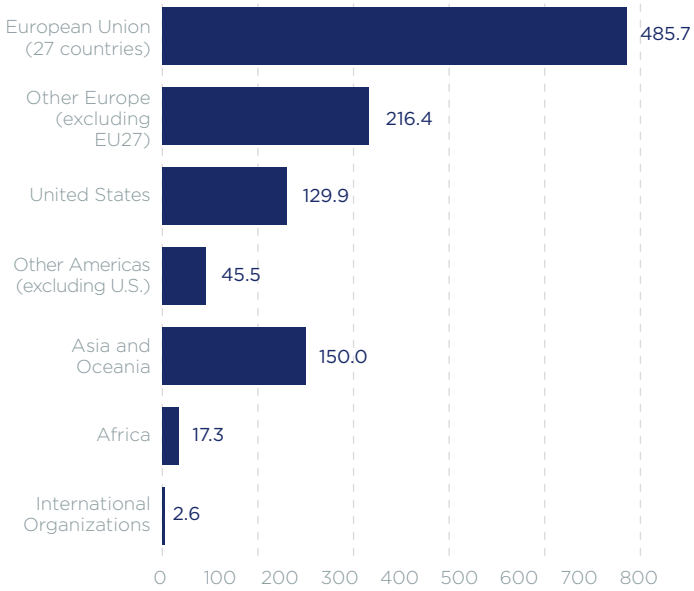
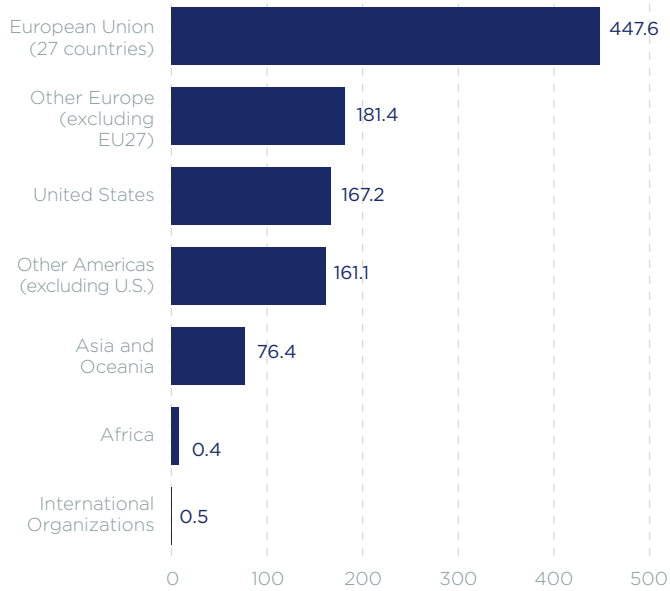


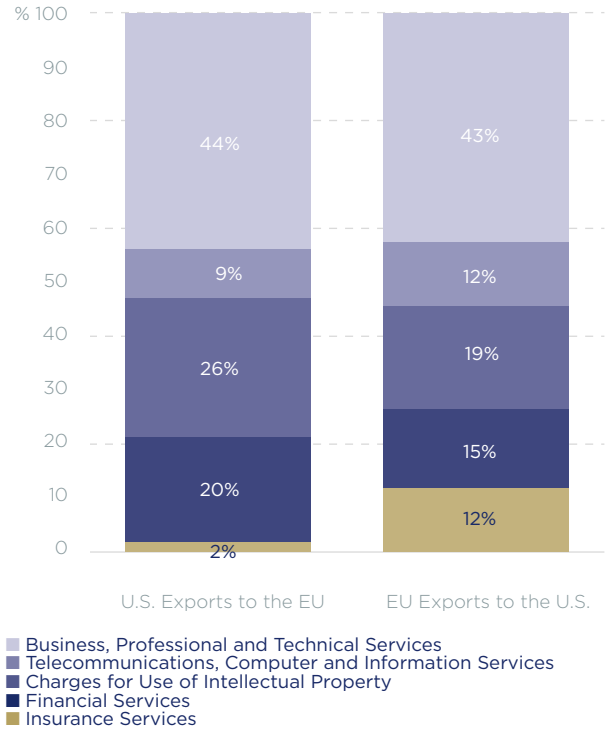
Table 5 Origin of EU27 Imports of Digitally-Enabled Services, 2019 (€Billions)



Note: Digitally-Enabled Services includes finance; insurance; IP charges; telecommunications, computer, information services; R&D services; professional and managemet services; architectural, engineering, scientific and other techhnical services; and select other business services. Asia includes Middle East countries. Data on EU28 exports and imports of services by product is not available from Eurostat for the year 2019.
Source: Eurostat. Data as of March 2021.

Table 6 categorizes U.S.-EU digitally-enabled services trade into five sectors. For both economies, the most important exports are represented by business, professional and technical services, which accounted for 43% of digitally-enabled services exports from the EU to the United States and 44% of digitally-enabled services exports from the United States to the EU in 2019. The second most important category consists of intellectual property, including royalties and license fees, most of which are paid on industrial processes and software, underscoring how integral such transatlantic inputs are to production processes in each economy.[37] Financial services comprise the third largest digitally-enabled services export category.

Table 6 U.S.-EU Digitally Enabled Services Trade by Sector, 2019



Share of Business, Professional and Technical Services in EU exports is based on authors' estimates. Data had been supressed to avoid disclosure of individual company data.
Sources: U.S. Bureau of Economic Analysis.
Data as of July 2020.

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. U.S. services supplied by affiliates abroad were $1.704 trillion, roughly double global U.S. services exports of $875.83 billion. Moreover, half of all services supplied by U.S. affiliates abroad are digitally-enabled (Table 7).

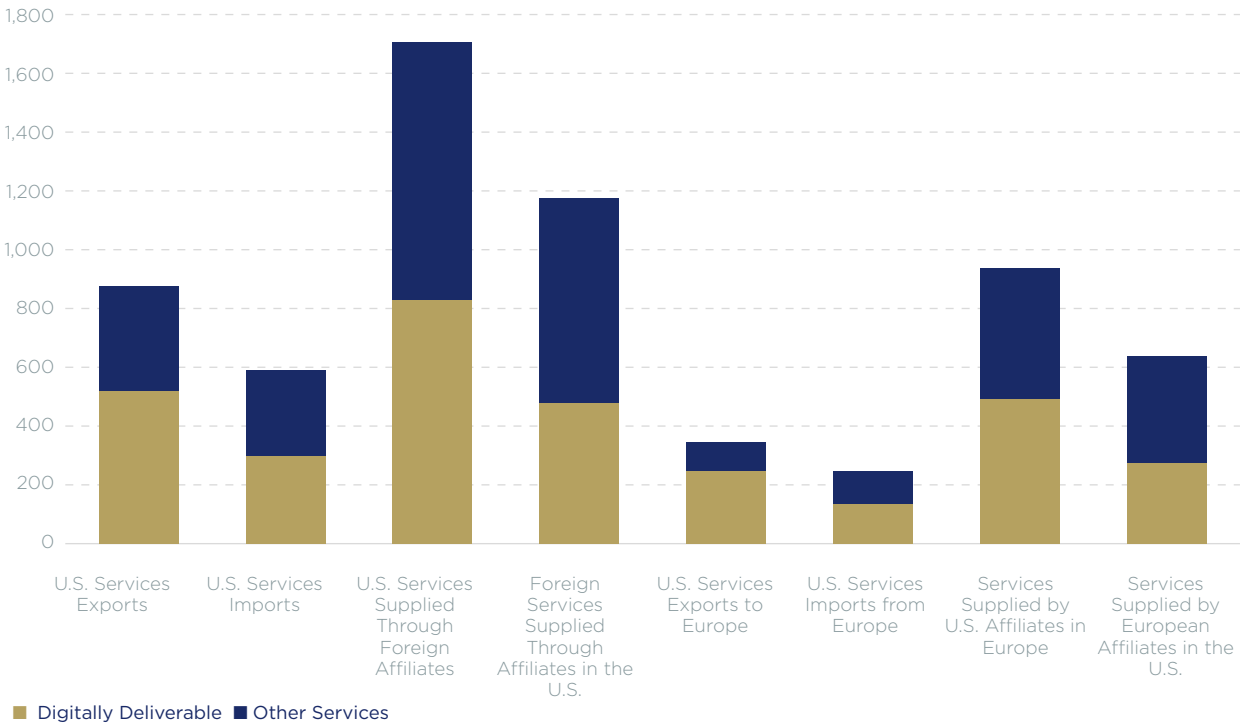
Table 7 underscores the relative importance of digitally-enabled services supplied by affiliates of U.S. companies located in Europe and affiliates of European companies in the United States, versus U.S. and European exports of digitally-enabled services. 52% of the $938 billion in services provided in Europe by U.S. affiliates in 2018 was digitally-enabled. In 2018 U.S. affiliates in Europe supplied $490.51 billion in digitally-enabled services, whereas European affiliates in the United States supplied $273.78 billion in digitally-enabled services. Digitally-enabled services supplied by U.S. affiliates in Europe were almost double U.S. digitally-enabled exports to Europe, and digitally-enabled services supplied by European affiliates in the United States were double European digitally-enabled exports to the United States.

Digitally-enabled services supplied by affiliates
(2018)

$490 billion
U.S. affiliates in Europe

$274 billion
European affiliates in the U.S.

Table 7 Digitally-Enabled Services Trade and Services Supplied through Affiliates* ($Billions)



**Trade data are for 2019. Affiliate data are for 2018, the latest available year.*
Source: U.S. Bureau of Economic Analysis.
Data as of October 2020.

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. Table 8 underscores this dynamic. In 2018, Europe accounted for 69% of the $289.6 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 more than double such investment in the entire Western Hemisphere outside the United States, and 33 times such investment in China. Equivalent U.S. investment in Germany was four times more than in China.[38]

Table 8 Information Services Supplied Abroad by U.S. Multinational Corporations through their MOFAs ($Millions)

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Canada	3,595	4,140	3,971	5,996	6,316	7,135	7,595	7,401	8,487	8,342	9,161	8,991	9,454
Europe	67,270	76,156	85,450	84,117	96,310	110,525	119,123	120,796	157,811	162,409	175,105	174,396	201,161
France	4,045	3,794	4,475	4,713	4,582	5,013	4,768	5,258	6,085	5,894	5,927	6,265	6,989
Germany	5,260	6,031	6,104	6,456	7,143	7,798	7,970	10,599	12,018	11,191	11,394	12,589	13,517
Netherlands	5,925	8,152	9,980	8,674	8,719	9,313	10,196	9,117	12,686	13,590	13,938	16,617	19,667
Switzerland	2,871	2,527	3,197	3,747	4,034	4,419	5,243	4,778	(D)	5,452	5,435	5,404	5,728
United Kingdom	33,512	35,711	31,479	29,906	24,941	26,446	25,996	23,876	30,228	33,512	35,854	37,684	38,268
Latin America and Other Western Hemisphere	7,255	10,845	13,165	13,798	17,578	20,943	21,887	21,751	22,457	20,672	20,320	21,698	23,272
Australia	5,722	6,365	6,369	5,961	6,852	6,960	5,531	7,735	7,045	6,266	6,431	7,018	8,349
Japan	3,447	(D)	6,224	7,856	4,575	4,828	5,204	5,807	7,796	7,821	11,252	9,856	11,378
China	n/a	n/a	n/a	1,252	1,633	1,627	1,581	1,656	3,016	2,675	2,726	3,250	3,599
Other Asia-Pacific and MENA Countries	5,217	(D)	(D)	7,623	8,582	10,320	11,663	14,226	33,461	36,891	36,293	30,498	32,416
TOTAL	**92,507**	**(D)**	**(D)**	**126,603**	**141,846**	**162,338**	**172,583**	**179,372**	**240,073**	**245,076**	**261,288**	**255,707**	**289,629**

MOFA: Majority-owned foreign affiliate.
(D) indicates that the data in the cell have been suppressed to avoid disclosure of data of individual companies.
Source: Bureau of Economic Analysis.

2. E-Commerce

Electronic commerce offers a second window into transatlantic digital connections and complements our lens of digitally-enabled services. E-commerce, which had already been registering double-digit growth in recent years, simply skyrocketed during the pandemic, generating what The Economist called "the biggest shopping revolution in the West since malls and supermarkets conquered suburbia 50 years ago."[39] Online shopping for food and personal care exceeded $400 billion in revenues in 2020, up by more than 40% from 2019. Other sectors took a hit, however: online revenues for travel, mobility and accommodation slumped by more than 50%, a drop of well over half a trillion dollars in annual consumer spending.[40]

When exploring the importance of e-commerce for the transatlantic economy, we again run into some definitional and data challenges. Most estimates of e-commerce do not distinguish whether such commerce is domestic or international. In addition, 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, there are no official data on the value of cross-border e-commerce sales broken down by mode; official statistics on e-commerce are sparse and usually based on surveys rather than on real data.[41]

Nonetheless, we can evaluate and compare many different estimates and surveys that have been conducted. According to UNCTAD, global e-commerce was worth $25.6 trillion in 2018 – equivalent to 30% of global gross domestic product.[42]

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. In 2018 B2B e-commerce accounted for 83% ($21 trillion) of the total value of global e-commerce, almost five times larger than business-to-consumer (B2C) transactions ($4.4 trillion).[43]

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. By 2023 cross-border B2B commerce is expected to account for two-thirds ($1.78 trillion) and cross-border B2C commerce for one-third ($920 billion) of an overall global cross-border e-commerce market of $2.7 trillion.[44]

Including all types of e-commerce, the United States is the top market in the world; online sales there are 2.6 times higher than in Japan and 3.8 times higher than in China. North America and Europe account for six of the top 10 e-commerce countries (Table 9). China has the largest number of internet buyers at 610 million; its large B2C e-commerce market reflects its billion-plus population. China is underweight, however, when it comes to B2B e-commerce. China's e-commerce activities as a share of GDP (17%) are also the lowest among the world's top e-commerce countries.

When it comes to cross-border B2C e-commerce sales, China and the United States lead in terms of total value, but the UK leads in terms of B2C e-commerce as a share of overall goods exports (8.2%) and overall B2C e-commerce sales (15%) (Table 10). Germany, France and Italy also record higher shares of cross-border sales as a share of overall B2C e-commerce activities. For some smaller European countries, the shares are even higher, for instance Belgium (30%), Ireland (27%), and Austria (18%).[45]

Table 9. Top 10 Countries by E-Commerce Sales

Rank	Economy	Total ($ billion)	As % of GDP	B2B ($ billion)	%) of all e-commerce	B2C ($ billion)
1	United States	8,640	42	7,542	87	1,098
2	Japan	3,280	66	3,117	95	163
3	China	2,304	17	943	41	1,361
4	Korea (Rep.)	1,364	84	1,263	93	102
5	United Kingdom	918	32	652	71	266
6	France	807	29	687	85	121
7	Germany	722	18	620	86	101
8	Italy	394	19	362	92	32
9	Australia	348	24	326	94	21
10	Spain	333	23	261	78	72
	Top 10 Total	*19,110*	*35*	*15,772*	*83*	*3,338*
	World	**25,648**	**30**	**21,258**		**$4,390**

Source: UNCTAD. Data for 2018, latest available. B2B: Business-to-Business. B2C: Business-to-Consumer. .

Table 10. Cross-Border B2C Sales of Top Ten Merchandise Exporters

Rank	Economy	Total ($ billion)	As % of merchandise exports	% of B2C
1	China	100	4.0	7.3
2	United States	85	5.1	7.8
3	United Kingdom	40	8.2	15.0
4	Hong Kong	35	6.2	13.1
5	Japan	21	2.9	12.2
6	Germany	15	1.0	14.9
7	France	12	2.0	10.6
8	Italy	4	0.8	13.9
9	Korea (Rep.)	3	0.5	3.2
10	Netherlands	1	0.2	4.4
	Top 10 Total	*317*	*3.2*	*9.6*
	World	**404**	**2.1**	

Source: UNCTAD. Data for 2018, latest available B2C: Business-to-Consumer.

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 digital 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.[46]

The OECD reports that the COVID-19 pandemic has caused a surge in the use of online platforms in OECD and G20 countries, but that this surge has been very uneven across sectors and countries. Online platforms in areas where activities could be pursued without physical proximity (e.g. mobile payments, online marketplaces, restaurant delivery) saw a rise in traffic above 20%. In other areas, however, where physical proximity is needed to consume the service being provided (e.g. accommodation, restaurant booking and transport), platform use declined sharply (-70%). The uneven use of online platforms across countries and regions is also a result of differences in access to digital infrastructure.[47]

According to Forrester, online marketplaces will account for 67% of global e-commerce sales by 2022.[48] While they have become known primarily for business-to-consumer (B2C) e-commerce, they are beginning to impact the far larger business-to-business (B2B) e-commerce market. Digital B2B platforms are likely to transform the Industrial Internet of Things (IIoT) by rendering data and information from countless sensors and smart devices usable, thus accelerating the digitalization of industry. Countries with a strong industrial base, such as Germany, stand to profit.

Platforms have also supercharged consumer-to-consumer (C2C) e-commerce (also known as peer-to-peer or P2P e-commerce), such as online distance work, music and video streaming, medical equipment and healthcare, retail, legal services, human resources and food delivery. At the same time, in 2020 the pandemic disrupted key segments of this model, such as home and car sharing.

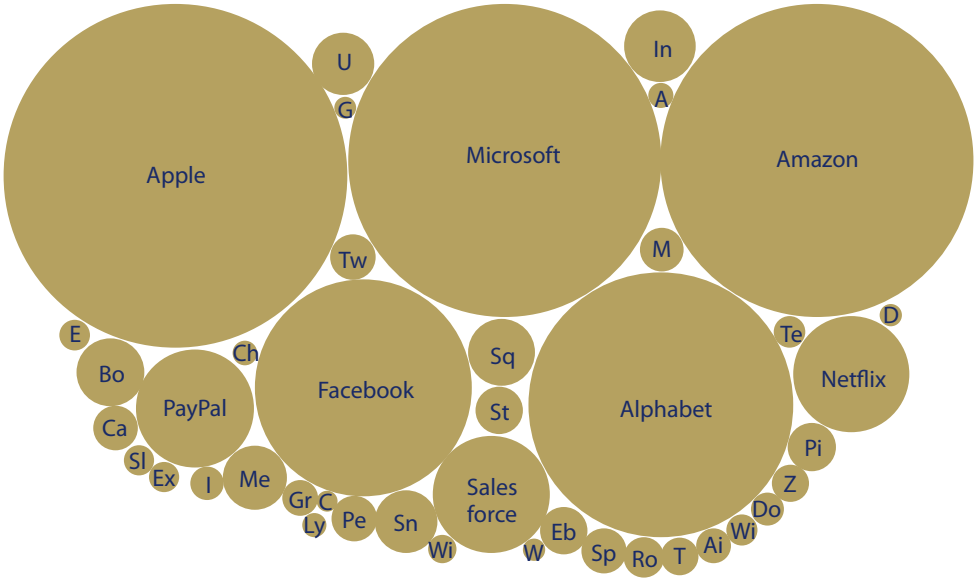
The total market value attributed to platform economics was estimated at $7 trillion in late 2018. It is projected to expand to around $60 trillion by 2025, or nearly one-third of all global commerce.

U.S. companies are leading platforms, although they are not alone. Next are firms from China, like Alibaba's AliExpress, which is among the fastest growing online marketplaces in Europe. European companies account for a marginal share of the market capitalization of the world's top digital platforms, and on average they are markedly smaller than their U.S. and Chinese counterparts (Table 11). This is causing considerable anxiety in European capitals that Europe is missing the platform revolution.

Despite the EU's effort to create a Digital Single Market, the European market remains relatively fragmented in terms of languages, consumer preferences and rules and regulations, which makes it much harder to achieve the kind of scale that platform companies have achieved in the large continental markets of the United States or China. There is also a more risk-averse culture that makes it generally harder to secure funding for potentially chancy bets on unproven technologies.[49]

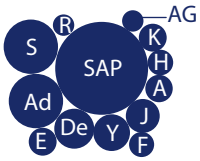
Table 11 **Geographical Distribution of the Top Global Platforms.** Based on MarketCap/last-known venture round valuation. Overall top 100 value $12.6 trillion. (October 2020)

America



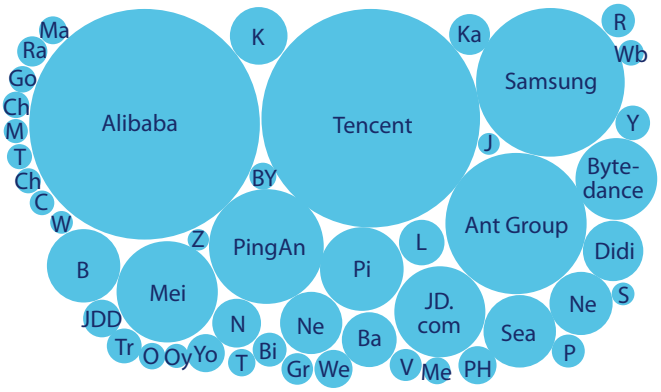
Airbnb
Alteryx
Booking
Carvana
Compass
Chegg
Doordash
Dropbox
Ebay
Etsy
Expedia
Grainger
Grubhub
Instacart
Intuit
Lyft
Match
MercadoLibre
Uber
Peloton
Pinterest
Roku
Slack
Snap
Splunk
Square
Stripe
Teladoc
Twilio
Twitter
Wikipedia
Wish
Zillow

Europe



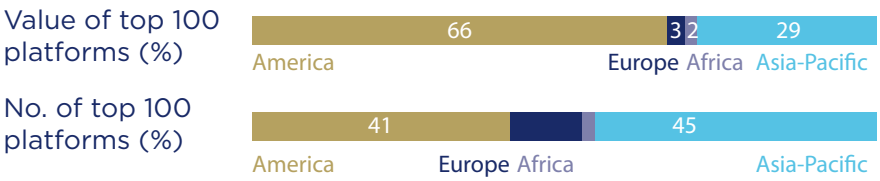
Adevinta
Adyen
Autotrader **G.**
Delivery Hero
Edenred
Hellofresh
Farfetch
Klarna
Revolut
Spotify
Just Eat T.
Yandex

Asia-Pacific



Africa

Baidu
Beike
Bilibili
BYJU
Chehaoduo
Coupang
Didi Chuxing
Go-Jek
Grab
JD Digits
Joyy
Kakao
Kuaishou
Lufax
Manbang
Meicai
Meituan
Naver
Netease
Ola
OYO
Paytm
Pinduoduo
PingAn Health
Rakuten
Rea
Sea Group
Sensetime
Tokopedia
Trip.com
VipShop
WeBank
WeOoctor
Weibo
YonYou



Sources: UNCTAD; Holger Schmidt, Hamidreza Hosseini, https://www.netzoekonom.de/plattform-oekonomie/.

Netzoekonom.de I TU Darmstadt I Ecodynamics.io I Platform-Index.com

Online marketplaces generated 59% ($94 billion) of the overall cross-border e-commerce market turnover of $160 billion in the EU and UK in 2019. U.S. platform companies accounted for six of the top ten marketplaces in Europe; Amazon accounted for a quarter of the market. Marketplaces with European capital, led by Vinted, G2A, Farfetch and Zalando, represented 11% of the market (Table 12). In our 2020 report we offered examples of successful European cross-border marketplaces that show how companies can achieve success even from relatively small home economies. It is expected that in 2025, marketplaces will represent 65% of cross-border online sales in Europe.[50]

Table 12 Top Ten Cross-Border Marketplaces Operating in Europe

1.	Amazon (US)
2.	eBay (US)
3.	AliExpress (China)
4.	Etsy (US)
5.	Discogs (US)
6.	Wish (US)
7.	Vinted (Lithuania)
8.	G2A (Poland)
9.	Farfetch (UK)
10.	Bandcamp (US)

Source: Cross-Border Commerce Europe, "Top 100 Cross-Border Marketplaces Europe. An Annual Analysis of the Best Global Cross-Border Platforms Operating in Europe, EU 28 Including UK," September 24, 2020, https://www.cbcommerce.eu/press-releases/press-release-top-100-cross-border-marketplaces-europe-an-annual-analysis-of-the-best-global-cross-border-platforms-operating-in-europe-eu-28-including-uk/.

4. Cross-Border Data Flows

Another way to understand transatlantic digital connections is to appreciate the role of cross-border data flows, which not only contribute more to global growth than global trade in goods, they underpin and enable virtually every other kind of cross-border flow. By the end of this year, cross-border bandwidth is slated to be 400 times what it was in 2005. By that time, global Internet Protocol (IP) traffic, a proxy for data flows, is projected to reach 150,700 gigabytes (GB) per second, over 3 times more than three years ago.[51]

For most of the history of the Internet, transatlantic flows of data were the fastest and largest in the world.[52] That dominance is dissipating, however, as data flows diffuse and as companies face significant and growing legal uncertainty in transferring personal information out of the European Union. In July 2020 the Court of Justice of the European Union invalidated the Privacy Shield framework that enabled over 5,000 mostly small- and medium-sized enterprises to transfer personal data for commercial purposes. The Court and European privacy regulators have raised concerning questions about other data transfer tools, including standard contractual clauses, which are used by the majority of companies sending personal information out of Europe.[53] This re-opened transatlantic disputes over privacy protections, disrupted transatlantic data flows, and further chilled the transatlantic economy, as prominent European officials called explicitly for data localization.[54]

According to Nikkei, the Chinese mainland and Hong Kong, the telecommunications gateway to the mainland, together account for 23% of the world's data.[55] That is almost double that of the United States (Table 13). In part because of China's burgeoning mobile payments platforms and its Belt and Road infrastructure initiatives, Chinese data flows are growing substantially with other Asian countries, which accounted for more than half of data flows in and out of China in 2019. The U.S. share of data flows in and out of China fell from 45% in 2001 to 25% in 2019.

Table 13 Countries with the Most Cross-Border Data, 2001-2019

2001	Rank	2019
United States	1	China/Hong Kong
United Kingdom	2	United States
Germany	3	United Kingdom
France	4	India
Japan	5	Singapore
China/Hong Kong	6	Brazil
Brazil	7	Vietnam
Russia	8	Russia
Singapore	9	Germany
India	10	France

Source: Nikkei Asia, November 25, 2020, https://vdata.nikkei.com/en/newsgraphics/splinternet/.

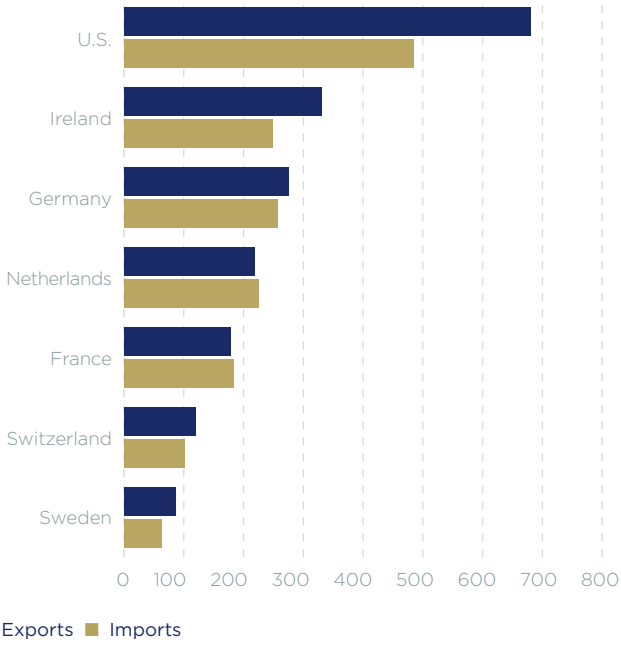
Global data flows now contribute more to global growth than global trade in goods

Data flows are not necessarily a proxy for commercial links, since data traffic is not always related to commercial transactions.[56] 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."[57]

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.[58] 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 but instead reveals itself as "consumer surplus." McKinsey estimates that this "consumer surplus" from the United States and Europe alone is close to €250 billion ($266.4 billion) each year.[59]

In other words, data flows are commercially significant, yet their extent, as well as their commercial value, are hard to measure and are in constant flux. The OECD has 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 has 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.[60]

Table 14 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). UK is not included due to differing data calculations, but OECD indicates the UK also ranks among the top traders in this category. Source: OECD, Perpectives on the Value of Data and Data Flows, December 2020.

5. Digital Hubs and Spokes: The Hardware of the Transatlantic Digital Economy[61]

Kleyerstrasse 90 is the address of an unassuming five-story building in Frankfurt am Main, Germany. It is also the busiest network node in the world, a "carrier hotel" data center where California-based Equinix rents equipment, space, and bandwidth to customers connected to every continent.[62]

Kleyerstrasse 90 is emblematic of the role that European and U.S. cities play as major cross-border digital hubs. Europe is the global leader, with tremendous connected international capacity. Frankfurt, London, Amsterdam and Paris substantially outpace North American and Asian cities (Table 15). Frankfurt's connected capacity, for instance, is over

three times greater than that of Los Angeles and almost five times greater than that of Singapore, the Asian leader. Marseille, France has become a major hub for traffic between Europe, Africa and the Middle East. The United States accounts for about 40% and Europe for an additional 35% of so-called colocation data centers. Each hosts more data centers than Asia, Africa, the Middle East and Latin America combined.[63]

Table 15 Highest Capacity International Internet Hub Cities

City	2020 Bandwidth (Tbps)
Frankfurt, Germany	110.6
London, UK	74.8
Amsterdam, Netherlands	71.2
Paris, France	67.9
Singapore, Singapore	56.3
Hong Kong, China	33.8
Stockholm, Sweden	32.0
Miami, U.S.	30.9
Marseille, France	28.8
Los Angeles, U.S.	25.2

Domestic routes omitted.
Source: Telegeography, The State of the Network 2021, https://www2.telegeography.com/hubfs/assets/Ebooks/state-of-the-network-2021.pdf.

These digital hubs are connected to digital spokes – the undersea fiber optic cables that transmit 95% of all intercontinental telecommunication traffic.[64] These cables serve as an additional proxy for the ties that bind continents. They show clearly that the transatlantic data seaway is the busiest in the world. Submarine cables in the Atlantic already carry 55% more data than transpacific routes, and 40% more data than between the United States and Latin America. Telegeography estimates a compound annual growth rate of 38% in transatlantic capacity until 2025. 8 new transatlantic cables will be needed by 2027 just to keep up with expected increases in demand, compared to 4 for intra-Asian routes, 3 for transpacific routes, and just one for U.S.-Latin American routes.[65] Military agencies also build submarine cables, yet those do not appear on public maps. Suffice it to say that if such connections are also considered, transatlantic submarine cables are even more dense than commonly depicted.[66]

Demand for international bandwidth is doubling every two years. All the stay-at-home activity induced by COVID-19 boosted average international internet traffic by 48%,[67] although plans to build out further submarine cable infrastructures lapsed, as cable ships logged months of inactivity.

The EU is building out its subsea cable infrastructure. The Ella Link from Sima, Portugal to Fortaleza, Brazil, is slated to come online in the first half of this year. Portugal is using its term at the helm of the European Council in the first half of 2021 to push for a pan-European investment plan to roll out additional submarine data connections in the Mediterranean, the North Sea, and with other continents. The initiative is prompted in part to alleviate potential chokepoints when it comes to European reliance on transcontinental data flows. A good deal of data to and from the United States from Europe, for instance, traverses the UK first. With the UK no longer in the EU, some are concerned that data flows could be subjected to additional legal restrictions. European connections to East Africa and Asia rely almost exclusively on cables crossing Egypt and the Red Sea, giving Telecom Egypt significant leverage in global data traffic that could be reduced via new cable routes. European interest in greater diversification is also prompted by concerns about undue reliance on Chinese carriers and the need to address the potential susceptibility of Europe's subsea networks to cyberespionage and interference.[68]

The new surge in transatlantic capacity, however, is being driven by private networks, mainly providers of content and cloud services, which have displaced national telecommunication carriers as the major investors in subsea cables and the largest source of used international bandwidth. Content providers keen on getting closer to customers and achieving economies of scale are quickly pushing the digital frontier. Rather than rely on leasing arrangements with backbone providers, they see advantages in owning these cable networks themselves as they anticipate continuing massive growth in bandwidth needs. Their densest connections are between North America and Europe. In 2006 backbone providers accounted for over 80% of international bandwidth. By 2019, content providers were accounting for 64% of used international bandwidth globally and a whopping 90% on transatlantic routes.[69]

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. Businesses are moving their computing from centralized data centers to more distributed locations. Analysts estimate that more than 50% of enterprise-generated data will be created and processed outside centralized data centers or cloud by 2023.[70]

This move is exponentially increasing demand for "interconnection" – private digital data exchange between businesses – and is another fundamental driver behind the proliferation of transatlantic cable systems.[71]

Private interconnection bandwidth is not only distinct from public internet traffic, it is slated to grow much more quickly and become much larger. Equinix projects that interconnection traffic – direct, private connections that bypass the public Internet – will see a three-year compound annual growth rate (CAGR) of 45%. This far exceeds the expected CAGR of global Internet traffic.[72]

It is unlikely that the public Internet is doomed, since it is such a pervasive force in most people's lives and a key to digitally-delivered services, e-commerce and the platform economy. Yet private interconnection is rising alongside the public Internet as a powerful vehicle for business. And as we have shown here, its deepest links are across the Atlantic.[73]

Endnotes

1 Rana Foroohar, "Big Tech's viral boom could be its undoing," *Financial Times*, May 17, 2020; Richard Waters, "Lockdown has brought the digital future forward — but will we slip back?" *Financial Times*, May 1, 2020.
2 Gigi Gronvall, "Improving US-EU Effectiveness in Health and Health Security," Woodrow Wilson Center, February 4, 2021, https://www.wilsoncenter.org/article/improving-us-eu-effectiveness-health-and-health-security; "Creating the coronopticon," *The Economist*, March 26, 2020.
3 Statistia, "Spending on digital transformation technologies and services worldwide from 2017 to 2023," January 11, 2021, https://www.statista.com/statistics/870924/worldwide-digital-transformation-market-size/#:~:text=Between%202020%20and%202023%20the,to%202.3%20trillion%20U.S.%20dollars; Ullrich Fichtner, "A Paradigm Shift Accelerated by the Coronavirus," *Der Spiegel*, April 23, 2020, https://www.spiegel.de/international/world/dawn-of-a-new-era-a-paradigm-shift-accelerated-by-coronavirus-a-5b12ce13-625c-42fe-bd22-07b77c0c4321.
4 Arne Holst, "Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2024," Statista, December 3, 2020, https://www.statista.com/statistics/871513/worldwide-data-created/.
5 There are significant differences between countries. GWI reports that Filipinos are the world's biggest consumers of social media, spending an average of 4 hours and 15 minutes per day using social platforms. Users in Japan, in contrast, say they spend less than an hour a day on social media. See Simon Kemp, "Digital trends 2021: Every single stat marketers need to know," the nextweb.com, January 27, 2021, https://thenextweb.com/podium/2021/01/27/insights-global-state-of-digital-social-media-2021/; App Annie, "State of Mobile 2021," https://www.appannie.com/en/go/state-of-mobile-2021/.
6 See Ovidiu Vermesan and Peter Friess, eds., *Digitising the Industry Internet of Things: Connecting the Physical, Digital and Virtual Worlds* (Gistrup, Denmark, 2016), http://www.internet-of-things-research.eu/pdf/Digitising_the_Industry_IoT_IERC_2016_Cluster_eBook_978-87- 93379-82-4_P_Web.pdf.
7 Cisco, Internet of Things, At-a-Glance, https://www.cisco.com/c/dam/en/us/products/collateral/se/internet-of-things/at-aglance-c45-731471.pdf.
8 John Chambers, "The Internet of Everything: Let's Get This Right," Wired, December 14, 2012, https://www.wired.com/2012/12/the-internet-of-everything-lets-get-this-right/.
9 https://www.securityweek.com/eu-regulator-hackers-%E2%80%98manipulated%E2%80%99-stolen-vaccine-documents.
10 Digital Economy Compass 2020, Statista.com; ZDnet; Accenture, 2020 Cyber Threatscape Report, https://www.accenture.com/_acnmedia/PDF-136/Accenture-2020-Cyber-Threatscape-Full-Report.pdf#zoom=50.
11 See OECD, *The digital transformation of SMEs*, February 3, 2021, https://www.oecd-ilibrary.org/industry-and-services/the-digital-transformation-of-smes_bdb9256a-en; "The Soon To Be $200B Online Food Delivery Is Rapidly Changing The Global Food Industry," *Forbes*, September 9, 2019, https://www.forbes.com/sites/sarwantsingh/2019/09/09/the-soon-to-be-200b-online-food-delivery-is-rapidly-changing-the-global-food-industry/?sh=7a6f2eeeb1bc; Eurostat (2020), "Community survey on ICT usage and e-commerce in enterprises," StatLink https://doi.org/10.1787/888934227564.
12 According to Gartner, businesses built on blockchain technology will be worth $10 billion by 2022. Subsequently, by 2026, the business value added by blockchain can grow to slightly over $360 billion dollars. "Blockchain: What's ahead?" https://www.gartner.com/en/information-technology/insights/blockchain.
13 Digital Economy Compass 2020, Statista.com.
14 3D parts produced to address COVID-19 included nasopharyngeal swabs, face shields and circuit splitters. See Karen Queen, "Despite pandemic, manufacturers continue to invest in digital factory plans," themanufacturer.com, October 29, 2020, https://www.themanufacturer.com/articles/despite-pandemic-manufacturers-continue-invest-digital-factory-plans; "In-depth: Industry 4.0 2020," September 2020, Statista.com; "Digital factories 2020: Shaping the future of manufacturing," PWC.de, https://www.pwc.de/de/digitale-transformation/digital-factories-2020-shaping-the-future-of-manufacturing.pdf; "Impact of Industry 4.0 in Global Manufacturing," Globalluxsoft, https://globalluxsoft.com/impact-industry-4-in-global-manufacturing; Yahong Zhang, "Industry 4.0: what it is and how it will change the world as we know it," Hapticmedia.fr, January 26, 2020, https://hapticmedia.fr/blog/en/industry-4.0/; Joshua Oliver, "How 3D printing will transform mass production," *Financial Times*, October 6, 2019; Steven Ezell, "Why Manufacturing Digitalization Matters and How Countries Are Supporting It," Information Technology and Innovation Foundation, April 2018, http://www2.itif.org/2018-manufacturing-digitalization.pdf; Louis Columbus, "Smart Factories Will Deliver $500B In Value By 2022," *Forbes*, July 30, 2017, https://www.forbes.com/sites/louiscolumbus/2017/07/30/smart-factories-will-deliver-500b-in-value-by-2022/?sh=5b307d452d22.
https://www.themanufacturer.com/articles/despite-pandemic-manufacturers-continue-invest-digital-factory-plans/;
15 Daniel S. Hamilton, *The Transatlantic Digital Economy 2017* (Washington, DC: Center for Transatlantic Relations, 2017); Digital Economy Compass 2018, Statista.com, file:///C:/Users/Owner/Downloads/study_id52194_digital-economy-compass.pdf; International Technology and Innovation Foundation (ITIF), "The Task Ahead of US," http://www2.itif.org/2019-task-ahead.pdf.
16 Gronvall, op. cit; Paul A. Rota et al., "Characterization of a novel coronavirus associated with severe acute respiratory syndrome," Science, May 2003, Volume 300, Issue 5624; McKinsey Global Institute, *The Bio Revolution: Innovations transforming economies, societies, and our lives*, May 2020, https://www.mckinsey.com/~/media/McKinsey/Industries/Pharmaceuticals%20and%20Medical%20Products/Our%20Insights/The%20Bio%20Revolution%20Innovations%20transforming%20economies%20societies%20and%20our%20lives/MGI-Bio-Revolution-Report-May-2020.ashx; Alison Snyder, Eileen Drage O'Reilly, "The race to make vaccines faster," *Axios*, April 23, 2020.
17 Lindsay Gorman, "A Silicon Curtain is Descending: Technological Perils of the Next 30 Years," German Marshall Fund of the United States, September 12, 2019, https://www.gmfus.org/publications/silicon-curtain-descending-technological-perils-next-30-years; McKinsey, op. cit.
18 Gronvall, op. cit.; McKinsey, op. cit.
19 WTO, *World Trade Report 2019*, op. cit. A recent UNCTAD research paper (Banga, 2019[55]) identifies a list of "Digitisable products" – those products which are "traded both in the physical form as well as online i.e. downloaded from the Internet e.g. music, e-books, software etc". Banga goes on to explain that the "electronic transmissions" associated with these digital transmissions are increasingly important. "Digital technologies like 3D printing, robotics, and Big Data analytics depend heavily on electronic transmissions and can therefore lead to exponential growth in this trade".
20 Ibid.
21 Ibid; OECD, "The impact of digitalisation on trade," https://www.oecd.org/trade/topics/digital-trade/.
22 Erik van der Marel, "Globalization Isn't in Decline: It's Changing," ECIPE Policy Brief 6/2020, https://ecipe.org/wp-content/uploads/2020/08/ECI_20_PolicyBrief_06_2020_LY06.pdf; Rachel F. Fefer, Wayne M. Morrison, Shayerah Ilias Akhtar, "Digital Trade and U.S. Trade Policy," Congressional Research Service, May 21, 2019, https://fas.org/sgp/crs/misc/R44565.pdf; Suominen, op. cit.
23 Soumitra Dutta and Bruno Lanvin, eds., *The Network Readiness Index 2020: Accelerating Digital Transformation in a post-COVID Global Economy* (Washington, DC: Portulans Institute, 2020), https://networkreadinessindex.org/wp-content/uploads/2020/10/NRI-2020-Final-Report-October2020.pdf
24 See Table 15. Also David Bartlett, "Transatlantic data flows: data privacy and the global digital economy," RSM, January 16, 2018, https://www.rsm.global/insights/economic-insights/transatlantic-data-flows-data-privacy-and-global-digital-economy.
25 For recent efforts, see Daniel Ker and Emanuele Mazzini, *Perspectives on the Value of Data and Data Flows*, OECD Digital Economy Papers, No. 299, December 2020, https://www.oecd-ilibrary.org/docserver/a2216bc1-en.pdf; UNCTAD, *Digital Economy Report 2019*, https://unctad.org/en/PublicationsLibrary/der2019_en.pdf; Erik Brynjolfsson and Avinash Collis, "How Should We Measure the Digital Economy?" Hutchins Center Working Paper #57, Brookings Institution, January 2020, https://www.brookings.edu/wp-content/uploads/2020/01/WP57-Collis_Brynjolfsson_updated.pdf; *OECD-WTO-IMF Handbook on Measuring Digital Trade* and OECD/IMF, "How to Move Forward on Measuring Digital Trade," December 2019, available at https://www.imf.org/external/pubs/ft/bop/2019/pdf/19-07.pdf; *Digital Economy Report 2019*, op. cit.; Fefer, Morrison, Akhtar, op. cit; Christian Ketels, Arindam Battacharya and Liyana Satar, "Digital Trade Goes Global," BCG Henderson Institute, August 12, 2019, https://www.bcg.com/publications/2019/global-trade-goes-digital.aspx.
26 U.S. Bureau of Economic Analysis, Defining and Measuring the Digital Economy Data Tables 1997-2017, April 2, 2019.
27 The U.S. Bureau of Economic Analysis (BEA) defines those services as including three categories of international trade in services: telecommunications services, computer services, and charges for the use of intellectual property associated with computer software.
28 The BEA approach draws on work by UNCTAD and the OECD. See BEA International Data, https://www.bea.gov/iTable/index_ita.cfm; Jessica R. Nicholson, " New BEA Estimates of International Trade in Digitally Enabled Services," May 24, 2016, Bureau of Economic Analysis, http://www.esa.doc.gov/economic-briefings/new-bea-estimates-international-trade-digitally-enabled-services. These products are often referred to as "digitally deliverable" (OECD-WTO-IMF, 2019[50]), meaning that they can, and are increasingly, being delivered in the form of data flows.
29 https://www.ntia.doc.gov/files/ntia/publications/measuring_cross_border_data_flows.pdf; United States International Trade Commission, "Digital Trade in the U.S. and Global Economies, Part 2", Pub.4485, Investigation No.332-540, August 2014, p.47.

30 Jessica R. Nicholson and Ryan Noonan, "Digital Economy and Cross-Border Trade: The Value of Digitally-Deliverable Services," Washington, DC. U.S. Department of Commerce, Economics and Statistics Administration, ESA Issue Brief # 01-14, January 27, 2014, available at http://www.esa.doc.gov/sites/default/files/digitaleconomyandcross-bordertrade.pdf.
31 The OECD/IMF/WTO Handbook defines digital trade as "trade that is digitally ordered and/or digitally delivered," yet data statistics have not yet been aligned to this definition. That leaves us with digitally-enabled services as the default metric. For more, see IMF/OECD, "How to move forward on measuring digital trade," Thirty-Second Meeting of the IMF Committee on Balance of Payments Statistics, Thimphu, Bhutan October 29–November 1, 2019, https://www.imf.org/external/pubs/ft/bop/2019/pdf/19-07.pdf; Joshua P. Meltzer, "The Importance of the Internet and Transatlantic Data Flows for U.S. and EU Trade and Investment," Brookings Institution, Global Economy and Development Working Paper 79, October 2014; Ryan Noonan, "Digitally Deliverable Services Remain an Important Component of U.S. Trade," Washington, DC. U.S. Department of Commerce, Economics and Statistics Administration, May 28, 2015, available at http://www.esa.gov/economic-briefings/digitally-deliverable-services-remain-important-component-us-trade.
32 Digital Economy Report 2019, op. cit.
33 Ibid; Meltzer, op. cit.
34 Ker and Mazzini, op. cit., p. 71.
35 Note that data on EU28 exports and imports of services by product is not available from Eurostat for the year 2019.
36 Note that these figures are sourced from the Eurostat International Trade in Services database, and can vary from the corresponding U.S.-EU bilateral trade figures reported by the U.S. Bureau of Economic Analysis. Differences can occur in how services are measured, classified, and attributed to partner countries, resulting in asymmetries in the two data sources. For more information on these asymmetries, please see Eurostat report, "Transatlantic Trade in Services: Investigating Bilateral Asymmetries in EU-US Trade Statistics, 2017 edition," https://ec.europa.eu/eurostat/documents/7870049/8544118/KS-GQ-17-016-EN-N.pdf/eaf15b03-5dcf-48dd-976f-7b4169f08a9e.
37 Ibid.
38 While affiliate sales are a more important means of delivery for digital services and digitally-enabled services than cross-border trade, the two modes of delivery are more complements than substitutes, since foreign investment and affiliate sales increasingly drive transatlantic trade flows. The fact that digital services and digitally-enabled services are following this same broad pattern of transatlantic commercial flows reinforces our point that intra-firm trade is critical to the transatlantic economy.
39 "The great mall of China," *The Economist*, January 2, 2021.
40 Statista.com. For official definitions and discussion of e-commerce, see U.S. International Trade Commission, Digital Trade in the U.S. and Global Economies, Part 2, Publication Number 4485, August 2014, https://www.usitc.gov/publications/332/pub4485.pdf; U.S. Census Bureau, https://www.census.gov/programs-surveys/e-stats.html; OECD, "E-commerce uptake," http://www.oecd-ilibrary.org/sites/sti_scoreboard-2011-en/06/10/index.html; https://10ecommercetrends.com/10-ecommerce-trends-for-2018/.
41 See UNCTAD, "In Search of Cross-Border E-Commerce Trade Data," Technical Note NO 6 Unedited, April 2016, available at http://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d06_en.pdf.
42 UNCTAD, "Estimates of Global E-Commerce 2018," https://unctad.org/system/files/official-document/tn_unctad_ict4d15_en.pdf; UNCTAD, "Global e-commerce hits $25.6 trillion - latest UNCTAD estimates," April 27, 2020, https://unctad.org/news/global-e-commerce-hits-256-trillion-latest-unctad-estimates.
43 Ibid; https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/march/2018-fact-sheet-key-barriers-digital;
44 "Cross-Border E-Commerce," Statista.com, file:///C:/Users/Owner/Downloads/study_id61740_cross-border-e-commerce.pdf. https://www.continuumcommerce.com; The Paypers, Cross-Border Payments and Commerce Report 2019 – 2020, December 2019, file:///C:/Users/Owner/Downloads/1239955.pdf; PPRO, "2019-2020 Payments and e-commerce report – Western and Central Europe, file:///C:/Users/Owner/Downloads/PPRO-WECE-Report-2020_web.pdf.
45 Statista Digital Market Outlook 2020, eCommerceDB.com.
46 The OECD definition of an online platform is "digital services that facilitate interactions between two or more distinct but interdependent sets of users (whether 6 firms or individuals) who interact through the service via the internet." OECD, Online Platforms: A Practical Approach to Their Economic and Social Impacts, Paris, 2018.
47 OECD, *The Digital Transformation of SMEs*, op. cit.
48 The Paypers, op. cit.
49 Ibid.
50 Cross-Border Commerce Europe, "Top 100 Cross-Border Marketplaces Europe. An Annual Analysis of the Best Global Cross-Border Platforms Operating in Europe, EU 28 Including UK," September 24, 2020, https://www.cbcommerce.eu/press-releases/press-release-top-100-cross-border-marketplaces-europe-an-annual-analysis-of-the-best-global-cross-border-platforms-operating-in-europe-eu-28-including-uk/.
51 *Digital Economy Report 2019*, op. cit.; https://blog.telegeography.com/466-tbps-the-global-internet-continues-to-expand.
52 Fefer, Morrison and Akhtar, op. cit.; Anthony Gardner, "A Transatlantic Perspective on Digital Innovation," September 2015, http://useu.usmission.gov/sp-092015.html.
53 https://www.digitaleurope.org/resources/schrems-ii-impact-survey-report/.
54 See https://www.politico.eu/article/in-small-steps-europe-looks-to-tighten-grip-on-data/; For more on the implications of this decision, see Daniel S. Hamilton, "Europe's new privacy ruling will help fragment the global economy," *Washington Post*, July 22, 2020, https://www.washingtonpost.com/politics/2020/07/22/europes-new-privacy-ruling-will-help-fragment-global-economy/.
55 485.66 million megabits per second, a unit that represents the amount of data that can be sent and received in one second. Comparisons are of the amount of data going in and out of a country or region in one second. See Toru Tsunashima, "China rises as world's data superpower as internet fractures," *Nikkei Asia*, November 25, 2020.
56 James Manyika, Susan Lund, Jacques Bughin, Jonathan Woetzel, Kalin Stamenov, and Dhruv Dhingra, "Globalization: The new era of global flows," McKinsey Global Institute, February 24, 2016, https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/Digital-globalization-The-new-era-of-global-flows,.
57 See "Measuring the Value of Cross-Border Data Flows," Economics and Statistics Administration and the National Telecommunications and Information Administration, U.S. Department of Commerce, September 2016, p. 21, https://www.ntia.doc.gov/files/ntia/publications/measuring_cross_border_data_flows.pdf.
58 Ibid; Manyika, et al., op. cit.; Michael Mandel, "Data, Trade and Growth," Progressive Policy Institute, April 2014, http://www.progressivepolicy.org/wp-content/uploads/2014/04/2014.04-Mandel_Data-Trade-and-Growth.pdf.
59 Manyika, et al., op. cit.; Raghu Das and Peter Harrop, RFID forecasts players and opportunities 2014–2024, IDTechEx, November 2013.
60 Ker and Mazzini, op. cit., pp. 71, 78, 79.
61 TeleGeography, Global Internet Geography, 2013; TeleGeography, Global Internet Map, 2012.
62 Telegeography, "State of the Network 2021," op. cit.
63 *Digital Economy Report 2019*, op. cit.; Jon Hjembo, Telegeography, "The Colocation Sector. Shifting Dynamics and Stable Fundamentals," presentation at Telegeography Workshop, Pacific Telecommunication Council '17, Jan 15-18, 2017.
64 Satellites transmit less than one-half of 1% of such traffic. They cannot compete with submarine cables when it comes to digital communication capacity, speed, or transaction time (latency). See Clifford Holliday, "Re-Imagining Telecom Subsea Cables," *SubTel Forum Magazine*, February 2020; David W. Brown, "10 Facts about the Internet's Undersea Cables," Mental Floss, Nov 12, 2015, http://mentalfloss.com/article/60150/10-facts-about-internets-undersea-cables; Geof Wheelwright, "Undersea cables span the globe to send more data than satellites," *Financial Times*, November 2, 2016; Nicole Starosielski, "In our Wi-Fi world, the internet still depends on undersea cables," The Conversation, November 3, 2015, https://theconversation.com/in-our-wi-fi-world-the-internet-still-depends-on-undersea-cables-49936. Telegeography, "Submarine Cables Frequently Asked Questions," https://www2.telegeography.com/submarine-cable-faqs-frequently-asked-questions.
65 Wayne Nielsen, "North Atlantic Regional Roundup," Presentation to the 2017 Pacific Telecommunications Council, January 2017, https://www.ptc.org/assets/uploads/papers/ptc17/PTC17_Sun_Submarine%20WS_Nielsen.pdf; http://aquacomms.com/wp-content/uploads/P54-55-Aqua-Comms-advertorial.pdf; https://cacm.acm.org/magazines/2020/1/241709-how-the-internet-spans-the-globe/fulltext?mobile=false; Mauldin, op. cit.
66 Ingrid Burrington, "What's Important About Underwater Internet Cables," *The Atlantic*, November 9, 2015, https://www.theatlantic.com/technology/archive/2015/11/submarine-cables/414942/; https://vmblog.com/archive/2019/11/20/infinera-2020-predictions-next-gen-submarine-cable-architectures.aspx#.XisZOchKiM8.
67 Telegeography, "State of the Network 2021," January 2021, https://www2.telegeography.com/hubfs/assets/Ebooks/state-of-the-network-2021.pdf.
68 Laurens Cerulus, "Lisbon eyes undersea investment to bolster EU tech infrastructure, *Politico*, December 10, 2020, https://www.politico.eu/article/submarine-cables-europe-lisbon-eyes-undersea-investment-bolster-tech-infrastructure/; European Commission, "BELLA: A new digital data highway between Europe and Latin America," August 13, 2018, https://ec.europa.eu/digital-single-market/en/news/bella-new-digital-data-highway-between-europe-and-latin-america.
69 Telegeography, "State of the Network 2021," January 2021,op. cit.; Miller, op. cit.; Alan Mauldin, "Rising Tide: Content Providers' Investment in Submarine Cables Continues," Telegeography, May 27, 2016, http://blog.telegeography.com/rising-tide-content-providers-investment-in-submarine-cables-continues; Wheelwright, op. cit.; Miller, "The Colocation Sector: Shifting Dynamics, Stable Fundamentals," Telegeography, February 3, 2017, http://blog.telegeography.com/ptc-colocation-presentation-2017-market-summary; Alan Mauldin, "Content, Capacity, and the Great, Growing Demand for International Bandwidth," Telegeography, May 30, 2018, https://blog.telegeography.com/t-growing-demand-for-international-bandwidth-content-providers-capacity; Alan Mauldin, International Internet Capacity Growth Just Accelerated for the First Time Since 2015," Telegeography, September 20, 2018, https://blog.telegeography.com/international-internet-capacity-growth-just-accelerated-for-the-first-time-since-2015; https://www2.telegeography.com/hubfs/2019/Presentations/Kate-Reilly-Capacity-North-America-2019.pdf; https://www2.telegeography.com/hubfs/2019/Presentations/mythbusters.pdf; Adam Satariano, "How the Internet Travels Across Oceans," *New York Times*, March 10, 2019, https://www.nytimes.com/interactive/2019/03/10/technology/internet-cables-oceans.html; Executive Summary: Telegeography Global Bandwidth Research Service, http://www.dri.co.jp/auto/report/telegeo/files/telegeography-global-bandwidth-research-executive-summary.pdf. Nielsen, op. cit.
70 Justin Dustzadeh, "5 Technology Trends to Impact Digital Infrastructure in 2021," Equinix, January 4, 2021, https://blog.equinix.com/blog/2021/01/04/5-technology-trends-to-impact-digital-infrastructure-in-2021/; Nick Jones and David Cearley, "Top 10 Strategic Technology Trends for 2020: Empowered Edge," Gartner, March 10, 2020, ID G00450640.
71 Jim Poole, "Submarine cable boom fueled by new tech, soaring demand," Network World, March 6, 2018, https://www.networkworld.com/article/3260784/lan-wan/submarine-cable-boom-fueled-by-new-tech-soaring-demand.html.
72 Equinix, GXI Vol.4, Forecasts and Data: Insights for the New Digital Economy, file:///C:/Users/Owner/Downloads/EQIX-GXI-Vol4_Forecast_FINAL_9_Sep%20(3).pdf; https://www.prnewswire.com/news-releases/private-connectivity-at-the-edge-forecast-to-grow-by-more-than-50-percent-annually-300938345.html.
73 See Pacific Telecommunications Council Secretariat, "Is this the end of the internet as we know it?" January 3, 2019, https://www.ptc.org/2019/01/is-this-the-end-of-the-internet-as-we-know-it/.