SECTION THREE

Transatlantic Digital Comparisons

CHAPTER 1

The ICT Sector

Although the digital economy is more than the information and communications technology (ICT) sector, ICT is at the heart of the digital economy.

The ICT Development Index (IDI), a composite index produced by the International Telecommunications Union, compares ICT developments among countries. It uses a three-stage framework called the ICT development process:

- Stage 1: ICT readiness — reflects the level of networked infrastructure and access to ICTs;
- Stage 2: ICT intensity — reflects the level of use of ICTs in the society;
- Stage 3: ICT impact — reflects the results/outcomes of more efficient and effective ICT use.

Advancing through these stages depends on a combination of three factors: the availability of ICT infrastructure and access, a high level of ICT use, and the capability to use ICTs effectively, derived from relevant skills. These three dimensions — ICT access, use and skills — form a framework through which countries can be compared.

Table 3.1.1 presents the findings. The Republic of Korea is ranked highest, while 18 of the top 25 economies are from Europe or North America, and 8 of the top 10 economies are from Europe. The difference in overall IDI values between these top-ranking countries is relatively small, reflecting the high level of ICT development that has been achieved in most developed countries and some high-income developing economies, where there are continued high levels of investment in ICT infrastructure and innovation, as well as high levels of adoption of new services by consumers.

All countries in Europe, apart from Albania, rank above the global average and fall within the high and upper quartiles of the Index, reflecting the region's high levels of economic development. Nonetheless, disparities are evident, as countries in northern and western Europe mostly are ranked higher than those in southern and eastern Europe. The five Nordic countries — Denmark, Iceland, Sweden, Norway and Finland — all rank within the top nine in the region and the top twelve worldwide. Denmark is Europe's top performer.

A second metric offering comparative data is Huawei's Global Connectivity Index (Table 3.1.2), which defines ICT in terms of five key technologies that enable economic digitization: broadband, data centers, cloud services, big data, and the Internet of Things. Huawei argues that investing in these five ICT tech enablers — especially broadband — lays a

TABLE 3.1.1: ICT DEVELOPMENT INDEX - TOP 20 COUNTRIES

ECONOMY	RANK 2015	SCORE
Republic of Korea	1	8.93
Denmark	2	8.88
Iceland	3	8.86
United Kingdom	4	8.75
Sweden	5	8.67
Luxembourg	6	8.59
Switzerland	7	8.56
Netherlands	8	8.53
Hong Kong	9	8.52
Norway	10	8.49
Japan	11	8.47
Finland	12	8.36
Australia	13	8.29
Germany	14	8.22
United States	15	8.19
New Zealand	16	8.14
France	17	8.12
Monaco	18	8.10
Singapore	19	8.08
Estonia	20	8.05

Source: International Telecommunications Union.

BOX 3.1.1: DENMARK: A GLOBAL ICT LEADER

Denmark ranks second in the ICT Development Index, just behind the Republic of Korea. It ranks first globally in ICT use, due to its third-highest fixed-broadband penetration ranking at 41.38 subscriptions per 100 inhabitants, and ninth-highest mobile-broadband penetration ranking at 115.77 subscriptions per 100 inhabitants. Almost all households have access to a computer and an Internet connection at home (94.99% and 93.12%, respectively), and Denmark has the third-highest percentage of individuals using the Internet in the world, at 95.99%. Among the most important ICT developments in Denmark since 2010 has been the roll-out across the country of high-speed wireless Long-Term Evolution (LTE) networks, which by 2020 are expected to connect more subscribers around the world than any other mobile technology.[1] Fixed-broadband coverage is 99%, while LTE mobile-broadband coverage increased from 74% in 2013 to 99% in 2015, well above the European Union average of 59%.[2]
Denmark's national broadband strategy aims to enable all households and businesses to have access to at least 100 Mbps download speeds by 2020. An estimated 70% of all households and businesses had access to infrastructure that could support such speeds by mid-2013, an increase from 60% in the previous year.[3] Data on the uptake of high-speed broadband plans shows that currently 33% of all fixed-broadband subscriptions are at speeds above 30 Mbps (compared with an EU average of 26% per cent), and that 3% of all connections are at speeds above 100 Mbps.[4]

BOX 3.1.2 ICT INNOVATION IN ROMANIA: NEIGHBORHOOD NETWORKS

Although Romania ranks 35th globally in ICT development, in terms of fixed-broadband prices it ranks higher than much richer countries such as Germany, Spain, Australia and even the Republic of Korea, the global ICT leader. The entry-level fixed-broadband plan, which costs less than $9 (corresponding to a relatively low 1.1% of gross national income), is not only affordable but also offers unlimited data at very high speeds (100 Mbit/s). The EU's Digital Agenda Scoreboard 2014 has also highlighted Romania as one of the Europe's leaders (together with Sweden, Latvia and Finland) in terms of offering the highest proportion of ultrafast broadband access (at 100 Mbit/s and above).

A key to the success of Romania's affordable and fast Internet access has been the country's "Neighborhood Networks," a unique networking scheme developed to overcome limited broadband connectivity.

In the early 2000s small, low-cost local area networks (LANs) run by small Internet service providers (ISPs), often using aerial fiber, emerged to generate very high connection speeds among homes within a neighborhood. As more people joined these networks, the large number of LANs increased competition and brought down prices. Consequently, and unlike many countries where the incumbent provider has wide command over the market, broadband service providers in Romania remain diverse, with intra- and inter-modal competition.[5]

Romania faces many digital challenges, particularly mediocre fixed-broadband penetration, and coverage to include rural areas. But the country's Ro-NET Project is expected to reduce Romania's digital urban/rural divide and to hundreds of thousands of new users.[6]

TABLE 3.1.2: GLOBAL CONNECTIVITY INDEX 2016

FRONTRUNNERS		ADOPTERS		STARTERS	
1	United States	17	Spain	38	Philippines
2	Singapore	18	Portugal	39	Egypt
3	Sweden	19	United Arab Emirates	40	Venezuela
4	Switzerland	20	Czech Republic	41	Indonesia
5	United Kingdom	21	Qatar	42	Morocco
6	Denmark	22	Italy	43	Vietnam
7	South Korea	23	China	44	India
8	Netherlands	24	Chile	45	Algeria
9	Japan	25	Malaysia	46	Kenya
10	Norway	26	Russia	47	Ghana
11	Australia	27	Poland	48	Nigeria
12	Germany	28	Saudi Arabia	49	Bangladesh
13	France	29	Romania	50	Pakistan
14	New Zealand	30	Brazil		
15	Canada	31	South Africa		
16	Belgium	32	Mexico		
		33	Colombia		
		34	Thailand		
		35	Turkey		
		36	Argentina		
		37	Peru		

Source: Global Connectivity Index 2016, Huawei Technologies Co., Ltd.

muscular infrastructure for digital transformation and long-term economic health, competitiveness, innovation, and productivity. The Index uses 40 indicators to assess the global connectivity of 50 countries representing 90% of global GDP and 78% of the global population.[7]

According to the Global Connectivity Index, the United States ranks first, followed by Singapore. The Republic of Korea, the leader in the ITU's Index, ranks seventh on Huawei's scale. Six of the top ten performers are European, and once again northern and western European countries are considered "frontrunners," while eastern and southern European countries are considered "adopters," i.e. their focus is on increasing ICT demand to facilitate industry digitization and high-quality economic growth, and register the biggest GDP growth from such efforts in the Index.

While the two Indexes use somewhat different metrics, they underscore a basic point: overall, North America and Europe are both advanced in term of ICT development and connectivity. There are disparities within societies on both sides of the Atlantic, but in general the ICT sector is a muscular backbone of the transatlantic digital economy.

Endnotes

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CHAPTER 2

Digital Density and Investment in Intangible Assets

Cross-border data flows differ fundamentally from traditional trade in goods and services. When a good or a service is sold from Country A to Country B, it is considered an export in Country A's accounts and an import in Country B's accounts. But cross-border data flows defy this logic. When data moves from Country A to Country B, it usually does so because it is copied and then sent digitally to Country B, rather than sent physically. That means even after the sale the item in question did not leave Country A, it is still potentially available in both Country A and Country B.[1] The result: cross-border trade dramatically increases the utility of data to the global economy. The value of these so-called "intangible assets" to the modern knowledge-driven economy is growing in leaps and bounds, but they cannot be measured by traditional means.[2] Important as investments in intangible assets are to companies and countries, in general economists have not properly accounted for them, and official GDP ignores them. How, then, should we quantify the economic value of data flows to a country?

Paul Hofheinz and Michael Mandel attempt to answer that question by comparing the "digital density" of a country — which they define as the amount of data used per capita in an economy — with the amount of money invested in intangible assets as a share of GDP. They define intangibles as investments made by firms in, for instance, research and development (R&D), computerized information, product development or training, and branding. They show that investments in so-called "intangibles" correlate directly with the production and use of data within an economy and is associated with greater digital density.[3] They suggest that digital density may be used as a proxy for consumption of cross-border data flows, and that those countries that improve their digital density through greater data usage will also experience a corresponding rise in investment in intangible assets, which, they conclude, "is the fuel, if not actually the engine, of modern economic success."[4]

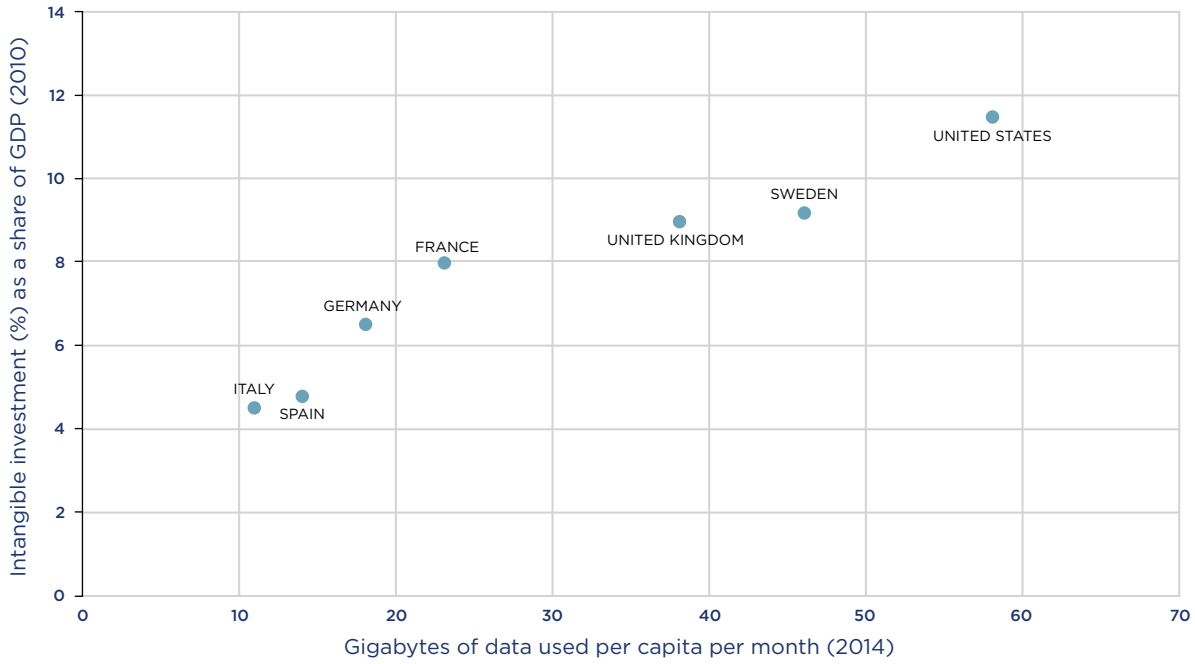
The Hofheinz/Mandel results for 2014 reveal that the United States is clearly in the lead with regard to digital density, followed by countries such as Sweden and the United Kingdom. These countries invest heavily into intangible assets, and individuals living there are heavy consumers of digital data. However, things look less rosy for countries such as Spain, Italy, France and Germany, which are lagging behind. It is estimated that a total of €209 billion worth of investments into intangible assets would be required for these four countries in order to raise their individual digital density level to that of the UK.

The results are similar if one concentrates on the estimated usage of data per capita in 2014. Again, countries like South Korea, the United States and Canada make up the first three places respectively, while countries such as Italy, Spain and Germany have fallen behind and find themselves below the western European average for per capita usage of data.

Accenture and Oxford Economics expand the definition of digital density beyond the limited Hofheinz/Mandel focus on a country's per capita data use. Instead, they define "digital density" as the extent to which economies or industries use digital technologies for economic activity.[6] They take account of more than 50 indicators across four broad activity areas of a business or economy:

- 'Making Markets,' including the digitalization of existing markets and creation of new digital markets;
- 'Running Enterprises,' or businesses' use of digital technologies and activities to execute key business functions;

TABLE 3.2.1: DIGITAL DENSITY AND INVESTMENT IN INTANGIBLE ASSETS



Source: Hofheinz and Mandel.[5]

» "Sourcing Inputs," or the use of digital technologies to source and/or use factors of production such as land, capital, talent, plant, and property; and

» "Fostering Enablers," or changes in institutional and socio-economic environments to facilitate digitalization.

The resulting Accenture Digital Density Index looks at the breadth and depth of digital technologies utilized by an economy or business, as well as the skills, ways of working, and regulatory frameworks needed to realize their economic potential (Table 3.3.2).

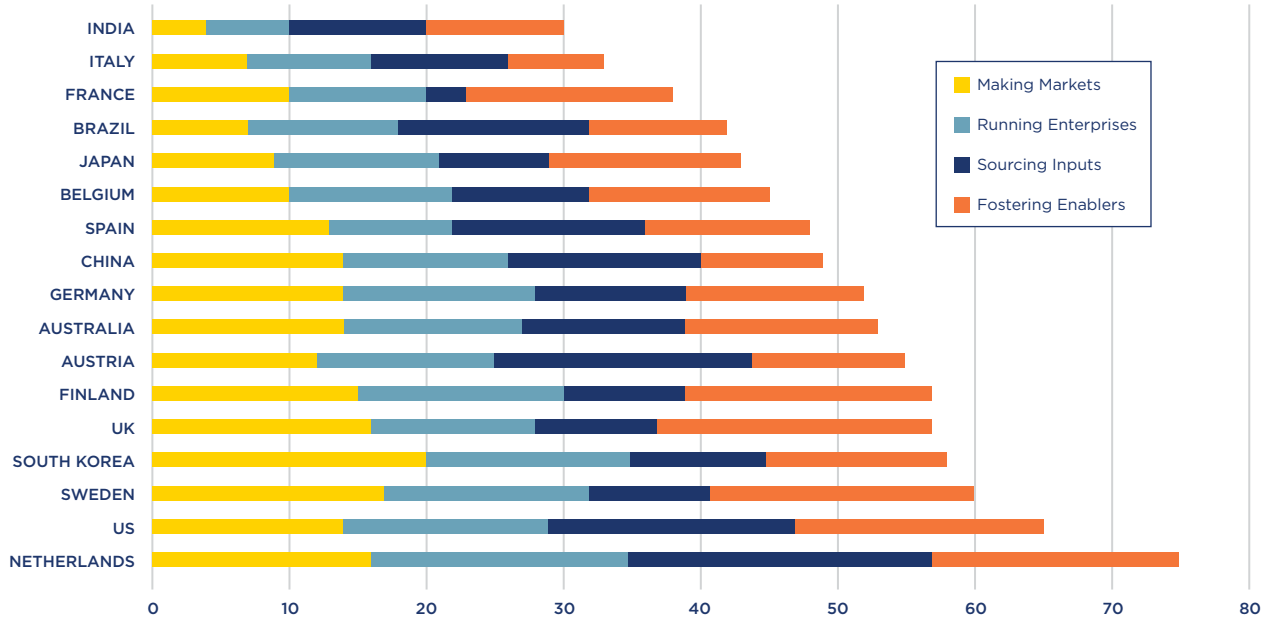
According to the Accenture Index, 11 of the top 17 economies were from North America or Europe. The Accenture Index ranks the Netherlands as the most "digitally dense" country in the world, followed by the United States and Sweden. The Netherlands outpaced other countries in two major areas. The first is "sourcing inputs," meaning the Dutch tend to make better use of digital technologies to source and/or use factors of production such as land, capital, talent, plant, and property. The second is "running enterprises," meaning that in general Dutch firms tend to outpace others when it comes to using digital technologies and activities to execute key business functions. The Netherlands was also similar to other leaders such as the U.S., Sweden, the UK and Finland in terms of "fostering enablers," meaning a regulatory framework conducive to digital use; and slightly behind South Korea, similar to Sweden, and slightly ahead of the U.S. and the UK in terms of "making markets," i.e. digitizing existing markets and creating new digital markets.

A November 2016 study by the Information Technology & Innovation Foundation offers a comprehensive digital look at the United States. The report draws on 20 indicators of the innovation economy to paint statistical portraits of all 435 U.S. congressional districts, 50 states, plus the District of Columbia. The metrics do not align directly with those used in the other studies for Europe, but they do offer relevant insights.

The indicators include measures of innovative vitality in four main areas:

1. Exports of high-tech goods and services, including manufacturing, IT services, and royalty and license services;
2. Workforce education and skills, including the numbers of workers in high-tech sectors and STEM occupations, and
3. the number of highly educated immigrants;
4. Innovative ideas, including patent-related activity and public funding for R&D; and

TABLE 3.2.2: DIGITAL DENSITY, 17 LEADING ECONOMIES (RANKING SCALE 0-100)



Source: Accenture Digital Density Index, 2015.[7]

5. Digital infrastructure, including the share of households with access to broadband Internet services and the number of broadband providers in each district.

The ITIF study shows that digital technology has become a critical driver of productivity and competitiveness not just for the U.S. ICT sector, but for the whole U.S. economy. It belies the widespread yet myopic view that America's innovation-driven, high-tech economy has centered on just a few iconic places, such as the Route 128 tech corridor around Boston, Massachusetts; Research Triangle Park in Raleigh, Durham, and Chapel Hill, North Carolina; Austin, Texas; Seattle, Washington; and, of course, California's white-hot Silicon Valley. Many other metropolitan areas and regions — from Phoenix to Salt Lake City to Philadelphia — are innovative hot spots, too, and many more areas are developing tech capabilities. The report sheds light on just how widely diffused the country's innovation-driven, high-tech economy really is. The high-tech sector employs nearly 30,000 people per congressional district, on average, totaling just under 13 million people nationwide.[8] Even though many Europeans work in the digital industries, the largest tech companies still have their headquarters in the United States.

Endnotes

1. This section draws on Paul Hofheinz and Michael Mandel, "Uncovering the Hidden Value of Digital Trade: Towards a 21st Century Agenda of Transatlantic Prosperity", Lisbon Council/PPI institute, Issue 19, 2015, http://www.progressivepolicy.org/wp-content/uploads/2015/07/2015.07-Mandel-Hofeinz-Uncovering-the-Value-of-Digital-Trade_Towards-a-21st-Century-Agenda-of-Transatlantic-Prosperity.pdf; also Ian Hargreaves and Paul Hofheinz (eds.), *Intellectual Property and Innovation: A Framework for 21st Century Growth and Jobs* (Brussels: the Lisbon Council, 2012).
2. Intangible assets are resources a company or country holds which have no physical presence, but which nonetheless amount to the actual materials the company uses to do business. Examples include patents, copyrights, user-generated digital content, franchises, goodwill, trademarks, trade names and technology — the types of assets created through investment in research and development (R&D), know-how, organizational capital like new business processes, and human capital. These investments lack physical form, but they do not lack value. According to Dale Jorgensen and Barbara Fraumeni, the value of human capital in the United States is five to ten times larger than the value of all the physical capital in the United States. See Dale Jorgenson and Barbara M. Fraumeni, "The Accumulation of Human and Nonhuman Capital, 1948—84," National Bureau of Economic Research, 1989, http://www.nber.org/chapters/c8121. Also Erik Brynjolfsson and Andrew McAfee, "Beyond GDP: How Our Current Metrics Mismeasure the Digital Economy," Markle Foundation, January 2014, http://www.markle.org/sites/default/files/Beyond%20GDP.pdf; Hofheinz and Mandel, op. cit.; Jürgen H. Daum, *Intangible Assets and Value Creation* (London: Wiley, 2012); Carol Corrado, Jonathan Haskel, Cecilia Jona-Lasinio and Massimiliano Iommi. "Intangibles and Industry Productivity Growth: Evidence from the European Union," INTAN-Invest database working papers (New York: The Conference Board, 2014); Ibid, "Intangible Capital and Growth in Advanced Economies: Measurement Methods and Comparative Results," INTANInvest database working papers (New York: The Conference Board, 2012).
3. Hofheinz and Mandel, op. cit. For a different approach, see Erik van der Marel, "Digital Investments, Data and Growth in Europe: A Framework for Analysis," ECIPE Policy Brief No. 2, 2016, http://ecipe.org/publications/digital-investments-data-and-growth-in-europe-a-framework-for-analysis/?chapter=all.
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6. M. Macchi, B. Berthon and M. Robinson, M., "Digital density index: Guiding digital transformation", Accenture Strategy, 2015, https://www.accenture.com/us-en/insight-digital-density-index-guiding-digital-transformation.
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CHAPTER 3

Apps, Bots and the Conversational Economy

Digitally-enabled services have catalyzed the growth of the App Economy on both sides of the Atlantic. Over the past decade more than 100 billion mobile apps have been downloaded, generating $40 billion in revenues for developers, billions more in subscriptions and other fees, and accounting for more than half of time users spend using digital media.[1]

The Progressive Policy Institute, a U.S. think tank, studied the App Economy in the United States and in 30 European countries, and concluded that as of January 2016 Europe and the United States had each generated similar numbers of App Economy jobs, 1.64 million versus 1.67 million, respectively. This corresponds to 0.7% of all jobs in Europe and 1.2% of all jobs in the United States — still small, but growing fast. The Institute noted that France's 229,000 App Economy jobs were only slightly less than the 289,000 net new jobs generated in the country between 2007 and 2015.[2]

By 2020, the App Economy could double in size to $101 billion, according to market researcher App Annie.[3] The European Commission estimates that by 2018, the App Economy will employ 4.8 million people in Europe, contributing €63 billion to the EU economy. Within the ICT sector, the App Economy is becoming more important. The Institute calculates that roughly 9% of ICT jobs in Europe, and roughly 11% of ICT jobs in the United States, are associated with the App Economy.[4] A study for the European Commission concludes that on balance, jobs in the App Economy are good ones.[5]

Although most app platforms are American, streaming music services are a notable but niche exception where European companies are holding their own. Nordic companies such as Rovio, King.com and Supercell or German software supplier SAP are also showing success. The App Economy is also being driven by companies whose primary business isn't apps: companies in financial services, retail, packaged goods, and media, for instance.[6]

EU citizens download more computer apps than Americans — although less than the Chinese. EU and U.S. app companies each account for 42% of app revenue across the United States and the EU.[7] Many EU developers are on contract work, or pay app platform fees, to U.S. companies — another indication of the depth of transatlantic linkages in the App Economy, and the powerful role of the transatlantic platform economy, as we discussed in chapter three of Section Two.

One important difference between the U.S. and European App Economy is that the success of EU app companies is still largely confined to national markets. Only Germany, France, and the UK have any meaningful number of app companies that are successful outside of their native markets. Some countries such as Italy have no app companies featuring in the top 50 slots outside of their domestic markets. This creates a drain on regional skills by encouraging developers in some regions of the EU to relocate to major EU app countries to seek work with the most successful app companies.[8] In addition, only five EU app companies — all of them game companies — represent 49% of EU companies in the top 50 grossing apps in the EU and in the Unite States, and only 28 EU companies account for all EU apps in the top 100 grossing apps in the EU and the United States. Large independent developer companies account for a full 86%, and small independent developers for just 9%, of the most successful EU developers.[9]

This concentration is reflected in jobs: roughly half of Europe's App Economy jobs are in just three countries — the UK, Germany, and France. App Economy jobs in the United States are less concentrated, despite anecdotes about the overwhelming importance of Silicon Valley. California still leads other U.S. states in terms of App Economy jobs, but its

TABLE 3.3.1: TOP 25 APP ECONOMY JOBS: EUROPEAN COUNTRIES AND U.S. STATES

		SHARE OF EUROPEAN APP ECONOMY JOBS	JOBS (THOUSANDS)			SHARE OF U.S. APP ECONOMY JOBS	JOBS (THOUSANDS)
1	UK	19.6%	321.2	1	California	22.7%	376.0
2	Germany	16.3%	267.9	2	New York	9.4%	156.2
3	France	14.0%	228.9	3	Texas	7.3%	121.1
4	Netherlands	7.6%	125.2	4	Illinois	5.1%	84.9
5	Italy	6.0%	97.5	5	Massachusetts	4.1%	67.2
6	Poland	5.1%	84.3	6	Florida	3.5%	58.7
7	Spain	4.8%	78.2	7	New Jersey	3.5%	58.7
8	Sweden	4.1%	67.1	8	Virginia	3.3%	55.5
9	Finland	2.9%	47.4	9	Michigan	3.2%	52.8
10	Norway	2.5%	41.6	10	Washington	3.0%	50.1
11	Denmark	2.0%	33.4	11	Ohio	3.0%	49.9
12	Switzerland	1.7%	28.5	12	Georgia	2.9%	48.6
13	Portugal	1.7%	27.4	13	Pennsylvania	2.9%	48.6
14	Belgium	1.4%	23.3	14	North Carolina	2.2%	37.0
15	Czechia	1.2%	19.7	15	Missouri	1.9%	32.1
16	Romania	1.2%	19.3	16	Indiana	1.6%	26.6
17	Hungary	0.9%	15.3	17	Arizona	1.6%	26.5
18	Ireland	0.8%	13.2	18	Maryland	1.6%	26.3
19	Austria	0.7%	11.9	19	Colorado	1.4%	22.4
	30-COUNTRY TOTAL		**1,642.0**		**UNITED STATES**		**1,670.0**

Source: Progressive Policy Institute, Indeed, ILO. Data for Europe January 2016; data for U.S. December 2015.[10]

lead is diminishing. The Golden State, which accounts for 12% of the U.S. population, accounted for 22.7% of U.S. App Economy jobs in 2015, down from 29% in 2012, whereas states such as New York, Texas, and Illinois quadrupled their App Economy jobs. Washington, which ranked 2nd in App Economy jobs behind California in 2012, actually lost jobs in this sector during this time.

When it comes to "app intensity," however, the picture changes. The Progressive Policy Institute compared "app intensity" — i.e. App Economy jobs as a percentage of all jobs — in both European economies and U.S. states. According to their analysis, the United States has an average app intensity of 1.2% and Europe an average app intensity of 0.7%.

Table 3.3.2 draws on this data to compare selected European countries with U.S. states. California, the District of Colombia and Massachusetts rank as the most "app intensive" when it comes to the transatlantic space. Finland ranks 4th, and tops in Europe, underscoring its role as a small country with a big presence in mobile apps, led by world-class companies such as mobile game makers Rovio Entertainment (maker of the mobile game hit Angry Birds) and Supercell. Norway ranks as the second most "app intensive" European country, just behind the state of New York, followed by the Netherlands and the U.S. state of Washington. New Jersey, Virginia and Sweden round out the top spots.

Germany ranks highly on total App Economy jobs but is only average when judged by app intensity. Italy, which is fifth in total App Economy jobs, falls to the bottom of the app intensity listings with 0.4%.

Is There a Bot for That?

Apps comprise one of the fastest-growing software markets ever, generating billions in revenue in less than a decade. But the market has matured, and many apps, once downloaded, are rarely used. As mobile messaging improves and artificial intelligence advances, the "bot" economy is poised to be another fast-growing, multi-billion dollar software market. In the rapid-fire digital economy, bots may be the new apps.[11]

TABLE 3.3.2: APP INTENSITY OF SELECTED EUROPEAN COUNTRIES AND U.S. STATES

COUNTRY/ STATE	APP INTENSITY*	COUNTRY/ STATE	APP INTENSITY
California	2.40%	Maryland	1.00%
District of Columbia	2.10%	South Dakota	1.00%
Massachusetts	2.00%	*France*	*0.90%*
Finland	*1.90%*	Ohio	0.90%
New York	1.70%	Colorado	0.90%
Norway	*1.60%*	New Hampshire	0.90%
Washington	1.60%	Utah	0.90%
Netherlands	*1.50%*	Indiana	0.90%
New Jersey	1.50%	North Carolina	0.90%
Virginia	1.50%	Pennsylvania	0.80%
Sweden	*1.40%*	*Europe*	*0.70%*
Illinois	1.40%	*Ireland*	*0.70%*
Connecticut	1.30%	*Germany*	*0.70%*
Michigan	1.30%	*Luxembourg*	*0.60%*
Oregon	1.20%	*Switzerland*	*0.60%*
Denmark	*1.20%*	*Portugal*	*0.60%*
United States	1.20%	*Poland*	*0.50%*
Oregon	1.20%	*Belgium*	*0.50%*
Missouri	1.20%	*Spain*	*0.50%*
Kansas	1.20%	*Italy*	*0.40%*
Georgia	1.20%	*Czech Republic*	*0.40%*
United Kingdom	*1%*	*Hungary*	*0.40%*
Texas	1%	*Austria*	*0.30%*
Arizona	1.00%		

**App Economy jobs as percentage of all jobs in a country/ state. Separate data unavailable for Bulgaria, Croatia, Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, and Slovenia. Data: Progressive Policy Institute, Indeed, Eurostat. Estimates for for Europe January 2016, for top 25 U.S. states December 2015. Source: Progressive Policy Institute, Indeed. See http://www.progressivepolicy.org/blog/app-economy-jobs-part-2/.*

A "bot" is software that automates tasks. A "chatbot" is software that uses artificial intelligence to simulate conversation with humans on messaging platforms. Chatbot users can check news, organize meetings, buy movie tickets, transfer money, order food or book a flight or a hotel by sending short messages.[12] But bots may also be tweeting or retweeting your tweet or alerting you to someone's else's tweet. One study estimates that between 9% and 15% of active Twitter accounts — up to 48 million — are bots.[13] Social bots are accounts controlled by software, algorithmically generating content and establishing interactions. Many social bots perform useful functions, such as dissemination of news and publications[14] and coordination of volunteer activities.[15] However, there is a growing record of malicious applications of social bots. Some emulate human behavior to manufacture fake grassroots political support, promote terrorist propaganda and recruitment, manipulate the stock market, and disseminate rumors and conspiracy theories.[16]

Unlike most apps, instant messaging services have shown real staying power. There are currently more than 3 billion active users on messaging apps. Their usage keeps rising, everywhere in the world and across all generations. Messaging apps have already caught up with social media apps in terms of users. Facebook, Apple, Google, Microsoft and Amazon are all developing artificial intelligence-based chatbots. Kik, a Canadian company, offers another chabot service that has become increasingly popular in the United States, with more than 270 million users.[17]

A recent transatlantic innovation is a service between Facebook and London-based fintech startup TransferWise, founded by Estonians Taavet Hinrikus and Kristo Käärmann. TransferWise has developed a Facebook Messenger chatbot that enables customers to send money to friends and family to and from the United States, Britain, Canada, Australia and Europe. It is the first to enable international money transfers entirely within Messenger. Customers in more than 50 countries send roughly $1 billion through TransferWise's website every month. While the TransferWise chatbot is now only available in Facebook Messenger, it can be adapted to work with other popular chat services.[18]

While many technical hurdles are still to be overcome, the Bot Economy is growing faster today than the App Economy did when it began. Bots will become a regular feature on people's smartphones, joining websites and apps and other things yet to be invented.[19]

Ambient Computing and the Conversational Economy

Chatbots are the gateway to ambient computing — the promise of continuous, multi-modal, computer-enhanced interaction with the real world.[20] Messaging and other natural language interfaces are the key, which in turn opens the door to the emerging "conversational economy," discussion of which ignited in 2015 when Chris Messina of Uber heralded a new age of "conversational commerce," in which individuals simply use their own voice to interact with people, brands, or services in a variety of new ways.[21] As investor Sarah Guo describes it, the conversational economy is one in which voice itself is an operating

system. Instead of being prompted to "download" and "install,"users will simply be invited to talk.[22]

Some use of voice control is already mainstream—in mid-2016, 20% of Android searches were voice-based, and Siri received 2 billion requests per week.[23] Innovations in voice-enabled hardware and big voice platforms are rushing forward.[24] The rise of voice-dominant ambient computing, in turn, is only one step removed from an even bigger step forward — towards cognitive commerce.[25]

While exciting, this field also carries a warning for the transatlantic economy, because here Asia — not the United States or Europe — is leading the way. The leader is China and its increasingly ubiquitous WeChat, which is a prime example of budding conversational economy. WeChat is the most integrated app today. It encompasses a messaging app, a portal, a platform, and even a mobile operating system. Its users have access to a variety of functions: search engine, taxi hailing, food delivery, banking, news, fitness tracker, shopping, socializing, etc. It has millions of small apps within it, which function a lot like webpages that live on the Internet. WeChat generates over $1.1 billion in revenue by offering its 760 million users[26] an all-in-one approach, letting them pay their bills, hail taxis, and order products with a text. Line, a Japanese messaging app with 200 million users, has rolled out LinePay, allowing its users to make mobile payments, order groceries, book taxis, and more.[27]

Within the confines of a single "app," WeChat has built a better app store than Apple, serving a much broader set of use-cases. When U.S.-based developers, product people, and founders interact with WeChat, they inevitably see the potential as transferable. Samsung's Android, IBM's Watson, Apple's iOS8 web extensions, and next-generation artificial intelligence platforms such as Viv, developed by Dag Kittlaus, a Norwegian living in the U.S. and his fellow co-founders of Siri, are moving into this space. But for the moment, the West is driven by WeChat envy.[28]

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CHAPTER 4

Crowdworkers in the Gig Economy

The digital economy is changing work on both sides of the Atlantic, yet there are currently no reliable ways to estimate the number or nature of digital jobs of jobs affected, or even how to describe the phenomenon.

Various terms are being used to describe work organized digitally via online platforms; perhaps the most prominent are "online gig work" and "crowdworking."[1] This work includes both relatively low-skill clerical and data entry work as well as higher-skill work such as software development, creative services and multimedia, and professional services such as law.[2]

Researchers at the University of Hertfordshire have broken crowd work down into four categories: non-manual high-skill online workers (working for platforms like Upwork or PeoplePerHour); non-manual low-skill online workers (working for platforms like Clickworker, Crowdflower or Amazon Mechanical Turk); manual driving workers working offline but managed online (working for platforms like Uber, Blablacar or Lyft); and manual service / maintenance/construction workers working offline but managed online (working for platforms like Taskrabbit, Helpling or Myhammer).[3]

Such online gig work may be understood as a smaller subset of the "gig economy," or as "contingent workers," both of which encompass a broader set of workers who are available when someone wants to hire them, but such work may or may be performed or facilitated digitally.[4]

Government statistics do not capture the broader phenomenon of the gig economy, much less its digital component. The U.S. government, for instance, stopped counting "contingent workplace" arrangements after 2005. European governments have been similarly challenged. This means that no comprehensive database exists on either employment in the gig economy or its geography.[5] Despite these limitations, additional light can in fact be thrown on the online gig economy. A number of unofficial efforts have been made to assess the size and nature of online gigging. Staffing Industry Analysts estimates that the total value of the skilled freelance crowd work online will reach $5 billion by 2018; Elance/oDesk projected that the online gig economy would increase to as much as $47 billion by 2020.[6]

There is no simple way, however, to translate such estimates of market size into numbers of workers. Nonetheless, various studies conclude that platform-enabled freelancing encompasses a relatively small but rapidly-growing segment of the job market in both the United States and Europe, but is unevenly distributed across each continent.

Crowdworkers in the U.S. Gig Economy

Researchers at the Brookings Institution, drawing on U.S. Census Bureau data on "nonemployer firms" in the United States, conclude that gig employment — whether digital platform-enabled or not — has been growing rapidly, representing 24 million "businesses," compared with total U.S. payroll employment of about 145 million, in 2014.[7] In short, a surge of nonemployer firm activity that has been explosive in ground transportation and quite noticeable in accommodations seems to directly coincide with the large-scale expansion of the gig economy and uptake of online platform services. Whereas payroll employment in the ride-sharing industry grew by 17% between 2010 and 2014, nonemployer firms (including gigging freelancers) increased by 69%. Likewise, although payroll employment in the home-sharing industry grew by 7%, nonemployer firms grew by 17%.

Here again one must be careful about extrapolating figures to estimate the full extent of such online work, since much evidence suggests that for many online giggers, crowd work is a not their main job, but rather a supplement. Nonetheless, 56% of labor platform users say

that the money they earn from these sites is "essential" or "important" to their overall financial situations, whereas 42% say the money is simply "nice to have."[8]

Brookings researchers conclude that while platform-based freelancing is not yet substantially displacing payroll employment, that could change. Nonemployer firm growth is clearly rising, and accelerating in the ride-sharing sector. These trends raise the possibility that online marketplaces could cannibalize competing payroll businesses in some industries, particularly given the rapid deployment of new technologies. For example, Lyft recently claimed that most of its cars will be self-driving in five years.[9] While that forecast seems overly ambitious, it would clearly spell trouble for human drivers, both those on payrolls and freelancers alike.

Brookings also concludes that online gig work is unevenly distributed in the United States. They show that online gigging in the rides and rooms industries is so far concentrated in large U.S. metropolitan areas. Between 2010 and 2014 no less than 81% of the four-year net growth in nonemployer firms in the rides sector took place in the 25 largest metropolitan areas, while 92% occurred in the largest 50 metros. For rooms, those figures were, respectively, 56% and 70% — just slightly more than it was across all industries.

The Brookings data suggests that the online platform economy is mostly an urban phenomenon, at least in rides and rooms, where it is having a sizable impact locally; and that its onset in early-adopter cities like San Francisco and San Jose is now extending to other large cities all across the nation. A study by the JPMorgan Chase Institute also concluded that online gig work is unevenly distributed across the United States, but that participation in labor platforms is highest among those who experience the highest levels of income volatility — the young, the poor, and individuals living in the West.[10]

According to the Pew Research Center, 23% of those who utilize digital "gig" platforms for work are students; a majority describe themselves as being employed either full (44%) or part time (24%), but 32% say they are not employed. Workers who describe the income they earn from these platforms as "essential" or "important" are more likely to come from low-income households, to be non-white and to have not attended college. They are less likely to perform online tasks for pay, but more likely to gravitate towards physical tasks such as ride-hailing or cleaning and laundry. They are also significantly more likely to say that they are motivated to do this sort of work because they need to be able to control their own schedule or because there are not many other jobs available to them where they live.[11]

Brookings, JPMorgan Chase and McKinsey all estimate that roughly 1% of the U.S. working-age population, or about 2.5 million people, participates in contingent work transacted on a digital marketplace.[12]

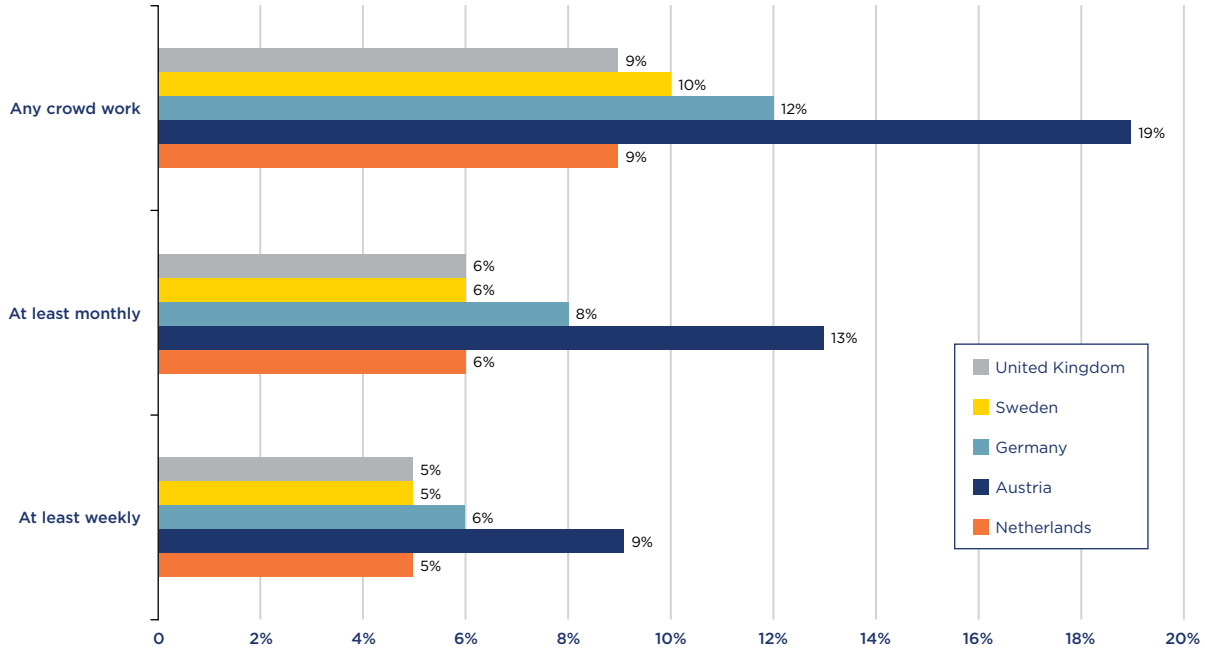
JPMorgan Chase, however, found that while only 1% of adults in their survey sample earned income from the online platform economy in a given month, 4% participated over a three year period, with most using the platform economy as a secondary source of income when outside income dipped or when they were between jobs. They estimate that between October 2012 and September 2015, 4.2% of adults, an estimated 10.3 million people — more than the total population of New York City — earned income on the platform economy, and that this number increased 47-fold over that period. They also estimate that those earnings represent roughly 20-30% of total income.[13] The Pew Research Center estimates that 2% of Americans earned money in 2016 by driving for ride-hailing services, and that an additional 6% earned money using digital platforms to take on other jobs or tasks.[14]

European Estimates

Oxford University's Online Labour Index (OLI) is a new economic indicator that provides an online labor market equivalent of conventional labor market statistics. Its weakness is that it only tracks English-language platforms, and so underplays online labor using non-English platforms. While English-language platforms are popular among employers and workers in non-English-speaking countries, the Index is likely to be biased toward English-speaking countries. Nevertheless, the OLI shows that U.S.-based employers account for 52%, and European employers an additional 16%, of the online labor market facilitated by English-speaking platforms. Of European countries, the UK accounts for 6.3% of the market, and non-UK European employers, notably from Germany, together account for approximately 10% of the market. India (5.9%), Australia (5.7%) and Canada (5%) round out the figures.[15]

The OLI also points to growth rates in online labor exceeding traditional payroll job growth. From May to September 2016, for instance, UK employers increased the volume of labor bought online by nearly 14%. Over the same period, there was a 7.5% rise elsewhere in Europe and 6% in the United States. These are striking figures when they are contrasted with growth rates in conventional labor markets. Moreover,

TABLE 3.4.1: PEOPLE DOING CROWD WORK, BY COUNTRY AND FREQUENCY



Source: Crowd Work in Europe, FEPS Studies, December 2016; Hertfordshire Business School Crowd Work Survey, 2016.
Base: 2238 respondents in the UK, 2146 respondents in Sweden, 2180 Respondents in Germany, 1969 respondents in Austria and 2126 respondents in the Netherlands (weighted).

the online gig economy's growth over this period was driven more by skilled occupations than routine work.

Other European studies complement the OLI. One study[16] looked at people-per-hour and found that the majority of its users (63.5%) were based in the UK, with the next largest shares in India (9.9%), the United States (5.3%), Pakistan (2.6%), the Philippines (2.0%), South Africa (0.7%) and Canada (0.7%).

The University of Hertfordshire study also corroborates the studies cited earlier that crowd work is not the largest income-earner for individuals using the internet, but that it could be a significant source of income for a minority of the population. The study reported that crowd work had generated an income for 9% of the UK and Dutch samples, 10% in Sweden, 12% in Germany and 19% in Austria (Table 3.4.1).[17]

As mentioned earlier, many people use crowd work to supplement their income; it is not their main occupation. However 5% of the sample in the UK, Netherlands and Sweden perform crowd work at least weekly, with the proportion in each of these countries going up to 6% when asked whether they perform crowd work monthly. In Germany, the proportion doing so are a little higher (with 6% crowd working weekly and 8% crowd working monthly). Austria is at the top in both cases (9% weekly, 13% monthly).

Crowd work thus constitutes more than half of all income for 2.4% of the total sample in Austria, 2.6% in Germany, 1.7% in the Netherlands and 2.8% each in the UK and Sweden — forming the main source of income for an average of 2.5% of the samples across all five countries. The majority of crowd workers do so only occasionally. However between 6% and 13% of the online population do so at least monthly and between 5% and 9% at least weekly. Even for these, it is not necessarily the only source of income. There is a small minority (ranging from 3% of crowd workers in Austria and Germany to 11% in the Netherlands) for whom crowd work provides the only source of income. More significantly, crowd work constitutes more than half the income of around a third of crowd workers in the UK and Sweden (33% and 36% respectively), 25% in Germany and the Netherlands and 14% in Austria. Nevertheless, for the majority, crowd work represents a small supplement to their main income: with the largest group (ranging from 33% in Sweden to 58% in Austria) estimating that it represents less than 10% of their total income.[19]

Just as other elements of the digital economy are in dynamic motion, so too is the nature of work in the "gig" economy. A Thumbtack study concludes that the on-demand, low-skilled gig economy is unlikely to last, since these relatively commoditized, undifferentiated services are supplementing income, not generating middle-class lifestyles. Moreover, these tasks are overwhelmingly likely to be automated over time, performed by self-driving cars and drones. They conclude that the gig economy, as currently understood, will cease to exist in 20 years. Of course, given onrushing digital and technological change, one could argue that services not considered to be commoditized today could be commoditized tomorrow.

Nonetheless, they argue that the future gig economy is likely to consist more of skilled professionals who offer specialized expertise and services for clients, rather than commodity services for employers. These professionals are likely to use technology to give themselves greater personal flexibility and choice in their careers, rather than to look for traditional 9 to 5 employment.[20] Others argue that the use of independent contractors helps labor platform companies avoid basic protection for workers, such as overtime pay and minimum wages, and that even though the types of gig work may change, companies will continue to exploit legal loopholes until new laws are in place mandating that such workers be treated as employees.[21]

These predictions notwithstanding, it is fair to say that the gig economy, both in terms of shifting commoditized services and more flexible, professionalized crowd work, will increasingly shape the nature of labor markets — and the digital economies — of both the United States and Europe.

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CHAPTER 5

Digital America, Digital Europe

Understanding the different modes of e-commerce or the significance of data flows is important but insufficient when it comes to measuring the digital economy. An important complement to such measures is to understand how various sectors of an economy, or particular segments of a country's population, are absorbing, assimilating and deploying digital capabilities and practices. The capacity to adopt and pioneer new technologies has proven to be the key for the United States and Europe to maintain their competitive edge and support their growth potential in the long term.

Digital America

The United States has become highly digitized. 98% of adults have access to high-speed internet and 87% use it, 69% of adults use smartphones, and 28% of payments are made digitally. But while U.S. companies and universities are recognized as digital leaders, many households and individuals are not as wired. McKinsey estimates that the U.S. economy as a whole is reaching only 18% of its digital potential, which it defines as the upper bounds of digitization in leading sectors of the economy.[1]

Digitization is happening unevenly across the United States, both across states and industries. The Center for Digital Government ranks Michigan, Missouri, Ohio, Utah and Virginia as among the leading "digital states," whereas it deems states such as Alabama, Louisiana, Nevada, New Jersey Alaska, Rhode Island, Wyoming and Kansas to be struggling.[2] In terms of industry, the information and communications technology (ICT) and media sectors and financial and professional services are surging ahead. Most sectors across the economy, however, are less than 15% as digitized as the leading sectors, and the gap has barely narrowed over the past decade. McKinsey sees this pattern at the company level as well as at the sector level, and refers to a widening gap between digital "haves" and "have-mores" as the most advanced users pull away from everyone else. This growing gap has profound consequences for business as well as labor. Workers in the most digitized industries enjoy wage growth that is twice the national average, while most U.S. workers in the broader economy face stagnant incomes and uncertain prospects.[3]

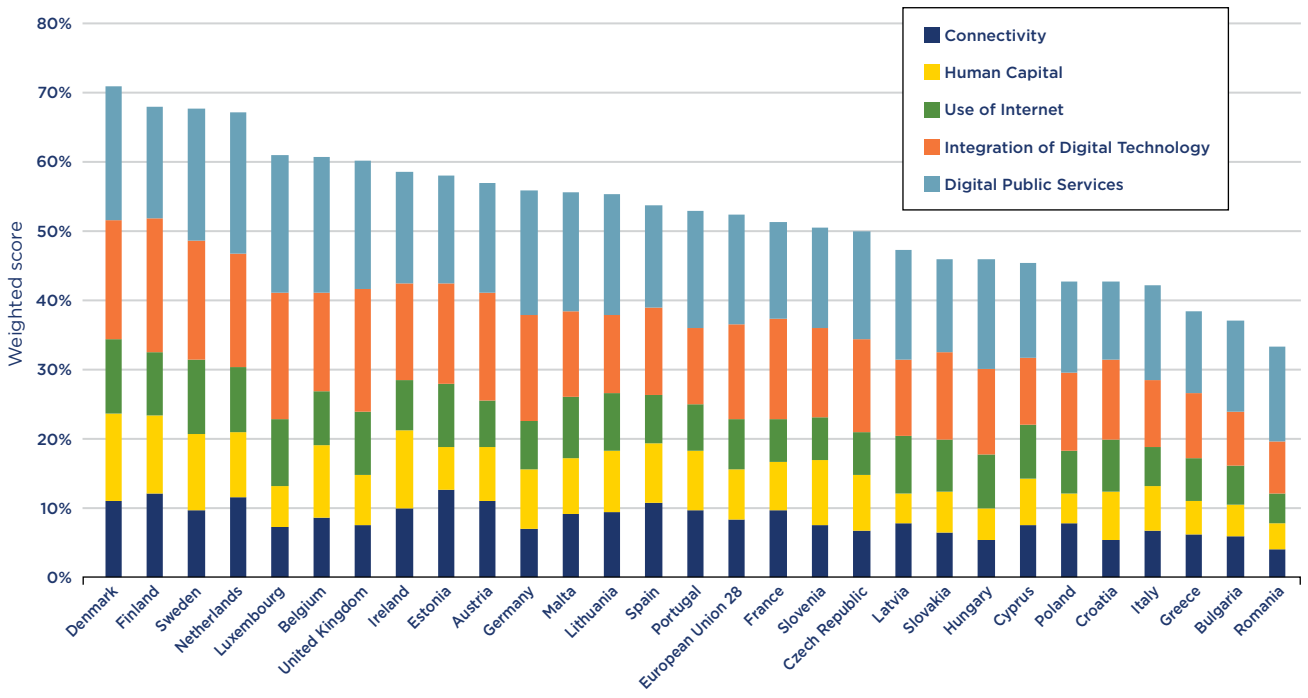
McKinsey estimates that U.S. utilities, mining and manufacturing are in the early stages of digitizing and connecting their physical assets, and could be at the forefront of a new wave of digitization. Labor-intensive industries such as retail and health care are expanding digital usage, but substantial parts of their large workforces do not use technology extensively. Industries that are both highly labor-intensive and localized, such as construction, leisure and hospitality, also tend to rank lower in usage, notably in the way they conduct customer transactions.[4]

Digital Europe

Like Americans, Europeans are heavily engaged in the digital world. 98% have advanced 3G mobile broadband coverage; 96% of millennials have used the internet in the past three months; 93% of enterprises have a fixed broadband connection; 83% of households have access to the internet in their homes; 76% of adults say they use the internet regularly; 61% look online for goods and services; 43% of individuals access the internet through a mobile phone; and 20% of enterprises buy cloud services used over the internet. Europe has been the incubator for world-beating digital firms such as Spotify, Skype, LEGO and AXA, and the home to thriving digital hubs, including Amsterdam, Berlin, Dublin, London, Paris, Helsinki, Tallinn and Stockholm. Many European firms are active in fast-growing areas; the largest digitized businesses are capturing 20-30% of revenue in big data and Internet of Things applications.[5] These and other positive developments given reason to believe that the digital gaps between Europe and the United States could narrow.

Nonetheless, Europe, like America, has a long way to go to tap fully the potential of digitization. McKinsey's

TABLE 3.5.1: DIGITAL ECONOMY AND SOCIETY INDEX, EU MEMBER STATES



Source: European Commission, Digital Scoreboard.[6]

Digitization Index shows that Europe overall operates at only 12% of its digital potential. Measured against total investment stock, McKinsey estimates Europe's asset base to be only 5% digitized. In terms of the usage of digital activities, European workplaces are only 9% digitized in terms of their digital potential.[7]

Like America, Europe is digitizing unevenly, with large variations across countries, sectors and firms. Countries like the United Kingdom and the Netherlands are net exporters of digital services to Europe, while Italy is a net importer. The ICT sector is at the digital frontier, and media, finance and professional services are close behind, but large, traditional sectors such as manufacturing and mining, quasi-public sectors such as health care and education, and highly localized and fragmented industries such as hospitality and construction, lag far behind. McKinsey estimates that qualities particular to specific economic sectors account for two-thirds of the variation in digital capability across Europe, and that the remaining third reflects individual country policies. Strategy&'s Industry Digitization Index generally corroborates those findings.[8]

The European Commission's DESI Index compares individual EU member states across five components of societal digitization. Table 3.5.1 underscores the uneven nature of the EU's digitization, with Denmark and its Nordic neighbors leading the field and northwestern EU member states turning in strong performances. The Index shows a clear divide, however, between north-western and south-eastern EU member states.

Comparing Digital America and Digital Europe

McKinsey's Country Digitization Index aggregates a variety of indicators from various sources measuring ICT supply and innovation, business use, consumer use, and government use to compare the digitization of selected economies. In each of these categories, Japan, Sweden, and the United Kingdom outperform the United States. The overall results place the United States only 11th among 34 OECD member states. Its performance is stronger on indicators that measure innovation and business use (such as business-to-business digital transactions and online advertising) than on consumer use, where it ranks 12th, reflecting the extent of its digital divide. The United States is among the lowest OECD countries for both household penetration and average speed of fixed broadband. It also posts some of the highest costs for high-speed broadband service.[9]

The World Economic Forum's Network Readiness Index compiles a related but somewhat different set of measures that assess the degree to which a particular country is

TABLE 3.5.2: THE NETWORKED READINESS INDEX 2016-2017, SELECTED COUNTRIES

RANK	COUNTRY	RANK	COUNTRY
1	Singapore	34	Malta
2	Finland	35	Spain
3	Sweden	36	Czech Republic
4	Norway	37	Slovenia
5	United States	40	Cyprus
6	Netherlands	41	Russian Federation
7	Switzerland	42	Poland
8	United Kingdom	45	Italy
9	Luxembourg	46	Macedonia, FYR
10	Japan	47	Slovak Republic
11	Denmark	48	Turkey
12	Hong Kong SAR	50	Hungary
13	Korea, Rep.	51	Montenegro
14	Canada	54	Croatia
15	Germany	59	China
16	Iceland	64	Ukraine
17	New Zealand	65	South Africa
18	Australia	66	Romania
19	Taiwan, China	69	Bulgaria
20	Austria	70	Greece
21	Israel	71	Moldova
22	Estonia	72	Brazil
23	Belgium	75	Serbia
24	France	76	Mexico
25	Ireland	84	Albania
29	Lithuania	91	India
30	Portugal	97	Bosnia and Herzegovina
32	Latvia		

Source: World Economic Forum.[10]

prepared to capitalize on the opportunities presented by the digital economy and make use of its network capital in a digitizing world.

The United States ranks 5th in the 2016-2017 Networked Readiness Index, moving up from 7th in 2015 and 9th in 2013.[11] According to the Index, the United States stands out in terms of its extremely favorable business and innovation environment (3rd), which has given rise to one of the most agile and digitized business sectors globally. The public sector is also using digital technologies effectively to deliver services to citizens (4th on Government Online Service index) and to facilitate participation (9th on the E-Participation Index). The overall impact of digital technologies in the United States is strong (it ranks 7th for both economic and social impacts) and growing.

Americans who *are* online lead highly digital lives. But U.S. households and individuals, on average, are less wired than those in northern Europe, Japan, South Korea, New Zealand and Israel. Nearly 80% of UK residents have ordered goods and services online; the share in the United States is less than 60%. More than 95% of 65-74-year-olds in Scandinavia use the internet, compared to less than 80% of U.S. seniors.[12] Much of Europe has also built impressive digital infrastructure. In fact, the United Kingdom leads the United States in terms of digital capital stock — resources that are key to developing new products and services, both tangible and intangible, for the digital economy.[13]

According to the 2016-2017 Networked Readiness Index, seven out of the top ten countries are European.[14]

The Nordic countries keep leveraging ICT and their digital economies to advance their national competitiveness strategies. Finland has extremely good access to the latest technologies (ranked 1st globally) as well as venture capital (6th), and its businesses are highly connected (5th on business usage). In Sweden, businesses are taking advantage of the fact that the country's consumer base is highly connected, which is reflected in one of the highest rates of business-to-consumer (B2C) e-commerce interaction globally (4th). Norwegian firms are also capitalizing on the high ICT literacy among the general population and workforce by using digital technologies heavily in their interactions with consumers as well as with each other (8th and 7th, respectively). Norway's digital economy is built on the very solid basis of top regulatory and innovation environments (6th and 7th, respectively) as well as the world's best ICT infrastructure. Norway is also moving up the rankings with regard to government promotion of advanced technologies, including in the digital realm, while both Finland and Sweden are perceived to be slipping.

The Netherlands remains one of the countries that makes the best use of digital technologies to achieve both economic and, in particular, social impacts. The Dutch population is one of the most technology savvy and connected in the world (8th for individual usage), an asset that both the government and the business sector are making good use of (3rd for B2C Internet use, 8th for the Government Online Service index, and 1st for the E-Participation index). Businesses are extensively deploying digital technologies to reshape their business and organizational models (4th in both indicators) and basic service providers, whether they are public or private, are working hand-in-hand with the population to facilitate access via their platforms (2nd). It

fell 2 spots from its ranking the year before because while it is near the digital frontier, other countries are moving even faster. This is true in particular for the business and innovation environment as well as ICT infrastructure. The Netherlands has enhanced its presence as a global leader in digital transfer by serving as a major port for traded goods as well as a hub for European data traffic. The McKinsey Global Institute ranks the Netherlands 2nd in country connectedness and in the top 10 for data flow, underscoring the crucial significance of open borders for data transfer and, subsequently, global competitiveness and innovation.[15]

Switzerland ranks 1st for business usage, driven by high business technology absorption and innovation capacity and high levels of digital business-to-business (B2B) interaction (interestingly, more than with consumers). This in turn has been generating strong economic impact (2nd rank), as reflected also in a steady upward trend in the share of knowledge-intensive jobs (3rd). But the government has been a less avid adopter and promoter of digitization, as reflected in a 43rd place for government usage. Although it is strong in the high-tech procurement market, it seems to be using digital technologies relatively less to interact with citizens.

The United Kingdom ranks 8th overall, thanks in particular to the fact that UK businesses are top in the world in making use of the Internet to interact with their consumers as well as with their production network (1st in B2C, 2nd in B2B). They are also pushing the boundaries in terms of using ICTs to reshape their business and organizational models (ranking 2nd and 1st, respectively). The government is also moving closer to the global frontier in terms of technology use, jumping six places into the top 10 of the government usage pillar.

Luxembourg ranks 9th, helped by its first-place showing with regard to a supportive political and regulatory environment and 2nd in individual usage. Government is perceived to play an important role in supporting Luxembourg's digital economy, with business executives attesting to a high importance of ICTs in the government's vision (5th) and its success in ICT promotion (6th). The country also achieved first place regarding the level of sophistication for ICT related laws (e.g., for e-commerce, digital signatures, and consumer protection). The country also boasts a top infrastructure with top ranks for international bandwidth (1st) and the number of secure servers per capita (3rd).

Europe's Uneven Landscape

Although Europe has high flyers, its performance range is uneven. Europe's divide runs essentially between "network-ready" western and northern Europe and less-ready countries in southern and eastern Europe. Estonia stands out as an important exception, ranking 22nd globally, ahead of countries like France and Belgium, and in terms of ICT infrastructure and digital content also ahead of Denmark, the Netherlands and the United Kingdom. Italy, the Slovak Republic, Poland, and the Czech Republic are making big strides, landing spots in the top 50. The only EU countries not among the top 50 are Croatia (54), Romania (66), Bulgaria (69), and Greece (70), all behind countries like South Africa and Ukraine.

In short, Europe is among the most networked regions in the world, but with some notable shortcomings.

Germany's 15th place rank is somewhat surprising, given the advanced nature of the German economy. It is still relatively difficult to start a new business, for example, and while Germany's infrastructure and skills base is one of the best in the world, fixed broadband prices are high and rising. Germany is one of the highest-scoring countries for business usage (6th), yet the government is not yet using digital technologies to their full potential (30th).

France is also behind in the rankings, placing 24th. France is the global leader in delivering public online services to its citizens and one of the best in terms of allowing their e-participation to the government's decision process (4th). Over the past year, the government has also increased efforts in promoting ICTs and providing a long-term vision for the sector, including a Digital Republic Bill aiming to guide the way in which the ICT revolution will shape French society in the future. French businesses have also stepped up their efforts to leverage ICTs, especially in terms of adopting new organizational models (26th, up 22 positions) and improving B2B transactions (33rd, up 11). The country can rely on a skilled workforce (18th) and on good infrastructure (22nd), allowing, among other things, one of the highest penetrations in the world of fixed broadband (4th). Issues remain especially in the environment for business, which has one of the highest taxation rates in the world.[16]

With an overall rank of 45th, Italy still ranks relatively low — but it climbed 10 places in the 2016 Index, due to a series of Italian government efforts to improve the provision of online services to its citizens and to create a better environment for start-ups and innovative companies. However, key constraints remain, including the lack of venture capital and the overall political and business environment. Here the country seems to be moving in the right direction, gaining in almost every aspect of the regulatory environment pillar, but it remaining far below the global average. Italy is currently doing best in

individual usage (37th), followed by business (52nd) and government use (62nd). Yet only a small portion of Italians are connected to fixed broadband: the number has been historically low but the gap with other advanced economies has only increased in recent years, when subscriptions per 100 people increased by less than 10 percent from 21.9 (28th highest, in 2010) to 23.5 (36th, in 2014).

While Italy's improvement reflects efforts by the national government to improve regulation and digital infrastructure, the country's performance is not uniform across the areas of networked readiness. Some areas, for instance, show an increase in the government's use of digital technology, while others show signs of deterioration. It seems the political and regulatory environment — for which Italy ranks 96th — still represents one of the country's Achilles heels.[17]

Moreover, overall Europe underperforms on its digital potential relative to the United States. The European digital frontier, represented by the ICT sector and its digitization of assets, uses, and labor, is only 60% as digitized as the U.S. frontier. Some large sectors, such as professional services, wholesale trade, and real estate, are further behind the digital frontier in Europe than they are in the United States. There are also large differences among Europe's countries. The United Kingdom, for instance, operates at 17% of its digital potential, France at the EU average of 12%, and Germany at only 10%.[18]

In sum, McKinsey estimates that, due to the digital gap between leading and lagging sectors and countries, Europe's economy operates at only 12% of the digital potential exhibited by companies at the digital frontier in the United States. If the European economy were to move towards digital maturity, there would be tremendous economic benefits for Europe. The situation is similar in the United States, where the largest economic sectors are also digital laggards. According to McKinsey, the U.S. economy is operating at only an estimated 18% of the potential shown by the digital frontier.

TABLE 3.5.3: SHARE OF DIGITIZATION POTENTIAL REALIZED COMPARED TO THE DIGITAL FRONTIER

United States	18%
United Kingdom	17%
Netherlands	15%
Sweden	15%
Europe*	12%
France	12%
Germany	10%
Italy	10%

**Weighted average of six countries that make up 60% of Europe's population and 72% of GDP*
Source: McKinsey Global Institute.[19]

Transatlantic Digital Interdependencies

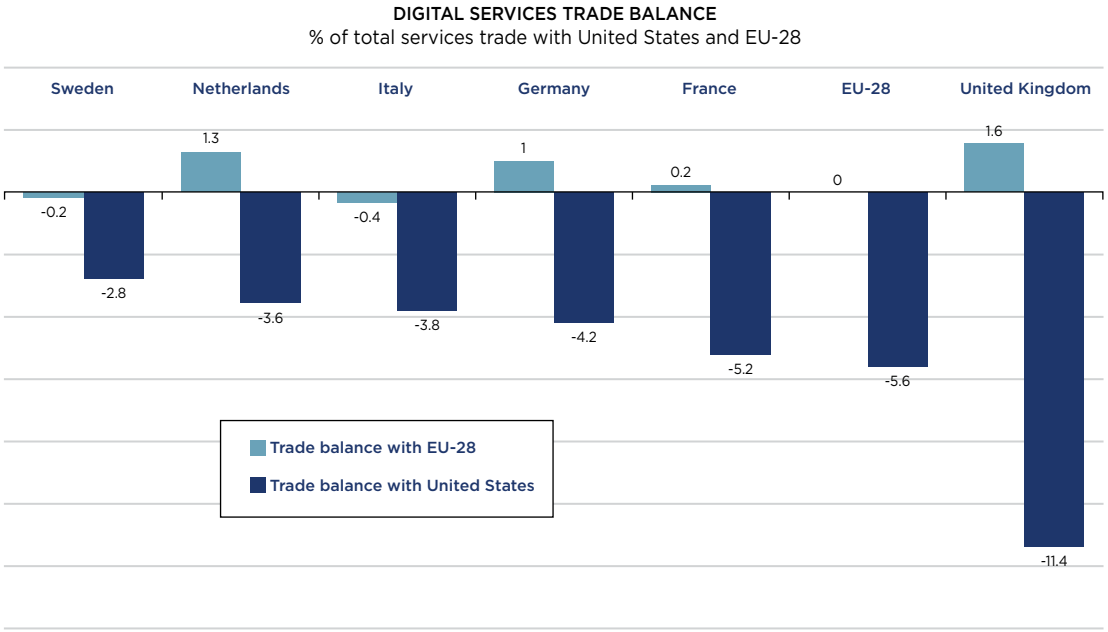
As we discussed in Section 2, Europe is a net importer of U.S. digital services, running a digital trade deficit amounting to nearly 5.6% of total U.S.-EU services trade. McKinsey finds that much of Europe relies on imports of U.S. technology for its own digital development. Ultimately, Europe does not rival the United States as a producer of global content, a creator of major platforms, or an incubator of successful internet companies. Measured by market capitalization, for instance, there are no European firms among the 20 largest digital companies. The proliferation of digital "unicorns" — start-ups with billion-dollar valuation — has not occurred in Europe as broadly and to the same extent as it has in the United States. Venture capital and growth investments are four times as high in the United States as in Sweden, and ten times as high as in Germany.[20]

Although many European countries rank relatively high on digitization overall compared with the United States, the United States is the dominant supplier of digital technologies to the world, including Europe. Among all publicly listed companies in the global ICT sector, U.S.-based firms account for nearly half of worldwide sales and two-thirds of post-tax profits. European firms generate only 17% of global revenue and 14% of worldwide profits. Of the 250 largest ICT firms in the world, 75 are from the United States and 50 from Japan; EU-15 countries together account for only 45 firms on the list.[21]

Nevertheless, some European firms have been highly successful, becoming digital giants. Among the world's largest ICT firms, the smaller number of European companies account for 22% of global sales, only slightly less than U.S. firms' 30% share. European firms are also showing promise in the new wave of industrial digitization, for instance accounting for a 21% share globally in Internet of Things companies, compared to only a 5% share by Chinese and Japanese companies (U.S. companies command a 74% share), and a 32% share of big data companies, compared to only a 6% share by Chinese and Indian companies and a 2% share by Japanese and Korean companies (U.S. companies command a 60% share).[22]

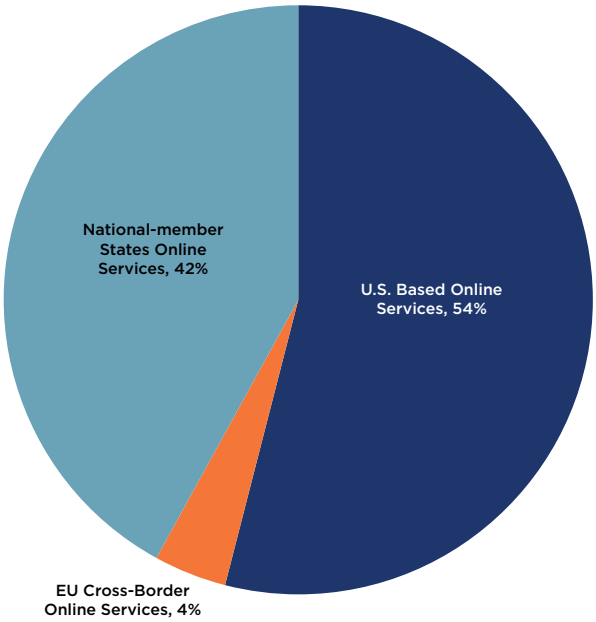
Domestic consumption is the primary driver of digitization in the European economy. However, the overall contribution of digital to GDP is reduced by the

TABLE 3.5.4: EUROPE IS DEPENDENT ON THE UNITED STATES FOR THE SUPPLY OF DIGITAL ASSETS



Source: Jacques Bughin, Eric Hazan, Eric Labaye, James Manyika, Peter Dahlström, Sree Ramaswamy, and Caroline Cochin de Billy, Digital Europe: Realizing the continent's potential, McKinsey Global Institute, June 2016, http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-europe-realizing-the-continents-potential.

TABLE 3.5.5: THE DIGITAL MARKET IN EUROPE



Source: World Development Report 2016: Digital Dividends. Data as of: January 2016.

fact that Europe imports a significiant amount of its digital capability. There are two broad types of such imports: digital hardware, primarily from Asia; and digital platforms, largely from the United States. The U.S digital economy also relies on hardware imports from Asia. Its homegrown digital platforms mean that the United States ranks high as a supplier of digital capabilities to the global and European economies. One study notes that the share of online services imported from the United States is "very substantial" but that 32% of U.S. online service providers export, and that these exports account for nearly twice as much as domestic demand.[23] The World Bank notes that around 42% of all online services trade volume in the EU is domestic and that 54% comes from the United States. Moreover, about two-thirds of all EU online services suppliers do not operate in more than four countries.[24]

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