software.org
BSA Foundation

The Growing €1 Trillion Economic Impact of Software

OCTOBER 2018

www.software.org/EUSoftwareImpact

WITH DATA FROM

The Economist INTELLIGENCE UNIT

Contents

This report was written by Software.org: the BSA Foundation, incorporating the analysis done by The Economist Intelligence Unit (EIU). The EIU compiled these data and economic impact assessments using publicly available government data, maintaining full editorial control of the process and using industry standard approaches. Any views or opinions expressed in this document are not necessarily those of The Economist Intelligence Unit.

The Findings: At a Glance

EUROPEAN UNION[a]

Software changes lives. The way we work, play, and move is being transformed by new software — not just on your computer, but by apps, big data, and access to the cloud. From optimizing plane routes to improving life for people with Parkinson's disease, innovation is happening at every level. To understand the impact of this, Software.org: the BSA Foundation commissioned the experts at The Economist Intelligence Unit (EIU) to examine the software industry's economic role. They studied the European Union (EU) and seven member states: France, Germany, Italy, the Netherlands, Poland, Sweden, and the United Kingdom. The research shows which countries are seeing the biggest benefits from software's growth — and how others can share in that success.

The stakes are high: All in, software was responsible for €1 trillion of total EU value-added GDP in 2016.[b] That's an increase of 9.9 percent from 2014, compared to overall GDP growth of 6.0 percent over the same period. And software supports other sectors, too — think of it as double-clicking on growth.

Total[c] Value-Added GDP:

€1 trillion

Up from €910 billion in 2014, **a 9.9% increase**

Direct Value-Added GDP:

€304 billion

Up from €249 billion in 2014, **a 22.4% increase**

EMPLOYMENT

Direct:

3.6 million jobs

Up from 3.1 million in 2014, **a 16.5% increase**

Total[d]:

12.7 million jobs

11.6 million in 2014

It's not just about coders. The software industry provides jobs in every field, from disaster recovery services to data processing and accounting. As Europe closes the digital skills gap,[e] companies are hiring for jobs that simply didn't exist a decade ago — roles like strategic cloud data engineer, big data product specialist, and futurist. Across the EU, work supported by the software industry through direct, indirect, and induced contributions represents 12.7 million jobs.

WAGES

Average Annual Salary for Software Industry:

€45,307

Total Annual Salaries Paid by Software Industry:

€162.1 billion

The total direct wages paid by the software industry for all 28 EU member states grew to €162.1 billion from €139.2 billion in 2014, an increase of 16.4 percent. Wage growth in smaller countries is particularly impressive: total salaries paid by the sector in Sweden grew 31.4 percent over the two years to 2016, and by 30.4 percent over the same period in Poland.

[a] All data is from 2016 and was provided by The EIU unless stated otherwise.

[b] Includes indirect and induced effects. Indirect effects stem from purchases of inputs by the software industry, whereas induced effects stem from the spending of income by employees affected by those direct and indirect effects.

[c, d] Total including indirect and induced contributions.

[e] "The Digital Skills Gap in Europe," EU Commission Factsheet, October 19, 2017, available at https://ec.europa.eu/digital-single-market/en/news/digital-skills-gap-europe.

Executive Summary

We are living in interesting times. Global power structures are shifting, and longstanding trade relationships are under stress even as the world becomes more connected than ever before. Countries, companies, and citizens are all seeking sources of growth. From apps to artificial intelligence (AI), the software industry is creating new products and technologies that improve lives. This report explores how that in turn contributes to stable economic growth, creates jobs, and drives innovation across Europe.

But how to measure that contribution? To understand the industry's impact on Europe's economy, Software.org: the BSA Foundation commissioned The Economist Intelligence Unit (EIU) to crunch the numbers. They produced a fascinating snapshot of an innovative, diverse continent. These latest numbers, two years after the first EIU study, show that while Europe's leading software nations continue to grow, smaller EU member states are increasingly harnessing software's growth potential as well.

What's happening is impressive: Software companies were responsible for €1 trillion of total EU value-added GDP in 2016, an increase of 9.9 percent over 2014. In addition, the software industry supports 12.7 million jobs across the EU. Software companies directly contributed €304 billion to EU GDP in 2016, a 22.4 percent increase over the two-year period. The industry directly provides 3.6 million well-paid, future-facing jobs, a rise of 16.5 percent. And the software industry paid some €162.1 billion in wages, up 16.4 percent since the inaugural edition of the report.

Numbers and statistics tell only part of the story, though. Lives worldwide are being improved by software products that do everything from improving crop yields, to creating 3D models of historic sites threatened by conflict. The growing power of AI means software can detect environmental hazards, help analyze medical scans, and push banks to avoid discrimination when they make lending decisions.

These examples are already here, but the continent of Newton, Curie, and Einstein has always been at the forefront of ideas. This report highlights how software solutions developed in the EU are supporting businesses in every sector.

It also discusses the ramifications of Brexit for the software industry. The UK's software industry is one of the region's leaders, with a direct value-added GDP contribution of €85.8 billion in 2016, an increase of 31.5 percent since 2014. In an internet-linked world, what does Brexit mean for this highly connected sector? And with agile smaller member states embracing the power of the app economy, what does Brexit mean for the EU27?

Overall, this study provides hard figures on the boost that software, in all its diverse forms, is bringing to Europe's economy — and inspiration for policymakers looking to ensure future growth.

Key Findings and 2014 Comparison

Strong Growth Across Europe

Two years on from the inaugural edition, the data in this report updates and expands the analysis of software's role in Europe's economy. Alongside new figures, it widens country-by-country analysis to include smaller, more recent EU member states who are expanding their software sector with impressive speed.

As in the last edition, this study sets out to quantify this economic impact of software in three channels: The industry's direct impact; its indirect impact through inputs of goods and services from their EU supply chain; and the induced impact, from increased general demand due to higher total wages paid to people in the software industry and to people in industries that supply to the software industry.

Direct Impact

- The software industry directly contributed €304 billion to the EU economy in 2016, representing 2 percent of total EU value-added GDP — up 22.4 percent from €249 billion in 2014.
- The sector employed 3.6 million people and paid €162.1 billion in wages. Software companies were responsible for an average of 1.8 percent of total jobs in the seven EU countries in this study (Sweden's software industry directly accounts for 3 percent of all jobs in the country).

Total Economic Impact

- **Combining the direct, indirect, and induced impact of the sector, software contributed €1 trillion to total EU value-added GDP in 2016 — up 9.9 percent from €910 billion in 2014. That compares to an overall EU28 total GDP growth of 6.0 percent over the same period.**
- **The industry supported 12.7 million jobs across the 28 EU member states.**
- **Every €1 million contributed by the sector to GDP meant €3.28 million for the EU economy.**[1]

Indirect and Induced Impacts

- Indirectly, the industry contributed a further €221 billion to EU GDP and supported an additional 2.6 million jobs.
- The induced impact — the economic effects driven by higher wages in the software industry and sectors supplying it — works out at another €474.6 billion, and 6.6 million more jobs.

What's Changed Since 2014

The software industry was responsible for **€1 trillion of total EU value-added GDP** in 2016, an **increase of 9.9 percent** over 2014.

The industry supported **12.7 million jobs across the EU, up from 11.6 million** in 2014.

The total direct wages paid by the software industry for all 28 EU member states **grew to €162.1 billion** from €139.2 billion in 2014, an **increase of 16.4 percent**.

Diverse Rates of Growth

The UK, Germany, and France contribute 63 percent of total EU direct software industry value-added GDP. But things are changing: during 2014–2016, the UK was the only one of these three countries that increased market share in the EU software industry. That's because smaller countries such as Sweden and Poland are grabbing a bigger piece of the software pie.

Europe's digital frontrunners are performing brilliantly: The direct value-added GDP contribution from Sweden's software industry grew 43.9 percent between 2014 and 2016. But the sector is also driving growth in countries where the economic situation has been tougher in recent years: Italy saw an increase in the direct value-added GDP impact of 12.7 percent during this period.

The industry's R&D expenditure varies greatly between countries. Germany and the UK saw just under €3 billion and €2.4 billion, respectively, in 2015.[2] Of the seven markets studied, Poland was home to least spending on R&D activity within the software industry — just €250.5 million in 2015.

There's a huge range of roles within the industry. Across Europe, 85.2 percent of software industry jobs are in computer programming, consultancy, and related activities. Software publishing contributed 3.6 percent of jobs; 11.2 percent were in data processing, hosting, and related activities.

And within those roles, there's a range of responsibility levels. Interestingly, while Sweden's software industry is larger than Poland's in terms of value-added GDP, Poland's software sector employs more people than Sweden's.

SOFTWARE IS...

Smoother Roadworks: Autodesk's Building Information Modelling system combined 3D scanning, a cloud service for remote teams, and centuries of Dutch engineering prowess to ensure the plan was solid before work started on the Velsertunnel renovation.

Software in Every Sector

To those who understand it, code can be beautiful. But software isn't a product that exists for its own sake. Europe's software developers, data architects, and project managers mainly work to create solutions for other sectors that drive the continent's economic growth — and create jobs for a range of professionals across every other economic sector. This results in €1 trillion in value-added GDP and 12.7 million total jobs across all sectors, and leads to real-life changes such as:

- **Better health care.** Germany's TeleClinic[3] offers a way for patients to talk to a doctor 24 hours a day, 365 days a year. They need to serve 400,000 users seamlessly in a way that also respects Germany's stringent standards on privacy and data protection. They used IBM Cloud infrastructure that includes a highly scalable Cloudant database. Now patients can contact a doctor remotely, knowing their data is safely encrypted.
- **Smoother roadworks.** Since 1957, the Velsertunnel has been a key part of Dutch road and rail infrastructure: Around 65,000 vehicles a day pass through it. It urgently needed renovating to accommodate modern trucks, new technical installation such as CCTV and fire protection equipment, and improved ventilation. On top of that — literally — the ventilations shafts are listed as part of the Netherlands' National Heritage. Autodesk's Building Information Modelling system combined 3D scanning, a cloud service for remote teams, and centuries of Dutch engineering prowess to ensure the renovation plan was solid before work started.[4]
- **Tastier beer.** Researchers at the Carlsberg Research Laboratory in Denmark are working with artificial intelligence (AI) to create 1,000 different beer samples every day as part of a new research study called the Beer Fingerprinting Project.[5] The technology uses sensors to assess the beer's aroma, mapping out a "flavour fingerprint" for each individual sample. Created by Microsoft, Carlsberg, Aarhus

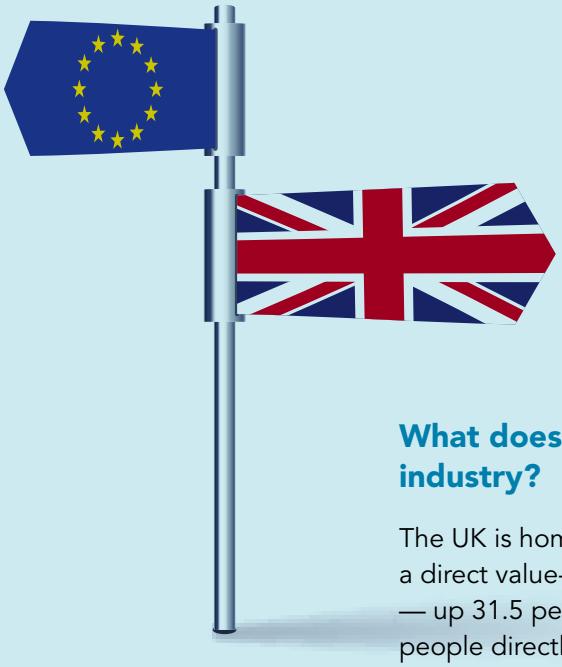
SOFTWARE IS...

Smarter teaching. Sweden's Berghs School of Communication uses Salesforce to manage their database to offer each student a more personalised learning experience — wherever they are. Software has helped them win "School of the Year" at the Cannes Lion Awards multiple times.

University, and other partners, the system aims to develop new kinds of brewer's yeast for application in classic, craft, and alcohol-free beers at a much higher speed and quality. Cheers to software!

- **Smarter teaching.** Sweden's Berghs School of Communication has been running for more than 75 years, but with the rise of digitisation, it faces new challenges, such as getting students learning online. The university now uses Salesforce to manage their database and can offer each student a more personalised learning experience — wherever they are. With 250 full-time and up to 2,500 more part-time students every year, software has helped them win "School of the Year" at the Cannes Lion Awards multiple times.

- **Access for all.** As online pioneer Vint Cerf noted, the internet is for everyone. In recent years, software companies large and small have worked to make the online world accessible to those with learning and communication challenges. Polish start-up Migam developed the Migam Interpreter app, which gives users real-time access to sign language interpreters via webcam. That gives deaf people instant access to services such as online banking or transport apps, bridging the communication divide.



Questions for the Future

What does Brexit mean for the EU's software industry?

The UK is home to the Europe's biggest software industry, with a direct value-added GDP contribution of €85.8 billion in 2016 — up 31.5 percent over two years. It employs almost 700,000 people directly and distributed €37.1 billion in wages. Thousands of start-ups took their first steps at London's Silicon Roundabout;[6] Microsoft set up its first research lab outside the US in 1997 in Cambridge, in an area that has become known as Silicon Fen.[7]

But the UK vote to leave the EU has led to a time of uncertainty, with the vision for the UK's future relationship with the EU still being debated at the highest political level.

The UK vote to leave the EU has led to a time of uncertainty, with the vision for the UK's future relationship with the EU still being debated at the highest political level.

The UK's positioning as an open economy has helped firms set up and grow there. At the same time, EU membership has made it very attractive to European tech talent, with no visa required to work in the UK.

Although the UK may be leaving, the effect on the software industry remains unclear. Stephen Kelly, CEO of Sage, a British company that supplies cloud-based accounting software to SMEs, told *The Times* recently that British companies have "just kept calm and carried on and grown their business, they haven't been distracted by Brexit."

Whatever the outcome of Brexit talks, the EIU figures show solid growth for the software industry across the EU and the individual countries surveyed. In a world where the power of apps, big data, and AI are changing lives, the industry looks set to continue creating jobs and inventing products regardless of political headwinds.

A Day in the Life of Software

Software improves our lives, but its impact can be hard to quantify. Although the EIU figures reflect the industry's huge economic impact, how does it affect our everyday lives? Most people now carry a smartphone, accessing apps that inform, entertain, and even track health.

In addition, large-scale software solutions used by governments, corporations, and others play a huge role in making our days more comfortable and efficient. Perhaps the best way to describe it is through a day in the life of software. Let's consider how it affects a European MRI specialist who's travelling to Milan for a conference.

Waking Up

Like hundreds of millions of Europeans, our doctor starts the day with a shower. When the water flows, it's partly thanks to software: Datastax's Apache Cassandra is a free, open-source database used by companies like the UK's i2O Water. It helps water utility companies around the world stop leakage by processing vast amounts of data from 15,000 sensor devices globally — saving 235 million litres of water every day.[8]

Next, she takes her morning medication. For public health providers like Stockholm County Council, managing people's needs is made easier by software. The Council uses several different solutions from SAS software for analysis and reporting.[9] One is a joint portal that can be accessed by officials, pharmaceutical centers, hospitals, and other care providers responsible for purchasing.

"When all units had their own databases, the information on the databases was not available for the other departments," explains Ivan Labbé-Reyna, SAS Officer of Stockholm County Council. "Now all information is accessible from a common analysis portal, and updates need only be made in one place." It's also saved the council several million Swedish krona.[10]

In Sweden, the software industry added a total (direct, indirect, and induced) value of €46.8 billion to GDP in 2016.

Getting There

Next, our MRI specialist gets a bus to the airport. Buses are the backbone of public transport in many cities across Europe, but they also tend to run on expensive, polluting, diesel fuel. British company Vantage invented a power system that can be retro-fitted to buses and enable them to run on hybrid fuel — reducing fuel consumption and emissions by more than 40 percent.

Vantage won first prize in the transportation category at the National Instruments Global Engineering Impact Award, but they couldn't have done it without software: They used Autodesk Inventor from Autodesk Product Design Suite for prototyping, 3D mechanical design, product simulation, and documentation of the hybrid powertrain.[11]

Once at the airport, she has no need to check in; she's already done it online and her boarding pass is on her phone. It's a short stroll to the gate where her Alitalia flight is ready to take off. Keeping things running smoothly is software. The Weather Company, an IBM business, created a product called WSI Fusion, which Alitalia uses to adjust its flight dispatch processes based on real-time weather analytics.[12]

"Not only do we need to factor in the weather conditions at the start of the flight, but throughout the course of the journey too," says Fabio Ceresani, Flight Dispatcher Duty Manager at Alitalia. Now, flights can even change route while airborne to avoid adverse weather conditions. "Some of our long-haul flights last ten hours or more — and weather conditions can change hugely in that time."

The UK's software industry directly employed just under 700,000 people in 2016.

On the Plane

Settling into the window seat, she notices the passenger next to her is catching up with all the latest magazines, in Polish, on an app on his phone. That's all thanks to Publico24, a Polish media company that uses Microsoft's cloud technology to help publishers go digital. It used to take as long as three days for weekly magazines to develop their digital edition, but Publico24 has slashed that to three hours, saving time and money. The app also enables readers to access titles offline as well — perfect for frequent flyers.[13]

Poland's software industry grew at a rate of 28.3 percent, in terms of direct value-add GDP, from 2014–2016.

Out the Window

Listening to podcasts, our traveler leans on the window and gazes at the green-and-yellow tapestry of fields below. French company Drotek can take some credit there — they make and program drones, sensors, and geolocalisation tools to help farmers manage their land. They also use IBM Watson cognitive technologies for precision farming projects, including food production. Watson software can analyze large volumes of unstructured data — the kind of thing farmers have been gathering for years — and build a model that takes into consideration weather, plant strength, and irrigation. The result is real-time advice for bigger yields and better production.[14]

The software industry in France directly distributed €22.9 billion in wages in 2016.

On Landing

The MRI conference is a big deal, so the city's hotels are solidly booked. Predicting demand is important for tour operators — every empty plane seat or hotel room costs them money. Fortunately, our doctor planned ahead. That's easier these days: Germany's DER Touristik Köln, for example, uses SAS software to forecast demand for travel and avoids tourists finding their room rates inflated by, say, a medical conference. The same technology can also help prepare evacuation plans for unexpected events such as volcanic eruptions.

The software analyzes data for trends including past bookings, customer preferences, and holiday dates, enabling it to predict future demand for flights. It also allows users to purchase the right hotel room capacity in the right destination at the most attractive price. Travelers can determine how many rooms they need, negotiate deals with hoteliers, and even use SAS to help recognize up-and-coming trends in the travel market early. So software, not just social media influencers, helps discover next year's hot city vacation destination.[15]

In Germany, the software industry supported a total (direct, indirect, and induced) of nearly 2 million jobs.

In Milan

The *Giro d'Italia* is well underway, and on a big screen in the lobby, the hotel receptionist is watching the cyclists tackle a particularly gruelling climb. After he's checked our doctor in and wished her good luck at the conference, his eyes flick back down to his phone, where he's enjoying a whole new level of insight into the race courtesy of the Eurosport app.

The France-based, pan-European TV channel wanted to give cycling fans a unique way of following the race, so they partnered with CA Technologies to create a second screen that helps fans of the pink jersey get closer to the action than ever before. They used GPS tracking, a live map, and biometric information on each rider to offer extensive live analysis on race developments, thanks to CA's API Management software toolkit. Eurosport could also see exactly how people were using the app in real time, so they could solve problems and tweak performance instantly. If only riding through the Alps were so easy![16]

Italy's software industry directly employed more than 304,000 people in 2016.

At the Conference

One presentation really captured our MRI specialist's imagination. Researchers at LMU Munich have been looking into the phenomenon of sensory compensation, where the other senses are heightened in an individual who has lost one. Some blind people have mastered the skill of echolocation — the ability to "see" their environment by listening to the echoes of clicking sounds they make with their mouth.

The researchers used MRI to investigate what happens when these people hear the sound waves. How do their brains process the received signal and "see" the clicks? The researchers studied how sounds used for echolocation were processed in both blind and sighted people. They found that the returning echolocation signals were activated in the region that processes sight, the visual cortex. The study was published in *The Journal of Neuroscience*.

This required a virtual space to test the clicks in. The researchers created a spectrogram — a sort of sonic image — of the chapel of Old St. Stephanus Church in Gräfelfing, Germany. Then, using Mathworks' MATLAB software, they scaled the virtual space up and down so it could be heard via headphones in the MRI machine.

"In effect, we took an acoustic photograph of a chapel, and we were then able to computationally alter the scale of this sound image, which allowed us to compress it or expand the size of the virtual space at will," stated Lutz Wiegrebe, a professor in the Department of Biology at LMU and lead author of the paper.[17]

The software industry in Germany directly distributed €39.4 billion in wages in 2016.

Over Dinner

Over Italian cuisine and a bottle of red, conversation turns to holidays, archaeology, and preserving ancient monuments. Sadly, it's not just ancient sites that are under threat: Conflicts, time, and nature threaten many places of historic significance worldwide. Paris-based Iconem creates 3D digital models of these landmarks threatened by war, conflict, time, and nature.

Using drones, they capture thousands of images of structures under threat. These are then stitched together using advanced algorithms and the computing power of Microsoft AI. The resulting high-resolution 3D models help experts assess damage. Iconem has surveyed sites in 20 countries: in western Syria, they took 150,000 photos of Crac des Chevaliers, one of the world's most famous Crusader castles, now damaged by fighting, as part of a project for UNESCO. Software may be providing the jobs of the future, but it's also playing an invaluable role in preserving our past.[18]

METHODOLOGY

In 2018, Software.org: the BSA Foundation commissioned The Economist Intelligence Unit (EIU) to assess the economic impact of the software industry. The EIU collected and analysed the most recent data available from several recognised and reputable sources. These sources included the EIU itself as well as Eurostat.

To estimate the total contributions of the software industry to the EU, French, German, Italian, Dutch, Swedish, Polish, and UK economies, the EIU analysed the direct contributions and estimated indirect and induced impacts using various economic multipliers. The economic contribution analysis presented in this paper uses input-output models, which describe the full inter-industry transactions between producers and intermediate and final consumers, to compute multipliers. Multipliers allow for the estimation and isolation of the direct, indirect, and induced contributions of an industry to economic outcomes (e.g., value-added GDP, employment, and wages).

Direct and indirect contributions are estimated using different multipliers:

1. **Direct contributions.** The levels of output or employment from the software industry itself.

2. **Indirect impacts.** The indirect impacts estimate the inter-industry economic activity resulting from the direct contributions (e.g., purchases of inputs). These indirect impacts look backward at the linkages of the software industry in the economy, and the demands inputs from other sectors, like real estate and other professional services. This demand generates additional output (and jobs) from those sectors that wouldn't exist if it weren't for that software industry demand. As a result, the indirect multipliers estimate this additional output from other industries that is attributable to the software industry.

3. **Induced impacts.** Induced impacts take the next step — identifying the additional economic activity supported by spending on goods and services by households whose income was affected by the direct contributions and indirect impacts. The software industry pays its employees but also supports incomes in other sectors, like real estate. These jobs come with additional wage payments, which increase total earnings to people working in these upstream sectors. These people then buy more goods and services, which generate additional demand (and output) across the broader economy. Induced multipliers estimate this additional output from increased general demand due to higher total wages paid to people in the software industry and people in industries that supply to the software industry.

The modern definition of the software industry used in the study reflects recent technological advancements in the software industry — from one that focused on tangible and packaged software products to one that includes software-related services like the cloud-based software as a service (SaaS), cloud storage and computing, mobile app development, and hosting. As a result, the EIU analysis has defined the EU software industry to include the following software sub-industries:

NACE 582: Software Publishing

NACE 620: Computer programming, consultancy, and related activities

NACE 631: Data processing, hosting, related activities, and web portals

The EIU compiled this data and economic impact assessments using publicly available government data, maintaining full editorial control of the process and using industry standard approaches. Any views or opinions expressed in this document are not necessarily those of The Economist Intelligence Unit.

ENDNOTES

1 Calculated by dividing software's total contribution to EU GDP by the amount GDP software directly adds to the EU economy.

2 Latest available data.

3 "TeleClinic Created a Telemedicine Platform to Offer Users Expert Guidance and Minimize Unnecessary Medical Appointments," IBM Case Study, August 2017, available at https://www.ibm.com/case-studies/d615643q72632b54.

4 Teresa Elliott, "Innovation and Renovation for Historic Tunnel," BIM Case Study, March 24, 2016, available at http://www.infrastructure-reimagined.com/bim-helps-renovate-aging-tunnel/.

5 Microsoft News Centre Europe, "The Beer Fingerprinting Project — How Artificial Intelligence Could Create Your Next Pint," December 5, 2017, available at https://news.microsoft.com/europe/2017/12/05/beer-fingerprinting-project-artificial-intelligence-create-next-pint/.

6 The nickname for East London Tech City, a growth cluster announced by the UK government in 2010. "East London Tech City," available at https://en.wikipedia.org/wiki/East_London_Tech_City.

7 For more on the Microsoft Research Lab, see Microsoft Research Lab Cambridge, available at https://www.microsoft.com/en-us/research/lab/microsoft-research-cambridge/; for an overview of Silicon Fen's history, see John Naughton, "They Call It Silicon Fen. So What Is the Special Draw of Cambridge?" *The Guardian*, December 1, 2013, available at https://www.theguardian.com/technology/2013/dec/01/silicon-fen-cambridge-global-success-university.

8 "Case Study: i2O Water — i2O Water Tackles Water Crisis With Apache Cassandra™" Datastax, 2018, available at https://www.datastax.com/resources/casestudies/case-study-i2o-water.

9 "Improving Quality and Lowering Costs in Health Care: Stockholm County Council Increases Efficiencies With Shared Skills and Shared Data," SAS Software Case Study, available at https://www.sas.com/en_us/customers/stockholm-county-council.html.

10 US $1 million equals 8.8 million Swedish krona as of July 2018.

11 "Vantage Power: Cleaner Mass Transit: Retrofitting Diesel Buses to Slash Fuel Costs and Emissions," Vantage Case Study, available at https://www.autodesk.com/sustainability/stories/vantage-power.

12 "Alitalia: Real-time Weather Analytics Lift Comfort Levels Sky-High for Happier, More Relaxed Passengers," IBM Case Study, May 2017, available at https://www.ibm.com/case-studies/alitalia.

13 "Print Isn't Dead, It's Just Evolving: Meet the Newspaper of Dreams," Microsoft News, April 18, 2017, available at https://news.microsoft.com/europe/2017/04/18/newspaper-dreams-print-isnt-dead-just-evolving/.

14 "DroTek: Revolutionizes the Agriculture Industry With Cognitive Solutions From IBM," IBM Case Study, October 2017, available at https://www.ibm.com/case-studies/drotek.

15 "Travel Operator Goes Further With Advanced Analytics," SAS Case Study, available at https://www.sas.com/en_us/customers/der-touristik-de.html.

16 "Epic Experiences Ride on Data: CA Helps Eurosport Pull Ahead of the Pack," CA Technologies Case Study, August 2017, available at https://www.ca.com/content/dam/ca/us/files/case-studies/ca-helps-eurosport-pull-ahead-of-the-pack.pdf.

17 Lisa Harvey, "Neuroscience Shows Blind People Can 'See' a Physical Space by Listening," MATLAB Case Study, October 24, 2017, available at https://blogs.mathworks.com/headlines/2017/10/24/neuroscience-shows-blind-people-can-see-a-physical-space-by-listening/.

18 Vanessa Ho, "'Heritage Activists' Preserve Global Landmarks Ruined in War, Threatened by Time," Microsoft News, April 23, 2018, available at https://news.microsoft.com/transform/heritage-activists-preserve-global-landmarks-ruined-in-war-threatened-by-time/.

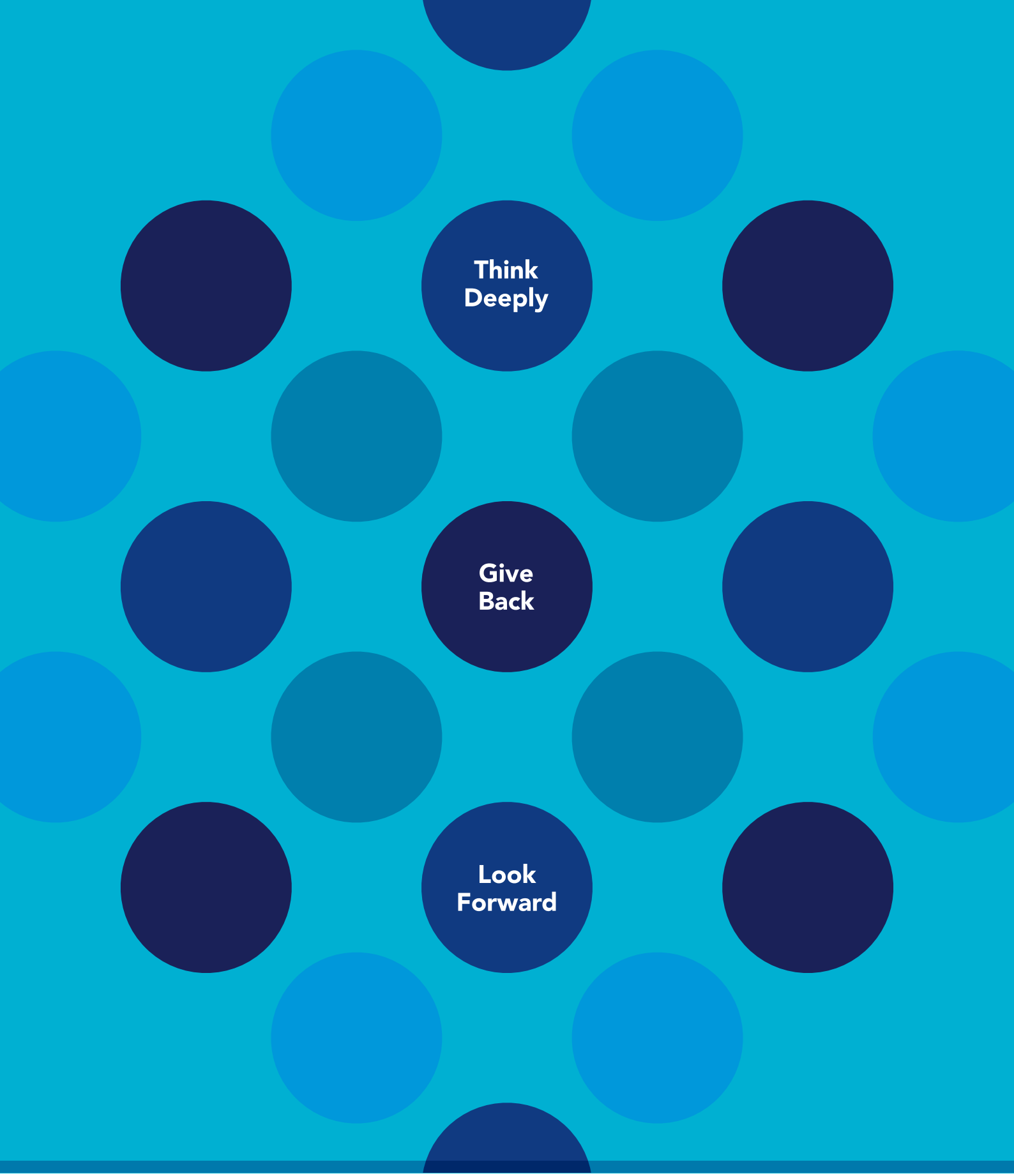
ABOUT SOFTWARE.ORG

Software.org: the BSA Foundation is an independent and nonpartisan international research organization that works to help policymakers and the broader public better understand the impact that software has on our lives, our economy, and our society. We believe that by working together to examine these issues we can better prepare for the future and help inform government policies and industry culture that will promote both technological advancement and widespread growth. At the same time, Software.org works to empower the workforce of the future and to help policymakers, stakeholders, and the technology industry itself look forward and prepare for the world of tomorrow.

software.org
BSA Foundation

20 F Street, NW, Suite 800 Washington, DC 20001
202 872 5500 **www.software.org**

software.org/facebook
software.org/twitter
software.org/linkedin



software.org
BSA Foundation