Aspen Institute Germany

Laboratories of Democracy Initiative

The Digital Transformation: Recommendations for the State Level and for Transatlantic Cooperation

Digital Economy Transformation Trade Data Networks Privacy Hydrogen Workforce Software Future Policy Electric Connection Youth Innovation Cooperation Standards Technology Skills Internet Cyberspace Labor Protection Energy Global Security Emissions Opportunity Education Investment 5G Open Automation Democracy Infrastructure Building Hacker Resilience Exchange Relations Broadband Regulation AI Awareness Transatlantic Hardware Attack

Action Report

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About the Project and the Group

The Laboratories of Democracy Initiative brings together German and U.S. American state legislators to promote a values-based discussion and exchange of ideas about common policy challenges on the subnational level. U.S. Supreme Court Justice Louis Brandeis once wrote about the power of states as the "laboratory of democracy," where new and innovative policy approaches can be tested. The project draws on that notion, focusing on the role of state legislators in creating policy solutions and fostering transatlantic relations. It creates a much-needed platform for in-depth discussions and solution-finding. It allows participants to identify pressing policy challenges at the subnational level, share best practices, and debate potential policy solutions and opportunities for transatlantic cooperation.

In 2020-21, the exchange focused on the topic of digitalization. Participating state legislators came from a wide range of German and U.S. American states. The bipartisan composition of the group underscored the participants' desire to jointly work on solutions and to strengthen transatlantic relations.

This one-year-long exchange, which was prolonged because of the COVID-19 pandemic, consisted of virtual meetings and an in-person meeting in Stuttgart, Germany. The participants had the opportunity to engage with each other and to meet with representatives from academia, the public and private sector, and administration. Based on this process, the participants developed bipartisan policy recommendations. These focus on the challenges and opportunities of digitalization and possible actions at the state and transatlantic level.

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Transatlantic Context: An Introduction

Today's challenges cannot be solved by one country alone. International cooperation is vital to adequately address global challenges and find suitable solutions for the future. Given their shared values, common interests, and belief in democratic principles, Germany and the United States are natural partners to work together on these issues. The two countries are connected through their people, businesses, ambitions, and history.

In recent years, the transatlantic relationship has come under more scrutiny and is perceived differently than in the past. According to a joint survey conducted by the Pew Research Center in the United States and the Körber-Stiftung in Germany between 2017 and 2021, public opinion in Germany towards the U.S.-German relationship was subject to significant fluctuations. German public opinion considerably worsened during the Trump administration, with 42 percent of Germans polled saying the relationship was good during Donald Trump's first year in office and even less, only 18 percent, saying the same at the end of the Trump presidency. With the beginning of the Biden administration, a stark change in public opinion occurred in Germany. As per the latest numbers from November 2021, 71 percent of Germans now view the transatlantic relationship as good.[1] According to the same joint survey, U.S. American public opinion towards the bilateral relationship with Germany was continually better and stayed more stable during the same time frame. In 2017, 68 percent of U.S. Americans polled viewed the relationship as good. This number continuously increased to 84 percent in the first year of the Biden presidency.[2] While these survey results demonstrate that the transatlantic relationship is on a positive trajectory, dialogue and concrete projects for cooperation are necessary to strengthen the transatlantic partnership further. They can also be a driver for finding solutions to common problems by sharing best practices.

Economic relations between the two partners remain strong. According to the United States Census Bureau (2021), Germany was the fifth biggest partner of the United States in merchandise trade (total trade, including exports and imports) and its largest trading partner in Europe (period December 2020 to December 2021).[3]

For Germany, the United States was the most important export destination for goods in 2020 and its third most important source for merchandise imports, according to the Federal Ministry for Economic Affairs and Climate Action (previously called Ministry of Economic Affairs and Energy).[4] However, a focus on trade alone underestimates the deep economic ties between the transatlantic partners. The United States is the most important destination of foreign direct investment (FDI) from Germany. In 2019, almost 30 percent, or 391 billion euros worth, of all German FDI went to the United States, according to the *Bundesbank*.[5] German-owned affiliates also provided about 859,900 jobs in U.S. states, which made them the fourth largest foreign employers.[6]

[1] Jacob Poushter, Shannon Schumacher, and Sneha Gubbala, U.S.-German Relations on the Mend as New Leadership Takes Hold, Pew Research Center, November 2021, p. 3, https://www.pewresearch.org/global/wp-content/uploads/sites/2/2021/11/PG_2021.11.22_us-german-relations_REPORT.pdf (accessed February 25, 2022).
[2] Cf. ibid.
[3] United States Census Bureau, Top Trading Partners – December 2021, December 2021, https://www.census.gov/foreign-trade/statistics/highlights/toppartners.html (accessed February 25, 2022).
[4] Federal Ministry of Economics and Energy, Fakten zum deutschen Außenhandel (2021), July 2021, p. 2, https://www.bmwi.de/Redaktion/DE/Publikationen/Aussenwirtschaft/fakten-zum-deuschen-aussenhandel.pdf?__blob=publicationFile&v=12 (accessed February 25,2022).
[5] German Bundesbank, Foreign Direct Investment Stocks up again in 2019, April 2021, https://www.bundesbank.de/en/press/press-releases/foreign-direct-investment-stocks-up-again-in-2019-864988 (accessed February 25, 2022).
[6] Representative of German Industry and Trade (RGIT), German Business in the USA, September 2021, https://www.germanbusinessusa.com/fileadmin/website/210921_RGIT_Flyer.pdf (accessed February 18, 2022).

Cooperation between the United States and Germany is not only taking place on the federal level. Over the last years, U.S. states and German *Bundesländer* have increased cooperation and exchange of ideas on issues such as climate change, manufacturing, digitalization, and mobility. At the start of 2022, Baden-Württemberg and California, for example, hosted multiple digital workshops on the future mobility.[7] North Rhine-Westphalia also conducted a series of seminars in 2021 on digitalization in manufacturing, bringing together stakeholders from the United States and Germany.[8] Investors from northern Germany and the Silicon Valley region in California have the chance to consult with a permanent Innovation Office in California. This office is supported by three German *Bundesländer* (Schleswig-Holstein, Hamburg, and Bremen) and allows German and U.S. American companies and investors to engage with each other and exchange best practices. It also allows U.S. businesses to navigate the investment processes in Northern Germany more easily.[9] Close cooperation is vital for maintaining strong relationships, both economically and culturally. Exchange and collaboration on the state level still have much more potential to offer and need to be increased further.

Over the past decades, especially since the turn of the century, the digital realm has become an essential part of everyday life. Technological innovations can promote the resilience of societies and economies by facilitating communication, increasing access to health care, and streamlining production processes. At the same time, they also pose new challenges. The world is more digitalized than ever before, and that trend will only continue. How democratic societies address digital challenges and opportunities will play a crucial role.

The COVID-19 pandemic has accelerated the speed of the digital transformation by leading to a faster adoption of digital technologies. It has also demonstrated how interconnected the world and supply chains are, highlighting the pivotal role of global communication and cooperation. The need for a robust digital infrastructure and connectivity became evident as soon as remote work took hold of many businesses and schools. The pandemic changed how people engage with each other, their employers, and colleagues as life and work increasingly moved to the digital space. Countries are finding themselves in a race to accommodate the digital needs of their citizens. How well a country is prepared for utilizing digital technologies is ranked every year by the World Economic Forum in its Network Readiness Index. According to the Network Readiness Index of 2021, Germany(8)[10] and the United States (4)[11] rank among the top ten countries. Both countries are in a favorable position to seize the opportunities of digitalization for their people and economies.

The sphere of digitalization is extensive. One example is industrial production. Industry 4.0 is considered the future of product design, manufacturing, and optimization. The workforce of today and tomorrow needs to be able to work in lockstep with machines and computers, artificial intelligence, and robotics, which are becoming more and more present. Humans will play a very different role in today's and tomorrow's industry.[12]

The United States and Germany are not only drivers in the field of digitalization but are also interconnected through it. The role of

[7] e-mobil BW GmbH, Veranstaltungsreihe mit Baden-Württemberg und Kalifornien, January 2022, https://www.e-mobilbw.de/service/termin-detail/baden-wuerttemberg-california-a-transatlantic-platform-for-future-mobility-solutions (accessed February 28, 2022).
[8] NRW.Global Business GmbH, Highlights der ersten virtuellen Transatlantik-Konferenz USA/NRW, May 2021, https://www.nrwinvest.com/de/ueber-uns/news/detail/news/detail/News/erste-virtuelle-transatlantik-konferenz-usanrw/ (accessed February 28, 2022).
[9] Northern Germany Innovation Office, Networks and Connections to Silicon Valley, 2022, https://www.inno-north.com/en/your-bridge-to-silicon-valley/ (accessed February 14, 2022).
[10] Portulans Institute, Network Readiness Index 2021 Germany, 2021, p.1, https://networkreadinessindex.org/wp-content/uploads/reports/germany.pdf (accessed February 14, 2022).
[11] Portulans Institute, Network Readiness Index 2021 United States, 2021, p.1, https://networkreadinessindex.org/wp-content/uploads/reports/united-states-of-america.pdf (accessed February 14, 2022).
[12] Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Production 4.0, 2022, https://www.fraunhofer.de/en/research/current-research/production-4-0.html (accessed February 14, 2022).

digital services in the area of ICT has increased substantially. Especially digitally-enabled services (services that can be, but not necessarily are, delivered remotely over ICT networks[13]) show how immense the current level of transatlantic trade already is. The United States exported potentially digitally-enabled services[14] worth approximately 247 billion U.S. dollars to Europe in 2020. In the same period, the United States imported potentially digitally-enabled services from Europe amounting to 142 billion U.S. dollars.[15] Europe is the biggest trading partner of the United States for these digital services.[16] The relationship between Europe and the United States also includes data flows that help facilitate over seven trillion U.S. dollars in trade and investment.[17]

As pioneers in many fields of digitalization, the United States and Germany have a unique opportunity to address pressing issues. One relevant issue concerns the security of data and data flows. As digitalization advances rapidly, IT infrastructures and systems grow in size and complexity, and an ever-increasing amount of information is stored online. This gives rise to new cyber vulnerabilities and raises questions about data security.[18] Ransomware attacks, cyber-theft, and supply-chain attacks must be anticipated and prepared for. Securing personal data and critical infrastructure has become even more important. During the pandemic, in 2020 and 2021, cyber attacks increased to an all-time high.[19] Overall, data breaches were 68 percent higher in 2021 than in 2020.[20] Securing IT infrastructure and raising awareness of digital security issues has become paramount. Transatlantic cooperation on cybersecurity can help address these issues head-on and make the digital world safer.

Policy-makers in state legislatures play a crucial role in discussing how to best approach the opportunities and challenges of digitalization. While federal politics are often in the spotlight of media coverage, individual states in federal systems – such as in the United States and Germany –, are not only tasked with implementing federal policies on the ground but also take on leadership roles when it comes to developing policy solutions. Transatlantic exchange can be a driver for new and innovative policies and an opportunity for both countries to promote and enable digital technologies and services for their communities, economies, and administrations.

The bipartisan policy recommendations, developed by participants of the 2020-21 Laboratories of Democracy cohort, focus on three main areas of digitalization. First, the future of work: Employers and employees find themselves in a time of digital evolution and require a different skill set than prior generations. Second, digital infrastructure and mobility: A functional, efficient, connective, and flexible digital infrastructure is an essential requirement for the digital age. In the same fashion, the future of mobility will be highly digitalized, interconnected, and greener. Third, the critical area of cybersecurity and data protection: With increased connectivity and unprecedented digital technology, the security aspects of the digital era are of tremendous importance.

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[13] Daniel S. Hamilton and Joseph Quinlan, The Transatlantic Economy 2021: Annual Survey of Jobs, Trade and Investment between the United States and Europe, Foreign Policy Institute, Johns Hopkins University SAIS/Woodrow Wilson Center, 2021, p. 45, https://transatlanticrelations.org/wp-content/uploads/2021/03/TransatlanticEconomy2021_FullReportHR.pdf (accessed February 14, 2022).
[14] Numbers for "potentially digitally-enabled services" include services delivered through ICT networks and services which can potentially be, but not necessarily have been, delivered through ICT networks.
[15] Bureau of Economic Analysis, International Transactions, International Services, and International Investment Position Tables: Table 3.3 U.S. Trade in ICT and Potentially ICT-Enabled Services, by Country or Affiliation, July 2021, https://apps.bea.gov/iTable/iTable.cfm?reqid=62&step=9&isuri=1&6210=4#reqid=62&step=9&isuri=1&6210=4 (accessed February 14, 2022).
[16] Cf. ibid.
[17] James Sullivan, The EU-U.S. and Swiss-U.S. Privacy Shield Frameworks. Why They Matter, International Trade Administration, September 2019, https://blog.trade.gov/2019/09/13/the-eu-u-s-and-swiss-u-s-privacy-shield-frameworks-why-they-matter/ (accessed February 28, 2022).
[18] Hamilton and Quinlan, 2021, p. 42.
[19] Cf. ibid.
[20] Identity Theft Resource Center, 2021 in Review: Data Breach Annual Report, January 2022, p. 5, https://www.idtheftcenter.org/post/identity-theft-resource-center-2021-annual-data-breach-report-sets-new-record-for-number-of-compromises/ (accessed February 14, 2022).

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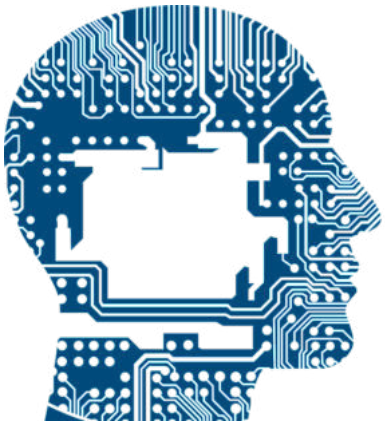

The Digital Economy and its Impact on the Future of Work

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Background

Digitalization fundamentally transforms global economies and the future of work. Digital and technology-driven innovations such as artificial intelligence (AI), machine learning, big data, 3D printing, cloud computing, the Internet of Things (IoT), and robotics, among others, have laid the foundation for major economic overhauls, creating opportunities for new products and services, innovative business models, new jobs, and productivity gains. While the digital transformation holds great promise, it also poses significant challenges for governments, companies, and individuals. Technological transformations will change production processes and value chains, job and skills requirements, and the organization of work. They require massive investment in infrastructure and education. Digitalization also poses new security challenges for both governments and companies. These trends highlight the need for action and proactive policies to keep pace with the immense speed of change and harness the opportunities brought forward by the digital transformation.

The COVID-19 pandemic has further accelerated the speed of digitalization. The 2020 "Future of Jobs Report" by the World Economic Forum estimates that the rate at which new technologies are being adopted is not slowing down and may even increase in certain areas, a trend which is partly driven by COVID-19. More than four out of five business leaders surveyed state that they are accelerating the digitalization of work processes as a response to the COVID-19 crisis. Half of them expect the rate at which jobs will be automated to increase for the same reason.[21] Thus, the COVID-19 crisis and the fear of future pandemics may very well serve as another driver for automation and the transformation of jobs at a greater speed, emphasizing the need for further action.

The fear of future pandemics is likely to serve as another driver for automation and the transformation of jobs.

It is hard to predict how technological innovations and automation will impact jobs and the labor market in the future. The debate on this is controversial: Some have a more optimistic outlook and believe these transformations will predominantly serve as a catalyst for creating new and better jobs. Others are more pessimistic and predict massive job losses. A popular yet shocking estimate comes from Frey and Osborne (2013), who predict that 47 percent of jobs in the United States are at high risk of automation.[22] Since then, several other analysts and researchers have contributed to the discussion. Arntz, Gregory, and Zierahn (2016), for example, put the number of potentially automatable jobs to a much lower estimate at nine percent across developed economies.[23] The Organization for Economic Cooperation and Development (OECD, 2018) predicts that one in seven jobs in advanced economies is highly automatable, while another 32 percent may substantially change. However, the OECD also points out that not all occupations which are theoretically automatable will ultimately disappear since not all technical possibilities will translate into reality for various reasons such as political or social preferences.[24] Other predictions give cause for optimism

[21] World Economic Forum, The Future of Jobs Report 2020, October 2020, p. 13, https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf (accessed November 30, 2021).
[22] Carl Benedikt Frey and Michael A. Osborne, The Future of Employment: How Susceptible are Jobs to Computerisation?, September 2013, p. 38, https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf (accessed February 17, 2022).
[23] Melanie Arntz, Terry Gregory, and Ulrich Zierahn, "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", in: OECD Social, Employment and Migration Working Papers, No. 189, 2016, p. 4, https://www.oecd-ilibrary.org/docserver/5jlz9h56dvq7-en.pdf?expires=1640129826&id=id&accname=guest&checksum=EA0C25872976198371A599CF574C2AFB (accessed December 3, 2021).
[24] OECD, Policy Brief on the Future of Work: Putting Faces to the Jobs at Risk of Automation, March 2018, p. 1-3, https://www.oecd.org/employment/Automation-policy-brief-2018.pdf (accessed December 3, 2021).

based on the assumption that technological change will spur more job growth than job loss. While 85 million jobs may be lost between 2020 and 2025 as a result of automation and other advances in technology, 97 million new jobs will be created in the same five-year time span, according to estimates by the World Economic Forum (2020).[25]

Not all economic sectors, jobs, and workers are equally affected by automation and digitalization. The reality is highly specific to industry, occupation, and skill-level. According to Nedelkoska and Quintini (2018), the risk of automation is highest in manufacturing and agriculture, with some service sectors being affected as well. There is also a relation between automatability and skill-level, which puts jobs with "low educational and skill requirements" most at risk. In fact, specifically AI seems to have a disruptive effect on low-skilled occupations.[26] This observation is supported by a study by Frey and Osbourne (2013), who identify so-called bottlenecks to automation based on current knowledge about what tasks cannot be easily automated. They find that tasks related to perception, creative intelligence, and social intelligence are hardest to automate.[27] But continuous progress made in artificial intelligence and machine learning suggests that highly-skilled occupations may not be exempted from technological disruption for long. Machines are continuously getting better at performing non-routine cognitive tasks and are becoming increasingly important in healthcare, transport, energy, and other sectors.

Whatever concrete scenario will eventually hold true when it comes to the future of work, the fear of job losses in light of ever-evolving digital technologies is real among the general population. A Pew Research Center survey from September 2018 found that large majorities in all ten countries surveyed were convinced that the world of work would significantly change in the next 50 years, with robots and computers definitely or probably taking over jobs currently performed by humans.[28] Majorities in both advanced and emerging economies believed that job automation would have more negative consequences than potential benefits. Roughly three-quarters or more in all countries polled believed people would have a hard time finding jobs if robots and computers prevailed in the workplace. An average of three in four people across all countries also voiced concerns that automation would increase inequality between the rich and the poor, while significantly less than half of the people surveyed across countries saw realistic prospects for new, better-paying jobs.[29] This general pessimism about the consequences of job automation among average citizens must be taken seriously by leaders in politics, business, and education.

In light of these changes in the workplace brought about by technological innovations, acquiring relevant skills becomes essential to meet future job requirements and take full advantage of the digital revolution. There is already a noticeable skills gap in OECD countries, with shortages in skills such as cognitive and social intelligence and an overabundance in skills needed for tasks at high risk of automation.[30] According to the OECD Survey of Adult Skills (2015) of 16-65 year-olds, 56 percent in Germany and 58 percent

[25] World Economic Forum, The Future of Jobs Report 2020, October 2020, p. 5, https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf (accessed November 30, 2021).
[26] Ljubica Nedelkoska and Glenda Quintini, "Automation, Skills Use and Training", in: OECD Social, Employment and Migration Working Papers, No. 202, 2018, p. 8, https://www.oecd-ilibrary.org/docserver/2e2f4eea-en.pdf?expires=1640129774&id=id&accname=guest&checksum=52917511C569A81F6A6AD6EAEF2A5692 (accessed December 3, 2021).
[27] Carl Benedikt Frey and Michael A. Osborne, The Future of Employment: How Susceptible are Jobs to Computerisation?, September 2013, p. 27, https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf (accessed February 17, 2022).
[28] Richard Wike and Bruce Stokes, In Advanced and Emerging Economies Alike, Worries About Job Automation, Pew Research Center, September 13, 2018, p. 2, https://www.pewresearch.org/global/wp-content/uploads/sites/2/2018/09/Pew-Research-Center_In-Advanced-and-Emerging-Economies-Alike-Worries-about-Job-Automation_2018-09-13.pdf (accessed November 29, 2021).
[29] Wike and Stokes, 2018, p. 4.
[30] International Labour Organization (ILO), the OECD, and the Global Deal Support Unit, The Global Deal for Decent Work and Inclusive Growth Flagship Report 2020: Social Dialogue, Skills and Covid-19, October 2020, p. 100, https://www.theglobaldeal.com/resources/2020%20Global%20Deal%20Flagship%20Report.pdf (accessed December 3, 2021).

in the United States of those surveyed have low proficiency in problem-solving in technology-rich environments, meaning they can either only carry out the simplest digital tasks, such as writing an email, or they have no digital skills at all.[31] The increasing demand for bottleneck skills as well as the ability to work in a digitalized and automated environment has implications for education systems, which need to provide children and youth with the "right" skills for tomorrow. At the same time, education and training also play a significant role in the current workforce. Whether workers are at risk of losing their jobs or must manage new tasks in their old jobs as a consequence of digitalization and automation, learning does not end when entering the workforce. According to the Future of Jobs Survey (2020), companies predict that around 40 percent of the workforce will need to partake in reskilling programs.[32] Workers themselves express similar views. A Pew Research Center poll (2016) finds that the majority of adults in the U.S. labor force believe they require reskilling or upskilling throughout their career to navigate the future of work successfully.[33] Despite this apparent need for training, adult learning opportunities are still lagging behind the pace of technological change. According to the OECD (2018), especially workers in low-skilled occupations, which are most at risk of being automated, are less likely to receive adequate training, with only about one in six having participated in training over a 12-month period.[34] As such, this data demonstrates the need for innovative policy approaches to fully seize the opportunities presented by digitalization and to deal with its challenges effectively.

Adult learning opportunities are still lagging behind the pace of technological change.

[31] OECD, Policy Brief on the Future of Work: Skills for a Digital World, December 2016, p. 2, https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf (accessed December 3, 2021).
[32] World Economic Forum, 2020, p. 38.
[33] Pew Research Center, The State of American Jobs, October 6, 2016, p. 5, https://www.pewresearch.org/social-trends/wp-content/uploads/sites/3/2016/10/ST_2016.10.06_Future-of-Work_FINAL4-1.pdf (accessed November 26, 2021).
[34] OECD, Policy Brief on the Future of Work: Putting Faces to the Jobs at Risk of Automation, March 2018, p. 2-3, https://www.oecd.org/employment/Automation-policy-brief-2018.pdf (accessed December 3, 2021).


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Policy Recommendations for the State Level

1 Create Adequate Educational Opportunities for Youth and Workers

To adequately equip youth and workers for the jobs of today and tomorrow, policy-makers need to expand and promote educational opportunities proactively. State governments should ensure their educational systems are designed in a way that teaches the necessary skills in an increasingly digitalized and automated world by anticipating the technological change ahead. Helping people prepare for and succeed in a changing world of work means helping them acquire the right skills for future jobs and future work tasks. As automation, robotics, and AI are gaining ground, certain kinds of jobs will be lost, new jobs with new skill demands will be created, and existing occupations will change. Workers need to be able to both operate in a digitalized environment and perform tasks beyond what automated and intelligent systems can do. For this, basic digital skills as well as cognitive and social skills are required. Policy-makers should ensure that the educational landscape offers such learning and training opportunities. This starts in schools, where young school children should receive digital literacy training and should have the opportunity to develop basic digital skills. The competence to recognize helpful and fact-based information on the internet is just as important as amassing knowledge. Additionally, more emphasis should be placed on developing problem-solving skills as children have to be able to solve problems on their own. Obstacles to achieving these aims might be insufficient qualifications among teachers, inadequate IT equipment, or a lack of internet connectivity. If necessary, such obstacles should be addressed by state governments to guarantee schools are not left behind in the digital age. The need for better digital educational opportunities also extends to vocational schools and training offers for the current workforce. Policy-makers should help establish new learning instruments and learning environments that prepare apprentices and workers for Industry 4.0 processes. States should further consider establishing or expanding dual education systems. The combination of work-based and school-based learning, as found in Germany's dual system of vocational education and in-company training, has not only proven successful in preparing people for permanent employment. It also helps to create a link between the education system and real-life work environment, allowing for quick adaptations to the changing needs of the labor market as propelled by the digital transformation.

2 Advocate for Continuous Learning and Upskilling

In the face of ever-evolving technology and an ever-changing labor market, adequate life-long learning opportunities need to be created to allow workers to continuously improve their skills throughout their careers. With today's rapidly changing work environment, the skills and knowledge acquired before entering the workforce or at the beginning of professional life may very well not be sufficient to successfully navigate through an entire work life. It is not fully predictable what new jobs will emerge and which skills will be in high demand in the future. Likewise, com-

panies cannot expect their employees to satisfyingly do their jobs with the existing skill sets for years to come. Thus, policy-makers should advocate for continuous learning and foster an environment that provides upskilling opportunities for the public and private workforce in close cooperation with the business and education sector so that employees may improve their skills in lockstep with the changing world of work. To successfully promote and realize upskilling, incentives for continuous learning should be created. Possible paths could include developing core requirements for periodical upskilling and introducing legislation that guarantees payment for employees who are taking up training offers to expand their skill sets. Promoting upskilling opportunities will help both companies and employees grow and thrive in the digital age.

3 Build Collaboration between State Governments, Business, and Academia

Expanding and investing in education and life-long learning opportunities will require decision-makers from multiple sectors – state government representatives, business leaders, and educators – to come together. To achieve this, and in light of the digital transformation, state governments should build collaborative relationships with the business community and educational players to initiate private-public partnerships with the goal of implementing and expanding training offers for the workforce. On the business side, policy-makers should prioritize cooperation with small and medium-sized enterprises (SMEs), which are key contributors to German and U.S. American economic strength. Due to their low critical mass, they often find themselves struggling to implement in-house learning and training activities for their employees. Private-public collaboration on inter-company training would help overcome these educational barriers in SMEs. State governments should further look into promoting educational offers of community colleges or German "Volkshochschulen" as they already provide valuable life-long learning opportunities. They should expand their course offerings to correspond to skill needs in SMEs and award certifications for completed courses. Generally, training opportunities should be made accessible to workers in low-skilled occupations, which are most at risk of being displaced or transformed by automation, AI, or other technological innovations. As such upskilling efforts represent an investment in a company's workforce and thus in one of their most important assets to stay competitive in a 21st century economy, employers should bear the expenses of such educational and training opportunities for their employees. Collaborations between state governments, businesses, and educational institutions may also help address regional concerns such as keeping residents in local communities, helping companies implement digital solutions with their existing workforces, and turning regions into a powerhouse for growth and innovation.

POLICY RECOMMENDATIONS FOR TRANSATLANTIC COOPERATION

1 PROMOTE AN INTENTIONAL APPROACH TO TRANSATLANTIC EXCHANGE

Looking beyond what policy-makers can do in their own states concerning the ongoing digitalization of the economic sector and its impact on the future of work, state governments should push for a more intentional approach to transatlantic exchange. There is no question about the value of exchange programs with regard to mutual learning and understanding, relationship building, and the individual growth of participants. Yet, such programs are at risk of being taken for granted, being defunded, or reaching only certain individuals. Thus, policy-makers should ensure exchange programs remain or become a political priority by, first and foremost, prioritizing funding for such programs. They should further make sure that programs that promote exchange between Germany and the United States become more inclusive and open to previously overlooked target groups. While high school and college students can choose between a plethora of exchange programs, young workers and apprentices have very limited opportunities to gain professional experience abroad. For this reason, more exchange programs seeking to address young workers and apprentices should be launched. Gaining international experience is crucial in today's globalized world and such programs would, additionally, be highly beneficial for mutual learning in regard to changing job requirements brought about by the digital transformation of work. At the university level, it might be worth considering providing exchange opportunities not only to students but also to the administration. Finally, the COVID-19 pandemic left no choice but to experiment with virtual exchange alternatives, exposing the benefits such virtual programs can have in addition to in-person exchanges. While virtual encounters cannot replace physical ones, they should still be considered as additional exchange possibilities, especially given their cost-effectiveness.

BEST PRACTICE

The program "**Azubis Go USA**" by the **Joachim Herz Foundation** offers German apprentices the chance to experience work and life in the United States.

- Young apprentices can spend a few weeks in the United States, either interning at a U.S. company in their professional field or participating in college courses.
- The program is open to vocational students from Bavaria, Saxony, Hamburg, and Berlin.
- It was established in 2014 with the goal to provide apprentices opportunities to go abroad, which have historically been almost exclusively available to college students.

2 ESTABLISH STATE OFFICES ACROSS THE ATLANTIC

To strengthen transatlantic exchange and dialogue on common challenges related to the digital transformation of economies and the workplace, individual states or *Länder* should consider establishing an official presence in Germany and the United States by opening state offices across the Atlantic. A very few U.S. and German states already operate such state offices (e.g., Schleswig-Holstein, New Jersey) but unfortunately, it is not a broad-ranging concept yet. Such

state offices may serve as hubs for transatlantic exchange on the state level, providing a platform for in-person meetings, dialogue, and mutual learning to fully seize the opportunities brought about by digital transformation. Such a subnational platform would provide an opportunity for local policy-makers, companies, and educational institutions to gain insights into the working methods of other states and countries, to learn from their counterparts on the other side of the Atlantic, to talk about common challenges and best practice solutions, and to potentially establish partnership initiatives that address questions surrounding digital economies and the future of work. The official state representations and their staff may help connect their state's decision-makers with the relevant players across the ocean, strengthen the relationships between regional communities, and explore opportunities for transatlantic cooperation.

Best Practice

The "**Northern Germany Innovation Office Schleswig-Holstein | Hamburg | Bremen**" (NGIO) provides a platform for exchange between Schleswig-Holstein and the two city states of Hamburg and Bremen on the German side and the Silicon Valley on the U.S. American side.

- The office was established in 2018 to connect people and companies across the Atlantic.
- It allows German companies to create networks in Silicon Valley and learn more about business models in the global center for tech innovation.
- It offers a platform for U.S. American companies to identify investment opportunities in northern Germany.

3 Develop a Strategy to Apply Best Practices

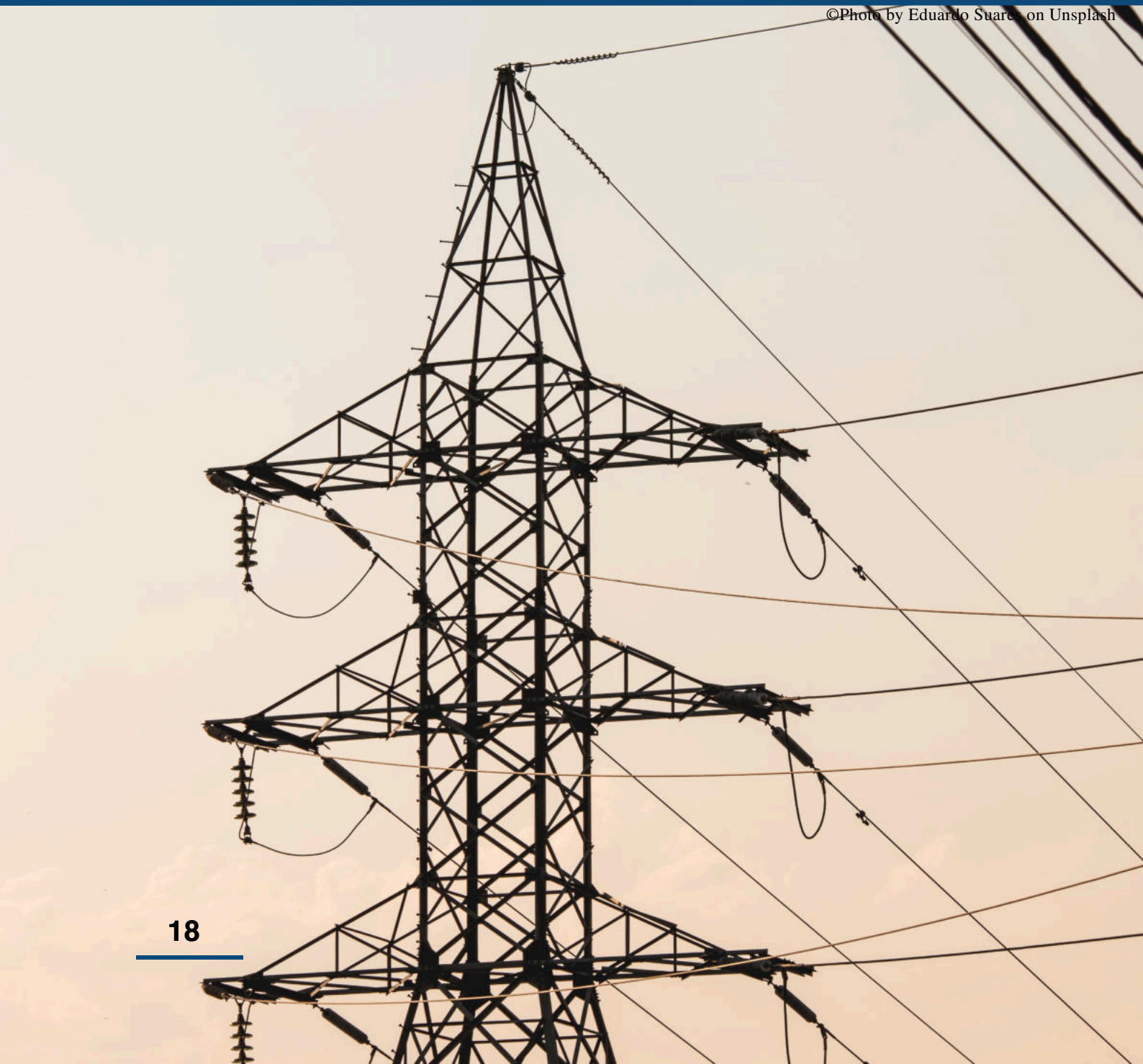
To facilitate and realize the implementation of identified best practices and lessons learned following transatlantic exchanges, policy-makers should develop more formal strategies to apply best practice solutions in their own states and countries. Identifying best practices is a common aim of transatlantic exchange formats which address mutual challenges. While mutually coming up with such examples and figuring out whether they could be applied to similar challenges in other places has proven fairly easy, turning rhetoric into action can be challenging. One such example within the framework of workforce development is the slow adoption of best practices in apprenticeship programs as found in Germany. While the benefits that come with a dual system of vocational education and in-company training have been widely acknowledged by U.S. Americans, the implementation of such programs at scale in the United States has been lagging behind. This is just one example in which policy-makers would profit from adopting a more strategic approach as to how to apply best practice solutions in their home state or country. A more formal strategy should define a clear target, break down the necessary steps for adoption, consider potential hurdles in the implementation process, and address existing cultural differences.

Best Practice

The "**German American Chambers of Commerce Midwest**" (GACC Midwest) supports companies in the United States to establish German-style apprenticeship programs.

- The GACC Midwest helps companies to implement apprenticeship systems which have proven successful in Germany with the goal of training highly qualified workers.
- It honors companies for their work in creating sustainable apprenticeship programs with the yearly „GACC Apprenticeship Award."

Digital Infrastructure and the Future of Mobility



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Background

Digitalization requires an increasingly powerful infrastructure to maintain and increase economic competitiveness and the overall functioning of societies. Access to fast and reliable internet has become a necessity of daily life and a driver of economic and regional development. In a world that is rapidly changing its ways to communicate, do business, interact, move, learn, and produce, a functional and capable digital infrastructure must be the fundamental base. Demands for digital networks and connectivity will further increase with the expansion of telemedicine, Industry 4.0, IoT, and smart mobility solutions. In light of these trends, policy-makers, together with communications service providers, hardware and software manufacturers, and industry, need to ensure digital infrastructure systems meet the requirements of a massively interconnected world. This extends to the construction and maintenance of high-performance fixed and mobile networks, internet exchange points, energy-efficient data centers, internet protocol (IP) interconnection, IT hardware and software, and other infrastructure components.

The need for an enhanced digital infrastructure became even more apparent during the COVID-19 pandemic. As daily life moved into the home, having reliable access to high-speed internet was paramount to many people. Many companies opted for some form of remote work where possible, which disadvantaged employees who had no or merely unreliable access to the internet. High-speed internet was also a necessity for many children and parents as schools closed their doors during the COVID-19 crisis and switched to at-home learning. According to the OECD, internet access increased by over 21 million new broadband connections in 2020, the year the pandemic broke out.[35] Yet, more than 14 million Americans remain without adequate broadband connection, according to the newest data by the U.S. Federal Communications Commission (FFC), which equals just over four percent of the U.S. population.[36] The situation in Germany is similar, where 96 percent of households have broadband access at or above an adequate minimum speed.[37] The digital divide becomes even more evident when looking at income groups. A Pew Research Center poll (2021) finds that 43 percent of U.S. adults in households with incomes below 30,000 U.S. dollars a year do not yet have broadband at home.[38] Particularly in rural regions, broadband deployment has been lagging behind due to topographical or settlement-related factors and a lack of financial incentives for broadband providers.[39] In Germany, just over 80 percent of rural households have adequate internet access, according to data from the Federal Ministry of Transport and Digital Infrastructure from 2021.[40] The data is even more concerning for the United States, where

Many people in Germany and the United States still do not have access to broadband.

[35] OECD, OECD Broadband Statistics Update, July 29, 2021, https://www.oecd.org/sti/broadband/broadband-statistics-update.htm (accessed December 1, 2021).
[36] Federal Communications Commission, Fourteenth Broadband Deployment Report, January 2021, p. 2, https://docs.fcc.gov/public/attachments/FCC-21-18A1.pdf (accessed December 21, 2021). The FCC's current broadband minimum benchmark speed is 25 Mbps for downloading and 3 Mbps for uploading.
[37] Federal Ministry of Transport and Digital Infrastructure, Aktuelle Breitbandverfügbarkeit in Deutschland, June 2021, p. 6, https://www.bmvi.de/SharedDocs/DE/Publikationen/DG/breitband-verfuegbarkeit-mitte-2021.pdf?__blob=publicationFile (accessed December 21, 2021). A minimum speed of 30 Mbps for downloading was considered as "adequate" for comparison purposes with the numbers from the United States.
[38] Emily A. Vogels, Digital Divide Persists Even As Americans With Lower Incomes Make Gains in Tech Adoption, Pew Research Center, June 22, 2021, https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/ (accessed December 9, 2021).
[39] Christopher Ali, "The Politics of Good Enough: Rural Broadband and Policy Failure in the United States," in: International Journal of Communication, Vol 14, no. 1, November 2020, p. 5983.
[40] Federal Ministry of Transport and Digital Infrastructure, 2021, p. 9.

only 72 percent of rural U.S. Americans claim to have broadband at home.[41] The existing social disparities in broadband access compound the existing connectivity problems as equal participation in work, school, and social life cannot be guaranteed.

The development of digital infrastructure is crucial to ensure new technologies can reach their full potential and benefit everyone.

The needs of individual citizens are just one of many aspects policy-makers have to acknowledge when it comes to digital infrastructure. A robust and well-connected infrastructure system has to be geared to the entirety of society. For policy-makers, this means promoting a digital infrastructure that answers to the needs of the economy, the future of mobility, and the general public. Regions with underdeveloped digital infrastructure systems will not be able to realize smart and digital solutions for current challenges and will also experience less economic growth. A Deloitte analysis (2021) of publicly available information on broadband access confirms the assumption that increased broadband penetration, greater broadband availability, and greater penetration of higher-speed broadband lead to economic growth.[42] Already today, many businesses build their success on digital or digitally-enabled services.[43] The Fourth Industrial Revolution has revolutionized the industrial landscape through IoT, cyber-physical systems, and information and communications technologies (ICT).[44] While Industry 4.0 offers great potential for new types of services and business models, production optimization, mass customization, and automatic exchange of big data amounts, it heavily relies on broadband, digital networks, and effective data processing. This highlights the need for countries, states, and local communities to provide modern infrastructure and digital connectivity for entrepreneurs and companies to keep their regions economically competitive. The development of digital infrastructure is not only important to attract businesses but is also crucial to ensure new technologies can reach their full potential and benefit everyone.

In addition to promoting equal individual opportunities and economic growth, digital infrastructure plays a paramount role in the 21st century mobility sector and more sustainable mobility solutions. Autonomous transport systems, smart vehicles, intelligent traffic systems, smart charging, and other digital innovations in transportation are all reliant on real-time communication. According to the United States Environmental Protection Agency (2019), transportation is the single most contributing economic factor to carbon emissions, which underlines the potential of environmentally responsible transportation alternatives.[45] At the same time, urban centers find themselves facing problems such as congested streets due to an increase of people moving into cities and urban areas. In rural regions, having access to transportation, and thus education, employment, and healthcare is imperative for the quality of life of residents. Digital innovations can help address these challenges in urban and rural mobility. Digitalization strengthens the position of public transport by creating new services, increasing efficiency, and reducing costs, thereby contributing to increased environmental, social, and economic sustainability.[46] Systems for autonomous truck transporta-

[41] Emily A. Vogels, Some Digital Divides Persist Between Rural, Urban and Suburban America, Pew Research Center, August 19, 2021, https://www.pewresearch.org/fact-tank/2021/08/19/some-digital-divides-persist-between-rural-urban-and-suburban-america/ (accessed December 9, 2021).
[42] Deloitte, Broadband for All: Charting a Path to Economic Growth, April 2021, p. 6, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-broadband-for-all-economic-growth.pdf (accessed December 21, 2021).
[43] Daniel S. Hamilton and Joseph Quinlan, The Importance of Digital Services to the U.S. and European Economies, Wilson Center, April 8, 2021, https://www.wilsoncenter.org/article/importance-digital-services-us-and-european-economies (accessed December 1, 2021).
[44] Petra Maresova, Ivan Soukal, Libuše Svobodová, et al., "Consequences of Industry 4.0 in Business and Economics", in: Economies, Vol. 6, no. 3, August 2018, p. 2.
[45] United States Environmental Protection Agency, Sources of Greenhouse Gas Emissions, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (accessed December 1, 2021).
[46] Paul Davidsson, Banafsheh Hajinasab, Johan Holmgren, et al., "The Fourth Wave of Digitalization and Public Transport: Opportunities and Challenges", in: Sustainability, Vol. 8, no. 12, November 2016, p. 2-3.

tion[47] and continuous electric truck driving, so-called *eHighways*[48], are an example of promising innovations which are being tested to optimize delivery and reduce carbon emissions. Trains and railway systems are also becoming more autonomous and digitalized in nature with continuous advances in automatic communications-based train control and train protection. This emphasizes the need for real-time wireless communication to safely operate these complex rail systems.[49] As all these innovations highlight, the future of mobility is highly dependent on a reliable and resilient digital infrastructure to manage the enormous amount of data and information processed by these smart systems. Digital networks and connectivity need to be expanded to ensure widespread adoption of sustainable mobility solutions is possible.

Finally, digital electricity infrastructure provides enormous opportunities for the energy sector. Especially the challenge of storing and transporting solar or wind energy is front and center when assessing the future needs of the electrical grid. According to McKinsey (2021), storing this energy to use it at a later point and to not overflow the electrical grid is a crucial challenge.[50] Solutions such as the implementation of smart grids are one possibility for how to digitalize the energy sector in an efficient manner. Through aspects like machine learning and optimized communication between the supply side and consumer side, the electrical grid can become more energy-efficient and create a smarter approach to dealing with bottlenecks.[51] These examples underline that there is more to energy infrastructure than its visible components, such as energy production facilities or power supply lines. While the future of the energy sector depends on smart and digital solutions, a growing digital infrastructure and digitalization in general also create new energy demands. Research conducted by Andrae (2019) finds that the electricity consumption of ICT infrastructure will significantly increase by 2030. Especially the growing demand for data centers drives energy consumption despite expected energy efficiency gains, with a predicted ninefold increase in needed electric power from 2018 to 2030.[52] Such predictions emphasize the need to also consider questions concerning renewable energy sources such as hydrogen when addressing digital infrastructure and the future of mobility.

The future of mobility is highly dependent on a reliable and resilient digital infrastructure.

While infrastructure is often considered a dry and unappealing topic for citizens, policy-makers have long understood the necessity of proper roads and highways, safe bridges, an adequate railway system, and clean water systems. The same understanding and political urgency need to be applied to digital infrastructure systems and broadband connectivity, which are just as important as having roads without potholes. Every citizen, business executive, and politician should have access to functional top-of-the-line connectivity in the same way they are accustomed to finding roads to their destinations. Only then will countries be able to exploit the full potential of the digital transformation to the benefit of all people.

[47] Steve Banker, The Autonomous Truck Revolution Is Right Around The Corner, Forbes, May 11, 2021, https://www.forbes.com/sites/stevebanker/2021/05/11/the-autonomous-truck-revolution-is-right-around-the-corner/ (accessed December 1, 2021).
[48] Institut für Energie- und Umweltforschung Heidelberg, Roadmap für die Einführung eines Oberleitungs-Lkw-Systems in Deutschland, July 2020, p. 6, https://www.ifeu.de/fileadmin/uploads/2020-08-05-Roadmap-OH-Lkw-web.pdf (accessed December 1, 2021).
[49] Digital Technologies Move the Rail Industry Forward, Railway News, July 6, 2021, https://railway-news.com/digital-technologies-move-the-rail-industry-forward/ (accessed December 21, 2021).
[50] Alberto Bettoli, Martin Linder, Tomas Nauclér, et al., Net-zero Power: Long-duration Energy Storage for a Renewable Grid, McKinsey & Company, November 11, 2021, https://www.mckinsey.com/business-functions/sustainability/our-insights/net-zero-power-long-duration-energy-storage-for-a-renewable-grid (accessed December 15, 2021).
[51] Osama Majeed Butt, Muhammad Zulqarnain, and Tallal Majeed Butt, "Recent Advancement in Smart Grid Technology: Future Prospects in the Electrical Power Network", in: Ain Shams Engineering Journal 12, no. 1, March 2021, 687-695, p. 690.
[52] Anders Andrae, Projecting the Chiaroscuro of the Electricity Use of Communication and Computing from 2018 to 2030, February 2019, p. 1, https://www.researchgate.net/profile/Anders-Andrae/publication/331047520_Projecting_the_chiaroscuro_of_the_electricity_use_of_communication_and_computing_from_2018_to_2030/links/5c630968299bf1d14cc1e9ad/Projecting-the-chiaroscuro-of-the-electricity-use-of-communication-and-computing-from-2018-to-2030.pdf (accessed December 21, 2021).

Policy Recommendations for the State Level

1 Create Equal, Accessible, Affordable, and Open Connectivity

Creating broadband connectivity at sufficient speeds and enabling every citizen to be "online" should be a top priority for state governments in Germany and the United States. Having access to fast internet is essential to prosper in an increasingly digitalized world, as the COVID-19 pandemic has demonstrated. State policy-makers must focus on funding fiber networks to create equal access for individuals and businesses in their regions. Access to the internet needs to be provided to all, regardless of region, and must be affordable for everyone. Unserved and traditionally underserved areas such as rural or low-income communities must be prioritized in this effort to address the digital divide with the necessary urgency. The expansion of fiber networks should be approached without weighing the cost-benefit of an investment – thus prioritizing the connectivity of every single household. While fiber should be the political priority, policy-makers should remain flexible in their approach. In regions where fiber connection cannot be implemented, alternative solutions which can provide comparable internet connectivity, such as 5G, need to be considered as well.

2 Promote the Expansion of a Resilient Digital Infrastructure

While providing internet connectivity is crucial to enable equal participation for citizens and boost the digital transformation, states must look beyond questions of internet access. To embrace the many opportunities digitalization has to offer, state policy-makers should promote the expansion of a resilient digital infrastructure in a broader sense, which guarantees the secure acquisition, storage, and transmission of data. This includes high-performance networks, energy-efficient data centers, and top-quality IT hardware and software, which all need to be designed in a way to thwart potential cyber threats. As the creation and maintenance of digital infrastructure is a shared responsibility between government actors, communications service providers, and IT manufacturers, states must collaborate with other relevant players to collect accurate data on the issue, identify digital infrastructure gaps, adequately allocate funding, and promote digital equity. To drive digital infrastructure development, states have to increase their investments in infrastructure components and prioritize funding for existing gaps in their regions. At the same time, sustainable power generation needs to be advanced to meet the energy needs of such infrastructure networks. Pioneering ideas, such as in the field of hydrogen, should be encouraged across all sectors and levels to maximize innovation potential and learn from each other. Investments in a cyber secure and resilient digital infrastructure will pay off for state governments as they bring forth economic growth and social prosperity. They also lay the foundation for other needed initiatives in the wake of the digital transformation, such as smart city initiatives. State policy-makers should fund both the digital infrastructure that is needed for implementing smart city ideas

as well as smart cities projects themselves to prepare their regions for the digital future.

3 Establish Affordable, Climate-Neutral, and Technology-open Mobility

Digitalization can be the answer to many defining challenges of today, the future of mobility being one example. If promoted earnestly on all levels, innovation in digital technologies provides countless opportunities for societies. State policy-makers must do their part and support the establishment of affordable, climate-neutral, and technology-open mobility. Overpopulated cities, urban centers, and rural areas alike depend on innovative and digital mobility solutions that offer citizens transportation options to move around in an inexpensive, climate-friendly, and flexible way. State lawmakers should consider introducing legislation that subsidizes car sharing, promotes innovations in public transportation, and advances the adoption of digital traffic control systems to tackle this challenge. Establishing interconnection standards for electric vehicles and charging systems could be another political instrument to help address rising mobility demands. In addition, especially city centers and urban regions can benefit from methods such as congestion pricing as it promotes the usage of public transportation or alternative mobility options. This helps tackle traffic and pollution challenges. Finally, state policy-makers should also turn their attention towards regulatory options and consider reasonable regulations of smart mobility solutions. The digitalization of mobility has to be understood as an intertwined opportunity to make the future of mobility affordable, manageable, and climate-friendly through digital and technological innovations.


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Policy Recommendations for Transatlantic Cooperation

1 Establish Unified Transatlantic Standards

In today's globalized world, increasing trade of goods, services, information, and technology lead to a growing interdependence of economies and societies. Digital infrastructure and mobility must therefore also be considered in the international context. To reduce barriers to transatlantic trade and investment and to pioneer new rules for digital innovations, German and U.S. American policy-makers should work towards establishing unified and non-proprietary transatlantic standards in the field of digital infrastructure and mobility. Harmonizing standards and removing unsubstantiated regulatory differences will make the European and U.S. economy more compatible, which will, in turn, help promote trade and investment between the two partners and strengthen their respective competitiveness. Common regulatory standards should, for example, be set for 5G and internet protocols, electric vehicle charging solutions, and autonomous driving as one of the pillars of the future digital economy. Such regulations would help accelerate the adoption of 5G, align the production standards for electric vehicles and charging stations, and provide wide applicability of autonomous driving technology. As not all regulations are set on the federal level, the division of responsibilities between the federal government, individual states, and the European Union (EU) have to be considered and might differ on both sides of the Atlantic. However, German and U.S. American policy-makers should not hesitate to engage in transatlantic dialogue on standard-setting in the field of digital infrastructure and mobility to further promote the digital transformation on both sides of the Atlantic. The recently launched EU-U.S. Trade and Technology Council, which aims to increase transatlantic cooperation on global trade as well as economic and technology issues, presents a suitable platform for such discussions. The existing communication channels of this forum should be used to also address the specific infrastructure and mobility issues raised here.

Best Practice

The "**Standardization Council Industrie 4.0**" promotes international cooperation on digital production standards.

- It was established in 2016 by multiple leading German institutions and organizations in the fields of standardization and industry.
- It enables the process of developing suitable standards in a field of high innovation.
- The council works together with an international network to address and close technology gaps identified by the industry.
- It is supported by the German Federal Ministry for Economic Affairs and Climate Action.

2 Strengthen Transatlantic Cooperation on Energy Storage

Transatlantic cooperation should further extend to digital electricity infrastructure considering common challenges and opportunities in the energy sector. Digital and smart technologies can help make energy production, transportation, and consumption more efficient and climate friendly. However, challenges in the electric grid remain both in Germany and the United

States. One such challenge relates to the efficient storage of renewable energy, for which policy-makers from both sides of the Atlantic should strive to find innovative solutions by working together. This cooperation should take place in numerous areas, such as research and development, and address multifaceted questions surrounding strategic implementation and political regulation. Looking at the field of research and development, for example, exchanging best practices and knowledge about workable energy storage solutions will benefit both sides. Research clusters should be expanded to cover not only one country or one sector but to incorporate a transatlantic approach with a variety of stakeholders to profit from a wider pool of knowledge and learn from each other.

Best Practice

With the "**U.S.-Germany Climate and Energy Partnership**" the two countries have created a platform to strengthen their shared vision of a more climate-friendly energy sector.

- The partnership was announced by President Joe Biden and Chancellor Angela Merkel during Merkel's visit to the White House in July 2021.
- The partnership aims to establish cooperation in energy storage, hydrogen technologies, and other areas.

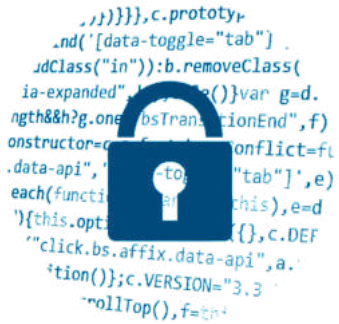
3 Enhance Transatlantic Cooperation on Hydrogen Strategies

Reducing carbon emissions is a vital aspect of international endeavors to reach the Paris climate goals and to keep the rise in global average temperature well below 2°C. Developing new strategies to reach this goal and achieve net-zero emissions is crucial for all sectors with high carbon emissions. The mobility sector is already in the midst of a fundamental transformation, with gas-powered vehicles getting phased out and replaced by more sustainable mobility solutions. Besides battery-powered electric vehicles, hydrogen-based technology is a promising alternative. Hydrogen-powered solutions would enable and accelerate major digital innovations in mobility. Autonomous vehicles, for example, fueled by hydrogen, would be able to enter zero-emission areas in urban centers in the future. Hydrogen could also be used to meet the growing energy demand of data centers and other ICT components, contributing to greener digital infrastructure. Thus, digital transformation and advances in hydrogen technology would complement and reinforce each other. While many regions are already pursuing hydrogen strategies, policy-makers in Germany and the United States should cooperate and pool their resources, ideas, and lessons learned to unlock the full potential of hydrogen technologies. Identifying the most effective strategies in this promising field for transatlantic cooperation will facilitate sustainable digital mobility solutions and CO2-neutral digital infrastructure.

Best Practice

The **University of Illinois Urbana-Champaign** and the **Technical University of Darmstadt** joined forces under an award grant to explore efficient production of green hydrogen.

- It is a 3-year $720,000 research grant awarded by the U.S. National Science Foundation and the German Research Federation in July 2021.
- The project aims to increase production viability and scalability of green hydrogen.
- It enables a strong transatlantic knowledge exchange in a pivotal innovation field.



Cybersecurity, Privacy, and Data Protection

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Background

As digitalization is advancing rapidly, IT infrastructures and systems are growing in size and complexity and an ever-increasing amount of information and data is stored online, ranging from medical and financial information to criminal records. Artificial intelligence, the Internet of Things, big data, advanced robotics, and cloud computing as well as their application in production, healthcare, mobility, energy, and other sectors promise to improve people's daily lives. However, they simultaneously give rise to new cyber vulnerabilities and raise questions of data security and privacy. In light of the existing dependence on digital technologies, questions surrounding the use and the protection of data and IT systems must be addressed by German and U.S. American policy-makers while also taking into consideration the global character and international dimension of these issues.

The amount of data that is generated in today's world is growing exponentially, fueled by the use of digital technologies and, in particular, an ever-growing number of connected and smart devices. It is estimated that there will be nearly 30 billion networked devices by 2023, which amounts to more than three times the global population.[53] While access to data and smart appliances facilitate everyday life, the same data may also cause potential harm if they are exploited.[54] It further gives rise to questions concerning the right balance between access to information on the one hand and privacy on the other. Privacy is a universal human right, enshrined in Article 12 of the Universal Declaration of Human Rights.[55] It is thus paramount to safeguard the individual's right to data privacy and to prevent data from being misused and exploited.

With a significant share of people's lives taking place in the virtual space, crime is moving online as well, resulting in significant human and economic costs of cyber attacks and data breaches. The types of cybercrimes range from ransomware attacks to phishing and data-harvesting and target states, public administration, critical infrastructure, businesses, and private citizens. Threats can emerge from multiple sources, including from nation-states, organized crime groups, terrorists, or individual hackers.[56] Whatever actors are involved, incidences in cyberspace continue to increase in sophistication, scale, and frequency. According to the 2021 mid-year report on cyber attack trends by Check Point, cyber attacks have increased by 29 percent globally in the first half of 2021.

The amount of data that is generated in today's world is growing exponentially, fueled by the use of digital technologies.

Countries in Europe, the Middle East, and Africa witnessed an astonishing 36 percent increase, while a 17 percent increase was observed in the United States.[57] The 2021 report on the state of IT security in Germany by the Federal Office for Information Security (BSI) reaches similar conclusions. The BSI detected 144 million new malware variants between June 2020 and the end of May 2021,

[53] Cisco, Cisco Annual Internet Report (2018–2023), March 2020, p. 29, https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html (accessed December 14, 2021).
[54] Hans de Bruijn and Marijn Janssen, "Building Cybersecurity Awareness: The Need for Evidence-based Framing Strategies", in: Government Information Quarterly 34, no. 1, January 2017, 1-7, p. 1.
[55] United Nations, Universal Declaration of Human Rights, 1948, p. 26, https://www.un.org/en/udhrbook/pdf/udhr_booklet_en_web.pdf (accessed December 14, 2021).
[56] Cybersecurity & Infrastructure Security Agency, Cyber Threat Source Descriptions, 2022, https://www.cisa.gov/uscert/ics/content/cyber-threat-source-descriptions (accessed December 14, 2021).
[57] Check Point Research, Mid-Year Attack Trends Report Reveals a 29% Increase in Cyberattacks Against Organizations Globally, July 29, 2021, https://research.checkpoint.com/2021/check-point-softwares-mid-year-attack-trends-report-reveals-a-29-increase-in-cyberattacks-against-organizations-globally/ (accessed December 15, 2021).

which is a 22 percent increase from the previous year.[58] These trends in the cyber threat landscape are mirrored by public sentiment.

Public awareness on cybersecurity remains low and does not reflect the urgency that is needed.

According to research conducted by The Harris Poll in ten different countries, more than two in five people feel more vulnerable to cybercrime in 2021 than before the COVID-19 pandemic.[59] The COVID-19 crisis has contributed to the observed increase in cyber attacks as cybercriminals found ways to exploit the disruptions and major shifts brought about by the pandemic. However, new techniques and more sophisticated methods are also drivers of these developments. Triple extortion ransomware, for example, has emerged as a new threat, contributing to a 93 percent increase in ransomware attacks in the first two quarters of 2021.[60] Recent high-level cyber attacks, such as the ransomware attack on the Colonial Pipeline and the SolarWinds incident, which breached 200 organizations around the world including governmental systems, brought further global attention to the issue of cybercrime.[61] So have recent cyber attacks on states and democratic elections launched with the goal of weakening democratic systems or manipulating election outcomes.

Focusing on technological safeguards such as threat detection software and building cyber secure systems are not sufficient measures to successfully prevent and mitigate cyber threats. Human sources of vulnerability must be considered as well, whether this relates to weak passwords, delayed security updates, or phishing emails. In fact, human error is one of the prime causes for the success of cyber attacks, making people an attractive target for cybercriminals.[62] Verizon's 2021 Data Breach Investigations Report, for instance, which analyzed 5,258 confirmed data breaches in 88 countries globally, found that 85 percent of data breaches involved a human element.[63] All the more worrisome is the fact that public awareness of cybersecurity remains low and does not reflect the urgency that is needed. De Bruijn and Janssen (2017) attribute this to the intangible nature of cybersecurity breaches, their socio-technological complexity, and their ambiguous impact.[64] This assessment finds support in a Pew Research Center study, which states that many U.S. Americans lack knowledge on key cybersecurity issues. On average, respondents only answered five out of 13 questions concerning cybersecurity topics correctly.[65] In Germany, not even 50 percent of people under the age of 50 years rate their own competence in IT security as great or very great. The share is even smaller for people aged 50 years or older, with only one in five people claiming a great or very great level of competence.[66] Cybersecurity awareness training may help in addressing such deficits, albeit its effectiveness and success depend on a variety of factors.[67] Nonetheless, appropriate training opportunities for employees are of-

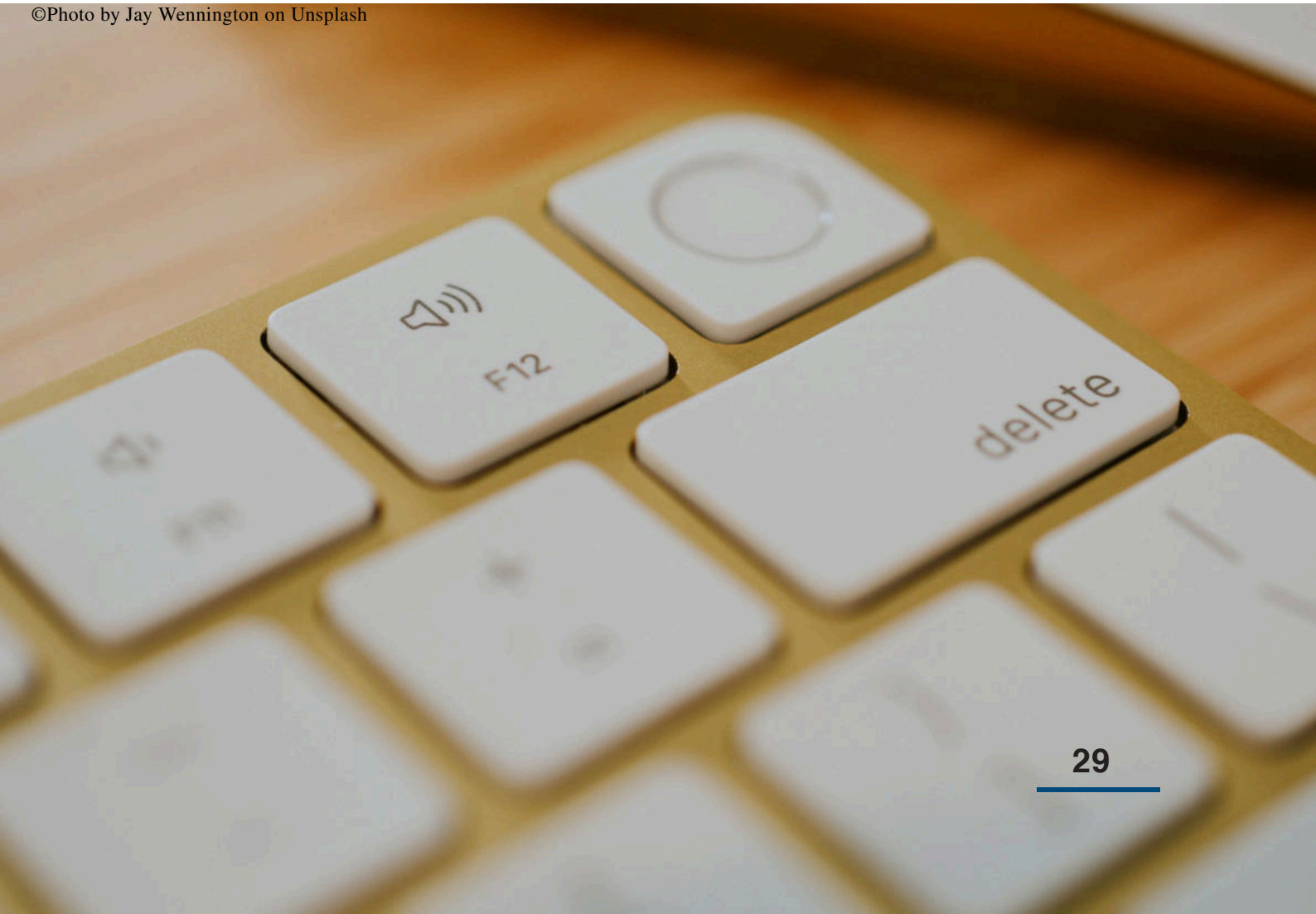
[58] Federal Office for Information Security, Die Lage der IT-Sicherheit in Deutschland 2021, September 2021, p. 11, https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/Publikationen/Lageberichte/Lagebericht2021.pdf;jsessionid=8B78AE3697FCB82F302A909A3F4BE1CA.internet481?__blob=publicationFile&v=3 (accessed December 21, 2021).
[59] Norton, 2021 Norton Cyber Safety Insights Report Global Results, May 2021, p. 7, https://now.symassets.com/content/dam/norton/campaign/NortonReport/2021/2021_NortonLifeLock_Cyber_Safety_Insights_Report_Global_Results.pdf (accessed December 15, 2021).
[60] Check Point Research, 2021.
[61] Center for Strategic & International Studies, Significant Cyber Incidents Since 2006, January 2022, https://csis-website-prod.s3.amazonaws.com/s3fs-public/220203_Significant_Cyber_Incidents.pdf?6nUHMBGT7zrGtFIeHU4gGdjD7dXFObfO (accessed February 18, 2022).
[62] Hans de Bruijn and Marijn Janssen, "Building Cybersecurity Awareness: The Need for Evidence-based Framing Strategies", in: Government Information Quarterly 34, no. 1, January 2017, 1-7, p. 4.
[63] Verizon, 2021 Data Breach Investigations Report, 2021, https://www.verizon.com/business/resources/reports/2021/2021-data-breach-investigations-report.pdf (accessed February 18, 2022).
[64] De Bruijn and Janssen, 2017, p. 3-4.
[65] Kenneth Olmstead and Aaron Smith, What the Public Knows About Cybersecurity, Pew Research Center, March 22, 2017, https://www.pewresearch.org/internet/2017/03/22/what-the-public-knows-about-cybersecurity/ (accessed December 14, 2021).
[66] G DATA, Cybersicherheit – Zahl der Woche: Jeder zweite unter 30 Jahren attestiert sich großes IT-Sicherheitsfachwissen, December 2021, https://www.gdata.de/news/2021/12/37179-cybersicherheit-jeder-zweite-unter-30-jahren-attestiert-sich-grosses-it-sicherheitsfachwissen (accessed December 21, 2021).
[67] Ahmed Alruwaili, "A Review of the Impact of Training on Cybersecurity Awareness", in: International Journal of Advanced Research in Computer Science 10, no. 5, September 2019, 1-3, p. 2-3.

ten lagging behind. Of 9,500 executives in 122 countries surveyed, only about half had implemented a security awareness training program for their employees, according to PWC's Global State of Information Security Survey in 2018.[68]

The issues of cybersecurity and data protection concern everyone, with individuals, businesses, and governments being at risk of falling under attack or having their data breached or misused. Securing IT systems against cyberthreats, safeguarding private and open data, and protecting people's privacy is thus a shared responsibility by all. This can become an opportunity if all actors – individuals, the private sector, as well as local, state, and national policy-makers – joined forces and did their part in strengthening the security of data systems. Concurrently, it raises questions about how responsibilities should be divided between the private and public sectors and what role state governments play in advancing strong cyber and data policies. Despite the complexity of the cyber ecosystem, states should not turn a blind eye to these issues. People will only be willing to actively engage in the digital transformation and fully seize the opportunities presented by innovations in digital technologies if they can place trust in today's massively interconnected world and feel their data is protected. Strong and innovative policy approaches on the state level as well as transatlantic cooperation on cybersecurity and data protection can help achieve this goal.

Securing IT systems against cyberthreats, safeguarding private and open data, and protecting people's privacy is a shared responsibility by all.

[68] PWC, Strengthening Digital Society Against Cyber Shocks: Key Findings From the Global State of Information Security Survey 2018, 2018, p. 4, https://www.pwchk.com/en/risk-assurance/publications/the-global-state-of-information-security-survey-2018.pdf (accessed December 15, 2021).



Policy Recommendations for the State Level

1 Raise Awareness for Cybersecurity, Privacy, and Data Protection

Cybersecurity, privacy, and data protection are immensely important issues of public concern, but not enough people show interest unless they are personally affected in some way. For this reason, state policy-makers must raise awareness among individuals and companies about cybersecurity, privacy, and data challenges. Failing to acknowledge the importance of these issues may result in a failure to take appropriate action with regard to prevention strategies or in the case of an incident. When looking at the issue of cybersecurity, for example, troubleshooting following a cyber attack is always more challenging than striving to prevent such an attack in the first place. Prevention, in turn, can only succeed if individuals from all parts of society were both aware of the risks associated with an increasingly digitalized world and acknowledged their significance. Raising awareness for cybersecurity, privacy, and data protection is more than stressing the general importance of these issues. It also means helping people understand vulnerabilities; the impact of an attack, breach, or misuse of data; the measures which need to be taken in case of an incident; and finally, the fact that a collective effort is needed to adequately deal with such challenges. While the policy-maker's toolbox offers various possibilities to raise awareness, the most obvious but also most important one is information sharing. Providing information on risks, vulnerabilities, prevention methods, and ongoing incidents helps create visibility and thus more attention as well as a greater sense of urgency.

2 Promote Education Programs and Training on Cybersecurity

Given the fact that most cyber attacks are caused by human error, educating individuals on cyber issues to combat the existing shortage of knowledge is essential for expanding cybersecurity protection. The lack of well-trained cybersecurity experts, both in the public and private sector, also makes the creation of training opportunities across sectors paramount to increasing cyber resilience. To contribute to these efforts, state governments should promote education programs and training for their own employees and government agencies as well as for schools and colleges. It is crucial to invest both in educational opportunities (e.g., funding programs at colleges) as well as in individuals (e.g., promoting upskilling programs). Given the fast-evolving cyber threat landscape, cyber training for individuals should be understood and implemented as a continuous learning process throughout life and employment to help them prevent, identify, and respond to the newest cybersecurity threats effectively. As employees might be reluctant to take up existing training offers due to the complexity of the issue, incentives for cybersecurity training and education should be considered.

3 Enforce Consequences for Cybersecurity Attacks

No matter the amount of implemented cybersecurity awareness training, individuals, businesses, and governments will never be immune from potentially becoming the victim of a cyber attack. This prompts questions about the role state governments should play in the aftermath of such an attack. State policy-makers should consider how they can support the enforcement of consequences for cybercrime. This encompasses two fronts for state governments: supporting the detection of crimes in cyberspace and strengthening the capacity for investigation and prosecution. Both are easier said than done, considering how challenging it is to identify attacks and cybercriminals. For this, artificial intelligence can be a helpful tool, not only for identifying weak links in IT systems to strengthen security infrastructure but also for detecting cybercrimes. Establishing virtual police stations on a state level could also allow for easier and faster reporting of incidents online to support the criminal prosecution of attackers. State policy-makers should further consider strengthening law enforcement programs to combat cybercrime.

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Policy Recommendations for Transatlantic Cooperation

1 Set Transatlantic Standards Based on Shared Democratic Values

The digital transformation is not taking place in a geopolitical vacuum. The United States and China have been driving the global race for digital and technological supremacy by power of innovation. The EU has primarily influenced the global digital market by setting regulatory standards based on fundamental rights, such as with its General Data Protection Regulation (GDPR) in the field of data privacy. Drawing on their individual strengths and shared common values of democratic principles and human rights, the United States, the EU, and Germany should strive to set transatlantic standards for digital technologies and drive multilateral standard-setting in accordance with their own values and norms. Innovations in the field of AI, big data, machine learning, and others are fueling questions on design characteristics, ethical aspects, legal questions, and data use. This is creating opportunities for the transatlantic partners to drive the debate on such issues like encryption, hardware design, connections, data security, data ownership, and prosecution of cybercrime by advocating common transatlantic standards. Policy-makers from the United States and Germany should identify the best opportunities for transatlantic coordination and cooperation to counter illiberal influence that characterize the standard-setting of authoritarian regimes. To achieve this aim, the transatlantic partners should make use of already existing cooperation channels, such as the aforementioned EU-U.S. Trade and Technology Council or the Summits for Democracy initiated by U.S. President Joe Biden.

Best Practice

The EU-U.S. Trade and Technology Council aims to increase transatlantic cooperation.

- The Council was established at the United States-European Union Summit in 2021.
- It met for the first time in Pittsburgh in September 2021.
- Ten working groups targeting key issues have been established. Working group 1 focuses on technology standards with the aim to increase cooperation on the development of standards based on democratic values.

2 Cooperate on Building IT Infrastructure Resilience

In light of a growing number of cyber attacks and data breaches globally, the need to provide and expand resilient IT infrastructure is apparent and will only intensify in the future. The deepening integration of digital technologies into every aspect of life increases the risk of systems being disrupted by cybercriminals or sensitive data being stolen or misused, highlighting the urgency of addressing and identifying potential vulnerabilities. Against this backdrop, policy-makers in the United States and Germany should cooperate on building and improving cyber secure options for IT infrastructure to strengthen the security and resilience of IT systems and networks. With cybersecurity and data protection being a common responsibility, transatlantic exchange and cooperation on this issue is conceivable on various levels and between different actors in the public and private sector. State governments should, for example, consider estab-

lishing transatlantic working groups in partnership with individual states on the other side of the Atlantic, bringing together German and U.S. American experts and decision-makers to facilitate a discussion and exchange of ideas about how to improve the resilience of IT infrastructure on the subnational level.

Best Practice

Working Group 4 of the **EU-U.S. Trade and Technology Council** aims to establish a secure digital infrastructure through close cooperation between the EU and the United States.

- It focuses on issues concerning interoperability, diversity, and resilience across ICT supply chains, especially with regards to digital infrastructure.
- The group works on protecting and securing 5G, undersea cables, data centers, and cloud infrastructure.

3 Elevate the Issue of Cybersecurity in International Relations

Malicious activities in cyberspace know no national borders, a trait that defines the global character of cybercrime. Repeated cyber attacks on critical infrastructure worldwide as well as recent attacks on democratic elections have not only caught the public's attention but have also elevated the issue of cybersecurity to the international policy stage in recent years. Given its global character and the high risks associated with incidents in cyberspace, policy-makers should attach more importance to cybersecurity in international relations. Like-minded countries should seek stronger coordination and collaboration on this issue. As such, the United States and Germany should cooperate to expand their defense capabilities to detect, mitigate, and prevent threats to their cyber systems by state or non-state actors. The transatlantic partners should further work together to identify the perpetrators of international cyber attacks and coordinate their response to such cybercrimes, ensuring cybercriminals receive the appropriate punishment and setting a deterring example for potential future violators of cyberspace.

Best Practice

Organizations and institutions from across Europe, North America, and Japan signed onto the **Charter of Trust**.

- The Charter of Trust lays out ten principles concerning cybersecurity
- It is a cooperation between multiple stakeholders from academia, civil society, and the business community.
- The charter aims to promote security throughout the digital supply chain, transparency, shared regulatory frameworks, and joint initiatives.

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About the Aspen Institute Germany

The Aspen Institute Germany is an independent, non-partisan organization that promotes values-based leadership, constructive dialogue between conflicting parties, and transatlantic cooperation to strengthen a free and open society. Founded in 1974 in Berlin, the Institute has been bringing together decision-makers and experts from politics, business, academia, media, culture, and civil society for 48 years to address the challenges of our time.

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