

INNOVATION, COMPETITIVENESS, OPPORTUNITY: A Policy Agenda to Build Tomorrow's German Workforce

The increasing use of and demand for technology is creating new types of jobs in every sector of the economy that require an evolving set of skills. Tasks associated with jobs across many sectors are not the same today as they were just 20 years ago. Yet, as job requirements change, new technologies are generating new jobs and increase productivity. These trends will become even more prominent with the use of emerging technologies, such as the use of artificial intelligence.

Among the great changes, software solutions that enrich every aspect of our lives are a great opportunity. Software innovation is transforming every sector of the German economy. A recent Software.org: the BSA Foundation study shows the software industry contributed more than €159 billion to German GDP in 2016 — a €7 billion increase over a two-year period.¹ The study also showed that the software industry is a powerful job creator in Germany, supporting more than 2 million jobs. And there are many more jobs available than there are people qualified to fill them.

Germany's strength in innovation is increasingly threatened by a shortage of STEM workers. For example, the German Economic Institute (IW) Cologne (Institut der deutschen Wirtschaft Köln, IW Köln) showed that in 2018, the German labor market was short of nearly 315,000 employees in the fields of mathematics, information technology, natural sciences and technology.² According

Enabling the German workforce to transition smoothly into the workforce demands of the new digital economy requires preparing new generations for jobs of the future. The current workforce needs to be supported as they move to the new opportunities of the digital economy, while at the same time expanding opportunities to reach a larger pool of talented people. The federal government and private sector must work together to:

- » Improve access to STEM education, especially for women.
- » Create alternative pathways to evolving workforce.
- » Expand workforce retraining.
- » Broaden access to technology.

to a study by Bitkom, an association of digital economy stakeholders in Germany, there were 82,000 vacancies for IT experts in September 2018.³ This is an increase of 49% from the previous year. The IW Köln also notes that the number of missing IT experts in Germany more than doubled between 2015 and 2018.⁴ In particular, the numbers of unfilled jobs in software development, computer programming, cybersecurity and related areas are growing at considerable rates.

¹ „The Growing \$1 Trillion Economic Impact of Software“ (Der stetig wachsende 1 Billionen Einfluss der Softwareindustrie auf die Wirtschaft), Software.org (Oktober 2018), abrufbar unter https://software.org/wp-content/uploads/2018_EU_Software_Impact_Report_A4_de.pdf

² IWD: MINT-Lücke auf Rekordhoch, 14. May 2018, <https://www.iwd.de/artikel/mint-luecke-auf-rekordhoch-388861/>

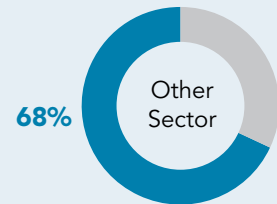
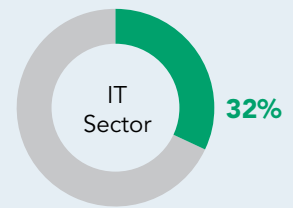
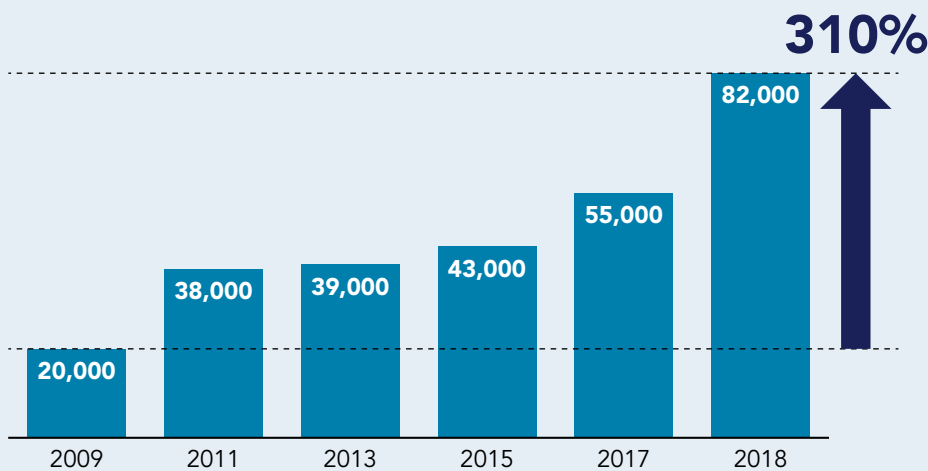
³ Dr. Bernhard Rohleder, Bitkom-Hauptgeschäftsführer: „Der Arbeitsmarkt für IT-Fachkräfte“, Berlin, 13. Dezember 2018: https://www.bitkom.org/sites/default/files/2018-12/181213_Bitkom_Charts_PK_IT-Fachkräfte_final.pdf

⁴ IW: MINT-Herbstreport 2018. MINT – Qualifizierung und Zuwanderung zur Stärkung von Forschung und Digitalisierung, Gutachten für BDA, BDI, MINT Zukunft schaffen und Gesamtmetall, [https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/Mint-Herbstreport%202018.pdf/\\$file/Mint-Herbstreport%202018.pdf](https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/Mint-Herbstreport%202018.pdf/$file/Mint-Herbstreport%202018.pdf) (Seite 7)

Meeting the Workforce Demands of the New Economy

Since 2009, the number of vacancies in IT-jobs in Germany has increased by over 300%.⁵

More than half of all programming jobs are outside the IT industry.⁶



89%

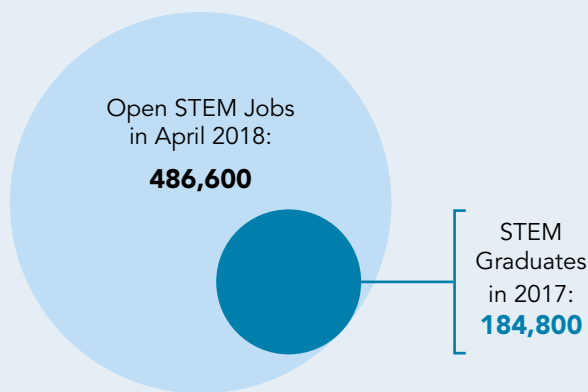
of companies believe that digital literacy will be as important as professional experience or social skills in the future.⁷

Immigrants in STEM contributed more than

€170 billion

to German GDP in 2016.⁸

STEM Education Must Expand to Keep Pace.⁹



85% of all companies are involved in continuing education and invest **€33.5 billion** annually.¹⁰

⁵ Der Arbeitsmarkt für IT Fachkräfte, Bitkom (2018), https://www.bitkom.org/sites/default/files/2018-12/181213_Bitkom_Charts_PK_IT-Fachkräfte_final.pdf

⁶ IT Fachleute, Berichte: Blickpunkt Arbeitsmarkt, Bundesagentur für Arbeit (März 2018), <https://statistik.arbeitsagentur.de/Statischer-Content/Arbeitsmarktberichte/Berufe/generische-Publikationen/Broschuere-Informatik.pdf>

⁷ Der Arbeitsmarkt für IT-Fachkräfte, Bitkom Research (2017), <https://www.bitkom.org/sites/default/files/pdf/Presse/Anhaenge-an-Pls/2017/11-November/Bitkom-Charts-Qualifizierung-17-11-2017-final.pdf>

⁸ Institut der deutschen Wirtschaft Köln: MINT-Frühjahrsreport 2018, [https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/MINT-Fruehjahrsreport_2018.pdf/\\$file/MINT-Fruehjahrsreport_2018.pdf](https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/MINT-Fruehjahrsreport_2018.pdf/$file/MINT-Fruehjahrsreport_2018.pdf)

⁹ Institut der deutschen Wirtschaft Köln, MINT-Herbstreport (2018) und Pressemitteilung der „Nationaler Pakt für Frauen in MINT-Berufen: „MINT-Studiengänge: Zahl der Erstsemester und Absolventinnen/Absolventen zeigt positive Entwicklung“ (vom 17.10.2018), <https://www.komm-mach-mint.de/Presse/Pressemitteilungen/Zahl-der-Erstsemester-und-Absolventinnen-zeigt-positive-Entwicklung>

¹⁰ Positionspapier der Bundesverband Deutscher Arbeitgeber zur Nationalen Weiterbildungsstrategie, 7. November 2018 [https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/Popa-Nationale-Weiterbildungsstrategie.pdf/\\$file/Popa-Nationale-Weiterbildungsstrategie.pdf](https://www.arbeitgeber.de/www/arbeitgeber.nsf/res/Popa-Nationale-Weiterbildungsstrategie.pdf/$file/Popa-Nationale-Weiterbildungsstrategie.pdf)

Investing in tomorrow's workforce:

...Ensures German Competitiveness in a Changing Global Economy.

...Spurs Innovation Across Industry Sectors.

...Strengthens Germany as a Location for Future Industries.

...Promotes Economic Security for Millions of Germans.

Software innovation is also generating new jobs across industry sectors, requiring new skills ranging from advanced manufacturing to new approaches to customer service and retail sales. Employers are encountering challenges in filling vacancies that require use of new technologies, but opportunities for qualified workers abound.

The federal government, the federal states and the private sector all have important roles in implementing policies that will prepare the next generation for the jobs of the future and allow the current workforce to transition successfully into the new job environment.

Improve Access to STEM Education

STEM education equips students with problem solving, critical thinking, and other abilities that are important for jobs in virtually every industry. Making STEM education inclusive and widely available builds interest in developing in-demand skills and expands the available workforce for technology-related jobs. BSA therefore supports:

Promoting STEM Education in Primary and Secondary Schools. STEM education is essential to building a highly skilled workforce, but too few students currently have access. Enhancing government investments in early STEM interventions and STEM-mentoring programs can counteract this problem. Expanding public-private partnerships, re-envisioning vocational education, and training more STEM-qualified teachers in primary and secondary education are critical priorities.

Encouraging Greater Diversity and Inclusivity in STEM Education. Making STEM education more widely available — and encouraging inclusion of underrepresented groups, especially women — through scholarships, loans, and other initiatives will help ensure the jobs of the future are available to the entire population.

Broadening Exposure to STEM in Higher Education. Although many students in higher education choose non-STEM areas of study, ensuring a baseline exposure to STEM fields among these students can prepare

graduates in all fields to embrace technology in whatever career they may choose. This is particularly important in the education of future school teachers. At the same time, it is becoming increasingly important that social competences, process competences and cognitive skills, such as active learning, become part of curricula throughout the education system, as AI and automation will take on more and more tasks in the future and thus enhance cross-functional skills.

Aligning STEM Curricula to Real-World Demands. Greater integration of high-demand practical disciplines, such as software engineering, data science, and cybersecurity, into computer science and other STEM curricula will ensure investments in STEM education translate into a qualified, highly skilled workforce.

Expand Workforce Retraining

Emerging technologies will create new jobs and change the skills demanded in many existing jobs. In addition to preparing the next generation workforce, we must ensure the current workforce has access to the skills needed as the job market evolves. Measures such as the development of a National Education Strategy are steps in the right direction. In the new economy, technical schools, apprenticeships, boot camps, and other alternative pathways may be just as effective as traditional classrooms in order to succeed in the digital age. Therefore, it is essential to adopt a cross-generational, inclusive and solidarity-based approach. BSA therefore supports:

Investing in Mid-Career Training in High-Demand Tech Skills. Mid-career retraining programs are essential to provide German workers with high-demand cybersecurity and IT skills, helping match qualified workers to growing occupational fields. Tax incentives to offset costs to workers for specialized training and certification programs could also pay dividends.

Strengthening "Dual" Vocational Training. The skills and experience required for the developing labor market should be acquired during apprenticeships. By developing public-private partnerships, honing the focus of requirements for candidates, and creating

incentives, apprenticeships will become more accessible and attractive for future workers. Vocational schools, based on their experience and existing cooperation with companies, can also play a greater role in the field of mid-career training and upskilling.

Modernizing the Professions' Profiles of the "Dual" Vocational Training System. The training regulations for dual vocational training must be adapted to the challenges of digitization, not only for occupations directly linked to technology but all. Government initiatives such as "Vocational Education 4.0" urgently need to focus not only on the hardware equipment of vocational training centers but also on the teaching of digital specialist skills — not to forget the increasingly popular soft skills, which cannot be replaced by machines. Qualified trainers are also urgently needed to achieve this goal. The quality of these training measures can be ensured in cooperation with the software industry.

Mainstreaming Boot Camps, Online Courses, and Other Alternative Education Models. Boot camps, online courses, community colleges, and alternative education models can each help reach new student populations, help students tailor their education to their own needs and pace, and impart high-demand skills to workers unable to participate in degree programs or other traditional pathways. Public investment should support these and other alternative models to expand the path to the 21st century for German workforce. Cooperation with companies, science and civil society can prevent conceptual gaps in the development of the National Continuing Education Strategy and strengthen a later alliance for its implementation.

Broaden Access to Technology

Technology enables the creation of jobs in all industries and in all parts of the country. Ensuring equal opportunity to access technology is fundamental to job creation and economic growth. BSA therefore supports:

Achieving Universal, Affordable High-Speed Internet Access. Affordable access to high-speed Internet is increasingly a necessity for many professions. To achieve this, however, optimal infrastructural conditions must be available everywhere in Germany. Germany's 5G strategy must be implemented swiftly. Nationwide broadband expansion and network coverage are the basis of the digital education measures.

Ensuring Equitable Access to Technology in the Classroom. Exposing students to cutting-edge technologies at an early age can improve educational outcomes and prepare students for technology-related careers; yet access to technology in the classroom varies widely across different social classes and income groups. Even though the implementation of the Digital Pact for Schools is essentially carried out at the state level, ensuring equal opportunities in access to technologies must be an orientation value.

Promotion of Women in STEM professions. A gender-balanced and influential alliance between politics, civil society, business and science, as called for by the German National STEM Forum as part of the German government's STEM strategy, should be supported. Politicians, companies, schools and parents should work together to increase the number of women in STEM professions.