diversITy Series

Promoting e-skills training for a diverse tech workforce

Country report for Germany

February 2019

Terms of use and disclaimer

The *diversITy series* of reports presents information collected and compiled by empirica, supported by J.P. Morgan, on the technology skills training landscape in seven target countries: Spain, Germany, the United Kingdom, Ireland, Poland, France and South Africa. External sources of information and data have been credited accordingly where applicable.

The term *Information and Communications Technology* (ICT) *sector* used in this report refers to the technology or digital sector in all target countries.

The term *ICT skills* used in this report comprises two main categories:

ICT user skills: the capabilities required for effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work, which is, in most cases, not ICT. At the general level, they cover "digital literacy": the skills required for the confident and critical use of ICT for work, leisure, learning and communication.

ICT practitioner skills: The capabilities required for researching, developing and designing, managing, producing, consulting, marketing and selling, integrating, installing and administrating, maintaining, supporting and servicing ICT systems.

The term *ICT skills training* refers to programmes and initiatives aimed at improving or upgrading peoples' skills and knowledge in ICT user and practitioner skills.

The term *ICT specialists* refers to the European Commission's definition of ICT specialists as workers whose main job involves ICT and who can deal with a wide range of tasks concerning corporate ICT systems. The terms *ICT specialists* and *ICT workers* are used interchangeably in this report.

This report has been supported by the JPMorgan Chase Foundation, the contents and opinions in this paper are those of the authors alone and do not reflect the views of the JPMorgan Chase Foundation, JPMorgan Chase & Co, or any of its affiliates.

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Preface

The diversITy project seeks to carry out an evaluation and assessment of ICT skills and training programmes to support diverse populations to enter the labour market.

It identified and analysed ICT training programmes that aim to prepare and place jobseekers into meaningful tech jobs, with a focus on diverse target groups, including women, youth at risk of social exclusion or from difficult socio-economic backgrounds, people with migrant background or unemployed adults changing careers.

In the context of this study, the term ICT skills includes both, ICT user and ICT practitioner skills. However, more importance is given to ICT practitioner skills, which the European ICT skills Forum defines as, "The capabilities required for researching, developing and designing, managing, producing, consulting, marketing and selling, integrating, installing and administrating, maintaining, supporting and servicing ICT systems".[1]

The target countries are Germany, France, the United Kingdom, Ireland, Spain, Poland and South Africa.

The work product of the diversITy project informs policy development on the European and national level and provides practical recommendations to non-profit organisations and training providers. An initial assessment and evaluation of identified ICT skills training programmes in the target countries produced a repository of 96 inclusive programmes. Brief descriptions of these 96 cases are available on the diversITy online repository, which can be accessed at www.eskills4diversity.com. In addition to the online repository of case studies, we produced seven country reports for each target country, analysing in-depth each country's ICT skills gap and unique training landscape. In each report we showcase a set of good practice show cases, setting a benchmark to foster exchange.

The diversITy project is part of the J.P. Morgan New Skills at Work initiative that aims to identify strategies and support solutions that help improve labour market infrastructure and develop the skilled workforce globally. This $250 million five-year global initiative, first launched in December 2013, brings together leading policymakers, academics, business leaders, educators, training providers and nonprofits with the goal of connecting labour market policy with practice, supply with demand and employers with the workforce.

We greatly acknowledge the support and collaboration of J.P. Morgan to produce this report.

We would like to thank **Eriona Dashja** and **Aleksandra Szczodrowski** from the empirica team for research support for this report.

We would like to gratefully acknowledge the support of:

Dr. Alexander Böhne, Stellvertretender Abteilungsleiter 'Arbeitsmarkt', BDA Die Arbeitgeber
Dr. Monika Hackel, Abteilungsleiterin „Struktur und Ordnung der Berufsbildung", Bundesinstitut für Berufsbildung (BIBB)
Carsten Johnson, CSR Territory Manager, Cisco Networking Academy
Christian Lorenz, Leiter Themenstrategie & Hauptstadtbüro Deutsche Gesellschaft für Personalführung e.V.
Anne Kjær Riechert, Founder, ReDi School.
Christiane Schubert, Deputy Regional Director, JOBLINGE.
Anna Wohlfarth, Sprecherin des Vorstands, Stiftung Neue Verantwortung

We would also like to thank all the respondents of our ICT skills training programmes survey for Germany.

We are grateful to all our workshop participants for their insightful comments and contributions.

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[1] See European Commission (2004), *e-skills for Europe*.

Executive summary

- Nine years of growth in the post-crisis environment has demonstrated above average economic performance for Germany with low unemployment and high material living standards.
- The German economy is nearing full employment.
- Positions in the Information and Communications Technology (ICT) sector are some of the hardest to fill vacancies in Germany. Employers experience a low supply of ICT workers due to the relatively smaller numbers of students graduating from subjects such as Computer Science and engineering or finishing vocational training in ICT occupations in Germany.
- Integrating overseas workers has been an additional challenge, as Germany still neither has an updated immigration policy reflecting recent developments – the last revision is from 2007 – nor an Immigration Act to attract skilled workers.
- Current immigration laws, though liberal, are too complex to be attractive to potential workers and employers. However, the grand coalition government for the first time wants to push through a law on the immigration of skilled workers before the end of 2018.

Current developments in the ICT labour market in Germany

Recent trends at the sector level show shortages in ICT skills supply. These shortages have the potential to affect future economic growth for Germany. empirica's ICT labour market survey estimates the shortage to be 625,000 in 2025. One of the causes is a low supply of workers because few students choose to graduate in ICT related subject – neither in higher education nor in vocational education and training - in Germany.

One of the shortcomings of Germany's ICT skills ecosystem is the low number of ICT graduates. The ICT graduates comprise the primary source of supply for employers. Since recruitment criteria depend on (academic) qualifications, shortages are likely to increase.

Women are underrepresented in the ICT sector. Women's share in the German ICT workforce is lower than in France, Sweden and fifteen other EU states. The share of women in the German tech workforce is roughly 16 percent. In France and Sweden, women make up 18 percent and 22 percent of the tech workforce respectively.

There have been great strides at the policy level to target ICT skills shortages. ICT skills development policies in Germany are part of national digital strategies, such as the Digital Agenda 2014-2017 and the Digital Strategy 2025. Recent policy measures have introduced modernization targets for digital education. The 'Education in the Digital World' strategy is one of these measures. It aims to adapt curricula, learning methods and teacher training to digital changes.

A key action for education policy in Germany is to reduce educational inequalities. Structural reforms of the secondary school system have improved the level of inequalities. These reforms introduced national standards and standard-based testing for students. The aim is to provide dedicated resources and school-based support to disadvantaged schools.

Germany's strength lies in its well-established Dual Vocational Education and Training (VET) system. VET graduates form a key part of Germany's ICT skills supply. All key stakeholders contribute to the development of occupational profiles in Dual VET. These profiles lead to direct labour market entry for individuals from diverse backgrounds.

Key Recommendations

Target training programmes to reflect employer demand for skills.

- Skills policies should target jobs with high vacancy rates. In Germany, many vacancies do not require academic degrees. There should be a responsive ICT framework with active monitoring of existing and new ICT skills profiles.
- The ICT sector should adopt a "skills profile" approach that ensures skills training sufficiently reflects employer demand. This also encourages employers to take part in creating and revising skills profiles.

Public and private entities should cooperate to deliver effective ICT skills training programmes.

- Local employment agencies can play an important role in streamlining training and employability outcomes for unemployed workers. Well-financed training programmes supported by extensive partner networks have managed to achieve successful results in integrating diverse groups into the labour market. By including all stakeholders, policy makers can ensure better results for effective training.

Establish an incentivised framework for business-education partnerships.

- Business-education partnerships are resource-dependent and need considerable public and private investment. It is challenging for education and training providers to find employers who are willing to train and hire workers. A better incentive framework can encourage such partnerships.

Adopt strategies to promote the participation of women in STEM fields.

- Tailored approaches should be developed to increase the participation of women in STEM fields. Strategies for engagement of women into STEM education and careers should be developed for early schooling. Government initiatives for the integration of women into STEM fields remain broad and unaccompanied by strategies aimed at raising awareness at early schooling. This is a potential area for development.
- Part of the task is to encourage greater partnership for joint activities to advance women in ICT fields. One example is the United Nations' 'International Girls in ICT Day' celebrated each year to promote equal access for women and girls in ICT fields. Important stakeholders can assist in adapting such campaigns to the national and local level.

Develop strategies to promote digital education for early schooling across Germany.

- Campaigns should target ICT skills development of younger cohorts in early schooling. Awareness-raising intervention mechanisms encourage young people to choose careers in technology. An example of such a campaign is the 'Informatik Biber (Informatics Beaver)' competition for children, which is an annual competition for coding and other tech activities for school-aged children.

Provide greater opportunities for lifelong learning.

- Another key area for public action is the up-skilling of the existing workforce. Adult learners with incomplete education or those who face a lower market demand for skills at risk of obsolescence, are vulnerable to long-term unemployment.
- The challenge of integration is also relevant here. Large numbers of older refugees who arrived in Germany do not have an extensive educational or training background. Training in ICT skills provides them with opportunities to up-skill in newer skill profiles. This can also help in the social and economic upward mobility of vulnerable populations.

Introduction

The German economy has demonstrated steady growth and strong labour market performance with consistently low unemployment following the 2008-09 financial crisis. Populations that have been particularly vulnerable in the post-crisis environment such as youth not in education, employment or training (NEET) and older workers, have experienced better economic outcomes in Germany than in other EU 28 member states. Recent trends at the sector level, however, indicate shortages in ICT skills supply, which have the potential to affect future economic growth for Germany. In this report, we discuss these issues and more, beginning with an overview for skills and diversity in the ICT labour market in Germany. The report provides an overview of policy measures introduced to address the development of ICT skills in Germany and findings from our diversITy survey of private sector approaches towards inclusive ICT skills training programmes. In the last section, we offer recommendations to key stakeholders for future action.

Introduction

The German economy has demonstrated steady growth and strong labour market performance with consistently low unemployment following the 2008-09 financial crisis. Populations that have been particularly vulnerable in the post-crisis environment in the European Union (EU) such as youth not in education, employment or training (NEET) and older workers have experienced comparatively better economic outcomes in Germany. Meanwhile, recent trends at the sector level indicate shortages in ICT skills supply, which have the potential to affect future economic growth for Germany. empirica's ICT labour market survey estimates the shortage to reach 625,000 in 2025. Effects of the ICT skills shortage can already be felt and are communicated by employers across Germany. In 2017, data for Germany showed the number of "hard-to-fill" vacancies in ICT jobs to be around 72,000.

There is recognition at the policy level of the need to address these shortages as demonstrated by a range of measures introduced to attract and retain ICT workers. empirica's survey of the ICT labour market based on Eurostat data and desk research, also indicates a large pool of potential supply, particularly women, foreign-born workers and workers with a migrant background. However, these groups also face considerable barriers to access the ICT labour market in Germany. In this report, we discuss barriers to entry for persons from diverse backgrounds, as well as actions to counter these.

There have been targeted policy measures introduced by the government in recent years, in particular to address high numbers of refugees who arrived in Germany in 2015 coupled with the emergence of initiatives and programmes of different stakeholders for labour market integration through ICT skills training. Data also indicates that women face considerable challenges in ICT fields, both, in education and the workplace. In addition to the untapped potential of women, a further untapped resource, namely refugees and people with a migrant background, face bureaucratic and socio-cultural barriers to labour market entry. This has resulted in the appearance of a range of private sector initiatives on the market with a focus on inclusive ICT skills training. The aim of these initiatives is to ease the barriers faced by diverse groups to enter the ICT labour market.

We conducted a comprehensive survey of inclusive ICT skills training programmes in Germany to assess the effectiveness of such programmes to improve the employability of diverse groups in the ICT sector. In this report, we provide an analysis of our main findings with the aim of understanding different approaches towards ICT skills training in Germany. We focus on diverse groups, such as refugees, young people from disadvantaged socio-economic backgrounds, people with migrant background, and other groups at risk of social exclusion.

One of the main shortcomings of Germany's ICT skills ecosystem is the low number of ICT graduates at all levels. . Many of the skills training programmes studied as part of our survey carry out successful skills training to counter considerable challenges for employment due to strict employer requirements and address employability issues to improve the chances of labour market integration for the different diverse target groups. The well-established German vocational and education (VET) system, which is an attractive option for many students looking to enter the ICT labour market in Germany, also faces competition from private initiatives for ICT skills training. The fact that the language of both instruction and work is German, represents an added challenge especially for recent arrivals to Germany.

In this report, we discuss these issues, beginning with an ICT skills forecast for Germany in Section 1, followed by trends in diversity in the ICT labour market in Section 2. Section 3 gives an overview of policies and frameworks introduced by the public sector to address the development of ICT skills in Germany. Section 4 presents the findings from the survey of private sector approaches towards inclusive ICT skills training programmes. It provides a brief look into the educational pathways available to gain an entry into the ICT labour market and investigates the success factors and challenges of a suggested training taxonomy. In the last section, we offer recommendations to key stakeholders for future action.

1

ICT Skills Forecast

In 2017, data for Germany showed the number of “hard-to-fill” vacancies in ICT jobs to be around 72,000. Effects of the ICT skills shortage are already being felt by employers across Germany. German employers experience a low supply of ICT workers due to the relatively smaller numbers of students graduating from ICT fields in Germany. Attracting and integrating ICT workers from outside Europe has been an additional challenge as Germany did not historically and still does not have an immigration policy to attract and integrate skilled workers. empirica’s ICT labour market survey estimates the shortage to grow to a very high 625,000 in 2025. The same survey and desk research also indicates a large pool of potential supply, particularly women, foreign-born workers and workers with a migration background. However, these groups also face considerable barriers to access the ICT labour market in Germany.

Baseline figures and forecast for Germany

The current ICT skills challenge for Germany

In 2017, Germany had an estimated 72,000 vacancies for ICT specialists. In 2015 and 2016, vacancies for Germany's ICT specialists were estimated to be 60,925 and 68,765 respectively (Table 1). The figures reflect an increasing trend for ICT vacancies in the country. Software developers, database designers and administrators, and systems administrators had the highest number of reported vacancies. Since 2015, vacancies for the administrator type jobs have decreased slightly but reasons behind this decrease are unclear. Vacancies with an increasing trend include ICT user support technicians and ICT installers and servicers and systems administrators. ICT installers and servicers and ICT user support technicians have experienced the largest growth in terms of number of jobs added (Figure 1 and 2 and/or Table 2).

A closer look at the development of the number of jobs for individual ICT occupations (Table 2) reveals huge variations in growth rates. These growth rates cannot be solely attributed to real labour market fluctuations but are also affected by redefinition of national classifications and job titles or a combination of both. To illustrate this using the example of Germany there was a change of national classification (KldB) in 2012 which led to a drop in the ISCO-08 category '1330 Information and communications technology service managers' from 55,800 (2011) to 40,300 (2012).

The figures also show that some of the fastest growing ICT jobs in Germany do not require an academic education (i.e. below skill level 4)[2]. In Table 2, these are the first three occupations.

Table 1 Vacancies for ICT specialists in Germany	2015	2016	2017
Software developers	22555	23821	21890
Database designers and administrators	9410	9382	8508
Systems administrators	5067	6177	8008
ICT managers	4195	5590	5437
Systems analysts	3410	3793	4092
ICT user support technicians	3374	3902	4519
Web and multimedia developers	3181	3597	4064
Computer network professionals	2640	3268	3729
Software and applications developers and analysts not elsewhere classified	1913	2683	2464
Applications programmers	1845	2909	4659
Computer network and systems technicians	1297	1245	1567
ICT installers and servicers	1100	1137	1456
Database and network professionals not elsewhere classified	649	843	1502
Web technicians	175	147	113
Broadcasting and audio-visual technicians	94	241	117
ICT operations technicians	20	30	28
Total	60,925	68,765	72,153

Source: Textkernel (2017)

[2] See ILO (2012), International Standard Classification of Occupations.

Table 2 ICT occupations in Germany	Number of Jobs		Growth			Linear Trend	
	2015	2012	Total	% (CAGR)	Rank	P.A.	Rank
ICT user support technicians	133,300	15,100	785%	106.9%	1	39,415	2
Telecommunications engineering techs.	40,200	13,000	210%	45.8%	2	9,074	6
ICT installers and servicers	208,200	85,200	145%	34.7%	3	41,023	1
Systems administrators	116,100	51,800	124%	30.9%	4	21,450	4
Information technology trainers	8,900	4,600	95%	24.9%	5	1,443	10
Software developers	208,500	129,100	61%	17.3%	6	26,459	3
Systems analysts	217,600	157,500	38%	11.4%	7	20,037	5

Source: empirica calculations based on Eurostat LFS data (2015)

Germany's ICT workforce: education, training and breakdown by gender

The share of women in the ICT workforce in Germany is quite small, around 16.3 percent on average.[3] Compared to 18.1 percent for France, 17 percent for the UK, and the 17 percent EU average, Germany's share is slightly lower for all categories. Women constitute only 14.3 percent of ICT graduates to enter the labour market.

Only 49 percent of ICT specialists have an academic degree. Barely 12 percent of the employers provide training to their ICT specialists. This figure is below the EU average of 62 percent, however the data does not indicate the field of education, for example, whether the education is in ICT or not. This makes it difficult to interpret the implication of the low share of academic educational attainment of German ICT specialists. At the same time, this could also be a reflection of the German apprenticeship system.

As the vacancy figures for ICT specialists demonstrate (Figure 1 and 2 above), there are not enough new ICT graduates suitable to fill in the open positions. Figures from 2015 for Germany show that 2.7 percent of vocational education graduates are in ICT fields, and 5 percent of bachelor education graduates choose ICT majors (Table 4). Vocational education graduates in ICT are slightly higher for the UK at 5 percent and lower for bachelor education at 4 percent. Germany's timeline data for both tertiary (bachelor and master graduates) and vocational education shows a decline in graduates from 2007 until 2012. In more recent years an increase in the numbers can be observed (Table 3).

German employers experience a low supply of ICT workers due to the relatively smaller numbers of students graduating from ICT fields in Germany. Attracting and integrating ICT workers from outside Europe has been an additional challenge as Germany does not have an effective immigration policy to attract and integrate skilled workers. Current immigration laws, though liberal, are too complex to be attractive to potential workers and employers. From 2011-2015, the number of skilled workers from non-European origin countries was less than 30,000.[4] Since then rapid development took place. In 2018 the figure of skilled ICT workers from non-EU countries reached a figure of 60,000 which is 5% of the entire skilled ICT workforce in Germany. The corresponding figure for skilled workers in ICT occupations from EU countries in Germany in 2018 is 46.445 which is 4% of the total skilled ICT workforce of 1.188 million.[5] In addition, one of the biggest barriers to employment in Germany for foreign workers is 'language'.

[3] Data for the share of women in single occupations was not available at the time of writing this report.

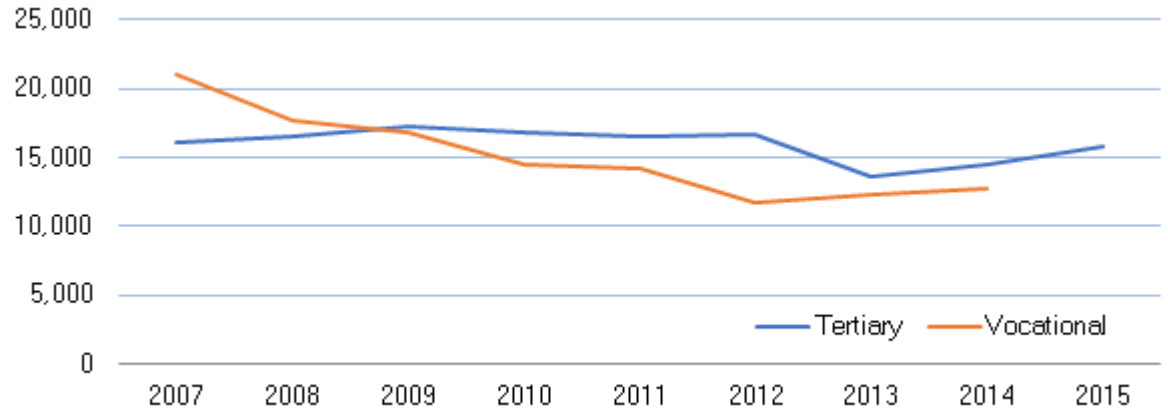
[4] See Mayer (2017), Germany needs an immigration law.

[5] Bundesagentur für Arbeit: Beschäftigte1) am Arbeitsort - nach Berufssektoren und Anforderungsniveau der KldB 2010: 30.06.2018: https://statistik.arbeitsagentur.de/nn_31966/SiteGlobals/Forms/Rubrikensuche/Rubrikensuche_Form.html?view=processForm&resourceId=210368&input_=&pageLocale=de&topicId=746984&year_month=201806&year_month.GROUP=1&search=Suchen

Table 3 Graduates in Germany	Total	% ICT Graduates	% Women
Upper secondary education - vocational	9063	2.7%	9.1%
Post-secondary non-tertiary education	3811	1.9%	11.9%
Bachelor's or equivalent level	15,836	5.0%	18.2%
Master's or equivalent level	7,816	4.0%	17.1%
Doctoral or equivalent level	1,103	3.8%	13.8%
Approximate max labour market inflow with ICT degree (1+2+3+4+5)	28,600		

Source: Eurostat [uoe_grad02] (2015).

Figure 1 ICT Graduates in Germany, first degrees



Source: Eurostat (2017) [educ_grad5 and uoe_grad02].

ICT skills forecast model for Germany

In addition to the expansion of the workforce, there is also replacement demand, which is the demand for replacing workers who leave the ICT workforce for good or temporarily. We estimate the annual net replacement demand based on Cedefop's baseline scenario for demand and supply of ICT skills in Europe. We calculate an annual net replacement demand of 54,100 ICT specialists in Germany.[6]

To assess the total demand for ICT specialists in Germany, we must additionally account for the vacancy backlog for ICT specialists. Data provided by Textkernel[7] for the diversITy survey shows 72,153 total vacancies for ICT specialists advertised in Germany during the first week of September 2017.[8]

Based on the above figures, we estimate the average annual need for ICT specialists to be 90,000, which is the sum of expansion (35,900) and replacement demand (54,100).

For ICT skills supply, we assume that all 28,600 ICT graduates (Table 3) enter the ICT labour market. Based on this assumption, an imbalance of 61,400 will remain. This is calculated as the difference between the average annual need for ICT specialists (90,000) and the number of graduates entering the ICT labour market (28,600). We assume this figure to be the minimum degree gap of 61,400.

[6] Cedefop publishes estimates of future replacement demand by occupation at ISCO-08 two-digit level. For the by far largest relevant groups of ICT professionals (ISCO-08 group 25) and the smaller group of ICT technicians (group 35) this is on average 3.8%/year and 3.3% respectively in Germany. It is therefore justified to apply a weighted average of 3.7%. 3.7% of the ICT workforce of 1.47M translates in a headcount of replacement demand of 54,100. As it cannot be accurately predicted on a yearly basis, we assume this a stable figure for the next few years.

[7] Textkernel is a specialist in machine intelligence for matching supply and demand on the job market. With its product Jobfeed, Textkernel aggregates information from millions of jobs found on the web: https://www.textkernel.com/

[8] Please note that the Textkernel definition of ICT specialistsis slightly differ from the one used by Eurostat

This structural gap is a hypothetical construct that does not take account of other sources of labour market inflow that are not captured very well, e.g. immigration and emigration of ICT specialists, lateral entries of non-ICT graduates and re-entry of former graduates

We thus postulate that a minimum lateral entry capacity of at least 61,400 workers exists. Our estimate for a baseline projection of Germany's ICT skills gap is presented in Box 2. For a detailed look into the methodology, please refer to Appendix A at the end of this report.

Box 1 Snapshot: Germany's ICT Workforce

In Germany, the ICT specialist workforce accounts for 1.47 million workers, or 3.6 percent of the workforce. In absolute terms, this is the second largest headcount of ICT workforce in Europe, accounting for 18 percent of Europe's ICT specialists. Germany's ICT workforce ranks 11th among all European Union (EU) member states on the indicator 'share of ICT workers among the domestic workforce'. The highest shares are in Finland, Sweden, the United Kingdom, Netherlands and Luxemburg, all of which have a share of 5 percent or more of their domestic workforce in ICT jobs. The larger continental countries all rank lower; France (16th), Spain (17th), Italy (18th) and Poland (24th).

Table 4 Key figures at a glance	DE	Rank
ICT workforce	1.5 M	2
As % of domestic workforce	3.6%	11
% female	16.3%	14
Estimated annual replacement need	54,100	
Latest vacancy figures	72,200	
Vocational graduates	12,900	3
Tertiary graduates (only first degrees)	15,800	2
Projected jobs potential until 2025 (8 years)	828,000	
Of which expansion	395,000	
% of enterprises that employ ICT specialists	22%	14
% of enterprises providing training for ICT specialists	12	12
% of ICT specialists with tertiary education	49	27

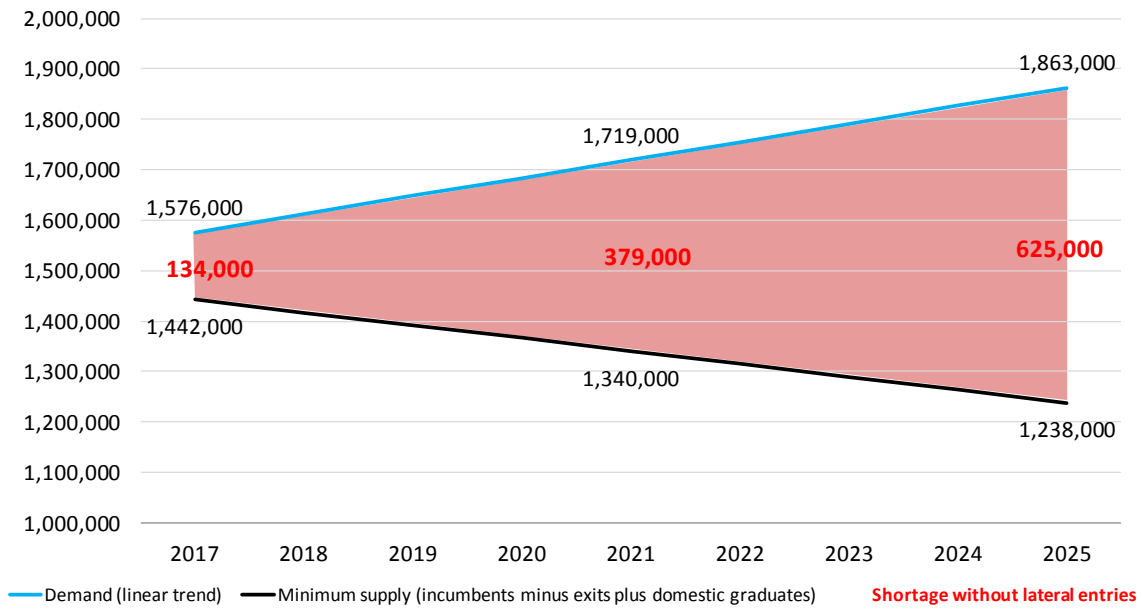
Source: Eurostat (2015).

Box 2: Baseline projection for Germany's ICT skills gap

A simple projection has been developed which is based on estimates for Germany, which rests on the assumption of a baseline scenario with a steady state of flows. It should be noted that this is a "Things stay the same"-scenario. It simply shows the number of jobs to be filled in the near future if demand keeps growing in a linear fashion and the annual supply of new labour remains as it was in the last five years. This is a projection based on a baseline scenario, and not necessarily the one empirica would deem most likely after a profound analysis of technological, socio-economic and political trends. Nevertheless, it shows a basis to ponder on trends and think about likely other, different scenarios; for example, technology leaps or disruptions; and social, economic or political developments – the possible impact of which is not taken account for in this model. Please refer to Appendix A for a detailed explanation of the methodology and yearly breakdown tables. The model rests on these inputs:

- Demand growth follows an "only" linear trend, i.e., grows by an absolute figure per year and not a percentage. Demand is set to grow by 35,900 p.a.;
- New supply is set by the average supply of the last available years.
- The degree gap or minimum lateral inflow has been 61,400 on average and this remains the case.

Figure 2 Baseline projection scenario for Germany's ICT labour market from 2017 – 2025



The shortage of skills of 625,000 in 2025 is highlighted red in the figure above. It is the shortage that remains when all expected domestic ICT graduates enter the labour market and does not take account of the lateral entries, i.e. people without a domestic degree. The model is constructed such that the actual projected shortage is exactly as "today", i.e. the rounded figure of 72,000 vacancies. According to this model, the total potential for new jobs from 2016 until 2025 will be 792,000, including 359,000 expansion and 433,000 replacement demand.

Source: empirica (2017)

See yearly data breakdown in Annex A.

2

Trends in Diversity

Populations that have been particularly vulnerable in the post-crisis environment in the EU such as NEET youth and older workers have experienced comparatively better economic outcomes in Germany. In 2018, Germany's share of youth unemployment at 7.1% was significantly lower than the EU average of 15.1%. The employment rate of older workers (55-64 years) increased from 45.5 percent to 68.6 percent in the last ten years and much of this growth is credited to pension and labour market reforms enacted introduced by the government in the late 1990's and early 2000's. However, certain trends persist in the ICT labour market in Germany that serve as barriers to a more diverse and inclusive workforce, particularly in the case of women, foreign-born workers and workers born in Germany but with a migration background. With 890,000 refugees entering Germany in 2015 alone, there has been renewed emphasis on measures for recruitment and training of ICT workers. Initiatives to train workers in ICT skills exist at all levels of the economy, from public policy, the private sector and nonprofit enterprises.

Employment and diversity in Germany's ICT workforce

Employment overview for Germany

The German economy has demonstrated steady growth and strong labour market performance with consistently low unemployment following the 2008-09 financial crisis. Germany's long-term unemployment rate is one of the lowest in the EU after Sweden, Denmark and the United Kingdom. Populations that have been particularly vulnerable in the post-crisis environment in the EU such as NEET youth and older workers have experienced comparatively better economic outcomes in Germany. In 2018, Germany's share of youth unemployment at 6.1 percent was significantly lower than the EU average of 15.1%[10]. The employment rate of older workers (55-64 years) increased from 45.5 percent to 68.6 percent in the last ten years and much of this growth is credited to pension and labour market reforms introduced by the government in the late 1990's and early 2000's.[11]

However, certain trends persist in the ICT labour market in Germany that serve as barriers to a more diverse and inclusive workforce, particularly in the case of women, foreign-born workers and workers with a migrant background. In this section, we discuss these challenges in detail.

The challenge of gender diversity in Germany's ICT workforce

Women are underrepresented in science, technology, engineering and mathematics (STEM) fields in education. According to a 2017 report by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung; BMBF), women are underrepresented in dual vocational training and additionally concentrated in fewer technical occupations.[12] In Germany, vocational education and training consists of both classroom learning and training at work, commonly referred to as dual training or Dual VET. Learners spend a part of their week in vocational school and the rest at a company. The most recent report[13] published by the Institute of Vocational Education and Training (Bundesinstitut für Berufsbildung, BIBB) shows that men predominantly chose training programmes for ICT specialists – the percentage of women in ICT training was less than 8 percent. In computer science fields alone, the share of women graduates is 14.5 percent. The female share of graduates in science, mathematics and computing is 38.3 percent in Germany. This compares to around 40% in countries like France and the United Kingdom.

Table 5 Employment and unemployment indictors for Germany	DE	EU28	Rank
Long-term unemployment rate	1.7	4.0	4th
Young people not in education, employment or training (15-24 years) – NEET 2016	6.7	11.6	5th
Youth unemployment	7.1	18.7	1st
Employment rate of older workers (55-64 years)	68.6	55.3	2nd
Age employment rate gap (15-64 vs. 55-64 years) in p.p.	6.1	11.4	3rd
Gender employment rate gap (15-64 years) in p.p.	7.6	10.5	11th
Non-natives born outside the EU, as share of total population (2016)	8.0	6.9	14th
Non-native employment rate gap, 20149, in p.p.	10.6	8.8	18th
Disability employment gap, 2011, in p.p.	20.6	19.6	11th
Disability unemployment gap, 2011 in p.p.	5.8	2.5	23rd

Source: empirica calculations based on Eurostat data (2016)

[9] See Ivan and Agafiţei (2016), *First and second-generation immigrants: statistics on labour market indicators*.

[10] Statista – the Statistical portal (2018), Youth unemployment rate in Europe (EU member states) as of May 2018 (seasonally adjusted): https://www.statista.com/statistics/266228/youth-unemployment-rate-in-eu-countries/ (visited: 30 August 2018)

[11] See Steiner (2017), *Labour market for older workers in Germany*

[12] See BMBF (2017), Report on Vocational Education and Training 2017

[13] BIBB (2017), Datenreport zum Berufsbildungsbericht 2017.

However, in three EU Member States, the majority of scientists and engineers were women: Lithuania (58% female), Bulgaria (54%) and Latvia (52%). Less than one third of scientists and engineers were women in Luxembourg (25%), Finland (28%), Hungary (31%) and Austria (32%).[14]

The most popular training profiles for women were in office management and medical and dental nursing. In comparison, information technology specialist, the fifth most frequently chosen occupation for young men, was only ranked as 42 by women[15]. For a detailed discussion on training and education pathways in Germany including the Dual VET system, please refer to Section 4 of this report.

The share of women in the German ICT workforce is lower than in fifteen European states, including France, Norway, Sweden and the UK.[16] Even though the gender gap in the overall workforce has narrowed in recent years from 66.79% in 2007 to 75.2% in 2017[17], two groups of women, mothers and women with migrant background, still face considerable barriers to employment.

Women are more likely to be employed in part time jobs. The OECD observes the gender gap to widen with age, a primary cause of which is motherhood. In Germany, mothers tend to work part time due to less accessible childcare and insufficient after-school support structures for working parents.[18] Part time employment, despite giving women with families the chance to participate in the labour market, limits their choice of jobs and progress. This refers to their progress in careers as well as their earnings prospects.

Women with migrant background in Germany face double barriers to employment. The employment rate of migrant women is lower than that of native-born women and foreign-born men. On average, the OECD employment rate for native-born women is 4.5 percentage points higher than foreign-born women.[19] Migrant women are also more likely to be unemployed. Interestingly, migration-based differences in employment in EU member states are highest in countries with the highest rates of employment, one example of which is Germany. Others are for instance the United Kingdom and Sweden. One reason for this is that many women are 'family migrants', who arrive in Germany with their husbands and families and do not have the same access to their host society that workers and students have through study programmes or business networks.

Lastly, more women choose to train for occupations in healthcare, education and social services due to the flexibility of working hours in these sectors. BIBB reports that competition for contracts for dual training in ICT companies is very high as too few contracts are offered, which further marginalises women in a sector that is predominantly male.

The challenge of an inclusive ICT workforce for people with migrant background

A person in Germany has a migration background if he or she or at least one parent was not born with German citizenship. The definition includes the following persons in detail: 1) immigrant and non-immigrant foreigners; 2) immigrated and non-immigrated naturalised persons; 3) (late) repatriates; 4) descendants born with German citizenship of the three aforementioned groups.[20]

Almost every fourth person of the around 80 million citizens in Germany has foreign roots. In 2017 year the number rose again and reached a new high. The largest group comes from Turkey. According to the Federal Statistical Office, 19.3 million women, men and children with a migration background lived in Germany last year. This was 4.4 percent more than in the previous year. The proportion of the total population was 23.6 percent.

Of the 19.3 million people with foreign roots, around 2.8 million (14 per cent) had a Turkish origin. 2.1 million a Polish, 1.4 million a Russian, 1.2 million a Kazakh and 0.9 million a Romanian background.

The figures are based on the micro census - a sample survey in which around one percent of the population in Germany is interviewed every year. According to the data, the migration status was only recorded by

[14] Eurostat: Women in Science and Technology (10/02/2018)
[15] BIBB: Rangliste 2017 der Ausbildungsberufe nach Neuabschlüssen: https://www.bibb.de/de/68756.php
[16] See Women in Tech Index (2018).
[17] Destatis: Europe in figures: Employment of Women: https://www.destatis.de/Europa/EN/Topic/PopulationLabourSocial/LabourMarket/EmploymentWomen.html (visited: 31 August 2018)
[18] See OECD (2017a), *Dare to Share: Germany's Experience Promoting Equal Partnerships in Families*.
[19] See OECD (2015), *Connecting with Emigrants*.
[20] BAMF: Migrationshintergrund (Definition): https://www.bamf.de/DE/Service/Left/Glossary/_function/glossar.html?lv3=3198544

people in private households, not by residents in shared accommodation.

Federal Statistical Office (Statistisches Bundesamt, DESTATIS) reported an increase in the employment gap between foreign- and native-born Germans between 2005 and 2016.[21] Foreign-born youth are also over-represented in NEET rates in Germany, with native-born NEET share at around 5 percent and foreign-born share at 16 percent. The population with and without a migrant background also differs in terms of their level of education.[22] People with a migrant background are far less likely to have school-leaving certificates above a secondary school leaving certificate and professional qualifications than native-born German. Only 1.7% of native-born Germans leave school without graduation. The figure increases up to 12.7% among those citizens with migrant background.[23] This is also reflected in the figures on labour market participation with just 5.5% unemployment rate in Germany in March 2018 compared to 34.8% unemployment rate among those with migrant background.[24]

The challenge of an inclusive ICT workforce for refugees

For Germany, integrating refugees into not only the labour market but also education and training is a challenge. Employment outcomes for refugees are subject to higher levels of scrutiny as most can only be hired within the first 15 months of receiving asylum and only if no suitable EU citizen is available for the job.[25] In 2015, 890,000 refugees arrived in Germany as part of the migration wave from Syria. In 2016, the largest groups of asylum applicants were Syrian nationals, followed by Afghan and Iraqi nationals.[26] 50 percent of the arrivals who applied for asylum were adults below 35 years of age. In Germany and most of the EU, a refugee is a person who has protection once his or her asylum process has been completed. Recent government reform has lowered the time required for processing asylum applications as well as barriers to employment by lowering restrictions on labour market testing but progress in this area is slow.

The integration of refugees into the labour market depends on various factors, for example, education and language skills play an important role. Qualification and education levels tend to differ, which affect the chances for employment. One of the core challenges facing refugees in Germany is the language barrier. Around 95 percent of the refugees who arrive in Germany do not to speak German.[27] Employers are less likely to hire applicants who do not demonstrate suitable use of the German language. In addition, employers are reportedly reluctant regarding prior educational and professional qualifications for new hires, especially when obtained from outside the EU.

In recent years, there have been policy initiatives that aim to decrease such barriers to entry. These include free integration courses and language classes as well as training schemes that attempt to standardise ICT skills to allow for easier employer recognition of these skills. For example, the European Structural Fund (ESF) and the Federal Office for Migration and Refugees (Bundesamt für Migration und Flüchtlinge, BAMF) ESF-BAMF programme offers courses for skills building. A strong emphasis is put on language courses. In the 2007-2014 funding period, approximately 147,000 participants received EUR 300 million in ESF funding from the ESF's "BAMF Language Courses" programme. For the current funding period, the allocation of funds for 2015 to 2017 was EUR 213 million ESF funding and approximately 22,000 people have already received funding in 2015.[28]

Germany's ICT skills challenge for diverse populations – the way forward

Nine years of growth in the post-crisis environment have demonstrated above average economic performance for Germany with low unemployment and high material living standards. There are signs however, that the German economy is nearing full capacity, identified by increasing shortages of skilled workers. ICT vacancies are reportedly some of the

[21] Federal Statistical Office [DESTATIS] (2017), *Integrationsindikatoren 2005-2016*.
[22] Ibid.
[23] Statista 2016
[24] Bundesagentur für Arbeit: *Der Arbeitsmarkt im März 2018 (29.3.2018, Presseinfo Nr. 10)*
[25] See OECD (2016), *Economic Surveys: Germany*.
[26] OECD (2017b), *International Migration Outlook – Country Notes: Germany.*

[27] See Handelsblatt Global (2018), *Five ways in which Germany is failing refugees*.
[28] Europäischer Sozialfonds für Deutschland: https://www.esf.de/portal/SharedDocs/Meldungen/DE/2016/2016-07-05-bamf-erfolg.html;jsessionid=FD9114037BDAB8D2C39D298AE7BFB11A

hardest to fill.[29] The integration of women, refugees, immigrants and people from disadvantaged socio-economic background is one suggestion aimed at reducing skills shortages. With around 890,000 refugees entering Germany in 2015 alone[30], there has been renewed emphasis on measures for recruitment and training of ICT workers. Initiatives to train workers in ICT skills exist at all levels of the economy, from public policy, the private sector and non-profit enterprises. Policy measures that aim to increase the participation of underrepresented groups in the ICT sector in Germany are discussed in the next section.

[29] See Delamaide (2018), *German economy faces shortages as growth tests limits.*

[30] Bundesministerium des Innern, für Bau und Heimat: https://www.bmi.bund.de/SharedDocs/pressemitteilungen/DE/2016/09/asylsuchende-2015.html

3

Policy Overview

Policies on ICT skills development have only been discussed broadly as part of national digital strategies, such as the Digital Agenda 2014-2017 and the Digital Strategy 2025. Digital literacy, awareness and education are addressed chiefly through education policies. Other measures introduced under the umbrella of digital policy include the Industry (Industrie) 4.0 initiative. A related initiative, Work (Arbeiten) 4.0 was launched by the Ministry of Labour and Social Affairs (Bundesministerium für Arbeit und Soziales) in 2015. The integration of refugees into training and jobs has been a priority issue for the German government. There have not been any direct policy measures at the national level to improve the outcome of women in technological fields except certain programmes, both at the national and regional levels to attract more girls and women in STEM. The duration of many such initiatives is dependent on state or federal funding and this adds to the uncertain outcomes of such programmes.

Policy initiatives to address ICT skills challenges in Germany

Policy challenges for ICT skills in Germany

The first challenge for Germany in terms of ICT skills lies in its skills supply. Recent trends in education show that students are less likely to choose STEM careers, specifically in technology profiles. The skills supply challenge is corroborated by the high number of vacancies and the reported "hard-to-fill" vacancies in the ICT sector. There is recognition at the policy level that measures must be introduced to address the integration challenge of people with migrant background (2nd and 3rd generation) and refugees into the German labour force.

Policies targeting digital education and literacy

During the national elections in 2017, Germany's digital challenge was a recurring theme, but policy aims focused around issues of broadband infrastructure, cybersecurity and digital privacy. Policies on ICT skills development were only discussed in general terms. The discussion took place as part of national digital strategies, such as the Digital Agenda 2014-2017 and the *Digital Strategy 2025* (Box 3). Digital literacy, awareness and education are addressed chiefly through education policies.

Other measures introduced under the umbrella of digital policy include the *Industry (Industrie) 4.0 initiative*, which was initiated in 2011 and addresses the challenges of rapid digitalization of industry. A related initiative, *Work (Arbeiten)* 4.0 was launched by the Ministry of Labour and Social Affairs (Bundesministerium für Arbeit und Soziales) in 2015. Measures include broad actions with the aim of integrating low-skilled workers, immigrants, people with disabilities and older workers in the Industry 4.0 workforce.

In August 2018 the German government established a new digitization council ('Digitalisierungsrat') as a strategic advisory board for the government to advice on this topic. This decision has been criticised by industrialists. They argue that there is no further need for another advisory board but for implementation of already defined policies and strategies.

The level of digital skills among young Germans has consistently increased in the last ten years, with 87.6 percent of young people aged between 16 and 24 years possessing basic digital skills. German policies in recent years have targeted digital education under

Box 3 Snapshot: Digital Strategy 2025 for Germany

In 2016, the Federal Ministry for Economic Affairs and Energy *(Bundesministerium für Wirtschaft und Technologie, BMWi)* introduced the Digital Strategy 2025 for Germany. The strategy addresses the development of digital infrastructure, fostering innovation and trade, and supporting digital transformation for German businesses. The plan proposes a set of goals for ten areas of action, which include setting up a gigabit fibre network for Germany, establishing new entrepreneurial opportunities for start-ups, modernising production under the Industry 4.0 agenda, investing in research and development of digital technologies and inclusive digital education for all ages. The Digital Strategy's digital education proposal aims to:

- integrate basic knowledge of information science, such as algorithms and programming languages to the school curriculum;
- promote the use of digital media in schools and colleges;
- strengthen the relationship between companies and educational institutes and facilitate structures that enable sharing innovation and knowledge management concepts;
- update existing training and continuing education programmes to teach necessary digital capabilities;
- strictly align the dual system of vocational training in ICT with practical, on-the-job skills;
- provide employees with industry-wide and practical knowledge in basic ICT;
- facilitate structures for continued digital education during employment;
- introduce information science and data analysis as interdisciplinary fields to be taught in majors apart from Computer Science; and
- integrate online education and training, such as Massive Open Online Courses (MOOCs) in university education.

Source: Federal Ministry for Economic Affairs and Energy (2016) Digital Strategy 2025.

the framework of the Digital Strategy 2025. A digital strategy for *'Education in the Digital World'* was adopted by federal states in 2016, which contains targets to modernise and adapt curricula, learning methods and teacher training to digital changes. Similarly, the *'Digital Pact for Schools' (DigitalPakt#D)* was launched by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung) in 2016, which committed to providing 5 billion Euros over the course of five years to modernise Germany's classrooms.[31]

Policies to reduce educational inequalities in schooling

Reducing inequalities in the education system has been a key issue for education policy in Germany. In 2000, OECD's Programme for International Student Assessment (PISA) study showed glaring disparities in educational achievement between children of native-born and foreign-born Germans, particularly in math and science scores. In Germany, immigrants or children of immigrants are most at risk of performing poorly or dropping out of school. The difference in mathematics performance between non-immigrant and immigrant students [32]with a similar socio-economic profile according to PISA is -47 score points in Germany (overall score for Germany: 374) compared to an average of -30 in all OECD countries and only -6 in the United Kingdom.[33]

Germany's education system separates students after primary school into three streams based on academic performance. Students around the age of 10 (Berlin and Brandenburg: 12) are identified to either pursue preparatory high school (Gymnasium) or vocational school, which includes the less ambitioned 'Realschule' for a mix of academic and apprenticeship training and 'Hauptschule', the lowest level of schooling. Real- und Hauptschule prepare for vocational training. This system has been criticised for offering little to no social mobility resulting in unequal employment outcomes for students who are selected for the latter two schools. Disparities in performance have been increasingly visible in student origins. The share of students with migrant background starting a university study reached 23%. This compares to a figure of 55.9% with respect to German students. The drop-out rate for Bachelor's programmes was 43%, compared to 29% for German students[34]..

The German government has introduced structural reforms of its secondary school system by introducing national standards and standard-based testing, as well as changing and updating teaching methods. The aim of these reforms has been to dedicate resources and school-based support to the most disadvantaged students. The Hauptschule has been phased out in the states of Berlin and Hamburg. Since 2015, the share of students from economically disadvantaged background who qualified for a university degree increased to 29 percent. Reforms of the education system are relevant particularly for future training outcomes as the decision to pursue vocational training in any field, including ICT, is made very early on by students. The type of schooling has an additional effect on pathways to higher education, training and jobs students can take.

Policies to integrate refugees into education, training and jobs

Several challenges exist particularly for the integration of refugees into the labour market. First, any individual with a foreign school-leaving certificate who wants to study in Germany must have a qualification for admission to higher education in Germany. Secondly, employers in the ICT sector in Germany, regardless of high vacancy figures, continue to adhere to traditional hiring standards which sometimes lack necessary flexibility.

The integration of refugees into training and jobs has been a priority issue for the German government. The government aims to create sufficient opportunities for teaching German language skills – and there is visible action in this respect by the German states (Länder). However, quality and accessibility of language trainings still constitute a challenge in some areas. The second challenge is more complex and requires a framework to determine the skills and competencies of refugees to address individual

[31] See Federal Ministry of Education and Research (2016), *Digitalpakt für Schulen*.

[32] In PISA the students have to report information on their country of birth as well as those of their mother and father. When parents were born abroad this qualifies them as immigrants

[33] OECD: *Education GPS. The world of education at your fingertips: Migrant background*: http://gpseducation.oecd.org/IndicatorExplorer?plotter=h5&query=17&indicators=M026 (visited: 10th September 2018)

[34] Statista; Entwicklung der Studienanfängerquote in Deutschland von 2001 bis 2018: https://de.statista.com/statistik/daten/studie/72005/umfrage/entwicklung-der-studienanfaengerquote/; Mediendienst Integration (31.08.2017): Mehr Studierende mit „Migrationshintergund: https://mediendienst-integration.de/artikel/mehr-studierende-mit-migrationshintergrund.html

training needs. The same applies to integrating young refugees into vocational education and training.

The German government is cooperating with the ESF (European Social Funds) of the EU, particularly with the ESF Integration Policy Federation to gradually integrate refugees into sustainable jobs. The ESF integration policy supports training measures in cooperation with regional employment services and with active involvement of companies and the non-profit sector. For example, the *ESF-BAMF 'German for Professional Purposes' programme* targets language training and skill building for immigrants in Mathematics and ICT.

One example of a federal-level programme targeting vocation education for people with migrant background and refugees is *Coordination Centre for Training and Migration (Koordinierungsstelle Ausbildung und Migration, KAUSA)*. The programme promotes and supports dual training in companies for persons with a migrant background and cooperates with a network of participating institutions and employers. In 2017, the Federal Government also introduced the *'Recognition Act'*[35] as a policy measure to address the skills challenge. Under the Act, a procedure for recognising foreign vocational qualifications was introduced, which can allow foreigners to be employed in the German labour market. The Act has proven effective: Nine out of ten skilled professionals with foreign vocational qualifications find gainful employment after a successful recognition procedure.[36]

Integration measures introduced by individual states include:

- *Integration through training and work (Integration durch Ausbildung und Arbeit, IdA)*[37] in Bavaria is a measure that provides various services to companies to employ refugees. These services include free language courses, competence checks that measure professional competencies, internships and dual training and jobs.
- *Refugees in higher education and language programmes (NRWege ins Studium)*[38] in North Rhine-Westphalia (NRW) is a project funded by the Ministry of Culture and Science of the German State of North Rhine-Westphalia (Ministerium für Kultur and Wissenschaft des Landes Nordrhein-Westfalen). It is a network of partner universities in the state of NRW, which offers opportunities for enrolling in education programmes, free language courses and other support services to refugees.
- *Employment pilot (Beschäftigungspilot)*[39] in Rhineland-Palatinate is a measure to make up for the lack of competence assessments of refugees, enabling them to integrate more easily into a labour market.
- *IQ Netzwerk* offers integrated technical and language learning in vocational qualification. One focus of the IQ funding programme is on qualification measures in the context of the Law on Recognition (Anerkennungsgesetz).
- *Make it in Germany/Jobboerse:* is the official multilingual website for international qualified professionals. It informs people interested in migrating to Germany how to successfully plan their move – from the preparations in their home country right through to their arrival and first steps in Germany and also offers an online job platform / exchange.

Policies to integrate women in ICT and STEM education and training

There have not been any direct policy measures at the national level to improve the outcome of women in technological fields except certain programmes, both at the national and regional levels to attract more girls and women in STEM. The duration of many such initiatives is dependent on state or federal funding and this adds to the uncertain outcomes of such programmes.

The initiative *Women in STEM Occupations* (*Frauen in MINT-Berufen)* was launched by the Ministry of Economy, Labour and Housing of Baden-Württemberg (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden-Württemberg) in 2010. MINT (Mathematik, Informatik, Naturwissenschaft und Technik) is the German acronym for STEM. The programme promoted careers in STEM for women with the

[35] See 'Recognition of Foreign Professional Qualifications': https://goo.gl/JLey8a

[36] Bundesministerium für Bildung und Forschung: Recognition of Foreign Professional Qualificatzions: https://www.bmbf.de/en/recognition-of-foreign-professional-qualifications-1413.html

[37] See 'Integration durch Ausbildung und Arbeit': https://goo.gl/sfYHtg

[38] See 'NRWege ins Studium': https://goo.gl/tvWnLR

[39] See 'Beschäftigungspilot': https://goo.gl/C8NFh1

support of a network of partners in private enterprises, education and training institutions and employment agencies. However, the initiative lasted only for one year. Other regional programmes include:

- *Network Women. Innovation. Technology (Netzwerk Frauen.Innovation.Technik)*[40]: The network was launched by the Ministry of Science, Research and Art (*Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg)* at the Hochschule Furtwangen. The initiative aims to increase the proportion of women in science and engineering through summer schools and different information services.

Various programmes promoting women workers in STEM fields are supported by the Ministry of Education and Training; one example is the programme *Come, make STEM* (*Komm, mach MINT)* which is a nationwide networking initiative that inspires girls and women in STEM programmes and careers.

Other nation-wide programmes include:

- *The Girls' Day*[41] *initiative* launched by the Ministry of Education and Research, German Trade Union Confederation (*Deutscher Gewerkschaftsbund)* and the Initiative D21. The Girls' day is one day in the year on which girls can gain insight into occupational fields that girls seldom consider in the process of career orientation. For one day they can gain insights into the everyday life of the companies or universities and test their skills practically.
- *The Cliché Free (Klischeefrei)*[42] *initiative* was launched by the *Ministry of Education and Research* and the Ministry (*Bundesministerium für Familie, Senioren, Frauen und Jugend)*. Five national ministries, some state ministries, the *Bundesagentur für Arbeit* and other partners from education and economy form part of the programme. The aim is to help young people choose jobs or studies without being influenced by gender roles.

Many other programmes are part of the *Come, Make STEM* initiative, like the following:

- *CyberMentor*[43]: This is an initiative by the University of Regensburg and the Friedrich-Alexander University of Erlangen-Nuremberg. Up to 800 girls in grades 5 to 12 are supported by a personal mentor for one year. The mentor acts as a role model for STEM activities and gives tips on studying and career choice. The programme is systematically scientifically monitored to develop and make available instructions for other mentoring projects and for the promotion of women in STEM.

[40] See ‚*Netzwerk Frauen.Innovation.Technik'*: https://scientifica.de/start/
[41] See 'Girls' Day': https://www.girls-day.de/
[42] See 'Klischeefrei': https://www.klischee-frei.de/
[43] See 'Cybermentor': https://www.cybermentor.de/

4

Findings

Out of 66 programmes identified through desk research in Germany, 38 programmes were found to be directly relevant to inclusive ICT skills training. In this section we analyze the results of our survey of private sector approaches towards inclusive ICT skills training programmes. We provide a brief look into the pathways available to gain an entry into the digital labour market in Germany and suggest a taxonomy to classify the programmes surveyed. We conclude this section with a summary of lessons learned from our selected programmes.

Methodology and research

We conducted a comprehensive survey to determine the impact and challenges of inclusive ICT skills training programmes for diverse groups to enter the digital labour market. Our research combined both qualitative and quantitative methods, including surveys, individual interviews with training providers, and in-depth interviews with the selected case studies and employers.

Out of 66 programmes identified through desk research in Germany, 38 programmes were identified as directly relevant to inclusive ICT skills training. Figure 6 and 7 show a further breakdown of these programmes in terms of target groups addressed and stakeholders involved.

Several programmes address more than one target group, and combinations of stakeholders in programmes could also be identified.

We identified three good practice showcases that serve as examples of inclusive ICT training in Germany. These programmes are Networking Academy (NetAcad) for Refugees initiated by Cisco Germany, ReDI School of Digital integration, a non-profit initiative in Berlin, and Joblinge goes MINT, an initiative that runs in cooperation with public and industry partners. An in-depth description of these three showcases can be found in Appendix D of this report.

Figure 3 Share of target groups in inclusive ICT training in Germany, % of programmes surveyed

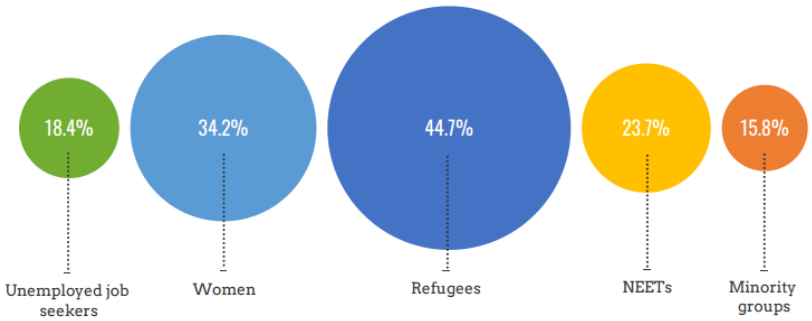
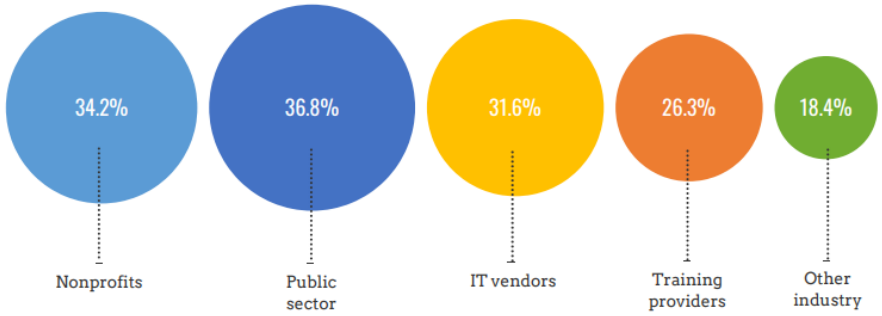


Figure 4 Share of stakeholders in inclusive ICT training in Germany, % of total programmes surveyed



Source: diversITy Survey, empirica (2017)

Pathways to ICT skills training and jobs

There are multiple pathways for individuals to gain an entry into the digital labour market. In Germany, traditional education in the form of university degrees as well as vocational education and training (VET) are the most important. Findings from our employer survey corroborate the reported inflexibility in hiring. The findings show employers' reluctance to recruit applicants for jobs who do not have standardised, state-certified diplomas or degrees. As a result, new pathways for young people seeking to transition from other industries into the ICT sector are very limited. Beyond university education and VET, only industry-led trainings and lifelong learning play a role. These four main pathways in Germany are discussed below

Pathways to digital jobs in Germany

University education

One traditional pathway for students is a university degree in Computer Science or a related subject. This is a four-year bachelor's degree, further differentiated by the qualifying institution, which can be a full university or a university of applied science (*Fachhochschule,* FHS). Full university education emphasises strong academic learning with less focus on training. FHS programmes include at least one semester of applied learning at a company.

Vocational education and training

There is a Dual VET system, in which trainees spend a part of their week at a vocational school and the other part at a company. Dual training usually lasts two to three-and-a-half years. It includes training competencies in over 330 occupations, with four of these in ICT. The Dual VET offers young people – specifically those not interested in or capable of a university study - individual career opportunities and a solid basis for their life. It combines theory and practice. Companies bear (some of) the costs and benefit from the practically relevant skills of the trained professionals. All this makes it an attractive option for the different target groups of the diversITy project.

Industry-lead trainings

Employers in Germany consider Industry-lead / ICT vendor trainings as useful further training certificates. The certificates enjoy a high reputation and are accepted as valuable also for career transitioning youth and adults and specifically if obtained from reputable international ICT vendors. However, they are not regarded as substitute for formal education degrees but rather as an add-on. One reason for this is the strong emphasis German employers put on the formal educational and training background for most occupations.

Lifelong learning

There is increasing use of trainings for updating the ICT skills of people already in employment. State funding is available if such training is likely to improve future employability of employees who work in industries that face restructuring. In the vast majority of cases up-skilling and re-skilling trainings are provided by further education and training providers. Employers' willingness to invest in lifelong learning measures for their staff has increased in recent years, also in response to increasing difficulties in recruiting new workers with advanced ICT user skills on the labour market.

Vocational education and training pathways

Germany's ICT skills supply is heavily reliant on VET graduates.[44] A BIBB report shows that 34.5 percent of workers in ICT occupations have a vocational educational qualification and only 4.9 percent who have no prior qualifications.[45] Dual VET qualifications are based around 'ICT occupations' such as software developers, network administrators and technicians particularly from a training perspective. These occupational profiles are developed with the support of employer organisations and trade unions, which drive major changes to the curriculum and updating and creating new profiles for training.

Vocational education is particularly important for individuals from diverse and disadvantaged socio-economic backgrounds for several reasons. First, VET provides direct pathways into the labour market for individuals who lack the funding, ability or motivation to continue higher education. Secondly, for diverse target groups such as at-risk youth and NEETs, VET options may be more attractive because they require less investment, offer some basic salaries and earlier entry into the labour market.

Pathways to jobs and employment

Based on responses from our employer survey, in terms of skills profiles (ICT occupations profiles in Germany), employers require workers to have a variety of ICT competences, which are all becoming more relevant due to rapid digitalization across all areas of work in Germany. These competences range from knowledge of data literacy to social digital technologies to more cognitive or problem-solving aspects of technology. Results from our interviews with employers affirm the importance of educational background and experience for employment in the German ICT labour market. Most of the German employers interviewed indicated a university or vocational education degree as the minimum entry standard for a potential employee in their company. At the same time, employers frequently expressed dissatisfaction with the standard of ICT skills and competences being taught in both academic and training programmes. A few employers also indicated the average age of new recruits to be in their mid- to late-thirties due to the years of experience required to fill open positions. Moreover, it was indicated that ICT skills training without a related university or college degree or VET certificate is generally considered insufficient to meet job entry requirements.

Employers considered ICT vendor certificates to be relevant for a few ICT skills profiles only and only if complemented by formal education certificates or degrees. Degrees and certificates are also only accepted if obtained from reputable international education and training institutions or recognised by federal German education standard. The recruitment process for filling vacancies in the IT sector itself was indicated to be lengthy, taking up to six rounds, which increases the costs of hiring and reflect the high entry standards for jobs in the ICT labour market in Germany.

A few firms reportedly used internal strategies to address ICT skills shortages; for example, one approach consisted of integrating experienced and skilled older workers in teams of new recruits in 'age-mixed teams' (altersgemischte Teams) who could influence and mentor younger workers.

In terms of strategies to recruit and attract skilled workers already at an early stage, employers developed business-education partnerships with universities. Few incentives exist for companies to become involved in inclusive ICT skills training programmes that lead to employment – for many employers, existing staff was not willing to commit to extra supervision and caring efforts. Other strategies that yielded more positive results were employer involvement in awareness-raising activities targeted at schools to motivate and encourage young people to ultimately join Dual VET training in ICT occupations

[44] See Steedman, Wagner, and Foreman (2006), *ICT skill supply in the UK and Germany*.
[45] See Hall, Maier, Helmrich, and Zika (2016), *IT-Berufe und IT-Kompetenzen in der Industrie 4.0.*

Good Practice Showcase: JOBLINGE goes MINT

Providing pathways to education and training in STEM

JOBLINGE goes MINT aims to integrate young people who are most at risk of social exclusion into the STEM sector with the help of specialised training programmes and by encouraging civil society actors and businesses to collaborate in these efforts. The programme aims at providing young people with opportunities for jobs and internships in STEM sectors. It motivates its participants to engage with STEM fields through a tailored approach designed to reduce the psychological barriers of entering such fields of work and study. In 2018 1,030 learners have participated in the JOBLINGE goes MINT programme nationwide. 305 started a STEM training. 229 companies joined the programme as new STEM partners.

Why a best practice?

- **Highly effective in terms of targeting young people at risk of social exclusion:** The target group, according to JOBLINGE, is one of the most difficult to place into sustainable jobs. The selection approach used takes place in phases in a two-hour workshop with a maximum of 12 candidates. Phase one starts with a non-binding getting to know each other which offers the possibility of a first assessment of the candidates for the companies. This is followed by a STEM sensitisation workshop presenting opportunities in STEM and raising interest and curiosity. In a second phase a special app is used for the playful introduction to central mathematical learning fields which allows for the identification of the level of motivation, related competences and skills and individual capabilities (e.g. ability to work in teams) needed for the subsequent training to be successful.

- **High impact in terms of employability by opening pathways for learners from diverse groups:** The programme uses a holistic approach to promote personal contact between participants and companies. Recruiting young people who are viewed as 'less-educated' has been an issue for most employers. However, with the help of the programme, its participants and potential companies get an opportunity to discover each other and successfully integrate training with practical experience.

For full details of the case, see Appendix D.

(*) MINT (Mathematik, Informatik, Naturwissenschaften und Technik) is the German acronym for STEM (Science, Technology, Engineering and Mathematics).

Training taxonomy targeting training needs

We classified the ICT skills training programmes identified in Germany in six categories based on the programmes' approaches to learning. The most promising programmes use multiple methods that are a combination of two or more approaches that address different training needs. These training needs are discussed below, followed by a discussion on the training taxonomy for ICT skills training in Germany.

Cognitive and non-cognitive skills

Interviews with German employers from our sample reveal that both cognitive and soft skills, such as the ability to work in teams, effective communication, negotiation, and decision making are essential requirements for a job. In ICT occupations, additional skills such as problem-solving are identified as desirable. However, employers also indicated that university graduates tend to lack such skills. This is also why employers increasingly demand prior work experience or at least internships, as a common prerequisite for a job in the ICT sector. NetAcad, for example, provides trainees with internship opportunities at Cisco once they have completed the training. As mentioned before, such internships as a direct result of ICT skills training programmes are limited. Programmes such as JOBLINGE address cognitive and soft skills development from a personal interaction approach. Their workshops and networking events are designed to acquaint trainees with the STEM sector by setting up face-to-face meetings and networking sessions with industry experts. For JOBLINGE, the challenge is to integrate young people from diverse backgrounds into employment. Most of these young people face an unfamiliar environment and may be further stigmatised due to their educational and social backgrounds.

Experiential learning

Training that accommodates on-the-job learning is the most desirable for both trainees and employers in Germany. Results from our interviews with German employers and training providers corroborate the importance of experiential learning. However, only well-structured programmes with significant support from sponsors and businesses can provide this type of integrated training. For example, companies like Cisco and the JOBLINGE programme provide internship or job placement for trainees through their network of business partners. Industry support is especially relevant for designing curricula of training programmes for both technical and soft skill-sets because employer-driven programmes respond better to market demands for ICT and work-relevant skills.

Certifications

ICT vendor certifications, such as those provided by Cisco, SAP, Microsoft and Oracle, provide an added value for both trainees and employers. An ICT vendor certification is an accepted form of certification for very specific task areas (e.g. IT network administration) because it is recognizable and uses benchmarks for skills assessment of trainees. It is not meant to replace VET or higher education degrees but seen as an add-on. In cooperation with schools the IT vendor Cisco is offering some of its certificate courses as electives in VET in an increasing number of schools. Moreover, these certifications are designed based on a variety of specific skill sets, which can be adapted and updated to match the changing needs of the ICT sector. For this reason, vendor certified programmes generally require individuals to retake assessments at regular intervals.

Good Practice Showcase: NetAcad for Refugees

An ICT vendor-driven partnership for guaranteed internships and jobs

The NetAcad for Refugees was initiated by the Cisco Networking Academy Programme (CNAP) in May 2016 and is run until the end of 2019. The CNAP - which includes the NetAcad - itself is of unlimited duration. It enables anybody interested to find online courses on the global Cisco Networking Academy platform, tailored to different target groups also offers a learning opportunity to refugees. It very much lends itself to specific groups, especially those from Syria, Iraq and Afghanistan since the courses are available free of cost in 16 different languages, including Arabic and Farsi. The offer of an online course is particularly useful for those who are still waiting for their right of asylum to be acknowledged. The online courses can be completed with an industry certification through which refugees are empowered to find jobs in the technology sector. Cisco also provides internship offers for successful participants to gain work experience. Partnerships have enabled Cisco to successfully run the programme in various vocational institutions. This shows its proximity to the formal education and training system in Germany.

Currently (August 2018), around 3,750 refugee learners can be identified as being subscribed to the programme with 783 new subscriptions in 2017 and 2,601 in 2018. Additional participants were subscribed by teachers from vocational schools, where “welcome classes” or “international classes” for refugees have been established. Success reports[46] show that course alumni successfully move forward to jobs or further education (20% internships; 28% study programs; 18% IT jobs; 8% entrepreneurs).

Why a best practice?

- **Experience of employment through internships and job placement:** Cisco relies on a network of partners to guarantee internships and job placements for trainees. Some of the Cisco sales partner companies started to offer internships to alumni with a refugee biography.
- **High effectiveness in terms of developing industry-relevant ICT skills through the design and implementation of certified training programmes:** Cisco creates and delivers high quality training through its Networking Academy, an online platform of certification teaching and assessment available to training providers and individual learners.
- **Highly effective in terms of delivering training by integrating tailored approaches for refugees and immigrants:** Training and assessments are available in different languages. This makes them accessible for new arrivals in Germany and enables their easier access to the ICT labour market.

For full details of the case, see Appendix D.

[46] from our partner ReDI School

Training taxonomy for Germany

The training taxonomy for Germany consists of 6 mixed approaches: bootcamps and workshops, classroom training mixed with online platforms for training; and experiential trainings with mentorships. These approaches are presented below.

Bootcamps

Intensive training programmes generally lasting one to three months. Training can be full- or part-time depending on the programme and consists of lessons, individual and team projects, 1:1 tutoring and tests.

Workshops

Best explained as mini-bootcamps lasting between one and three days. Training is on specialised topics and consists of presentations and interactive peer-to-peer sessions.

A variety of training providers use both bootcamps and workshops. Coding bootcamps for example have a skill-intensive focus that cover areas such as intermediate to advanced programming languages, supplemented by smaller sessions or workshops on soft skills training.

Success factors

- **Flexibility:** Compared to university programmes, bootcamps are more flexible in terms of curricula and can respond faster to changing market demands.
- **Prior Experience:** Bootcamps are less selective than universities in terms of prior qualifications. Individuals who are interested and do not necessarily have an ICT background can enroll in training bootcamps.

Challenges

- **Certifications:** Bootcamps tend to not offer standardised certifications but rather follow a variety of teaching and training techniques.
- **Employability:** In terms of employability, bootcamp qualifications are not sufficient and employers tend to require more traditional technology qualifications or longer work experience in the ICT sector.
- **Affordability:** In Germany, bootcamp training is perceived as commercial. It is seldom free and normal opportunities for funding available by the German state, such as state scholarships, do not usually cover bootcamp costs. It is also not a widely adopted method of training, especially in smaller cities and town.

Classroom

Traditional, instructor-led training in a classroom setting, in most cases using tailored e-learning platforms. Training usually leads to a certificate and can last for several months.

Online

Training includes but is not limited to massive open online courses (MOOCs). Courses are available on online platforms, are mostly free to join and may or may not have instructors. Assessments are either self-administered or based on peer-to-peer feedback.

Classroom training with online learning elements is by far the most popular approach towards ICT skills training used by most training programmes in Germany. *(See Good Practice Showcase example: JOBLINGE* and *ReDI School)*

Success factors

- **Flexibility:** Learning through online platforms can be more flexible as trainees can access courses and schedule tests based on their own availability. However, this may not be possible with classroom training if programmes follow a strict in-house schedule. Trainings with the combination of both have become the most popular way of ICT training.
- **Certifications:** Online courses include but are not limited to content provided by IT vendors, such as Microsoft, SAP, Cisco and Oracle. Vendor-specific trainings follow a partner-centric approach in which companies create the curriculum which is then delivered by partners – Cisco Networking Academy is one example.

Challenges

- **Employability:** Such trainings have the advantage of providing certifications that are valued by employers.
- **Prior Experience:** These programmes, especially if offered for free, tend to be more selective when choosing prospective participants. Stricter selection criteria have the risk of excluding those who may have the most to gain from such employability skills.

Experiential

A mix of technical and experiential learning including classroom-oriented learning and company placements. In most cases, placements take place once trainees have passed all the learning components. Training normally lasts from six to nine months.

Mentorships

Not a stand-alone training type and is integrated with other types. A trainee can choose or is appointed a mentor who is an experienced instructor or employee. The mentor is responsible for providing guidance.

Experiential programmes that include internships or optional workplace experience are a more recent approach towards ICT skills training. Depending on the programme, training can last from three to six months, followed by an internship at a company. Many such ICT trainings in Germany are developed due to effective business-education partnerships as the training curriculum is designed to reflect the demands of employers.

Success factors

- **Certifications:** Depending on the programme, a trainee may or may not receive a certification. However, the number of hours worked are recognised as formal work experience.
- **Employability:** Internships and workplace learning programmes have high added value for trainees as they learn both technical skills and a variety of valuable soft skills.
- **Industry demand driven:** As training is structured to reflect the demands of employers, employers can benefit from being involved in the training by getting relevant skills in return. This is a major success factor of experiential training programmes, especially those developed with the help of business-education partnerships.
- **Mentorships:** In many such programmes, technical training is accompanied by mentorships. Mentors are a valuable source of learning for new trainees or employees at the beginning of their careers. Additionally, many programmes utilise the mentorship model to encourage girls and women to consider ICT careers by providing access to female mentors and role models.

Challenges

- **Prior Experience:** Trainees must be enrolled in a training programme to get placed into an internship. Few training programmes guarantee an internship for all participants and places are usually limited. Training programmes that offer compulsory work experience tend to be more selective in terms of prospective participants.
- **Affordability:** It is challenging for training providers to find employers who are willing to train and hire interns because of the resource burden on employers. Usually, experiential training is offered by well-reputed training programmes with a vast network of partners.

Good Practice Showcase: ReDI School

A collaborative and integrative approach to ICT skills training

ReDI School of Digital Integration is a non-profit digital school for tech-interested newcomers applying for asylum in Germany. The idea of the School originated at a refugee home in Berlin in 2015. Among the newcomers in the recent refugee wave in Germany, there were incredible ICT-talents eager to learn and participate in the ICT sector and who could help fill the 72,000 open IT-jobs in Germany. ReDI was co-created by an innovative team with the help of refugees and the tech community of Berlin. The School highlights its main differentiator vis-a-vis other integration initiatives in Germany as the added value of co-creating along with refugees. The ReDi School offers three-month IT programmes, workshops, corporate training projects, as well as short-term summer courses. The initial classes in 2016 started with more than forty students.

So far around 874 individuals were trained in the 'ICT career' programme by around 130 volunteer teachers. ReDI managed to develop an ecosystem of engaged companies involved and active in a partnership.

Why a best practice?

- **Highly effective in terms of attracting and sustaining participation from diverse target groups, such as refugees and learners with a migrant background:** ReDI's initial learners were refugees who arrived in Germany in 2015. Most were originally from Syria, but other countries included Afghanistan, Eritrea and Iraq. Originally facing considerable difficulties in integrating, ReDI provided a welcoming and attractive environment, focusing on co-creation as many learners went on to start their own tech initiatives. A recent survey among 415 alumni has shown that 26% of the graduates in Berlin (161 graduates) and 18% in Munich (46 graduates) found an IT job, 34% an internship or another job and 25% are proceeding with their career at university.
- **Highly effective in terms of an ICT vendor- and employer-driven curriculum:** ReDI partners with Cisco, Microsoft, SAP and Daimler to design and deliver training courses and to develop projects. Its learners can also access internship and work placement opportunities at ReDI's partner companies.
- **Initiative for increasing employability and opening future pathways for learners through a diverse network of partners:** ReDI has a diverse network of partners from the tech community, companies, and alumni. This network provides its learners with opportunities which include build soft skills, benefit from mentorships and experience deeper collaboration and integration with the surrounding communities.

For full details of the case, see Appendix D.

Lessons learnt

Challenges and lessons learned from inclusive ICT skills training programmes

Based on our interviews with training providers of inclusive ICT skills training programmes in Germany, bureaucratic mechanisms are a barrier for both potential trainees and training providers. Training schemes for unemployed workers, for instance, usually require the involvement of local employment agencies to streamline training and employability outcomes. Cooperation with local employment agencies, for example, as undertaken by JOBLINGE is a successful approach for outreach to young people from socio-economically disadvantaged groups. However, only well-financed training programmes supported by extensive partner networks have managed to achieve this successfully. For more details, please see the Good Practice Showcase for JOBLINGE goes MINT.

In the case of refugees and immigrants, language is a barrier since most activities are advertised or promoted in German. Secondly, there is no one platform or method through which most new arrivals in Germany can access information about training and employability schemes. The difficulties in outreach to such communities are what resulted in the creation of ReDI School and its ICT skills training programmes. ReDI School's approach is to develop outreach strategies to target a very specific market –refugees. Outreach to its target group is achieved through recruiting from and advertising its courses in refugee centres.

Strict requirements for new hires remain to be a challenge for most jobs in the ICT sector. Employers in Germany are reluctant to hire candidates who do not have an academic background in ICT or related fields, or passed formal vocational education in ICT occupations regardless of certifications. The recognition of foreign qualifications is another issue, which is being partly addressed through national policy measures for foreign qualification recognition. However, programmes like Cisco's NetAcad have developed self-assessment and certification testing platforms, which allow trainees to assess their ICT skills. These assessments and certificates are recognised by employers.

ICT skills training landscape: addressing the challenges

The established Dual VET system also provides an opportunity for employers and training providers to start cooperative training programmes that support the existing system of vocation educational education in training. Cisco with its Cisco Networking Academy Programme (CNAP) has entered into vocational education and training by partnering with vocational schools throughout Germany. This has several advantages. First, due to active ICT vendor involvement, ICT skills occupations in the education and training system remain up-to-date. Secondly, specialised services such as providing training curriculum in different languages – as done by the CNAP - may be too costly for educational institutions. However, ICT vendors such as Cisco have provided these services by running their training programmes in vocation education and training institutes. Lastly, a mix of Dual VET and ICT vendor qualifications in specialised ICT skill profiles included in the VET curriculum can provide students with learning opportunities they cannot otherwise access due to high cost.

For most employers, conventional education remains an important factor for potential employment opportunities. Employers acknowledged that there were considerable challenges of integrating diverse groups into the ICT sector, with many companies trying a variety of integration programmes but none of the programmes have been successful. Training and bringing together actors from many of the relevant target groups require tailored approaches and not 'one-fit-for-all'. The initiative to integrate these target groups has been left mostly with the non-profit and public sector. Successful programmes demonstrate how tailoring the training to a specific group, such as refugees, generates better results than loosely structured programmes that target a wide range of trainees from different backgrounds.

In terms of the changes required to address the various challenges of ICT skills training in Germany, the first point that should be addressed is the promotion of public and private ICT skills training programmes. Germany's reliance on its traditional training system (VET and Dual VET) means that privately-run initiatives are too few due to too little demand. Formal qualifications and degrees are valued highly in Germany. Some experts argue that measures

aimed at 'rapid placement' in the labour market without providing a formal qualification are in principle likely to have a negative impact on those concerned under changing labour market conditions. In times of economic crisis, it is mainly employees without a formal qualification who are the first to lose their jobs. Therefore, it appears desirable that in all inclusive ICT training programmes outside the formal education and training system in Germany the connectivity to the state-recognised training should be considered and 'built in'. Such programmes should incorporate the 'followability' /connectivity' ('Anschlussfähigkeit') of measures to formal education, with the possibility of obtaining a training place or apprenticeship and a formal qualification, at the same time, thus reducing negative effects in changing labour market conditions. The JOBLINGE approach has taken this into account and incorporated it from the outset.

Secondly, based on our survey at least we can assume that the private training market is unlike the one in the UK and France where there is a wide variety of training initiatives. Education and training in ICT professions is much more likely to be carried out through schools and colleges, more so because the cost of public education is considerably low when compared to privately-offered courses and programmes. Thirdly, to encourage enterprise involvement in ICT training and education, the optimal approach is to use a combination of public and private frameworks.

Box 4 Key lessons learned from ICT skills training programmes in Germany

Outreach

- Programmes heavily target refugees and immigrant groups (see Figure 5). Programmes are identified to specifically target women but little to no evidence points to successful strategies for integrating women into the ICT sector.
- Outreach to highly vulnerable groups is done jointly with the public sector, for example, through employment agencies due to established bureaucratic structures.
- Non-profit organisations are the most effective in terms of outreach, particularly through active campaigning in refugee centres and inclusive local communities established in various cities in the years following the arrival of refugees from Syria. It may be worthwhile scaling up these types of initiatives and their training service provision for that reason.
- Programmes have only recently started targeting the younger cohorts, such as school students to promote STEM education and careers.

Training

- Business-education partnerships are essential for developing training curricula. This is primarily addressed through the Dual VET system, which relies on a network of partners to keep the curriculum up to date.
- Training programmes in various profiles use industry specified curriculum, such as that provided by ICT vendors. A few new programmes have emerged in recent years that exclusively target coding skills, but these are not widespread.
- Training programmes designed collaboratively with industry experts or ICT vendors, such as Microsoft, SAP and Cisco are mostly targeted towards university graduates and require a considerable commitment of time and finances. However, Cisco with its Cisco Networking Academy Programme (CNAP) has entered into vocational education and training by partnering with vocational schools throughout Germany. This now offers innovative and attractive ICT learning opportunities in VET they would normally not be able to offer due to high cost.
- Successful trainings combine a variety of training methods. The most important aspect of multi-level training is the development of both technical and cognitive skills, such as the ability to work in teams, effective communication and problem-solving skills.

Employability

- In most cases, certifications alone are not sufficient to meet employment criteria at least in Germany. They provide a high added value for job seekers when complemented by other educational qualifications.
- For employers, technical skills profile, prior experience and prior education are important to meet employment criteria.
- Experiential training combined with an internship experience is usually considered sufficient for most graduates from an academic track. For vocational education graduates, work experience is included in the overall learning programme and hence has an added advantage for trainees to sustainably integrate into the labour market.

Source: diversITy Survey, empirica (2017)

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Conclusion

ICT jobs are the hardest to fill and industry is faced with a large and increasing number of IT vacancies in Germany. Despite many activities, policy and the education and training system have not managed to increase the share of women in ICT education and training and in the workforce. Integrating overseas workers has been an additional challenge as Germany still neither has an updated immigration policy reflecting recent developments – the last revision is from 2007 – nor an Immigration Act to attract skilled workers. Current immigration laws, though liberal, are too complex to be attractive to potential workers and employers. However, the grand coalition government for the first time wants to push through a law on the immigration of skilled workers before the end of the year 2018. The training programmes studied in this report offer some promising alternatives to fill in this gap. Intervention mechanisms for which recommendations have been specified should be developed to reach a variety of vulnerable communities.

Conclusion

The main shortcomings of Germany's ICT skills ecosystem include a low number of ICT graduates, who comprise the primary source of supply for employers. Employer strategies towards hiring workers who do not possess adequate academic qualifications are another reason that inflates this shortage. Many of the skills training programmes studied as part of our survey carry out successful skills training only to encounter considerable challenges for employment.

Private initiatives for ICT skills training face competition from the well-established German vocational and education (VET) system. The latter is an attractive option for many students looking to enter the ICT labour market in Germany, unfortunately mainly for men and not women. In Germany the share of women getting trained in ICT occupations in VET amounts to just 10%. Despite many activities, policy and the education and training system has not managed to counter this situation and increase the share of women in ICT education and training and in the work force.

The German VET system as well as other ICT training initiatives aimed at NEETs in general and specifically at young unemployed and socio-economically disadvantaged groups and people with migrant background, many of whom with poor levels of education or school drop-outs, struggle to motivate and attract these target groups for a career not only in ICT but also in general.

Finally, and as the language of both instruction and work is German, many of the underrepresented groups who constitute the recent arrivals to Germany are by default excluded.

Below we provide preliminary recommendations, which can help to address some of these challenges.

Recommendations

Better standards of monitoring integrative policy actions must be established. Language programmes are part of the overall integration measures for refugees and offered to individuals with migrant background and poor command of the German language. It is difficult to monitor the effectiveness of these language measures in relation to their effect on labour market integration. Combined language and skills training implemented by a few training providers has more successfully addressed this challenge.

Integration programmes must be aligned with labour market needs. Training providers and policymakers may want to consider integrating this knowledge when designing integration programmes for skills development. To some extent, this is addressed by existing policy and private sector programmes but to what extent remains uncertain.

Integration programmes should be combined with and have a connectivity to vocational training qualifications as is already being realised in some states. It is difficult for foreigners to enter the German education and training system. Measures to counter barriers are being implemented, however, integration programmes aimed at training must also provide recognised qualifications for easier access to the labour market. The challenge here and with any other inclusive ICT training programme addressed to other target groups is the connectivity (Anschlussfähigkeit) of different (inclusive) ICT training programmes to the formal and recognised education and training system in Germany. This is rather difficult to achieve for many of the target groups in such programmes, specifically those training people with no or low education background since they do not fulfil the necessary admission criteria to start an apprenticeship. Ideally, inclusive ICT training programmes incorporate 'connectivity' to formal education measures, with the possibility of obtaining an internship followed by an apprenticeship and a formal qualification, at the same time, thus reducing the negative impact of changing labour market conditions. The JOBLINGE approach has taken this into account and incorporated it from the outset.

Flexibility options in the regulatory framework for national VET exist, are hardly used but their use could help in improving access of vulnerable groups of people to apprenticeships and the VET system. The reasons for this are still unknown and have not yet been analysed. Specifically applying the options 'extension of apprenticeship period' and 'part-time apprenticeship' could help diversity target groups with low education or social background in successfully finishing an apprenticeship which they would otherwise fail to do.

Promote the existing option of 'external auditing or review' (Externenprüfung) at the chambers of commerce as a further pathway into the VET system. For exceptional cases this option is offered in the

Berufsbildungsgesetz (BBIG) § 45 Abs. 2. In order to be allowed to an external audit the person interested in taking this option needs to proof that s/he has been employed in the targeted occupation for more than one and a half times of the apprenticeship duration. The reasons for the rare use of this option are still unknown and have not yet been analysed.

Skills policies should be targeted to jobs with high vacancy rates. This applies especially to those that do not require academic degrees. This requires the establishment of a responsive ICT framework with active monitoring of existing and new ICT skills profiles. In general, it means that the ICT sector should not be viewed as a whole but should integrate a "skills profile" approach. This approach is not used frequently in education and training and Germany. It requires active employer engagement to ensure that skills profiles in education adequately reflect the demands of the ICT labour market.

A better incentive framework is needed to encourage business-education partnerships. Such partnerships are also highly resource-dependent; most of these efforts are a result of considerable public and private investment. A better incentive framework could relieve employers who currently cover most resources

Employers are asked to engage with education and training providing institutes to provide more than simply resources for curriculum and programme design. Employer dissatisfaction with new graduates indicates weaknesses with new recruits' interaction with the business environment. Opportunities such as business networking, collaborating on business projects and experiencing different work environments can help to address this challenge but it requires a high level of engagement from all stakeholders which may also include support from the policy front in terms of setting attractive framework conditions and incentives.

Tailored approaches must be developed to increase the participation of women in the ICT and STEM sector. ICT skills training programmes for women, are an area that has obviously largely been ignored by training providers. Today only 18% of ICT graduates, 16% of ICT workers and 10% of students in ICT education VET are women. Despite all past activities and policy action which mostly failed to achieve higher levels of woman participation in the ICT area this calls for some creative action. Policy as well as education and training stakeholders and industry may want to investigate whether increasing the offer and supply of interdisciplinary IT related education and training programmes at all levels (e.g. higher education, VET, further education) could help to increase participation of women in the ICT and STEM sector. Such offers have shown to be attractive to women. This is confirmed by the high shares of women in studies such as bio informatics (Bioinformatik), media informatics (Medieninformatik) and medicine informatics (Medizininformatik) in Germany which range from 36%, 40% to 44% respectively.

Strategies for engagement of women into ICT and STEM education and careers should be developed for early schooling. Government initiatives for the integration of women into ICT and STEM fields remain broad and unaccompanied by strategies aimed at raising awareness at early schooling. This is a potential area for development. Policies mechanisms aimed at schools in general are slow to take effect. This presents an opportunity for private sector engagement. This could become a key area for the development and increasing awareness of ICT and STEM occupations in Germany.

Campaigns to encourage the participation of younger cohorts in ICT should be promoted. Intervention in the form of awareness-raising is already being utilised in a global movement to encourage young people to contemplate careers in technology. For example, the United Nations' 'International Girls in ICT Day' is celebrated each year to advance the inclusion of women in ICT fields.[47] Such campaigns can be adapted to the national and local level with the help of participation from enterprises and the non-profit sector. An example of such a campaign is the 'Informatik Biber (Informatics Beaver)' competition for children, which is an annual competition for coding and other tech activities for school-aged children.

Policy should attract and motivate problem target groups for a career in ICT and STEM. Policy decision makers at Federal and Länder level together with key stakeholders from industry and education and training are asked to thoroughly evaluate the successes and failures of the programmes identified in reaching out and motivating problem target groups to careers in ICT and STEM. This mainly refers to young unemployed and socio-economically disadvantaged people with migrant background, many of whom with low levels of education but also school drop-outs.

[47] See UN News 'Girls in ICT Day' (2017).

Specifically the good practice showcases identified in Germany offer experiences from which lessons should and could be learned.

Volunteer mentors, who enable an intensive care of the target persons are considered as guarantors for the success and make such programmes feasible and financeable (see e.g. ReDI School). They are of essential importance for the educationally disadvantaged or socially disadvantaged target groups as well as for refugees in order to successfully complete the measure and reach a successful conclusion. In many cases, support for the target persons can (and must) extend over a long period of time (e.g. for JOBLINGE over the entire training period) in order to lead them to a successful conclusion

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Appendices

Appendix A: Forecast Methodology

ICT workforce per ISCO-08 classification

ICT Occupations Classification	ISCO Code	Skill Level	2015	2012	Total Growth	CAGR	Growth Rank	Linear Trend (P.A.)
ICT service managers	1330	4	47,500	47,200	1%	0.2%	12	86
Electronics engineers	2152	4	20,100	51,300	-61%	-26.8%	19	-10,398
Telecommunications engineers	2153	4	18,000	37,500	-52%	-21.7%	17	-6,494
Graphics and Multimedia Designers	2166	4	120,300	111,700	8%	2.5%	11	2,884
Information technology trainers	2356	4	8,900	4,600	95%	24.9%	5	1,443
ICT sales professionals	2434	4	38,700	32,400	19%	6.1%	10	2,082
Systems analysts	2511	4	217,600	157,500	38%	11.4%	7	20,037
Software developers	2512	4	208,500	129,100	61%	17.3%	6	26,459
Web and multimedia developers	2513	4	21,100	21,400	-1%	-0.4%	13	-79
Applications programmers	2514	4	94,300	209,100	-55%	-23.3%	18	-38,256
Software and applications developers and analysts not elsewhere classified	2519	4	15,200	86,400	-82%	-44.0%	23	-23,736
Database designers and administrators	2521	4	6,500	21,100	-69%	-32.4%	20	-4,860
Systems administrators	2522	4	116,100	51,800	124%	30.9%	4	21,450
Computer network professionals	2523	4	1,800	26,600	-93%	-59.1%	24	-8,257
Database and network professionals not elsewhere classified	2529	4	5,600	21,900	-74%	-36.6%	21	-5,431
Electronics engineering technicians	3114	3	18,800	90,400	-79%	-40.8%	22	-23,880
ICT operations technicians	3511	3	13,800	11,500	20%	6.2%	9	758
ICT user support technicians	3512	3	133,300	15,100	785%	106.9%	1	39,415
Computer network and systems technicians	3513	3	10,500	17,700	-41%	-16.1%	15	-2,416
Web technicians	3514	3	1,600	3,100	-49%	-20.0%	16	-500
Broadcasting and audio-visual technicians	3521	3	25,600	19,500	32%	9.6%	8	2,060
Telecommunications engineering technicians	3522	3	40,200	13,000	210%	45.8%	2	9,074
Electronics mechanics and servicers	7421	2	74,500	94,300	-21%	-7.6%	14	-6,597
ICT installers and servicers	7422	2	208,200	85,200	145%	34.7%	3	41,023
Total			1,467,600	1,359,000	8%	2.6%		35,870

Source: Eurostat (2015)

Methodology for baseline projection of ICT skills gap

Demand is following a linear trend, i.e. the average absolute growth of the last few years with plausible data is extrapolated.

Minimum supply is calculated as incumbents' workforce in a previous year minus exits plus domestic graduates. Exits are calculated using a percentage derived from Cedefop applied to the last year where data for the incumbent workforce available (it is fixed, i.e. static, to avoid repercussions from the model itself). Domestic graduates are assumed to be constant and equal to the latest available plausible official statistics. Graduates counted are VET graduates, short cycle programme and bachelor level graduates. Master's and Ph.D. level graduates are not counted because they usually have a previously earned a bachelor's degree and would hence be double counted.

Supply in a scenario with constant lateral entries adds also the "Minimum lateral entry inflow" to minimum supply

Minimum lateral entry inflow is the calculatory structural gap that remains when the number of domestic graduates (as defined in minimum supply) is subtracted from the need for new labour market entries (expansion and replacement).

Shortage without lateral entries is the gap that remains when the need for new labour market entries were only covered from domestic graduates.

Shortage with constant lateral entries ("everything stays the same") is the gap the remains when a constant number of lateral entries flows into the labour market.

The total potential for new jobs until 2025 is calculated as:

Demand 2025	**1,863,000**
Minus incumbent jobs 2016	- 1,504,000
Plus cumulative replacement 2017-2025	+ 433,000
Jobs potential	*792,000*

Yearly breakdown for baseline projection of ICT skills gap

(in '000s)	2017	2018	2019	2020	2021	2022	2023	2024	2025
Demand (linear trend)	1,576	1,612	1,648	1,683	1,719	1,755	1,791	1,827	1,863
Minimum supply (incumbents minus exits plus domestic graduates)	1,442	1,417	1,391	1,366	1,340	1,315	1,289	1,264	1,238
Supply in a scenario with constant lateral entries	1,504	1,539	1,575	1,611	1,647	1,683	1,719	1,755	1,791
Shortage without lateral entries	134	195	256	318	379	441	502	563	625
Shortage with constant lateral entries ("everything stays the same")	72	72	72	72	72	72	72	72	72

Yearly breakdown for baseline projection scenario for Germany's ICT labour market (2017 - 2025)

Source: empirica (2017)

Appendix B: Definition of ICT occupations according to ISCO

ICT Specialists by skill level according to ISCO (International standard classification of occupations)	
Level	ISCO (International standard classification of occupations)
High	Management, architecture & analysis
Mid	Core ICT practitioners – professional level
Mid	Other ICT practitioners – professional level
Lower	Core ICT practitioners – associate / technician level
Lower	Other ICT practitioners – associate / technician level

Eurostat: ICT specialists according to ISCO
Management, architecture & analysis
133 ICT Service managers
2511 Systems analysts
Core ICT practitioners – professional level
2512 Software developers
2513 Web and multimedia developers
2514 Application programmers
2519 Software and multimedia developers and analysts not elsewhere classified
2521 Database designers and administrators
2522 Systems administrators
2523 Computer network professionals
2529 Database and network professionals n.e.c.
Other ICT practitioners – professional level
2152 Electronic engineers
2153 Telecommunication engineers
2166 Graphic and multimedia designers
2356 Information technology trainers
2434 ICT sales professionals
Core ICT practitioners – associate / technician level
3511 ICT operations technicians
3512 ICT user support technicians
3513 Computer network and systems technicians
3514 Web technicians
Other ICT practitioners – associate / technician level
3114 Electronics engineering technicians
3521 Broadcasting and audio-visual technicians
3522 Telecommunications engineering technicians
7421 Electronics mechanics and servicers

Appendix C: Workforce Diversity Indicators

Indicator	Definition/Source
Long-term unemployment rate	Share of persons unemployed for 12 months or more in the total number of active persons in the labour market. Source: Eurostat [une_ltu_a], data from 2016.
Young people neither in employment nor in education and training (15-24 years) – NEET	Percentage of the population in age group 15-24 years who is not employed and not involved in further education or training. Source: Eurostat [edat_lfse_20], data from 2016.
Youth unemployment	Number of persons under 25 years who are unemployed, as share of the total number of young people in the labour market. Source: Eurostat [une_rt_a], data from 2016.
Employment rate of older workers (55-64 years)	Number of persons in age group 55-64 years who worked at least one hour for pay or profit during the reference week or were temporarily absent from such work, as share of the labour force in that age group. Source: Eurostat [lfsi_emp_a], data from 2016.
Age employment rate gap (15-64 vs. 55-64 years) in p.p.	Difference in percentage points between the employment rates of persons in age group 15-64 to age group 55-64 years. A positive figure denotes that the employment rate for older persons is lower than for the entire workforce. Source: Own calculation from Eurostat [lfsi_emp_a], data from 2016.
Gender employment rate gap (15-64 years) in p.p.	Difference in percentage points between the employment rate (15 to 64 years) for women and the rate for men. A positive figure denotes that the employment rate for women is lower than for women. Source: Own calculation from Eurostat [lfsa_ergaed], data from 2016.
Non-natives born outside the EU, as share of total population	Total population born outside of the EU (borders as of 2016) on January 1. Source: Eurostat [migr_pop3ctb], data from 2016.
Non-native employment rate gap, in p.p.	Difference in percentage points between the employment rate (15 to 64 years) for population born outside of the EU (borders as of 2016) and the rate for the population born in the reporting country. A positive figure denotes that the employment rate for persons born outside of the EU is lower than for those born in the reporting country. Source: Own calculation from Eurostat [lfsa_ergaed], data from 2016.
Disability employment gap, 2011, in p.p.	Difference in percentage points between the employment rate (15 to 64 years) of persons reporting difficulties in performing basic activities, and the rate for persons reporting no such difficulties. Difficulties can relate to seeing, hearing, walking, and communicating, and must have lasted or be expected to last for six months or more. A positive gap figure denotes that the employment rate for persons facing difficulties in basic activities is lower than for those without. Source: Own calculation from Eurostat [hlth_dlm010], data from 2011 (latest available).
Disability unemployment gap, 2011 in p.p.	Difference in percentage points between the unemployment rate of persons reporting difficulties in performing basic activities, and the rate for persons reporting no such difficulties. Difficulties can relate to seeing, hearing, walking, and communicating, and must have lasted or be expected to last for six months or more. A positive gap figure denotes that the unemployment rate for persons facing difficulties in basic activities is higher than for those without. Source: Own calculation from Eurostat [hlth_dlm030], data from 2011 (latest available).

Appendix D: Survey Methodology

Research framework and survey design

The analysis and findings of this report are a result of extensive desk research and two surveys carried out with ICT skills training providers and employers across the target countries. The approach to select and benchmark good practice showcases of ICT training programmes was based on a four-step process illustrated below. The research findings were further analysed and strengthened expert workshops. Three expert workshops were held in Spain (Madrid), Germany (Berlin) and United Kingdom (London) and attended by a panel of experts from academia, policy, the non-profit sector and businesses.

Step 1: Collection of 300 initiatives	Step 2: Selection of 96 initiatives for the online repository
The first phase of the project, using comprehensive desk research we identified more than 300 initiatives based on the following criteria: 1 **Type of programme**: Any type of ICT training programme activity, project, initiative and multi-stakeholder partnership of different levels of government, PPPs (public private partnerships), MSPs (multi-stakeholder partnerships), non-profit organisations, IT vendors, addressed to: 2 **Target group**: diverse target groups, including women, vulnerable youth with low educational achievement or from difficult socio-economic backgrounds, people with migrant background, unemployed adults changing careers, etc., 3 **Scope**: to enable them to obtain and develop in-demand ICT skills and support their entry into the labour market. The process started with the: 4 **Analysis of around 300 e-skills programmes and initiatives** identified in desk research throughout selected countries, followed by: 5 **Identification of further programmes** not covered by the initial list by national correspondents from the empirica Global Network for Innovation Research (ENIR) (www.enir.org) and other national experts where appropriate.	In the second phase, 96 inclusive programmes were shortlisted from the 300+ collected cases. Each case was given a score on a scale from 0 (low) to 2 (high) based on the following evaluation scheme: 1 **Outcome:** To what extent is the programme effective in enabling diverse population's access employment opportunities through the acquisition of demand-driven e-skills? 2 **Target Fit:** To what extent does the programme or initiative target diverse populations to support to enter the labour market? 3 **Scalability and Continuity:** What is the potential for the initiative or programme to replicate, expand or continue to reach more beneficiaries and contribute to the skills development at regional and national level? 4 **Maturity:** Has the programme been in operation for long enough to make it possible to assess performance and to learn from its experience? 5 **Policy Fit:** To what extent is the programme or initiative embedded in a broader policy context? Textual descriptions of the relevant inclusive ICT skills training programmes were developed based on a common format to get an overview of training measures and how these were addressed and implemented. The selected training programmes are part of an online repository of an estimated 96 programmes, which were selected for further analysis.

Step 3: Identification of Good Practice Showcases	Step 4: Evaluation of Good Practice Showcases
The selection of good practice showcases from the shortlisted programmes was based on the following framework, with each case given a score from 1 (low) to 3 (high): 1 **Relevance:** To what extent is the programme relevant in terms of creating a diverse skilled workforce responding to demands in the labour market? 2 **Transparency:** To what extent is it possible to have access to information about the programme? 3 **Effectiveness:** How effective is the programme in providing participants with the ICT knowledge and skills, in line with current demands in the labour market? 4 **Efficiency:** How efficiently has the programme been implemented? 5 **Impact:** What were the effects of the programme on the target groups involved? 6 **Sustainability:** To what extent are the achieved benefits from the programme sustainable?	The main objective of the final phase of analysis was to further evaluate and benchmark the 22 good practice showcases against a set of defined criteria (evaluation criteria), to identify best practice elements and lessons learned. The evaluation and assessment of best practice ICT skills training programmes was carried out making use of a qualitative survey of key stakeholders. This consisted of in-depth interviews (with decision makers from the selected best practice programmes and selected employers) and a SWOT analysis to help address and understand issues relevant and factors influencing the success of training measures from different perspectives.

Employer survey

Format: in-depth telephone interviews of around 60+ minutes duration each plus completion of a questionnaire by the interviewee either prior or after the telephone interview.

Target group: 12 HR key decision makers in mainly large organisations from Spain, the United Kingdom, Germany, France, Belgium, the Netherlands, Poland and South Africa, several of which global players. ***Objectives:*** to gather insights about experiences and expectations related to (inclusive) training programmes. The primary objective was to find out whether the current ICT training(s) are attractive and making use of these would equip participants with the in-demand ICT skill sets and would qualify them for further consideration by employers. The interview results served as an input for the policy recommendations developed in the course of the project to inform policy development on the European and national level, and provide practical recommendations to non-profit organisations and training providers.

Structure of interviews:

1. General – Job profiles: type of ICT people / professions needed in the organization; roles / competences relevant and required in the organization.
2. (Digital) skills and competences needed: relevant digital skills and competences required from an employee in the organisation either already working for the organisation or those applying for a job.
3. Recruitment criteria: recruitment process, the different steps involved and main decision makers as well as main sources of recruitment and main prerequisites; minimum entry standards / credentials (e.g. degrees and certifications) required for a potential candidate to be eligible.
4. Employer involvement and collaborations: organisation already involved in training schemes addressed to diverse / vulnerable groups of people including vulnerable youth with low educational achievement or from difficult socio-economic backgrounds, people with migrant background or unemployed adults changing careers; providing any offers to such training schemes (internships, apprenticeships, mentoring, training for specific subjects, other) or involved in any collaborations with the training providers (skills needs assessment / matching, curriculum reform, research & development, equipment and facilities, advisory panels, on the job placement, certification standards, other).
5. Proposed policy interventions and programmes
6. Recommendations: to training providers for assuring delivery of the skills and talent needed in the labour market and the organisation through their education / training programmes as well as recommendations to policy makers.

Timing: October – November 2017

Appendix E: Good Practice Showcases

Appendix E1: JOBLINGE goes MINT

JOBLINGE GOES MINT AIMS TO RAISE AWARENESS OF STEM FIELDS AMONG ALL ITS PARTICIPANTS THROUGH TRAINING COURSES AND APPRENTICESHIPS IN ORDER TO COUNTERACT THE SHORTAGE OF SKILLED WORKERS IN THE STEM SECTOR.

Target group

Unemployed young people aged between 16 and 25 years; young people from socio-economically disadvantaged background or those facing difficulties due to an immigrant background.

Main activities

JOBLINGE goes MINT began as a pilot initiative, which operated in Frankfurt from 2015-2017. In 2017, the nationwide rollout of the programme began at all JOBLINGE locations in Germany. Its aim is to integrate young people who are most at risk of societal exclusion into the STEM sector with the help of specialised training programmes and by encouraging civil society actors and businesses to collaborate in these efforts. Through a six-month programme, participants can qualify for an internship or a job at one of JOBLINGE's partner companies. According to JOBLINGE, programmes like these are essential because of two primary reasons:

- For young people, new pathways are opened in a stable and future-oriented industry and;
- For businesses, it helps to counteract the shortage of skilled workers in the STEM sector.

JOBLINGE partners with companies to reach out to young people by providing jobs and internships. At the same time, it motivates its participants to engage with STEM fields through a tailored approach designed to reduce the psychological barriers of entering such fields of work and study. Towards this end, the programme uses interactive forms of learning, such as STEM and recruiting workshops focused on introducing the participants to the work place environment; designing and holding events for participants to get acquainted with companies; and developing innovative learning and skill assessments.

Industry input

Design and delivery with the help of effective partnerships

One of the programme's incentives is to tackle the skills shortage in STEM fields – hence, the focus is to train young people to ultimately be placed in careers in this sector. During the pilot phase, 84 new companies joined the programme as long-term STEM partners committed to addressing the skills need in the industry.

Impact

1,030 learners have participated in the STEM programme in 2018	**73% of the learners** were placed into VET and jobs nationwide	**305 learners** were placed into STEM training in 2018

2.230 learners participated in STEM workshops since 2015	**1,120 internships** were secured for learners	**229 companies** joined the programme as new STEM partners

Funding and sustainability

The programme is funded by J.P. Morgan and supported by other organisations such as the Königsteiner Agentur and the Boston Consulting Group (BCG). The long-term vision for JOBLINGE goes MINT is to be implemented nationwide after the rollout at every location in Germany. The modules and courses specifically geared for STEM fields would then be incorporated into the overall programmes offered by JOBLINGE.

Challenges and lessons learned

Joblinge goes MINT has high rates of participation by young people from vulnerable backgrounds. 60% of the programme participants come from immigrant backgrounds; more than 70% depend on social welfare; and 60% only have a lower secondary school diploma, including some with no formal education diplomas.

On average, JOBLINGE participants have already been in the transition system for two years without success and on their own, face problems in what is termed as the 'bureaucratic jungle'. This continues to present a challenge for the programme.

The most important factor, in the view of the programme representatives, is personal contact between participants and companies. In the current environment, recruiting young people who are viewed as 'less-educated' has been an issue for most companies. However, with the help of the programme, its participants and potential companies get an opportunity to discover each other and successfully integrate training with practical experience. The numbers suggest that so far this approach has been successful in placing the target group into vocational training and jobs.

Joblinge aims to reduce psychological barriers for learners. The target group, according to JOBLINGE, is one of the most difficult to place into sustainable jobs. Through a tailored approach, the programme attempts to reduce the psychological barriers learners face about entering STEM fields – whether for work or study. JOBLINGE educates and ultimate encourages students to choose STEM pathways.

Appendix E2: ReDI School

REDI SCHOOL OF DIGITAL INTEGRATION IS A NON-PROFIT DIGITAL SCHOOL FOR TECH-INTERESTED PEOPLE WITH MIGRANT BACKGROUND AND SOCIALLY DISADVANTAGED IN GERMANY.

Target group

Tech Talents from socially disadvantaged or immigrant background

Main activities

ReDI School of Digital Integration is a non-profit digital school for tech-interested newcomers in Germany. ReDI was co-created by an innovative team with the help of refugees and the tech community of Berlin and Munich.

ReDI offers 3 month IT programmes, soft skills workshops, mentorships, internships, corporate training projects, as well as short term summer courses.

At ReDI:

- **Companies are an integral part of the training programmes:** ReDI partners with Klöckner, Cisco, Microsoft, Google, Bosch, SAP, Daimler amongst others, to design and deliver training courses, develop projects and for offering internships and work placements.
- **Project oriented learning:** Instead of using standardised training curriculum, ReDI develops its curriculum with its teachers with a strong focus on learning through doing, matching theory with practise.
- **Platform of people from the tech community, companies, and alumni:** A network that provides the students with various development opportunities including building soft skills and mentorship and encourages deeper collaboration and integration with the surrounding communities.
- **Strong community with "Pay-it-forward" culture**: Special courses targeted to women and children have been developed. These women have little exposure to technology, and need childcare and translation support. The Kids courses help spark interest in technology from an early stage. The ReDI alumni are used as mentors and translators.

Impact



Almost **900 learners** have participated in training since 2016	**60% of the trained learners** are in paid jobs or internships	**8% of the learners** have started own ventures



Currently (9/2018) **392 students** are in training, **40% of whom women**	**250+ volunteers mentors** are active at both ReDI locations	**25% of the learners** are continuing education at university

Almost 900 people have participated in one or more courses at ReDI School. The students come from 31 countries, but the majority are from Syria. 26% of the graduates from the IT Career programme in Berlin and 18% from Munich – which equals 207 individuals - are now in full time ICT jobs in Germany in companies such as CISCO, Bosch, Dropbox, Zalando and Capgemini.

Despite the many challenges for refugees to found a company in Germany, 8% of the ReDI Alumni have started their own ventures, solo or in groups.

Design and delivery with the help of effective partnerships

Stakeholders like CISCO, SAP, Facebook, BITKOM, and Google are highly relevant in the tech industry and ensure important links to the labour market. Additionally, ReDI is also cooperating with CISCO and Google in running courses from the Cisco Networking Academy and Google Coursera campus. The majority of the school's courses are delivered by volunteers who are working in the tech industry, either in tech

companies, start-ups or in technical universities. The School is of recent AZAV certified and will start delivering full time courses by paid teachers in 2019.

Funding and sustainability

Currently, ReDI is funded through partnerships with for-profit organisations (such as Klöckner & Co and Cisco), Donations from companies and foundations (such as Facebook, Coca-Cola Foundation, salesforce.org and JP Morgan Foundation), public funding (such as the City Council of Munich - MBQ) and self-earned revenue (such as workshops, keynotes and tours). From 2019 funding will also come through the Germany Jobcenter through student-vouchers. In addition in kind, donations are provided by organisations such as Airbnb, Microsoft, Zalando, Deutsche Telekom, Daimler and Gestalten, among others. ReDI has also been involved in raising funds through crowdfunding, for example, with Betterplace (https://www.betterplace.org). The majority of teachers are volunteers and donate their time, skills and network to support the school and the students.

To become financially sustainable, ReDI foresees additional funding from three sources:

- **Corporates:** Corporates are ReDI's main source of financing, supporting them through partnerships and donations both monetary and in-kind (e.g. training locations, laptops). ReDI will continue to build on this partner ecosystem and explore models of charging service fees to develop corporate courses and get early access to tech talent.
- **Training vouchers from the Federal Employment Agency:** ReDI is now certified as an educational institution for the local German Employment Agency (Bundesagentur für Arbeit). Through this channel some of its students who are registered with their local Employment Agency can get training vouchers for attending ReDI courses. More than 40% of its students are currently eligible for receiving such training vouchers.
- **Foundations:** For the School's children, youth and women's courses, ReDI will continue to utilise its funding model based on donations.

Challenges and lessons learned

ReDI measures its success in several ways 1) the level of engagement of the students 2) the number of lessons taught 3) The number of workshops and events organised 4) the number of graduates 5) the number of volunteers engaged 6) The number of partner companies engaged 7) Community satisfaction 8) Staff commitment 9)Financial sustainability

Other measures of course consider the success stories of its students, such as the 900 participants who successfully completed their training and moved into jobs and internships or entrepreneurial ventures. ReDI however needs to develop a career department to place more students into jobs or internships after completed courses.

The main challenge for ReDI is to ensure its long-term financial position – specifically to support ambitious plans to expand into other German cities and eventually, into other European cities that have indicated a strong interest hosting a ReDI School.

Appendix E3: NetAcad for Refugees

ACCELERATE LABOUR MARKET INTEGRATION OF REFUGEES BY PROVIDING SOLUTIONS FOR BARRIERS TO ENTRY, I.E. LANGUAGE, CERTIFICATIONS AND PARTNER NETWORKS.

Target group

The programme is targeted at refugees.

Main activities

The NetAcad for Refugees was initiated by the Cisco Networking Academy Programme (CNAP) in May 2016 and is being run until the end of 2019. The CNAP - which includes the NetAcad - itself is of unlimited duration. It enables anybody interested – but with the NetAcad activity especially addressed to refugees - to find online courses on the global Cisco Networking Academy platform. It lends itself to specific groups, especially those from Syria, Iraq and other Arabic speaking countries since the courses are available free of charge in 16 different languages, including Arabic. The offer of an online course is particularly useful for those who are still waiting for their right of asylum to be acknowledged. The online courses can be completed with an industry certification through which refugees are empowered to find jobs in the technology sector. Industry certifications can outbalance disadvantages if e.g. degrees or certificates from home countries of refugees are not recognized in Europe. Cisco also provides internship offers for successful participants to gain work experience. During the last 2 years 6 former interns with a refugee biography have been hired in technical roles. Partnerships with Ministries of Education and almost 600 education institutions have enabled Cisco to successfully run the programme in various vocational training institutions. This shows its proximity to the formal education and training system in Germany.

The online courses can be completed with industry certifications like CompTIA A+, CCENT, CCNA, Linux Essentials, C++ Institute and others. The courses have been embedded in qualification offers from NGO partner institutions, such as Asylplus and ReDI School of Digital Integration, Codedoor, CodingSchule among others. Moreover, CISCO cooperates with NGOs and foundations whose work is focused on job placement of asylum seekers to aid their smooth transition into the German labour market.

Industry input

Design and delivery with the help of effective partnerships

One of the leading ICT vendors for certifications, Cisco provides its curriculum through its online Networking Academy, which can be accessed by institutions as well as training providing institutes. This is referred to as its 'Network of NetAcads'. The option of self-assessment and self-learning is available on the platform – however, the real strength of the programme lies in its network of partners. These are schools and VET institutions where Cisco programmes are open for joining.

Impact

IMPACT

Approx. 7,000 learners are currently subscribed to NetAcad, incl. 3,750 refugees	Learners moved forward to: **internships (20%); study programmes (28%); IT jobs (18% Munich, 26% Berlin))**	**8% of the learners** have started own ventures

Currently (August 2018), around 3,750 refugee learners can be identified as having subscribed to the programme courses with 783 new subscriptions in 2017 and 2,601 in 2018. Additional participants were subscribed by teachers from vocational schools, where "welcome classes" or "international classes" for refugees have been established. Cisco has further published a tech skills assessment in German and English. ; The eval-U test enables test participants to receive invitations for self-enrolment in online courses that match their skills and preferences.

Cisco aims at reaching a level of 10,000 eval-U test users until 2019.

Success factors

Network of NetAcads: The most promising partnerships include the three with:

- **ReDi School** (www.redi-school.org) in Berlin, which has been running the programme since 2016.
- **AsylPlus/ChancenPlus** (www.chancenplus.de) with a regional focus on Bavaria. The association started

with online language learning and has started professional IT training early in 2017.
- MigrantHire (www.migranthire.com) a professional online network that is supporting the match making process between refugees and employers.

Other outreach partnerships include:
- Dortmund – at the "Heinrich -Schmitz Bildungszentrum", in collaboration with the city government.
- Berlin – in collaboration with volunteers from the U.S. Epicentre Church, combined with English language classes.
- ReDI School Munich – in collaboration with the IT companies in the Munich regions. Volunteer teachers from IT companies' teach participants with a refugee biography.

Reducing barriers to training: the first barrier – language, is addressed by the availability of 16 languages in which learners can access the courses. Cisco Germany and its sales partners also committed to easier integration of refugees in the workplace by providing jobs and internships.


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NEW SKILLS AT WORK
J.P.Morgan