Policy Brief

ICT Skills Training for Diversity

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emp**i**rica

NEW SKILLS 뵨 WORK J.P.Morgan



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The past and present trends show increasing shortages in ICT skills supply. The six European countries under review in our study are today facing a shortage of 477,000 ICT specialist at different skills levels. This could increase up to 1.26 million in 2020 and 1.67 million potential vacancies in 2025. These figures demonstrate that there is a huge employment potential for anybody who can acquire relevant up-to-date ICT skills and complementary "transversal" skills in Europe. A recent study¹ revealed that 16% of all future vacant jobs were foreseen at the highly qualified positions in ICT management, architecture and analysis. In contrast, 84% of all jobs are for all other ICT professionals. This leaves plentiful room for lower and mid level jobs.

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Diversity in the ICT workforce is a challenge. The share of women in the ICT workforce in Europe is only 17%. Only around 19% of computer science students are female and this low level of representation persists through higher education and in the workplace². The ICT and STEM 'enrolment funnel' for girls and women is characterised that a significant percentage of women already drop off at an early school stage and continue to do so at each further stage in their career. In order to increase the share of women in ICT and boost enrolment it is necessary to increase the number of prospects in each stage of the funnel or to try and improve them by motivating women to continue in the ICT field at each step in their career. The share of young people not in employment, education or training (NEET) in the EU28 averages 11.6%, which is a challenge and cries for action. The same holds true for the share of early leavers from education and training (age 18-24) in Europe which is substantial with 12.1 % of young men and 8.9 % of young women in the EU being early leavers from education and training.

Finally, the average disability employment gap for ICT specialists in Europe is 19.6 percentage points.

From countries where statistical data is available we know that less than 20% of ICT specialists have an ethnic minority background. The figures of foreign-born ICT specialists and those with migrant status are at a similar level.

Why ICT skills for a diverse tech workforce?

"Organisations have learned that there is a difference between singing in unison (uniformity) and singing in harmony (diversity), and that this difference can be measured in terms of efficiency, competitiveness, and innovation. On complex tasks, diverse teams will overtake teams of talented but similar individuals by a sizeable margin; demographically diverse groups outperform homogeneous groups on various occasions" says Paul Evans, The Shell Chair of Human Resources and Expert statements on diversity: "Focusing on diversity and inclusion is crucial to overcome the fractures and inequalities of our age". Moreover, "diversity is a crucial leverage for innovation". "The capacity to leverage diversity requires bold and visionary leadership - at the level of organisations, cities, and nations". "Organisations have learned that there is a difference between singing in unison (uniformity) and singing in harmony (diversity), and that this difference can be measured in terms of efficiency, competitiveness, and innovation. On complex tasks, diverse teams will overtake teams of talented but similar individuals by a sizeable margin; demographically diverse groups outperform homogeneous groups on various occasions".

Policy makers should - amongst others - seek to

- set up supportive policy and funding framework conditions together with an appropriate stakeholder eco-system,
- address the ICT and STEM 'enrolment funnel' to boost enrolment of girls and women in ICT and STEM at each stage in education starting at primary school up until university enrolment and job start in the labour market,
- offer activity spaces and funding for the co-creation and regular updating of inclusive ICT training programmes in partnership between training providers and industry,
- increase permeability of inclusive ICT trainings into the formal VET,
- develop light-weight certification options as quality labels for inclusive ICT training making it easier for graduates from inclusive ICT training programmes to enter the labour market. A first step would include commissioning the development of a 'guide to alternative certification' to training providers throughout Europe which would help to make best use of these,
- support the initial setting up of cross-organisational and crossregional mentor networks,
- investigate whether tax-based funding can operate as incentive to further training in companies and how this could best be implemented, and
- demonstrate good practice of inclusive ICT training programmes.

Organisational Development and co-editor of the Global Talent Competitiveness Index Report³ Bruno Lanvin, Executive Director for Global Indices, INSEAD and co-editor of the report adds "The capacity to leverage diversity requires bold and visionary leadership - at the level of organisations, cities, and nations".

Several types of skills are needed. Vinod Kumar, Chief Executive Officer and Managing Director, Tata Communications, asserts the view that in terms of technical skills specifically Information and Communications Technology (ICT) skills are crucial as "digital transformation becomes a priority for more and more organisations (and ...) humans and machines start to work side-by-side". "Ensuring that everyone has the right skills for an increasingly digital and globalised world is essential to promote inclusive labour markets and to spur innovation, productivity and growth".⁴

Hence we need to emphasise the importance of ICT but also collaborative and interpersonal skills as well as inclusion and diversity in our workforce. For those who either dropped out of the formal education system or constitute a minority group in the ICT labour market, effective and inclusive ICT training programmes could make the difference.

There are a number of successful inclusive ICT training programmes and a range of promising approaches, but the overall picture is one of "too little, too few". Given the size of the challenge, these initiatives are unlikely to make a difference at scale. There is a need for scaling existing training schemes and for the creation of large and ambitious training schemes, which generate sufficient visibility to reach large shares of diverse groups of people underrepresented in the workforce.

ICT skills and Jobs

The term *Information and Communications Technology* (ICT) *skills and jobs* used in this brief refers to *ICT practitioner and specialist 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 International Standard Classification of Occupations (ISCO) provides a breakdown of ICT specialist skills levels:

- HighManagement, architecture & analysisMidCore ICT practitioners professional levelMidOther ICT practitioners professional levelLowerCore ICT practitioners associate /
technician level
- Lower Other ICT practitioners associate / technician level.

To these levels almost 30 different ICT occupations have been allocated. In 2016, the profession with the most workers was core ICT practitioners at professional level (software developers, web and multimedia developers, application programmers). The second biggest group was core ICT practitioners at associate/technician level ICT operations and user support technicians, computer network and systems technicians, web technicians), followed closely by other ICT practitioners at professional level (electronics and telecommunications engineers, graphic and multimedia designers, ICT trainers, ICT sales professionals) and the group of management, architecture and analysis.

ICT workforce in Europe 2016



- Management, architecture and analysis
- Core ICT practitioners professional level
- Other ICT practitioners professional level
- Core ICT practitioners associate/technician level
- Other ICT practitioners associate/technician level
- Mechanics and servicers

Source: emprica (2017), based on Eurostat data

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

ICT skills shortages today and in the future

Recent trends are showing large shortages in ICT skills supply. These could increase up to 1.26 million in 2020 and 1.67 million potential vacancies in 2025 in the six European countries under review in our study are today. A recent study⁵ revealed that only 16% of all future vacant jobs were foreseen as highly qualified positions in ICT management, architecture and analysis. In contrast, 84% of all jobs are for all other ICT professionals. This leaves plentiful room for lower and mid level jobs. Already today, and when looking at the labour force survey data for the European countries broken down by the ISCO classification (international standard classification of occupations), the majority of these jobs is available for mid level skills (47.9%) and low level skills (30.7%). Positions requiring high level skills make up 21.4% of the workforce.

Diversity in the workforce today

While in general 65% of European employees are women the share of women in the ICT workforce is only 17%. The highest shares of women are found in the occupational groups 'Graphic designers', 'Assemblers of electrical and electronic products' (both 35%) and 'IT operations technicians' (24%) against 14% for programmers/software developers and 10% for ICT directors.⁶ The first set of obstacles concerns women's perspective of and expectations towards the ICT sector. These start to develop at an early age and during education, and are based on a combination of long-held stereotypes, misconceptions on girls' aptitudes and a bias in teaching materials and pedagogy. The second set of obstacles faced by women concerns a phenomenon usually described in the literature as the 'leaky pipeline'. Moreover, women are faced with a double barrier. We can observe an already low number of women in management position in general. Their share in senior management positions in the EU28 is at 26.7% in 2018. That, in combination with a low rate of women in the ICT sector, leads to even less women in ICT management positions.

Besides the fact that ICT is a sector with a low share of female workers, additionally a great number of women drop out of their ICT careers for a number of reasons: organisational constraints (segregation into (lower paid) women's jobs and men's jobs), maledominated environment, lack of role models and poor work-life balance.⁷ Despite long standing campaigns from governments, the European Commission and industry there remains a marked gender imbalance in those studying computing. Only around 19% of computer science students are female and this low level of representation persists through higher education and in the workplace. Such shortcomings in inclusion levels for ICT jobs have changed very little since 2011.⁸ Moreover, studies show many young women opting out of STEM subjects whenever possible in their educational pathways⁹. In order to increase the share of women in ICT and boost enrolment it is necessary to increase the number of prospects in each stage of the funnel or to try and improve them by motivating women to continue in the ICT field at each step in their career.

The share of **young people not in employment**, education or training (NEET) in the EU28 averages 11.6%, which is a challenge.¹⁰ In 2017 the share of early leavers from education and training (age 18-24) in Europe was substantial with 12.1 % of young men and 8.9 % of young women in the EU being early leavers from education and training. In Europe the proportion of early leavers from education and training in 2017 ranged from 3.1 % in Croatia to 18.6 % in Malta. In the countries of the present study the share of Spain was highest with 18.3% followed by the UK where the share was at 11.2% and thus higher than shares in the other countries Germany (10.2%), France (8.8%), Ireland (6.3%) or Poland (5.0%).¹¹

The situation is similar for the shares of ICT specialists in the workforce who have a disability. The average **disability employment gap** for ICT specialists in Europe is 19.6 percentage points¹².

The UK is a country where statistical data is available on **employees of Black and Minority Ethnic (BME) backgrounds**. 17% of ICT specialists are of Black and Minority Ethnic (BME) backgrounds – the same low rate as for the entire working age population.¹³ Taking the example of the UK 18% of the employees in the digital sectors are **foreign-born**, about onethird of which are from EU countries.¹⁴

Opportunities, success factors and pathways

The identification and assessment of several hundred inclusive ICT training programmes in the seven countries under review (France, Germany, Ireland, Poland, Spain, South Africa, United Kingdom) have revealed several pathways for (supporting) access to the labour market for diverse populations. The 22 Good Practice Showcases (GPS)¹⁵ demonstrate the most promising pathways to inclusive ICT skills training, jobs and labour market integration, showing opportunities to include those at risk of social exclusion. Relevant success factors such as the importance for experiential and practical training with a strong involvement of businesses and industry were identified. Others included the importance of mentorship and, for some, the importance and value of certification and quality labelling - as offered through the integration and use of vendor-based training programmes within the VET system - for (later) labour market integration. Additionally, trainings should not focus on the technical skills only but also address the lack of market relevant skills which reach beyond ICT skills and include what has been termed "transversal" skills.

Specifically pathways into lower and mid-skilled ICT jobs with a higher proximity to vocational education and training (VET) and related jobs and occupations

as opposed to higher education and training are followed as promising pathways for most of the target groups. Women and many with migrant background are an exception since for these higher as well as vocational education and training apply.

Experts in some countries argued for the need to link inclusive ICT programmes and integrate these with formal education and training systems. This was seen as a means to get better recognition by employers of the skills gained and as such help achieve better job sustainability. The details of how this could look like still need to be developed.

More details on the opportunities, success factors and pathways are provided in the final report "diversITy – Promoting Integration and Diversity in the Digital Labour Market", the seven Country Reports and the additional Practitioner Brief developed within the diversITy project.¹⁶

Policy responses - key priorities for inclusive ICT skills policies

Policy developers need to bear in mind that "focusing on diversity and inclusion is crucial to overcome the fractures and inequalities of our age"¹⁷. Moreover, "diversity is a crucial leverage for innovation".¹⁸ Developing the key priorities for inclusive ICT policies and addressing the issue of ICT training, job placement and sustainable labour market integration for a diverse tech workforce will require more and bold as well as coordinated and joint action. This needs to be taken up by policy makers, education and training institutions and providers, businesses and industry, together with NGOs, trade unions, charities, foundations and – depending on the (national) context - further players active in this field.

A prerequisite for success is the existence of supportive framework conditions such as targeted and focussed policy strategies at national level but also at European level and an appropriate stakeholder eco-system, both, needed to build a diverse tech workforce at a much larger scale than at present. Governments in the countries under review have announced and launched different types of policy strategies to address these challenges (e.g. the red.es Strategy 2017-2020 but also different policies that aim to fight youth unemployment or the Digital Strategy 2025 in Germany). Some have only been launched recently (e.g. the UK Digital Strategy 2017 which aims at enabling a more diverse digital workforce and has, starting in 2018, resulted in activities to establish new Digital Skills Partnerships (DSP) and local digital skills partnerships (LDSP)). Others have released new laws (e.g. German government announcement of a new law on the immigration of skilled workers). In France policy is addressing gender equality in the digital workforce, diversity and inclusion in education, as well as structural reforms to the VET system. In Germany, much of the policy addresses the general labour market, industry and work. A new digital strategy was introduced in 2016 together with a digitisation council (2018). Most of Ireland's strategies are running until 2020 to 2025 and address ICT skills, the further education and training system, as well as better integration for girls and women. In Poland the Government created a dedicated Ministry of Digitisation in 2015 focusing on the provision of digital literacy. Additional programmes also focus on ICT skills development. The focus in South Africa lies on the development of ICT and broadband infrastructure while also focusing on the ICT user and specialist skills. In recent years, Spain's strategies primarily faced youth unemployment. Since 2017, a new digital strategy was introduced to also focus on improving ICT skills of the Spanish workforce. Since 2017, the UK has launched many new strategies and programmes to address the ICT specialist shortage, both on national and regional level.

Several of these policy strategies are associated to funding programmes (national as well as European ones) which offer more or less clear opportunities for funding specific activities in the area of inclusive ICT training for the creation of a more diverse workforce. These policy programmes set the policy framework (and nothing more) for things to happen.

Addressing the challenges arising from the ambition for a more diverse tech workforce through related inclusive ICT programmes at a large scale will require action to be taken at different levels (European, national, regional, local) and in different areas (curricula / programme co-creation, operation quality labeling, certification etc.).

Key priorities for inclusive ICT skills training policies and programmes

We propose the following key priorities for inclusive ICT skills policies and programmes to facilitate take up the opportunities and promote inclusive ICT training which in the end will be leading to a more diverse workforce.

Supportive framework conditions

Policy makers together with the relevant subordinate authorities (e.g. employment services agencies, national public institutions for vocational education and training) and in consultation with further stakeholders (e.g. chambers of commerce, chambers of craft) need to set up supportive framework conditions such as targeted and focussed policy strategies at national level and the European Commission at European level together with an appropriate stakeholder eco-system. Such framework conditions need to include an expression of willingness for policy action towards creating a truly diverse workforce in government programmes. In many countries policy programmes in this area already exist but their intentions remain at a rather general level. Ideally these are to be supplemented by an implementation of related financing and funding mechanisms and incentive structures. These may include tax-based as well as financial incentives which are addressed to both, training providers as well as individuals.

Financial viability of inclusive ICT training programmes is a challenge. Simplification of accreditation procedures for inclusive ICT training providers at employment services agencies (without lowering training quality standards) is recommended. The latter is of crucial importance since such types of cooperation significantly **help to secure funding of inclusive ICT training programmes**.

Finally, and since formal education degrees are indispensible for achieving more sustainable jobs, permeability between inclusive ICT training programmes and the formal education and training systems is an issue. Today, permeability may exist but the options are often very complex and difficult or cumbersome to use and follow. It is recommended to develop **clear pathways showing** inclusive ICT training programme providers and students as well as graduates **the way forward to a formal degree**. This will allow training providers to consider it as career opportunity in their programmes right from the start.

Co-creation in partnership between training providers, employers and industry

A strong emphasis should be put on the **co-creation** of programmes in partnership of training providers on the one hand and employers on the other. Companies should also be involved in the delivery of inclusive ICT training programmes as providers of internships or apprenticeships to students in these programmes. Policy should offer co-creation and codelivery spaces and support the development and delivery of training programmes. In France programmes and projects of the Grande École du Numérique have made this type of partnerships mandatory specifically also for entry level jobs. Industry is closely involved in the vast majority of GPS and in different roles which include e.g. programme co-creation, providers of practical experience, internships and apprenticeships, and (later) the role of employer. This is one reason why these programmes are successful. We strongly recommend as a **prerequisite for any state funding** the co-creation of training programmes with default industry participation and direct involvement in the operation and delivery of inclusive ICT training programmes. Governments could even be asked to incentivise university and industry cooperation to ensure the offer of internships and placements to become integral part of these programmes or even the norm. Intensive promotion campaigns may help to make this happen at large scale.

Linking and permeability of inclusive ICT training programmes to formal education and training

Ideally inclusive ICT training programmes are linked specifically to a formal VET education and training system or offer some permeability into it. This would allow obtaining a formal and recognised certification and degree and thereby increase the chances for sustainable employment even in times of economic crisis where those without (formal) degree or certificate will lose their jobs first. In most countries the relevance of formal degrees is rated as highly important.

Permeability of inclusive ICT trainings into the formal VET, although seen as important, still is an exception since options to achieve this are rare. One way offered in Germany is for the candidates to take part in an "external examination" at the Chamber of Industry and Commerce. Admission is subject to conditions. A candidate is admitted to the final examination if proof can be furnished that he or she has worked in the occupation in which the examination is to be taken for at least one and a half times the time prescribed as the training period. Such an approach could help to develop this path as a solution option towards state-recognised training in the formal education system. However, where this opportunity already exists, very limited use has been made of this option. The reasons for this have not

yet been dealt with in a structured manner. It is recommended to investigate and analyse these, share the results and experiences to see whether there is an interest in pursuing such an approach in other countries and then decide whether and how this approach could best be re-designed and implemented.

Guide to alternative certification

Several ICT training programmes - not only those addressed to diverse groups - face the problem of lack of recognition of skills and competences trained since they do not offer a recognised certificate awarded to programme participants. A way out of this dilemma could be the use of alternative certification methods including certification in form of badging (e.g. OpenBadge). A number of technology companies have started with these types of workforce credentials which students can earn. These started but are no longer limited for participants of MOOCs but include many different types of trainings of varying duration. We recommend the European Commission and / or national governments analysing the market of alternative certification methods, thereby taking care of national peculiarities in each Member State with the view of helping (inclusive) training providers in offering certified courses to their clientele more easily and thereby increasing the employment chances for them. The results should be published, widely disseminated and made available as a 'guide to alternative certification' to training providers inside and outside the formal education and training systems in European countries and regions.

Increase flexibility through 'modular apprenticeships'

Due to the high evolving pace in the ICT sector **'modular apprenticeships'** are increasingly going to become an option. These are shorter vocational training programmes which do not last for a long 3 – 4 years as for instance in Germany but for instance 10 months which is closer several of the UK apprenticeship models. Such programmes are believed to be **more attractive to employers as well as students** and are deemed to be sufficient for making students productive to start the job and then progress step by step. The modular format would also **allow adapting programme modules towards anticipated new skills needs** more easily and thereby guide students towards choices that lead to good outcomes and higher chances for a job.

Better use of existing state-financed accompanying measures

State-financed accompanying measures can contribute to the success of education and training programmes especially for target groups of the diversITy project. The same holds true for the flexibility offered within the regulatory framework of national VET systems. However, these opportunities are rarely used. So far, the reasons for the lack of use have not been analysed. The results and findings of such a study would be helpful and could help to adapt or improve the instruments accordingly or design more suitable accompanying measures in order to increase their use. Funding for mentoring could be one of these measures. The importance of and need for mentoring was strongly emphasised in all countries under review. Mentoring is seen as key and essential for the success of inclusive ICT training. Today, this takes place on a voluntary basis. Some sort of funding for setting up cross-organisational and cross-regional mentor networks may ease the provision of mentors in sufficient numbers during and even after training completion (see below).

Policy initiatives for cross-organisational and crossregional mentor networks

Given the importance mentoring was given by the experts and actors in the GPS we recommend policy to provide some initial support to initiatives to help kick-start setting up cross-organisational and crossregional mentor networks. Mentoring using (mostly) volunteer, seasoned ICT specialists as mentors and role models has been tried and tested and proven to effectively address challenges in attracting and supporting underrepresented groups, in particular women to encourage people from these groups to consider ICT careers. Many members of these groups have typically perceived a range of gender and other target group related obstacles and are therefore keen to help remove those obstacles in a voluntary mentor role. In general, relatable role models have been found to play a key role in people's attitude to working in the digital sector. It is against this background that the establishment of cross-organisational and cross-regional mentor networks could help in supporting the diverse target groups in successfully completing training programmes.

Use of (revised) incentives motivating for further (inclusive) ICT training

Funding of ICT training, whether through formal higher and vocational education and training or inclusive ICT training programmes, is crucial and requires solid budgets. Companies and businesses show some reluctance in offering training for employees and often need to be motivated to offer and finance further trainings. According to Worldbank figures for 2017 just 41.3% of firms in the EU offer formal training. Here a better use or revisions of financial and / or tax-based funding instruments may help since these can operate as an incentive to further training in companies not only for large companies but also SMEs and also in general and at the level of an individual. It is recommended to critically review existing incentives which have been implemented several decades ago with the view of revising these and making them more applicable to today's training needs and target groups. Countries such as the UK have started with the wider use of a tax-based instrument. The UK Apprenticeship Levy introduced in April 2017 is a tax-based instrument implemented as a means to fund expansion of apprenticeships. The Levy is a payroll tax on large employers, with funds raised ring-fenced in a digital account and only available to be spend on apprenticeships. It also is an instrument with the potential to open up avenues for SME training activities including admittance of apprentices from underrepresented groups if one uses unspent money wisely. So far no final evaluation results are available but it appears worthwhile to further follow it and learn from its application and flexibility in use also for the purpose of inclusive ICT training for diverse target groups.

Diversity to become part of local digital skills strategies

Depending on the situation and VET system context in a country **local level initiatives and partnerships** may turn out to become an appropriate means to increase the digital capability needed to build inclusive local economies. The objective could be to increase collaboration between businesses, NGOs, and public sector organisations to help address local digital skills needs in more targeted and innovative ways. We argue that the process of building up local structures and processes in the digital training domain offers a window of **opportunity for the establishment and mainstreaming of diversity and inclusiveness in ICT training**. Associations representing groups currently underrepresented in the ICT workforce should mobilise their resources to lobby for a strong emphasis on diversity in the local digital skills strategies being drafted. An example worth consulting for this purpose is Skills Development Scotland's 'Equalities Action Plan for Modern Apprenticeships in Scotland'.

Good practice demonstration of successful inclusive ICT training programmes and showcases

Good practice demonstration of inclusive ICT training programmes would help to create awareness, raise interest and increase participation of industry (in different roles as outlined above) in such training schemes. It would also help attract individuals from diverse und underrepresented groups to find an interest in and attend these programmes. This could be achieved through the publication of valuable information and best practice examples of how diversity can be boosted. The present diversITy online repository of Good Practice Showcases (GPS) from six European countries and South Africa can be seen as a starting point for such an initiative which policy actors at national or European level may want to expand geographically and in terms of numbers of GPS but also in terms of further types of services offered. These activities may be complemented by marketing campaigns devised at national and European level, complemented by targeted promotional efforts at local level.

Analysis and (where appropriate) re-focussing of labour market programmes

Despite the rather limited successes of previous active labour market programmes we propose to thoroughly analyse and then re-focus and where applicable further develop existing labour market programmes. The GPS, their experiences and lessons learned may be used as guidance and orientation for the re-design and / or specification of (new) programmes. This could help labour market programmes to become more innovative and welltargeted and well focussed on the target groups of the present project such as women but also vulnerable youth with low educational achievement, those who dropped out of education, migrants and unemployed adults changing careers or jobseekers with outdated or inadequate skills. Media can also play an important role specifically in reaching and impacting parents or children directly but also other target groups at later stages in life to convince them of the opportunities of ICT careers through education and training at all levels, schools, apprenticeships, universities, further education and

training etc. Governments could build promotion alliances with (public) radio and TV channels, develop and launch attractive formats to be broadcasted widely or run other types of initiatives starting at young age and directly addressing children from disadvantaged group. An interesting existing example is the BBC micro:bit initiative – which is part of the BBC 'Make it Digital programme'. It can be seen as an activity initiated by media to enable and inspire children to participate in the digital and ICT world, with particular focus on girls and those from disadvantaged groups. micro:bit was designed to encourage children to get actively involved in writing software for computers and building new things. Founded in September 2016 it has already reached more than one million young people throughout Britain.

Further information

For further details about our survey results and methodology, you can request access to our full report, forthcoming in 2019. For questions and queries, please contact:

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Disclaimer

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- Hüsing, T., Korte, W., Dashja, E.: e-Skills in Europe -Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets (2015-2020). empirica, 2017
- ² Eurostat: Statistics explained: ICT specialists in employment, July 2018
- ³ 2018 Global Talent Competitiveness Index: Talent Diversity and Competitiveness will fuel the future of work: <u>https://www.insead.edu/news/2018-gtci-talentdiversity-competitiveness-fuel-future-of-work</u>
- ⁴ OECD: Skills for a Digital World Policy Brief on the Future of Work. December 2016.
- Hüsing, T., Korte, W., Dashja, E.: e-Skills in Europe -Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets (2015-2020). empirica, 2017
- ⁶ Eurostat: Employment statistics 2007-2016: <u>https://ec.europa.eu/eurostat/statistics-</u> <u>explained/index.php?title=Employment statistics#Em</u> <u>ployment rates by sex.2C age and educational att</u> ainment leve
- ⁷ European Parliament: Women in ICT, July 2012; Eurostat: Graduates in tertiary education, in science, math., computing, engineering, manufacturing, construction, by sex - per 1000 of population aged 20-29 [educ_uoe_grad04] (last update: 12-09-2018): http://appsso.eurostat.ec.europa.eu/nui/show.do?dat aset=educ_uoe_grad04&lang=en
- ⁸ Eurostat: Graduates in tertiary education, in science, math., computing, engineering, manufacturing, construction, by sex - per 1000 of population aged 20-29 [educ_uoe_grad04] (last update: 12-09-2018):

http://appsso.eurostat.ec.europa.eu/nui/show.do?dat aset=educ uoe grad04&lang=en

- ⁹ ICEF Monitor: The enrolment funnel: Better results start with the prospects you already have, 2015; The example of the UK: WISE: From classroom to boardroom – the STEM pipeline: https://www.wisecampaign.org.uk/statistics/fromclassroom-to-boardroom-the-stem-pipeline/
- ¹⁰ European Commission (2017): Education and Training Monitor 2017: United Kingdom.
- Eurostat Statistics Explained: (2018): Early leavers from education and training: <u>https://ec.europa.eu/eurostat/statistics-</u> <u>explained/index.php/Early_leavers_from_education_a</u> nd_training
- ¹² Comparisons are made difficult because of the different definitions being used for measuring disability. The latest data that are comparable across the EU are from 2011.
- ¹³ See BCS (2017)
- ¹⁴ See techUK et al. (2016), London's Digital Future The Mayoral Tech Manifesto 2016.
- ¹⁵ diversITy online repository of Good Practice Showcases: <u>http://eskills4diversity.com/en/best-practices.html</u>
- ¹⁶ diversITy project website: <u>http://eskills4diversity.com/</u>
- ¹⁷ Alain Dehaze, Adecco Group Chief Executive Officer: 2018 Global Talent Competitiveness Index: Talent Diversity and Competitiveness will fuel the future of work.
- ¹⁸ Peter Zemsky, Deputy Dean and Dean of Innovation of INSEAD: <u>https://www.insead.edu/news/2018-gtci-talent-diversity-competitiveness-fuel-future-of-work</u>