

# ***e-SKILLS IN EUROPE***

## **GERMANY**

### **COUNTRY REPORT**

JANUARY 2014

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# 1 Overview

The demand for ICT practitioner skills is closely linked to the skills shortage in this area. Education and further education is a critical success factor in the ICT sector, and is expected to gain more importance still in the future. Almost all companies surveyed in a recent study by BITKOM, the German ICT industry association, indicated the importance of education for the fight against the lack of skilled workers and emphasized its positive effect on innovation. With an annual average of 4.5 training days per employee, the ICT industry is at the forefront of all sectors in the country. A debate has started among experts about the specific qualification of leaders in the ICT area, i.e. e-leadership skills, as indicated in the BITKOM report.

In spite of the continued discussion about skills shortages, the number of ICT professionals with a regular employment contract has increased in recent years: Around 191,000 were counted by VDI, the German association of engineers, in 2011 – 7,700 more than the year before.

The number of students in ICT related fields also increased by 7,000 to 48,400; the increase is partly a one-time effect, however, of the shortening of schooling to 12 years in some of Germany's *Länder* as well as the abolishment of compulsory military service).<sup>1</sup> In 2010 the number of students increased in "Electrical engineering and information technology" by 7.5 percent. At universities, the number increased by 8.7 percent, in universities of applied science by 6.7 percent<sup>2</sup>. Importantly, the number of female students rose in the academic year 2010 compared to 2009 by 11% according to data from the Federal Statistical Office and calculations of the office of National Pact for Women in MINT Careers "Go MINT".<sup>3</sup>

One of the main challenges affecting e-skills supply has to do with trends in demographic developments. In fact, ageing has been identified as an emerging problem for companies in the STEM sectors. 2.1 million working academics who have a degree in mathematics, computer science, natural sciences or engineering, are between 56-65 years old in 2013. This implies that in the coming years more and more STEM graduates will drop out of the labour force due to age. Around the year 2025 almost 50% more STEM professionals will retire each year than today.<sup>4</sup>

It is against this background that there is a consensus among experts in Germany that current growth rates in numbers of graduates from universities and colleges will not be sufficient to meet the demand.

In response, new qualification courses have been implemented with the intention to suit the demands from industry and commerce (e.g. IT "Professional"). However, these occupations are not as yet very well known in professional circles. A lot of different certificates at all levels exist, such as Master Levels, Bachelor's Degree, IT professionals, etc. They can be hard to distinguish from each other. Sometimes the course design is so specific that those with multiple professional IT-related tasks (IT Management, Project Management et.) can hardly find out the right one for their personal demands.<sup>5</sup>

Experts agree that companies will increasingly have to respond with education and further education measures themselves, also including measures targeting their older employees (50+) and

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<sup>1</sup> <http://www.computerwoche.de/a/interesse-an-informatik-steigt,2528307><http://www.it-ausbildung-info.de/>

<sup>2</sup> <http://www.komm-mach-mint.de/MINT-News/Partner-News/VDE-StudienanfängerInnen>

<sup>3</sup> <http://www.komm-mach-mint.de/Service/Presse/PM-MINT-Studienanf-Absolv>

<sup>4</sup> See <http://www.komm-mach-mint.de/MINT-News/News-Archiv/MINT-AkademikerInnen-Aeltere-gehen-in-Rente-AuslaenderInnen-in-die-Heimat>

<sup>5</sup> See for example: <http://www.kibnet.org/fix/files/doc/StudieITwebT2.8.pdf>; <http://www.cio.de/karriere/personalfuehrung/2307240/index.html>

possibly also with outsourcing (often offshoring) to address the current needs of about 38,000 vacancies for IT professionals<sup>6</sup>.

Education profiles need to be adapted to employers' specific requirements for qualification and specialization in the ICT area. This includes a focus on the specific needs of SMEs; future e-leadership skill needs; and innovative ways to integrate learning methods (e.g. online-learning, blended learning, learning-on-the-job) in order to make them better suited to the work context of ICT Professionals.

Furthermore, it appears necessary for companies to adapt recruitment methods to the profiles of prospective employees. This indicates the need for training of HR managers.

There is a strong consensus about these challenges among all main stakeholders in German politics and in the business community. A range of initiatives and projects have been thought up and implemented since 2007. Strategic and operational multi-stakeholder partnerships appear to operate successfully, but need to be further deepened and widened.

Providers of ICT related training and education have been called upon to make their offers more transparent and compatible with Germany's established qualification system. This would also improve awareness of training options within companies.

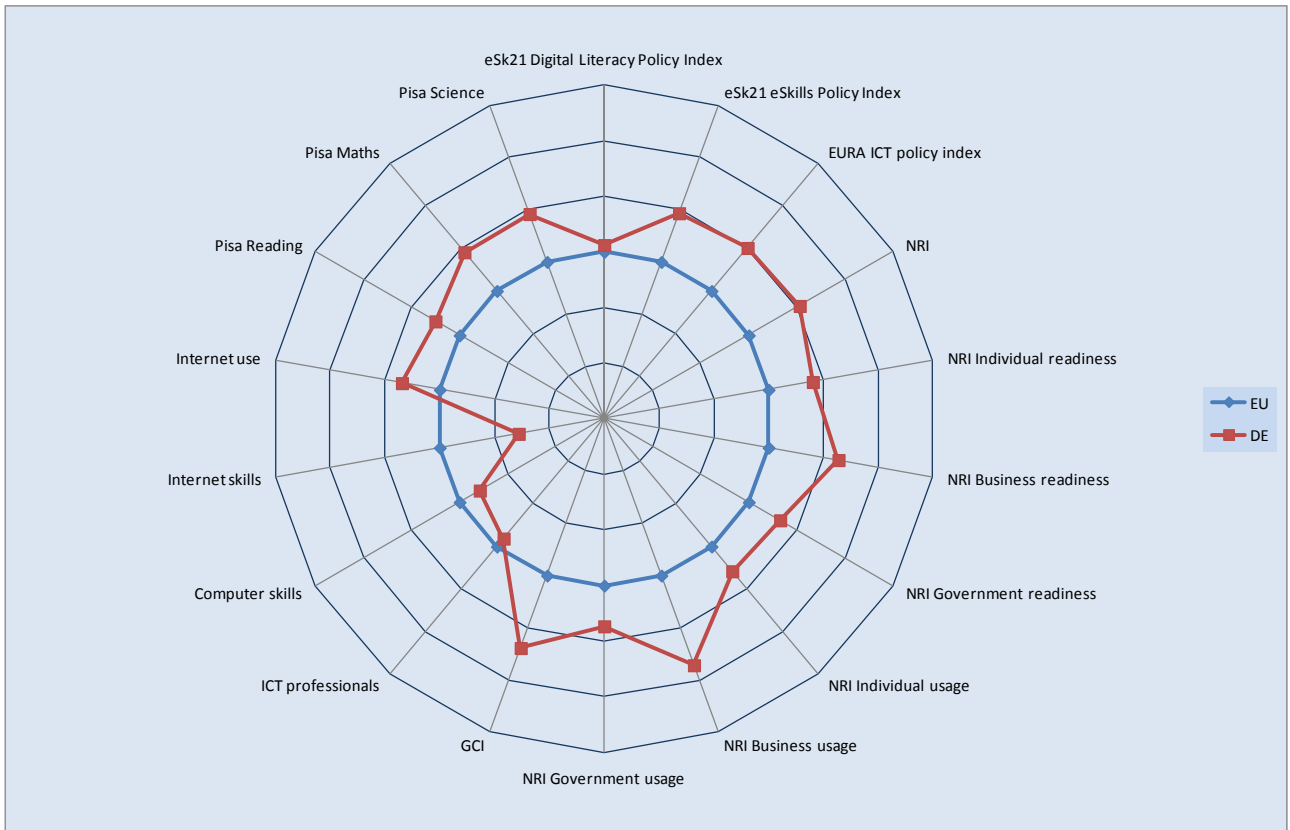
There has also been a lively debate about the country's ability to recruit more suitably skilled workers from foreign nations, and the policy measures which are required to become more attractive in the international "race for talent".

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<sup>6</sup> Source: BITKOM, data from end of 2012

## 2 Indicators on innovation, competitiveness and ICT skills

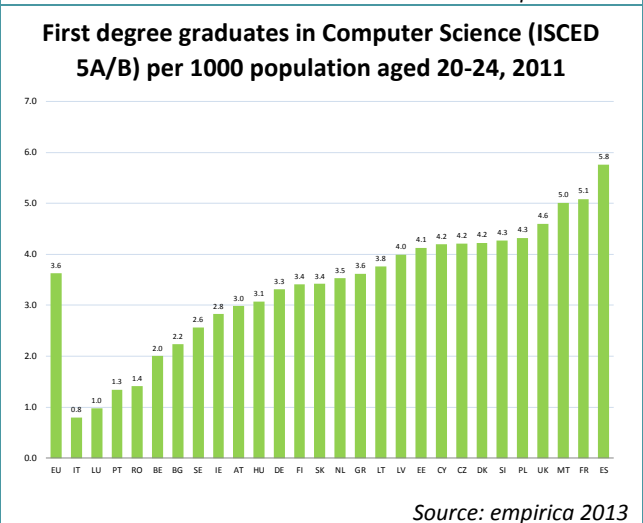
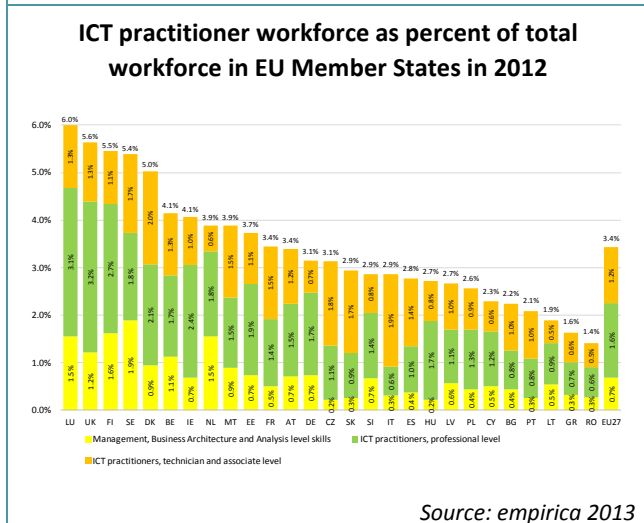
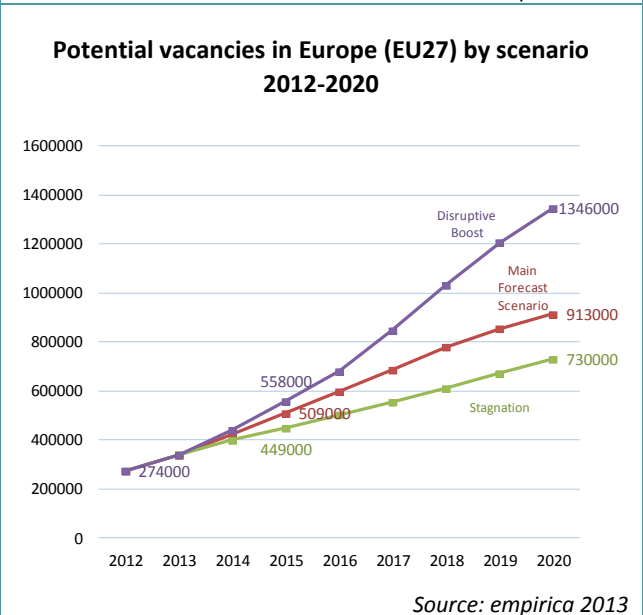
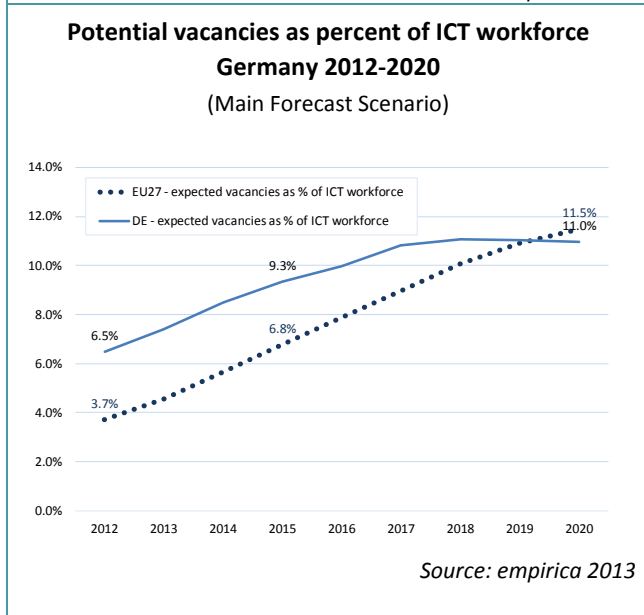
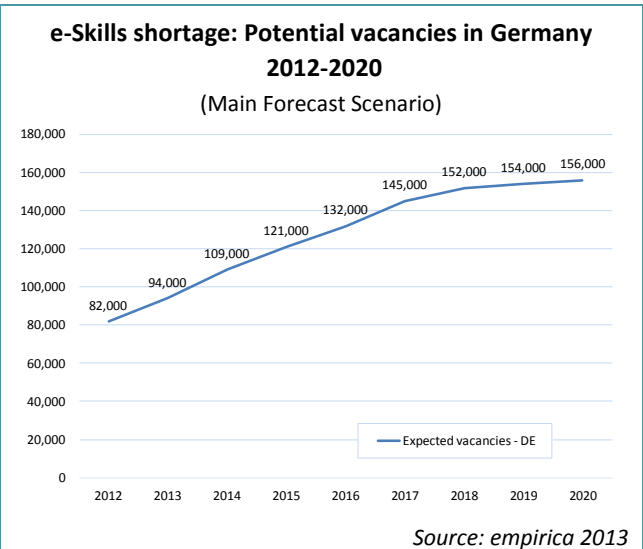
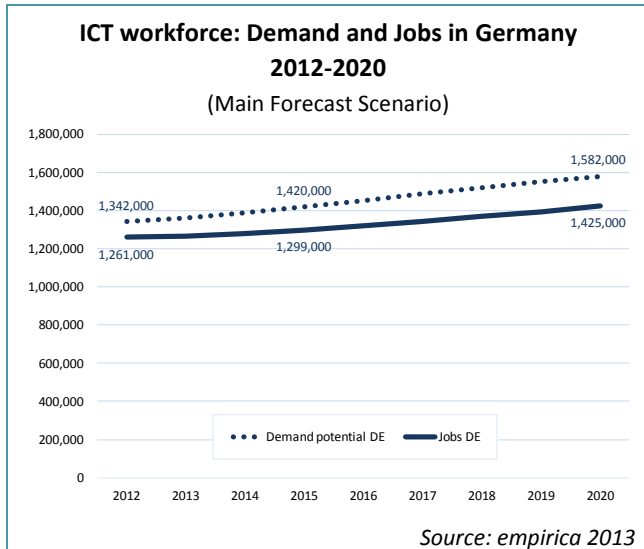
Germany						
	Score 2009/2010	Rank 2009/2010	Score 2011/2012	EU27 Rank 2011/2012	Change (Rank)	Comment
eSkills21 study: 'e-skills' index 2010	3.5	6				Max.: 5.0
eSkills21 study: 'Digital literacy' index 2010	3	10				Max.: 9.0
EuRA e-skills index	4.4	5				Max.: 5.0
ICT practitioners in % of total employment 2012			3.15%	13		EU average: 3.43%
Digital literacy skills of the population 2009/11:						
• Individuals with high level of computer skills	28%	12	25%	17	↓	EU average: 28.52%
• Individuals with high level of Internet skills	6%	21	5%	27	↓	EU average: 13.67%
• Individuals using the Internet (last three months)	77%	7	81%	27	↓	EU average: 71.33%
Global Competitiveness Index (GCI) 2010/12	5.4	4	5.41	3	↑	Max.: 5.61 EU median: 4.52
Networked Readiness Index (NRI) 2010/12	5.2	8	5.14	5	↑	Max.: 5.6. EU median: 4.5
• Individual readiness	5.97	13	5.4	7	↑	
• Business readiness	5.78	2	5.27	3	↓	
• Government readiness	4.7	12	4.75	8	↑	
• Individual usage	4.51	8	5.37	8	↔	
• Business usage	6.04	3	4.8	2	↑	
• Government usage	4.7	12	4.67	8	↑	
PISA scores (2009) in:						
• Mathematics	513	4				EU median: 493
• Science	520	4				EU median: 498
• Reading	497	6				EU median: 489



### 3 E-skills demand and supply forecasts 2012 – 2015 - 2020

Germany			
	DE	Rank EU27	EU27
ICT practitioner workforce 2012	1,261,000	2	7,403,000
ICT practitioner workforce 2012 as percent of total workforce	3.1%	13	3.4%
Assumed excess demand 2012	82,000	1	274,000
Forecast excess demand 2015	121,000	2	509,000
Forecast excess demand 2020	156,000	3	913,000
Forecast ICT practitioner jobs 2015	1,299,000	2	7,503,000
Forecast ICT practitioner jobs 2020	1,425,000	2	7,950,000
Workers 2012 - Management, business architecture and analysis level	295,000	2	1,477,000
... as percent of total workforce	0.7%	9	0.7%
Workers 2012 - ICT practitioners, professional level	693,000	2	3,393,000
... as percent of total workforce	1.7%	9	1.6%
Workers 2012 - ICT practitioners, technician and associate level	273,000	4	2,532,000
... as percent of total workforce	0.7%	22	1.2%
Growth core ICT workforce 2001-2010	2.7%	18	3.0%
Growth core ICT workforce 2008-2010	4.4%	7	2.6%
Growth core ICT workforce 2011-2012	3.8%	20	3.9%
Growth broad ICT workforce 2011-2012	2.0%	18	1.8%
ISCED 5A/B first degree graduates in Computer Science, 2011	16,526	3	113,000
... graduates per 1000 population aged 20-24	3.3	17	3.6
... graduates 2011 as percent of 2006 (= peak EU)	116%	8	88%
Vocational training graduates in Computer Science, 2011	14,169	2	67,000

Sources and notes: see annex.





## 4 Policy and major stakeholders initiatives

Despite a range of efforts the German education system has not yet succeeded to provide the country's labour market with a sufficient number of qualified employees and STEM (Science, Technology, Engineering and Mathematics) professionals. Available data suggest that there has not yet been a significant reduction of the shortage in ICT practitioners. In spite of a large number of individual initiatives, Germany lacks a general and comprehensive e-skills strategy covering both for IT user and ICT practitioner skills.

Many industry actors and other stakeholders have started initiatives to implement the European e-Skills Agenda at national and regional level. Government activities focus on digital literacy and the improvement of the vocational training for the ICT industry. Germany is one of a few countries in Europe where non-academic vocational training plays a significant role in educating ICT practitioners for the labour market. Hence some effort has gone into coordinating and updating the curricula for new ICT jobs.

The implementation of the e-Skills Agenda at university level is overlapping with the reform of the university education following the Bologna process. There is a general openness on government side to collaborate with industry partners. Due to the split responsibility for education policy between the *Länder* (provinces) and the national government, activities need a good deal of coordination. Until now, no coordinating actor or institution has been established, which provides a challenge to progress in the e-skills domain in Germany.

Major policy initiatives with relevance to e-skills include:

- **Germany Digital 2015** is the current ICT strategy of the Federal Government. It was adopted in November 2010 and provides the framework under which the different ministries plan and implement their ICT related policies. The strategy has a clear focus on strengthening Germany as a business location. The main objective in the "Education, Media Competence and Integration" domain is, amongst others, to push for innovation in vocational training, continuing education and further education. A further core focus is on roll-out of an "intelligent networked education infrastructure".
- **Skilled Workers Offensive** ("Fachkräfteoffensive"): This programme of the Federal Ministry of Economy and Technology comprises a range of measures to tackle skills shortages in Germany's STEM sector. It includes a high-profile campaign (in cooperation with the Federal Ministry of Labour and Social Affairs and the Federal Employment Agency) to attract qualified professionals from abroad to come and work in Germany. Another measure is the support of private sector's efforts to provide their staff with advanced training opportunities and to better harness the potential of older employees. A centre of excellence was set up to provide SMEs with practical assistance and best practice examples about how to cover their skills requirements.
- The **Qualification Initiative for Germany** ("Get Ahead through Education") was launched in 2008 by the Government and the Federal States. A major objective of the initiative is to get more young people interested in the STEM professions, for which purpose a range of actions were initiated targeting different age groups, e.g. provision of basic scientific experiences for children, a push to increase the regular number of lessons in STEM subjects in schools, a scheme for sending representatives of the STEM sector as mentors into schools, and **Go MINT!, the National Pact for Women in STEM Careers** (see description in next section).
- A "**New Innovation Concept**" was launched by the Federal Minister of Economics and Technology in May 2012 under the title "**Desire for Technology**" ("Lust auf Technik"). The concept further develops the Ministry of the Economy's technology policy into a comprehensive approach to innovation. Supplementing the federal governments High-Tech

Strategy, the New Innovation Concept is to form the basis for a qualification offensive and the development of ICT-related qualification modules for vocational education and training.

- The annual **IT Summit** hosted by the German Ministry of the Economy (BMWi) brings together policy makers and ICT industry, with concrete actions being prepared and agreed upon in a number of working groups including one on "**Education and Research for a Digital Future**". A communiqué was adopted in 2009 containing declarations of intent with regards to broadband rollout, intelligent networks, supporting R&D in SMEs, government IT investment, strengthening software development competences, supporting Green IT, addressing demographic change and health, fostering trust and security in electronic networks, consumer protection, accessibility of e-government, data protection, e-justice and the potential of ICT for education and qualification. Of major importance for the present study, the latter point includes monitoring of STEM related opinions and trends. Against the background of the adoption of the ICT-Strategy "Deutschland Digital 2015", the 7th IT Summit took place in November 2012. The Workgroup 6 "Education and Research for a Digital Future" focused on two key areas: "education and further education of skilled workers" and "research for a digital future" ("Futureproject Industry 4.0"). Special emphasis was placed on qualification of IT-leaders, the core objective of the "Softwarecampus" launched at the IT Summit in 2011. A newly launched initiative, the "Academy Cube" (see below), seeks to qualify young skilled workers from all of Europe through an eLearning platform to improve their chances on the German labour market.

Industry stakeholders such as **BITKOM**, the German ICT industry association, have played a major role in pushing policy makers to deal more with digital literacy and supply of ICT practitioners, e.g. by pointing out the continuing need to make progress in modernising the education system. Important initiatives in which industry has taken the lead include:

- The **Software Campus** has been set up in 2012 to develop innovative academic ICT projects with an individually tailored training curriculum with outstanding academics and managers at its core. Software Campus is a multi-stakeholder partnership of major stakeholders from industry and research, with financial support from the Federal Ministry of Education and Research (BMBF) of up to € 100,000 for each IT project. See next section for a description.
- **Academy Cube** is an online platform targeting academics, young professionals and job seekers from across Europe. The platform provides job offers and information about what courses will qualify them best for their desired job. Immediately they can attend those courses online, for free. In particular, e-learning-based training courses for professionals in the IT and engineering area are provided. The Academy-Cube initiative is an alliance of international companies, e.g. DFKI, BITKOM, EIT ICT Labs, Festo Didactic GmbH, Society for Computer Science e.V., LinkedIn Germany GmbH, Microsoft Germany, Robert Bosch GmbH, SAP AG, Software AG, ThyssenKrupp AG, University Duisburg-Essen etc. and public institutions, e.g. the Federal Employment Agency.
- **e-Skills im Mittelstand – Potenzial Mitarbeiter** ("e-Skills in SMEs – Employees as Potential"), co-ordinated by a major publisher in cooperation with the Ministry of Economics and other stakeholders, seeks to boost ICT skills of employees in SMEs (see next section for a description);
- The **IT-Fitness** initiative by BITKOM, the German Public Employment Agency and a range of major industry players (e.g. Microsoft, Cisco, State Street Bank, Signal Iduna, Bahn AG, Zentralverband des Deutschen Handwerks, Randstad), education providers and NGOs has set up an e-learning platform free of charge with special focus on disadvantaged groups and awareness campaigns;
- The **Cisco Networking Academy Programme** has entered a partnership with public sector education providers in all 16 German *Länder*, often in the area of education and training of

apprentices and students in vocational training. Joint agreements on the use of the Academy programme in public schools exist with several state governments. There are 339 active teaching Networking Academies (status: February 2012) and 400+ partner institutions in total. Total number of students in Germany was 33,500+ at that time.

- **Cisco meets APO** is a cooperation initiative between a state backed (APO IT) and a vendor backed (Cisco Networking Academy Programme, CNAP) qualification system for lifelong learning addressed to ICT practitioners (see description in next section).
- **IT 50 plus** is a joint initiative of the trade union IG Metall and BITKOM, the German association of ICT employers, with the main goal of improve employment and employability of senior employees in the sector (see description in next section).
- The National STEM Forum (**Nationales MINT Forum**) was established in 2012 on the initiative of the German Academy of Science and Engineering (acatech) and the BDA/BDI initiative "MINT Zukunft schaffen" (see below). Today, the National STEM Forum brings together 24 stakeholders who have joined forces to advance education in the fields of mathematics, computer science, natural sciences and engineering. Members include major foundations, academic institutions, professional associations, university alliances and other initiatives. The Forum deals with the entire STEM education chain, from early childhood education and extra-curricular, vocational and academic education to further education and lifelong learning. The Forum supports the initiatives of individual members and promotes joint activities. In a number of working groups, strategies for how to promote and improve STEM education are developed, resulting in policy recommendations, common quality standards and joint projects.

Initiatives for attracting young individuals to think about a career in ICT include the following:

- **Technikum**, an internship project offering internships in enterprises active in the STEM fields for vocational and academic orientation of secondary level school graduates. Graduates get to know techno-scientific vocations during this internship.
- The **ROBERTA** robotics for girls campaign is an example for ICT job promotion in Germany, starting from the premise that robots are an ideal educational tool for hands-on introduction to technology. ROBERTA started in 2009 and is an initiative of Fraunhofer IAIS, supported by the EU and the German Ministry for Education and Research. It is widely considered a success as it has helped establish robotic workshops at a large number of schools, enabling teachers to qualify in the field and also often creating partnerships with companies.
- The **National Initiative to Promote Young Information Scientists**: Aimed at children, teenagers and young adults, the initiative applies age-specific promotional instruments to gain the attention of young individuals.

**Awareness raising initiatives** include the industry-initiated platform "**MINT Zukunft schaffen**" (Making STEM Future) and the government-initiated **Girls' Day**, which has existed for 13 years already. Both are described in the following chapter.

Vendor-initiated qualification and education programmes include:

- The **Siemens Master Programme** "generation21";
- LPI, the **Linux Professional Institute** partnership programme for vocational training schools and universities;
- The **VMware Partnership Programme** for vocational training schools and universities;
- **Oracle Academic Initiative**, a partnership programme for vocational training schools and universities;
- The **SAP University Initiative**, which in cooperation with the Steinbeis Center of Management and Technology (SCMT), the SRH Heidelberg and the Technical University of Munich (TUM), offers training of young managers and professionals. The SAP Corporate Master Programme

trains and promotes excellent young firms and consulting companies from various business fields.

- **SAP** also has as **Bildungspartner** (Training partner) programme in cooperation with Germany's Public Employment Service (BfA). This works as follows: The unemployed are eligible for receiving a voucher from the BfA which they can redeem for a training measure. Among the options available are ICT training courses provided by SAP-certified partners, to which SAP provides training systems and materials. In 2011, about 900 persons attended SAP consultant training and 14,000 attended end user training courses. Internal evaluation indicates that the placement rate into jobs after completion of SAP training is about 70%.

Also to be noted are the National Academy of Science and Engineering **Acatech** and German Academy of Sciences **Leopoldina**, which both take an important position through their monitoring efforts and studies on ICT and e-skills in professions and education, as well as through their activities for fostering the acceptance of science and technology in Germany. Finally, **VDE Association for Electrical, Electronic and Information Technologies**, one of Europe's largest technical-scientific associations, has a range of activities of relevance to the e-skills field. VDE is engaged in promotion of young professional talents as well as youth interested in science and technology. The VDE awards prizes and scholarships to gifted students, graduates and young scientists, and also conducts nationwide competitions like INVENT a CHIP. The **VDE Career Portal** is an online platform targeting young graduates and jobseekers with an interest in ICT/engineering.

#### Summary Assessment of German e-Skills Activities: ●●●●

Although little top level commitment towards an e-Skills Master Strategy could be detected, a large range of policy and stakeholder initiatives is in evidence in Germany. There is an institutionalised stakeholder summit, and a regular monitoring exercise of e-skills (broadly) demand and supply. Major industry stakeholders are very active in training and certification. The level of activity at the regional (*Länder*) level has significantly increased in recent years.

#### Summary Assessment of German Digital Literacy Activities: ●●●

Some measures are taken in the areas of promotion/awareness raising, self learning/self assessment tools and broad training measures. IT-Fitness and IT 50 plus are initiatives reaching out to disadvantaged groups.

#### Summary Assessment of German e-Leadership & Digital Entrepreneurship Activities: ●●●

The Software Campus set up in 2012 is among the first major initiatives in Europe that focuses explicitly on e-leadership skills. It has led to an increased awareness about the need for e-leadership skills and related training and education offers.

Like in the precursor study<sup>7</sup> the assessment of the information gathered resulted in two activity indices, one for digital literacy and one for e-skills computed for each country. These were computed based on data from 2009 and 2013. The e-leadership skills activity index was computed only for 2013, as no data had been collected on this topic in 2009. In the following the focus will be on the e-skills activity index; we first mapped the e-skills activity index values against the Networked Readiness Index (NRI)<sup>8</sup> for each of the 27 Member States.

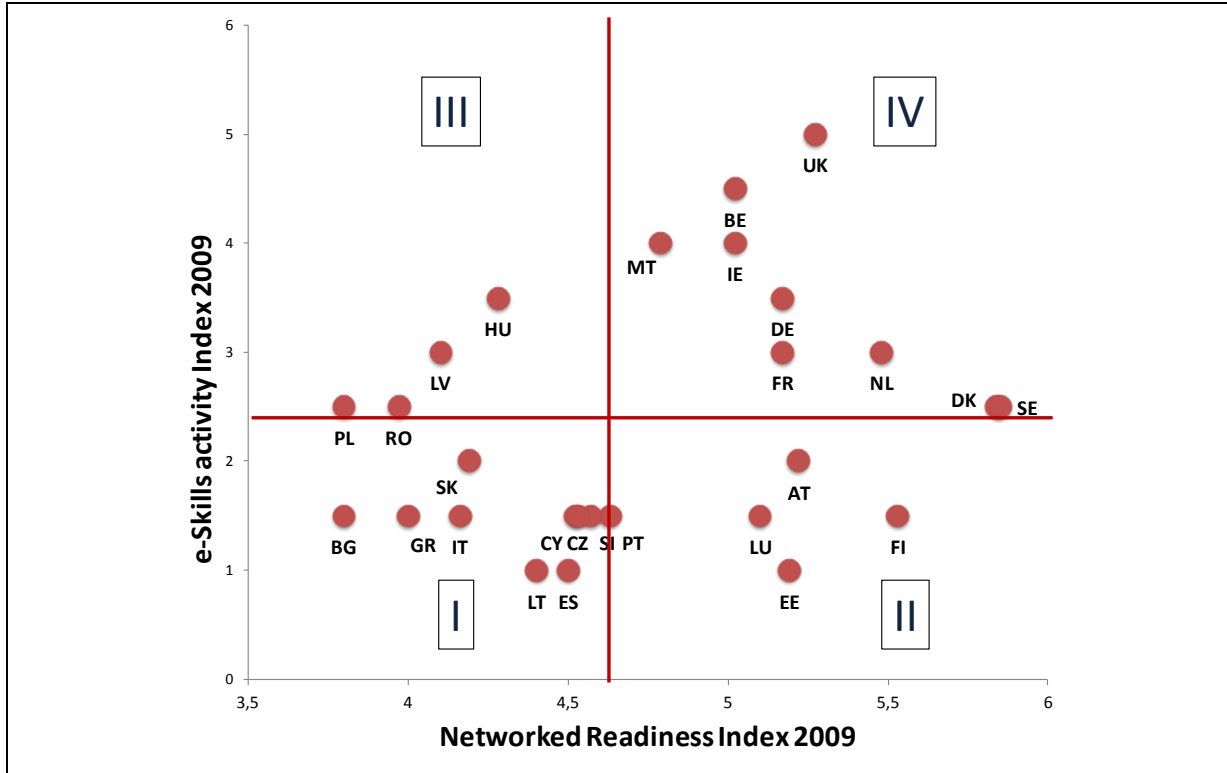
<sup>7</sup> Hüsing, T. and Korte, W.B. (2010) "Evaluation of the Implementation of the Communication of the European Commission 'e-Skills for the 21st Century'", URL: [http://ec.europa.eu/enterprise/sectors/ict/files/reports/eskills21\\_final\\_report\\_en.pdf](http://ec.europa.eu/enterprise/sectors/ict/files/reports/eskills21_final_report_en.pdf)

<sup>8</sup> The World Economic Forum's Networked Readiness Index (NRI) measures the propensity for countries to exploit the opportunities offered by ICT. It is published annually as part of the Global Information Technology Report. The NRI is a

This allows for putting the results of the e-skills policy and activity analysis in the different countries in the wider context of each country’s propensity to exploit the opportunities offered by ICT using data which can be obtained from the country values on the Networked Readiness Index (NRI).

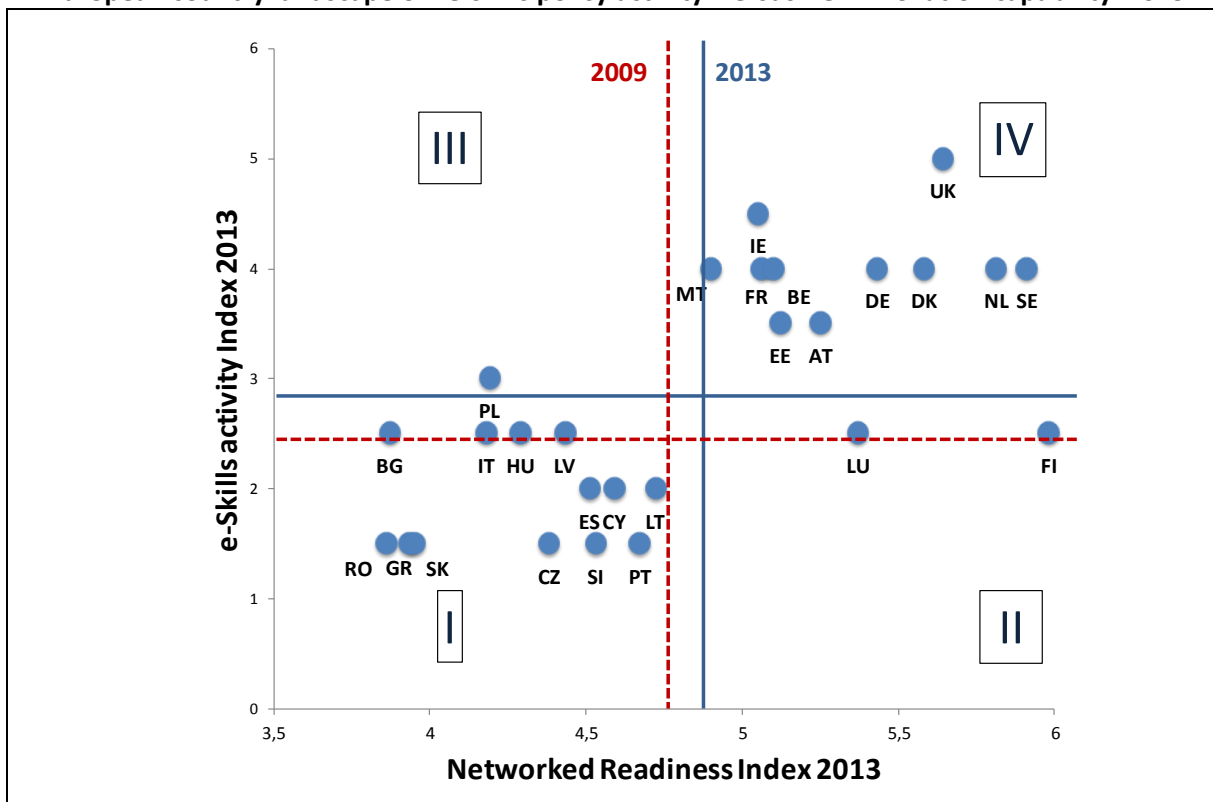
The following figure allows a comparison of the results from this exercise for 2009 and 2013. In the graphical illustrations four quadrants are shown which are built by using the European averages on the NRI and those on the e-skills policy activity index for the respective years in order to group the countries into four main clusters.

**European country landscape on ‘e-skills policy activity’ versus ‘ICT innovation capability’ 2009**



composite of three components: the environment for ICT offered by a given country (market, political and regulatory, infrastructure environment), the readiness of the country’s key stakeholders (individuals, businesses, and governments) to use ICT, and finally the usage of ICT amongst these stakeholders. For further information on the NRI see [www.weforum.org/issues/global-information-technology](http://www.weforum.org/issues/global-information-technology).

## European country landscape on 'e-skills policy activity' versus 'ICT innovation capability' 2013



Overall and for e-skills related policies and initiatives a strong increase of activity levels over the five-year time span can be identified. The unweighted average e-skills policy index score increased from 2.4 to 2.9 between 2009 and 2013. This is encouraging news.

Our analysis revealed that in 2009 three of the four quadrants are well populated by different countries with only 7 countries belonging to the group of top performers both, in terms of e-skills policy index as well as NRI, and 11 Member States constituting those best described as low activity countries (bottom left quadrant).

Five years later the situation has changed significantly; we are now faced with a situation which can be described as a dichotomy in Europe on these indicators: top performing countries as opposed to countries with low activity levels and NRI performance, with only three countries (Poland, Luxembourg and Finland) in transition phases between these clusters.

The group of top performers has grown from 7 to 11 with Sweden, Denmark, Austria and Estonia entering this cluster to which the United Kingdom, the Netherlands, Belgium, Ireland, Malta, Germany and France already belonged in 2009. However, the group of low activity countries is still substantial in terms of numbers of countries with 13 EU Member States – almost 50% showing a below average performance on the NRI and on the e-skill skills policy activity index.

EU Member States fall into two very distinct groups: 41% of the Member States are top performers, almost 50% are low activity countries, and 11% located between these two clusters.

While the former have been successful on the e-skills front and capable of exploiting ICT to become innovative and more competitive the latter group of low activity countries still has a rather long way to go to achieve both.

A look at the Member States' positions in the NRI ranking (Networked Readiness Index) reveals that again, those countries with high NRI positions also show high e-skills policy activity levels. The countries moving up in terms of migrating into the 'top performers' cluster include Sweden,

Denmark, Austria and Estonia, as well as the Netherlands and France which managed to further increase their e-skills policy activity level.

Countries at the risk of losing ground include Hungary, Latvia and Romania which dropped down into the first cluster of countries, i.e. those lagging behind.

**European country clusters on 'e-skills policy activity' versus 'ICT innovation capability' 2013**

<b>I : low NRI + Low level of e-skills policy activity</b>	<b>II : High NRI + low level of e-skills policy activity</b>
Romania, Greece, Slovakia, Czech Republic, Slovenia, Portugal, Spain, Cyprus, Lithuania, Bulgaria, Italy, Hungary, Latvia	Luxembourg, Finland
<b>III : Low NRI + high level of e-skills policy activity</b>	<b>IV : High NRI + high level of e-skills policy activity</b>
Poland	United Kingdom, Ireland, Sweden, Netherlands, Denmark, Germany, Belgium, France, Malta, Austria, Estonia

## 5 Selected multi-stakeholder partnerships

The following is a list of multi-stakeholder partnerships of major relevance to the e-skills issue:

- **Qualification Offensive Lower Saxony:** The initiative wants to effectively address the current skills shortage especially in the STEM area and thus respond to the demographic and structural challenges of the labour market, focusing on one of Germany's *Bundesländer*, Lower Saxony. The partners of the campaign, lead by the Entrepreneurs' Association Lower Saxony (UVN) in cooperation with other business associations, unions, the Federal Employment Agency, Chamber of Industry and Commerce and the Federal State of Lower Saxony, deem it necessary to increase significantly the number of young people in technical education or STEM studies. Key objectives of the initiative are: 1) To promote the professional orientation on commercial-technical professions and STEM studies; 2) To prevent academic skill shortage and increase the number of STEM graduates; 3) To encourage further education leading to an academic degree for people already in employment.<sup>9</sup>
- **Skilled Workers Offensive (Fachkräfteoffensive):** A number of measures are included in this initiative lead by the objective to tackle the problem of missing skilled workers in Germany's engineering sector. The programme was initiated by the Federal Ministry of Economy and Technology in 2012 and is ongoing. Amongst others a campaign "Make it in Germany" was launched together with the Federal Ministry of Labour and Social Affairs and the Federal Employment Agency to attract qualified professionals from abroad to work in Germany. Another measure is the support of private sector's efforts to provide their staff with advanced training opportunities and to better harness the potential of older employees. The initiative's activities are targeting qualified professionals not yet employed according to their potential, employers which should invest more in further training, the wider public in Germany and also qualified professionals abroad.
- **Software Campus (Leadership qualification) [selected as Good Practice]:** Industry, universities and the Federal Government have set up Software Campus in order to promote the development potential of young talents and to help create a new generation of managers with an advanced ICT background. Software Campus is aimed at outstanding Master's and PhD students of information technology and young professionals from other disciplines with the relevant IT knowledge. Software Campus brings together the most successful leadership trainings provided by the industry partners involved. Six modules enable participants to develop leadership, method, social and personal competences. All Software Campus participants will be personally supported by a top executive from an industry partner with strong leadership qualities – a mentor. The young ICT professionals are to benefit from advice and insight into the daily work of ICT leaders. All participants immediately become part of the active network of top managers of leading German ICT companies and outstanding scholars and researchers. In addition, Software Campus alumni create their own network of ICT industry decision-makers. A first target was to include around 100 ICT PhD students, ICT Master students and students from other ICT-related disciplines into the programme by the end of 2012. The total budget amounts to € 10 million, funded by the Federal Ministry of Education and Research. Industry partners include major names such as Bosch, DATEV, DHL, Deutsche Telekom, SAP, Siemens, Software AG, Scheer Group and Holtzbrinck. Academic partners are TH Berlin, TH Darmstadt, KIT, TU München, Universität des Saarlands, DFKI, Fraunhofer, Max-Planck-Institut für Informatik.
- **Girls' Day:** The campaign, initiated by the Federal Ministry of Education and Research in cooperation with the Federal Ministry for Family Affairs, was organised for the first time in

<sup>9</sup> [http://www.mw.niedersachsen.de/portal/live.php?navigation\\_id=5647&article\\_id=15607&psmand=18](http://www.mw.niedersachsen.de/portal/live.php?navigation_id=5647&article_id=15607&psmand=18)



2001 and since then has taken place each year. It intends to encourage the surroundings of the young women – i.e. families, school, media and employers – to participate in the campaign and change their common attitudes towards vocational orientation. Information material, an all-embracing interactive website and an individual advisory service provide support for all target groups. The measures target girls and young women from age 10 upwards, with the aim to arouse interest in technical issues and thus to influence the vocational choices of girls in a positive way. For companies, Girls' Day has evolved as an important instrument of their recruitment policy. In 2013 9,003 events are scheduled to take place in the context of the initiative. The initiative brings together STEM enterprises, enterprises with technical departments and technical training facilities, universities and research centres, Chambers of Industry and Commerce, the German Trade Union Association, the Federal Employment Agency, the Employers Association, the Federation of German Industry, and many others in a concerted effort to increase the share of women in the STEM sector.

- **Academy Cube:** This is a project of the Working Group "Education and research for the digital future" of the 7<sup>th</sup> National IT Summit. The initiative combines the experience and networks of European companies, research institutions and universities. Target groups include academics, professionals and job seekers in the STEM area. The platform is an invitation to broaden participants' knowledge and increase labour market opportunities. Employers are to benefit from the platform as a first point of contact to identify and attract talent. Job seekers are to use the website to make contacts with employers and to build expertise related to their area of expertise.
- **"e-Skills in SMEs – Employees as Potential" (e-Skills im Mittelstand - Potenzial Mitarbeiter):** This initiative of BestPractice-IT (an online campaign targeting SMEs) together with SAP, the global IT provider, and Deutsche Messe AG aimed at continuous updating of the IT skills of employees working in SMEs. It does so by advocating the interests of SMEs in defining ICT curricula and competence frameworks and by entering into a dialogue with policy makers about the active role policy can play in developing e-skills through giving the right incentives for life-long learning of employees of SMEs. Among the recommendations it has made are introduction of a "Lifelong IT Learning Passport", of a quality mark "Computer Professional Company", of a learning module "IT and media competence" for university graduates and lifelong learning in non-STEM fields, and promotion of knowledge sharing among STEM employees. The approach chosen is to kick off a dialogue between SMEs and stakeholders in government, industry, science and related associations.
- **Cisco Meets APO:** This is a cooperation initiative between a state backed (APO IT) and a vendor backed (Cisco Networking Academy Programme, CNAP) qualification system for lifelong learning addressed to IT practitioners. It is run by the union IG Metall together with the Cisco Networking Academy. It aims at skills improvement of employees in the IT industry and the achievement of both e-skills qualifications and certificates in one. In recent years, however, the initiative has ceased to be active with the exception of a smaller programme in the Saarland region.
- **IT 50 Plus:** This is a joint initiative between the trade union IG Metall and BITKOM, the German association of ICT employers. The goals of the initiative are to: improve the employment and employability of senior employees; facilitate the reintegration of ICT practitioners after periods of unemployment; shape the competence development of ICT practitioners with a hands-on approach and according to workplace requirements; further develop the Advance IT Training System (AITTS) to better facilitate unemployed professionals' access to titles and certificates. These goals should be achieved by modelling appropriate personnel development concepts for those who are employed and qualification concepts for those seeking employment. Of particular relevance to this study is the sub-project FuTEx (Future Technologies for Development Expertise) which is aimed at ICT practitioners aged over 40 who wish to qualify in work on real projects, but currently have no chance in doing so.

- **Finish IT [selected as Good Practice]:** This is a project for supporting university dropouts, career changers, immigrants with gaps in their education and IT-interested individuals who want to obtain a vocational qualification in IT in the fastest possible way. "Finish IT" combines IT skills qualification modules with paid internship at a company. The project is sponsored by the Federal Ministry of Education and Research as part of their initiative supporting modular professional certification training programs ("Abschlussorientierte modulare Nachqualifizierung") and is run by Cyberforum e.V., a networking forum of the IT industry in the Karlsruhe region, in cooperation with the City of Karlsruhe and the local Chamber of Industry and Commerce (IHK), the Federal Employment Agency and a number of organisations from the civic society (e.g. alfatraining, Die Chancengeber, Lutz Grub).
- **The Software Cluster:** A large number of universities, companies and research institutions work closely together in this initiative revolving around the key software development centres in the southwest of Germany (Darmstadt, Kaiserslautern, Karlsruhe, Saarbrücken, Walldorf and the surrounding area). A strengthening of the important position held by the Germany economy within the corporate software sector is one of the primary objectives of the Software Cluster. This will be achieved by improving the basic conditions for the software industry, for example via the utilization of shared, application-oriented training courses etc. Since February 2013 providers of training and education in the field of software development can apply to become certified as "official providers of qualification within the Software Cluster".
- **Smart Business IT – IT Excellence for BW:** This regional initiative aims to strengthen the IT-location Baden-Württemberg with a special focus on company software. Qualification of IT-workers is one of the three main strands of the initiative. Measures like further education for IT-professionals, preserving of the potential of older skilled workers and managers, and recruitment of students and trainees are to secure a good local supply of skilled workers also in the future. Activities include set up of "Meta Academy", an institution making existing further qualification and vocational training offers and certifications more transparent; and a mentor programme in which senior specialists (so called "silver professionals") are made available to provide consultancy to IT companies in the region.
- **"Educate yourself" – Initiative for extra-occupational education:** The project objective is to strengthen the vocational training efforts in IT companies, to increase the participation of employees in vocational trainings and, with regard to this, to realise the contractual provisions agreed between the social partners in the companies. To this end, members of the works councils of IBM Germany and T-Systems receive training and support to manage the transformation process within their companies. The initiative was set up by ver.di, the German United Services Union, in 2012 and is to run until 2014.
- **Strategic cooperation between GI and eco:** The Society for Computer Science (GI) and the German Association of Internet Industry (eco) agreed on a strategic partnership in March 2013 to address the skills shortage in computer sciences. Particular importance is placed on joint training of young IT professionals and executives. This will open the opportunity for students at an early point of their studies to gain practical experience in companies of the Internet industry in Germany. In return, eco member companies will have the opportunity to gain access to computer science students when these are still at university, opening the possibility to win them later as employees.
- **IT For Work:** This network of universities, enterprises, municipalities, plus (since 2012) the Association for SMEs in the ICT industry was founded by the Darmstadt Chamber of Industry and Commerce with the target to promote the Darmstadt region as a business location in Germany. Qualification and competence development is seen as an essential task to avoid shortages of IT-professional. From vocational education to postgraduate studies, the region already offers a wide range of IT-skills measures, which so far appear not to have been sufficiently promoted to companies and interested workers.

- **STEM Initiative – MINT Zukunft schaffen:** This is a platform for the public awareness raising initiatives of German's employers and business associations. It was established in 2008 and is comprised of a monitoring system ("MINT-meter") which provides data about the shortage of STEM professionals on the national labour market, plus a database of local, regional and national projects. It also features an ambassador programme; in 2011 alone, more than 5,500 **STEM Ambassadors** were deployed as mentors in schools. Schools can apply to be awarded as STEM-friendly. More than 50 schools were awarded in the first year (2011). The coordination body of the State Ministries of Education (KMK) is the official supporter of the STEM Initiative.
- **Go MINT!:** This, the National Pact for Women in IT Careers is an alliance formed in 2008 as part of the Governments "Get Ahead Through Education" qualifications initiative. Its main goals are to: (a) increase the proportion of female students enrolling in STEM course programmes at least to the level of the European average; (b) increase the proportion of women graduating in a STEM subject at least to the proportion of college/university graduates in the relevant subjects; (c) increase the proportion of women in executive positions at universities, colleges and research institutions by one percentage point per year; (d) to significantly increase the proportion of women in executive positions in the member companies. Stakeholders include major companies, scientific establishments, universities and colleges and higher education associations, employers' and employees' associations and the media. The Federal Ministry of Education and Research and *Länder* governments are involved as supporters and promoters of specific measures. The Pact is seen as very successful: The number of partners could be increases from 46 in 2008 to 100 by the end of 2011. More than 1,000 projects have been initiated. The number of female students in STEM subjects has increased. The second phase of Go MINT! was launched in December 2011; it will last until 2014 and will receive public funding in the amount of around € 4.5 million.

## 6 Success of e-skills policies and activities in meeting the objectives of the EU e-skills agenda and other relevant European initiatives

From the perspective of the enterprises shortage of skilled workers is mainly seen as a qualification mismatch. Graduates often lack key competences such as project management; in addition they lack practical experience and soft skills such as communication and social skills. A lack of economic and technical expertise is also emphasized. In a representative survey, 70% of companies indicated that applicants lack the combination of IT and business know-how. Further it is mentioned that the general qualification of the applicant is deficient (64%), followed by lack of IT expertise (57%), lack of IT work experience (57%), lack of soft skills (51%), lack of key skills such as project management (51%) and lack of IT knowledge width (49%). From companies view the specialists of tomorrow does not only require knowledge of computer science, mathematics and programming, but they also must be talented to understand others and have an intercultural understanding in general.

Companies consider it as urgent to expand the supply of communicative, social and personal key skills as well as a technical expertise. Moreover social skills such as customer orientation, teamwork, conflict management, self-organization competence, problem solving competence, self-directed learning- and working competence, time management etc. are seen as necessary abilities of applicants for new IT- positions. Also knowledge of data security, licensing law, liability law, business administration, project management, personnel management, Marketing and PR should be given.

Specific requirements regarding the content of education are stated from IT specialties, such as the fibre-optic cable technology. Relevant industry associations and interest groups recommend meeting these special occupational requirements better in the existing qualification courses. They see a need for broad skill-profiles with specific technological knowledge on the one hand and a better understanding of business processes and customer relationships on the other.

Learning methods should be adapted to the expertise and working conditions of "Brain-worker" in the IT-Branch. A study found out that the IT-sector has in a manner a pioneer's role regarding innovative education and (self)-learning concepts. Live-online-seminars, web-based trainings and virtual learning platforms have already an important meaning in this field. This should be taken into account, if new qualification measures are planned (BITKOM-study).

Concerning the capability of the country's education system (incl. vocational education & training) to provide the e-skills demanded by employers, the research conducted by the BIBB on labour market demand for the nationwide recognized education "IT Professional". "IT Professional" was created as an alternative to higher education, leading to specialized and product-related certificates. The education is offered by the Chambers of Industry and Commerce. It is based on the requirements of SMEs and rated by providers and graduates as very positive: these way employees can learn at the workplace or extra-occupational.

However, so far there is a lack of broad acceptance of this education system. This is attributed to a lack of awareness and an unexplained relationship with the Bachelor's degree. Here more transparency must be urgently ensured. A finding of the Working Group 6 "ICT for SMEs" of the "ICT summit" proves the need of appropriate IT education offers for SMEs: 90 percent of the 3.5 million small and medium businesses can hardly fall back on their own, trained IT professionals due to the size of their enterprise. Today, most managers in SMEs primarily put their focus on the

operational core competencies within the company and not with the same priority on the use of modern IT. Thus promoting the necessary IT skills among employees could fall behind.<sup>10</sup>

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<sup>10</sup> <http://www.bmwi.de/DE/Service/suche,did=320230.html>

## Annex: data sources

	Source
eSkills21 study: 'e-skills' index 2010	eSkills21 study carried out by empirica. Report available at <a href="http://goo.gl/WKV7r">http://goo.gl/WKV7r</a>
eSkills21 study: 'Digital literacy' index 2010	
EuRA e-skills index	EU-RA 2009: Financial and fiscal incentives for e-Skills: State of play in Europe. Synthesis report. <a href="http://www.e-skills-funding.com/images/stories/PDF/synthesisreport.pdf">http://www.e-skills-funding.com/images/stories/PDF/synthesisreport.pdf</a>
ICT practitioners in % of total employment 2012	LFS data made available by Eurostat
Digital literacy skills of the population 2009/11:	Eurostat, database "isoc_ski"
• Individuals with high level of computer skills	
• Individuals with high level of Internet skills	
• Individuals using the Internet (last three months)	
Global Competitiveness Index (GCI) 2010/12	The Global Competitiveness Report 2011-2012: <a href="http://www.weforum.org/reports/global-competitiveness-report-2011-2012">http://www.weforum.org/reports/global-competitiveness-report-2011-2012</a>
Networked Readiness Index (NRI) 2010/12	The Global Information Technology Report 2011-2012: <a href="http://www.weforum.org/issues/global-information-technology">www.weforum.org/issues/global-information-technology</a>
• Individual readiness	
• Business readiness	
• Government readiness	
• Individual usage	
• Business usage	
• Government usage	
PISA scores (2009) in:	OECD, <a href="http://www.oecd.org/pisa/">http://www.oecd.org/pisa/</a>
• Mathematics	
• Science	
• Reading	

Indicator	Source	Further remarks
ICT practitioner workforce 2012	Eurostat Labour Force Survey. Some imputations and assumptions not in the original data but done by empirica apply	The definition can be looked up in the final report, Gareis et al. 2014: E-SKILLS: MONITORING AND BENCHMARKING POLICIES AND PARTNERSHIPS IN EUROPE.
ICT practitioner workforce 2012 as percent of total workforce		LFS based, number of ICT practitioners / number of workers in all occupations
Assumed excess demand 2012	Empirica, IDC	This is calculated using the percentage of vacancies per existing job and is based on a survey carried out in 2012. As some countries were not covered, several assumptions apply
Forecast excess demand 2015		Forecasts are scenario based and the methodology can be found in the final report (see above). Forecast of demand in the six largest countries (DE, UK, FR, IT, ES, PL) is based on country specific economic scenarios, for the 21 smaller countries only an aggregate scenario was developed and figures allocated according to ICT employment shares.
Forecast excess demand 2020		
Forecast ICT practitioner jobs 2015		
Forecast ICT practitioner jobs 2020		
Workers 2012 - Management,	Based on Eurostat Labour Force	LFS based, definitions can be looked up in the final

business architecture and analysis level	Survey, some definitions and calculation by empirica. Some imputations and assumptions not in the original data but done by empirica apply.	report.
... as percent of total workforce		
Workers 2012 - ICT practitioners, professional level		
... as percent of total workforce		
Workers 2012 - ICT practitioners, technician and associate level		
... as percent of total workforce	Based on Eurostat Labour Force Survey, some definitions and calculation by empirica. Some imputations and assumptions not in the original data but done by empirica apply.	ISCO-88 groups 213 and 312. Due to the break in series in 2010/11 only partly comparable to later data.
Growth core ICT workforce 2001-2010		
Growth core ICT workforce 2008-2010		
Growth core ICT workforce 2011-2012		ISCO-08 groups 25 "ICT professionals", 35 "Information and communications technicians".
Growth broad ICT workforce 2011-2012		Equals the "ICT practitioner workforce"
ISCED 5A/B first degree graduates in Computer Science, 2011	Eurostat, database "educgrad_5"	This figure represents a count of first degrees in ISCED 5A and first qualifications in 5B. See discussion of this indicator in the final report.
... graduates per 1000 population aged 20-24	Eurostat, databases "educ_grad5" and „demo_pjangroup"	Graduates as above. The denominator is used to make data comparable but there is no age restriction in the number of graduates. Some imputations and assumptions may apply.
... graduates 2011 as percent of 2006 (= peak EU)		
Vocational training graduates in Computer Science, 2011	Eurostat, database "educ_grad5"	Number of Computing graduates in Upper secondary education (level 3) - pre-vocational and vocational programme orientation and Post-secondary non-tertiary education (level 4) - pre-vocational and vocational programme orientation. Some imputations and assumptions may apply.