Sharing Inspiration 28. März 2019

14:10 – 15:30 Workshop Rooms

Policy: Promoting Stem and digital competence in the EU/Friederike Sözen – Austrian Federal Economic Chambers (Wirtschaftskammer Österreich)

Industry Role	Technology Supplier and Employer – Industry between all chairs in STEAM?
Moderator	Emir Demircan (SEMI Europe)
Panel	Helena Lovegrove (Digital Europe) Friederike Soezen (WKO)
SEMI	SEMI Is the global industry association representing the electronics manufacturing supply chain, connecting over 2,000 member companies and 1.3 million professionals worldwide.
Growing demand in high tech industry: a brief overview of the changing skills needs and some insights for the future…	According to Cedefop's European skills and jobs survey (ESJS), the key 5 skills for science and engineering associate professionals are *problem solving, job-specific skills, learning, teamwork and planning*. Tasks within occupations for Science and engineering technicians in EU in 2016. The top three are Gather and evaluate information, Creativity and resolution and Autonomy These skills could support employees in this occupation to also tackle anticipated future skill challenges. Almost half of the workers in this occupational group hold medium-level qualifications, while one in ten has low-level qualifications. Balance among the levels of qualification is expected to remain roughly intact in the next decade, except from the share of highly qualified workers that will reach about 42% (rising by 20% percentage increase). Science and engineering associate professionals are employed across economic sectors, but almost half of them are concentrated in five sectors: *Construction, wholesale and retail trades, architecture and engineering, basic metals & metal products and other machinery & equipment.* Compared to 2015, all these sectors (but basic metals & metal products that expect a slight decline) will employ more of these workers by 2025, with wholesale and retail trade foreseen to have the highest rise, of almost 25%. Science and engineering is a broad umbrella term for multiple fields and disciplines such as *life sciences, computer science, automobile engineering* . Therefore, very different drivers may affect workers in this occupational group or the same drivers may affect their jobs and skills in distinctive ways. As construction is the most significant employer for this occupational group, developments in the sector will have a weighted prominence. Technological advancements introduce new ways of planning and building in construction of infrastructure. Workers employed in this

	sector will subsequently need to have pertinent skills, as will science and engineering professionals. It is understood that technology already affects all sectors and thus jobs across the economy. Particularly for these workers, advancements in tools, machines and processes in manufacturing will not only revisit their must-have skills, but also increase the risk of replacement due to automation. At the same time, if manufacturing that uses 3D printing takes off, smaller units carrying out specialised jobs may come into existence, influencing jobs and labour demand in industry sectors that provide specialised capabilities and services connected to manufacturing. In the long-term, more specialised skills with technical proficiency across multiple industry segments where manufacturing capabilities play a part are also likely to be in demand. The same applies to a wide range of other occupations within science and engineering associate professionals, from geology technicians who may be employed in mining or building construction, where innovations such as higher-definition surveying and geolocation are expected to soon change the game; to air traffic safety technicians. •Increased demand for interoperability, globalisation, and growth in smart devices could lead to exponential growth in standardisation activity. There is already increased activity on standards in relation to 5G, the internet of things, 3D printing, and autonomous vehicles. This trend is expected to lead to increased demand for science and engineering associates who work on technical and operational specifications of products in multiple industry sectors. This growth in standards and patents is likely to continue and result in increased demand for science and engineering associates in professions related to standardization activities. Due to increased standardisation, some of the more specialised technical and operational positions may be lost as some of the existing practices and standards become obsolete. (CEDEFOP, 2017, Skills Panorama) "3D printing, resource-efficient sustainable production and robotics are all seen as strong drivers of employment growth […], in light of a continued and fast-growing need for skilled technicians and specialists to create and manage advanced and automated production systems." The Future of Jobs, World Economic Forum, 2016
Concerns about quantity and quality of STEM graduates: do we have a shortage of STEM skills in Europe? Or we just don't use what is available?	When it comes to the question of what influences the need for future STEM skills for STEM professionals and related professionals, there are a variety of societal, technological, economic and political factors that make predictions in this area relatively difficult. Some important trends to mention are f.e. the **technological convergence**, namely the fusion of different technologies, in particular the areas of nanotechnology, materials technology and microelectronic sensor technology or photonics, which enable completely new products or technical services and functionalities. Technology convergence requires future STEM professionals to work

	together with specialists from a wide variety of scientific and technical fields and is considered a key prerequisite for technological innovation (keyword: interdisciplinary / transdisciplinary competencies). A second oft-cited trend is the topic of big data and the digitization of the production and service sectors. Cloud computing and the Internet of Things enable the full and integrated use of digital technologies in advanced manufacturing systems (Industry 4.0) and services. As a result, R & D activities will build on more and more data and teams working with ICT across multiple locations around the world. This requires a higher degree of modern technical expertise from STEM professionals, e.g. to be able to make better use of sensor technologies in new products. Furthermore, design and innovation skills are needed to identify and evaluate new market opportunities. At present, the global demand for data analysts and data visualization experts is increasing with competences in statistics, mathematics and computer science combined with business and innovation expertise. Growing demand for STEM professionals capable of interdisciplinary collaboration across disciplines is driven not only by technology convergence, but also by global specialization trends in research and development (R & D) and by the fact that innovation processes need to run faster and faster, for which teams that are needed across organizational, geographic and cultural borders. There is shortage of STEM professionals all over Europe. The UK STEM Skills Indicator suggests that nine in 10 STEM businesses have found it difficult to hire staff with the required skills in the last 12 months. The STEM skills shortage findings come in a time of significant technological, economic and societal change. As a result, the recruitment process is taking much longer for the majority of STEM employers, pushing many to turn to expensive temporary staffing solutions; hire at lower levels and train staff in-house; and inflate salaries to attract the right talent. Around half of STEM businesses are looking abroad to find the right skills, while seven in 10 are hiring candidates without a STEM background or simply leaving positions empty. How will the STEM skills shortage effect the sector? Employers are concerned that the EU could fall behind in terms of technological advancement or lose its research and development credentials. Some also warn that a lack of talent could put off foreign investment in the sector. Building future skills will be key to maintaining the EU's standing in the STEM sector. Thus, governments should invest in mathematics, digital and technical education programmes. However, businesses will also need to start investing in sustainable talent now. Nearly one in five STEM businesses that are finding it difficult to recruit, admit that employers need to do more to attract talent to the sector. STEM Learning is therefore calling for businesses to join

	its efforts to inspire young people in local schools and colleges and help grow the future workforce. The shortage is a problem for employers, society and the economy, and in this age of technological advancement, the EU has to keep apace. MS need to be in a better position to home grow their talents, but it cannot be left to government or schools alone – businesses have a crucial role to play too. The Cedefop Skills Panorama 70 gives a recommendation on how to meet the challenges of new skill requirements for future natural and engineering professionals: _ An important approach is taken here in the area of "in-house training" by the companies themselves in order to further develop both job-specific and transversal skills, such as in the field of leadership, management expertise or entrepreneurial thinking. National authorities could also raise the skill level of in-house training by promoting particularly innovative skills development training. _ Another issue is twinning or joint action between public authorities, social partners, businesses and other interested groups to speed up skill shortages and / or speed up appropriate education and training, especially when dealing with relatively young industries , for the very specific new skills and knowledge needed. Partnerships should also be "outside the classroom" (for example in the field of study visits or internships in companies). _ Another important topic is increasing the attractiveness of STEM subjects in primary, secondary and tertiary education. In order to make STEM topics more attractive, it is recommended to include teachers and trainers as well. Teachers should be enabled by their education to combine science and engineering topics with current developments, trends and issues (keyword climate change, sustainability, environmental technologies, etc.). These efforts should go hand in hand with innovative and more effective career guidance. Some countries in the EU now have special initiatives when it comes to this
Gender gap in STEM: what are the best practices? How to fix it? What is the time frame? How can we tackle the root causes of gender divide in STEM?	Some countries in the EU are now taking specific initiatives to increase the attractiveness of women's STEM careers in order to increase the diversity and participation of women in science and engineering. The European Commission is also making some efforts in this area (see, for example, the online portal "GenPORT" 72). However, other target groups, which are currently underrepresented in the field of STEM specialists, could also be addressed more intensively. According to the European Institute for Gender Equality (EIGE) women in STEM study fields are underrepresented in all Member States. Percentages are especially low in BE, NL, LU, SI, SK CZ, AT, HU, PL, Germany, PT FI, MTT, IT, FR, LT, ES, UK, EI, DK, HR (< 20%)

	and above 30 % in BG, Cyprus, Romania, EL (Greece) The latest PISA results for Austria point to significant gender differences in attainment: in science, boys outperformed girls by 19 points – the largest gap in OECD countries. In the field of mathematics, boys in Austria are 27 points ahead of their female peers, again the largest gender gap in all OECD countries. Whereas in reading, girls are 20 points ahead of boys. Around 40 % of men in the 25-64 age group have completed Higher Education in the areas of manufacturing or construction compared to just 9 % of women. In 2014 graduates in technical studies were predominantly men, while 83 % of graduates in teacher training were women. But it seems that there is a shift in gender make-up with the ratio of women in technical studies rising. The principle of "Education to Equality between Women and Men**"** has been integrated in Austrian school curricula of since 1995, and statutory for all types of schools since 2007 (BMBWK: Principle). Relevant information packs are available free of charge to all primary and secondary schoolteachers. Although the principle is incorporated in all curricula and outlined in the basic didactic principles, as well as in various subject-specific curricula, there is no nationwide evaluation of implementation. **Handicraft lessons**: in new secondary schools (grades 5 to 8), the formerly separate subjects of Technical Work and Textile Work were merged in 2012, in a bid to avoid early gender-differentiation in students' path of study. The new system is expected to have an impact on students' subsequent choice of subjects, particularly by reducing girls' inhibitions in the areas of technology and crafts. The new, merged subject will also be taught in academic secondary school lower level from 2020. **Vocational orientation at schools**: The provision of gender-sensitive vocational orientation and educational counselling at grades 7 and 8 has been a key priority of the Ministry of Education since 2010, implemented under the IBOBB (Information, Counselling, Orientation in Education and Profession)strategy (www.schule.at/ibobb). IBOBB aims to develop schools' gender-sensitive vocational orientation, including high standard, girl-focused teaching of STEM (science, technology, engineering and mathematics) subjects. To that end, vocational orientation has been integrated into the curricula of new secondary and academic secondary (lower level) schools, along with clear-cut guidelines on gender equality. A mandatory gender module is also part of training courses for coordinators and teachers of vocational orientation, as well as for educational counsellors. An important way of reducing gender stereotypes and gender gaps in education is by mainstreaming the gender and equality skills of key players – most obviously, teachers (OECD 2015a). The Ministry of Education's equality target ("Improvement of equal opportunities and gender equality in the education system") entails two policies: the introduction of a new teacher-training programme (PädagogInnenbildung Neu, or Teacher Training New), which aims to strengthen the gender and diversity skills of teachers and

	managers, and the expansion of vocational orientation and educational counselling in lower academic secondary schools, which has a particular focus on gender-sensitive vocational orientation (see below). Advanced training programmes targeted specific groups (e.g. vocational-orientation teachers and commissioners for gender affairs at schools and teacher-training colleges). The most recent Ministry of Education equality index on the ratio of female students and pupils in 'gender-atypical types of schools' in grade 10 already indicates a slight increase in girls and boys in such institutions, in a sign of reduced gender-specific segregation and the greater diversification of educational and professional choices (BKA 2016). Since 2010, the Ministry of Education has increasingly promoted the development of gender competence in future teachers, increasing awareness of gender research and theory and encouraging a reflective approach to gender issues, under the Teacher Training New programme. The new-style programme has been offered by teacher-training colleges and four universities in regional development alliances since 2013. Nationwide implementation at primary-school level began in October 2015, followed by the secondary level in October 2016. Developing the gender competence of academics at universities and teacher-training colleges where future teachers are taught is of the utmost importance. According to the Quality Assurance Council for Teacher Training (QSR), gender competence is now part of those institutions' curricula, albeit to varying extents. QSR is now preparing to monitor implementation going forward. In 2015, the University College of Teacher Education in Salzburg established a professorship in gender pedagogy, which is expected to significantly enhance research and reflection on the subject of teacher training and gender. Similarly, the new Federal Centre for Gender Pedagogy and Gender Research will provide nationwide coordination, expertise and resources, encouraging improvements in teacher-training colleges while supporting policy reform in the Ministry of Education. **Gender-sensitive education: expanding the professional choices of girls, women and boys** Females into Technology or FiT is an orientation programme for girls from grade 9 and up (academic secondary schools – AHS – and colleges for higher vocational education – BHS), aimed at familiarising students with technical and scientific fields of study. The programme comprises information days at universities, including universities of applied sciences, as well as workshops involving FiT "ambassadors" (women role models studying natural sciences and technology; see https://www.bmb.gv.at/schulen/unterricht/ba/fit.html). Girls' Day, Daughters' Day and Girls' Mini Day: Girls' and Daughters' Days are targeted at girls aged 10 and up, while Girls' Mini Day, introduced in 2015, is aimed at girls aged four to school age. The Days focus on familiarising girls with professions and

	courses of study in IT, handicrafts, natural sciences and technology, offering an opportunity to take part in experiments and meet leading women in economic and political life (see http://www.bmgf.gv.at/home/Girls_Day/ and https://www.bmb.gv.at/schulen/unterricht/ba/gs/girlsday.html). Boys' Day aims to diversify boys' range of career choices in the care sector, raising awareness of such options, among parents, trainers and the public at large, as well as boys themselves. Boys' Day experiences include a taster day, workshops and excursions to kindergartens, hospitals, retirement homes and other organisations, providing boys with an opportunity to get acquainted with the work environment and to meet male role models in the care professions (see www.boysday.at). According to a survey of boys' work expectations, income and career opportunities are key determinants of job satisfaction, while work/family balance is of less importance. This finding is extremely significant to the future development of Boys' Day. The survey also found that a significant number of Boys' Day participants with an interest in the care sector were unable to pursue training because their expected school-leaving qualifications were not sufficient. It is therefore important to consider the introduction of care-profession training options that do not require a secondary-level certificate (Scambor 2015). meine Technik – my technology is an online platform for girls and women (www.meine-technik.at) introduced in line with the government's 2013-2018 programme, which aims to increase the ratio of girls and women in technical professions. The platform offers a centralised help desk for jobs and projects in science, technology, engineering and mathematics (STEM subjects), as well information about workshops, excursions, competitions, counselling centres, mentoring programmes, job information days, teaching materials, handbooks and advanced education programmes for teachers, companies and parents. "FiT" – Women in Technology and Crafts: Under the FiT programme, AMS (the Public Employment Service) offers unemployed women the opportunity to train in the technical professions or craft trades. Introduced in 2006, more than 8,600 women (1,036 in 2015 alone) have undergone several years of non-traditional training, gaining a "technical pre-qualification", an apprenticeship certificate or other equivalent qualification. FiT is open to all women registered with AMS, independent of educational background, age or qualifications. The training, funded by AMS, includes career-guidance and may be undertaken at a university of applied sciences or a post-secondary technical school (AMS 2016). The Austrian Chambers are sponsors of the following initiatives: *The Spürnasenecke* is a facility for researching and experimenting with kindergarten children. The advantage of the science corner is that all materials and experimentation instructions can be found in one place. There are already 61 science corners in the province of Salzburg. As part of the educational campaign of the Austrian

	Chambers, this project is going be rolled out in other federal states by 2020. *CodeWeek* As part of the educational campaign, the European initiative CodeWeek will be rolled out all over Austria. The CodeWeek takes place throughout Europe annually in October. Goals of CodeWeek are: • Encourage youth, children and women to learn how to program. • Promoting cooperation between existing initiatives and groups • sharing examples from practice • Organization of events and workshops on programming • Open technology labs Austria-wide open technology laboratories with local / regional sponsorship near schools are to be established. *STEM projects of the Austrian Chambers* Austria has a wide variety of initiatives. The WKO is an active partner or *organizer* of regional and national projects. Around 100,000 young people are reached each year. Examples: Dream profession Technology / Upper Austria, Leonardino / Vienna, FIT - Women in technology / Vorarlberg, Talentecamp / Carinthia, Young researchers in technology / Tyrol and many more. First Lego League, Robotics Competitions
Additional Qs: In some tech sectors, the workforce is aging rapidly and creating unsustainable workforce demographics, causing knowledge transfer problems. How to keep effective inter-generational knowledge transfer?	
What is the impact of globalization on skills? (for instance, with globalization, we hear that soft skills, managing distant teams, virtual teams are becoming important.. what are the differences of acting local or global when it comes to skills?	