



PEOPLE, MACHINES, ROBOTS AND SKILLS

Technological unemployment is a recurring theme, but joblessness in the digital age will depend on human, not artificial, intelligence

With forecasts that nearly half of jobs in advanced economies may be automated out of existence, excitement at the prospects of what the World Economic Forum says is a Fourth Industrial Revolution is tempered by worries that people will either lose their jobs to robots and machines, or be unable to find suitable work in the new digital age.

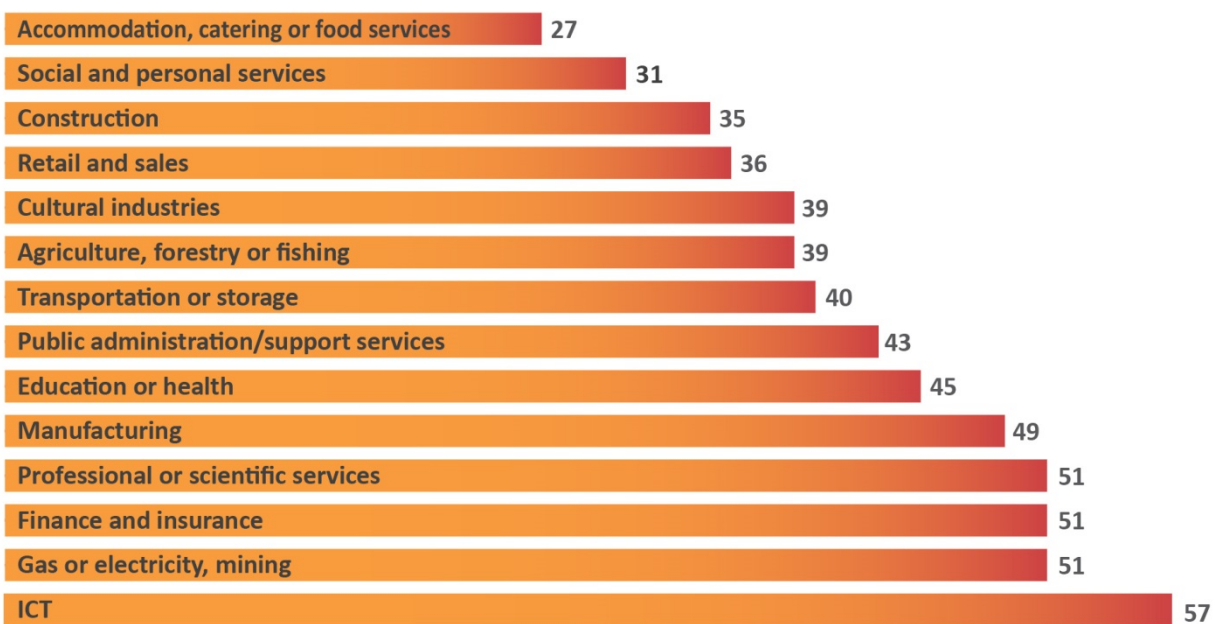
Change is certainly happening. Cedefop's European skills and jobs survey (ESJS) ⁽¹⁾ found that across the 28 European Union (EU) Member States, 43% of adult employees have seen the technologies they use change in the past five years, making some people's jobs vulnerable to automation; 47% have seen changes in working methods or practices. Some

sectors are changing faster than others; 57% of adult employees in ICT have seen changes in their jobs during the past five years compared to 27% of those in accommodation and catering (Figure 1).

Before reaching conclusions about the future, it is important to understand the different ways technology is changing the world of work: job substitution, job creation and job transformation.

⁽¹⁾ Carried out in 2014, the ESJS collected information on how the skills of about 49 000 adult workers (aged 24-65) across the EU matched the needs of their jobs. For more information, see <http://www.cedefop.europa.eu/en/events-and-projects/projects/european-skills-and-jobs-esj-survey>

FIGURE 1. ADULT EMPLOYEES WITH TECHNOLOGICAL CHANGE IN WORKPLACE IN PAST FIVE YEARS BY SECTOR, EU-28



Source: Cedefop European skills and jobs survey.

Job substitution, creation and transformation

Job substitution is the real source of concern over job losses. Fears that technology will replace labour are not new, but historically technology has had positive effects on employment. The worry is that this time it is different. Innovation cycles are much faster; big data, cloud computing, 3D-printing and the platform economy are changing product markets, business models and work and, consequently, skill needs in all sectors. More disruptive change is on the way; the internet of things, robotics, new materials and nanotechnology, are all expected to affect value chains in the next decade. The reach of digitalisation and robots is also greater. In the past, technology replaced routine, low-skilled manual work. Now it can perform non-routine work, such as financial market analyses, surgery and legal searches. Taxi drivers' jobs were once thought safe as driving is unpredictable, but self-driving cars are now a reality. While technology becomes cheaper and penetrates deeper into the economy, labour's share of total income is falling. Technology is polarising the labour market, creating high-skilled, well-paid jobs at one end of the scale and low-skilled, low-pay jobs at the other, hollowing out the middle. New technology sectors also tend to employ fewer people. In 2014, the smartphone messaging company WhatsApp, with 55 workers was purchased for USD 19 billion, the same value as US clothes retailer GAP with 137 000 employees.

However, the amount of work is not fixed. Greater use of technology has created many new jobs. A couple of decades ago there were no web analysts, applications developers and big data specialists. ICT sector job growth in the EU was almost three times higher than in the rest of the economy over the past decade and remained strong during the economic crisis. Cedefop forecasts another half a million new jobs in ICT occupations by 2025. History also shows technology has unforeseen job benefits; who foresaw the benefits to tourism of the first flying machines?

Technology may destroy some jobs and create others, but its greatest effect is transforming jobs and content. A 2016 study of a range of OECD countries calculated that on average just 9% of jobs were at high risk of automation, but at least 70% of the tasks in these jobs could be automated. Rather than the job itself, some tasks in a job are more likely to be automated than others.

The digital divide

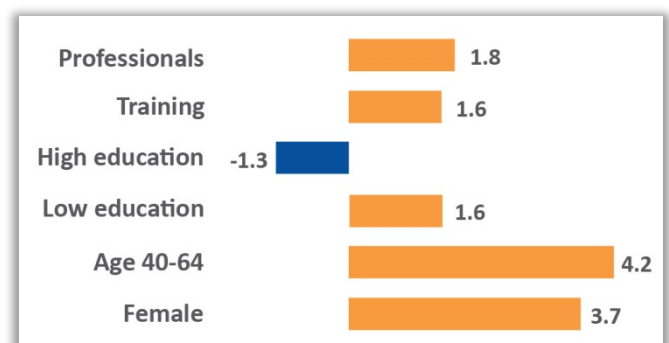
As technology transforms jobs, the question is will an ageing EU population be able to acquire the skills needed to find good jobs in the digital age? If not, who will be on the wrong side of the digital divide?

Digital skills are changing fast. Cedefop's ESJ survey found that around 10% of adult workers in the EU are at high risk of technological skills obsolescence. Around 21% of adult employees think it very likely that several of their skills will be outdated in the next five years. This rises to 30% for those working in ICT services. Adults working in science, engineering and management professions also have a high risk of skills obsolescence.

Despite the spread of technology, the ESJ survey also shows a worryingly high share of the EU workforce is excluded from the digital economy; 56% of workers in elementary occupations, 33% in agriculture, and 25% in service and market sales do not need ICT skills in their jobs. And, while many are seeing change at work, 46% of the adult workforce, especially those working in the primary sector and in personal care services, have not seen, nor expect to see, the skills they use in their jobs change significantly.

Those in jobs that do not require digital technologies may be less inclined to use them outside work. This may underlie the high proportion of the EU population with low digital skills and who do not use the internet. Some groups are disadvantaged in their ability to keep up with the digital technologies of their jobs (Figure 2). Women, older-aged and lower-educated workers, as well as professionals in high-skill-intensive jobs and who need to update their skills continuously, have a higher likelihood of digital skill gaps. Enterprises are more likely to provide continuing

FIGURE 2. RISK OF DIGITAL SKILL GAP, ADULT WORKERS, EU-28



Source: Cedefop European skills and jobs survey.

training for employees at risk of digital skill gaps, irrespective of their education level. This highlights the relevance of vocational training for mitigating skill gaps.

Digital plus

Evidence shows that to keep up with digital developments, simply improving digital literacy is not enough. ESJ survey data show adults in jobs requiring at least moderate-level ICT skills also require a strong level of complementary skills, such as foundation skills (literacy, numeracy), soft skills (planning and organisation) and behavioural skills (communication and teamwork). Jobs requiring advanced ICT skills depend heavily on people being able to solve problems, learn, adapt, apply new methods and technologies as well as in-depth technical knowledge (Figure 3). The probability of a job using ICT not also requiring a foreign language is low (yellow bar); the more proficient in foreign languages someone is, the more likely they are to be in a job using advanced ICT technologies.

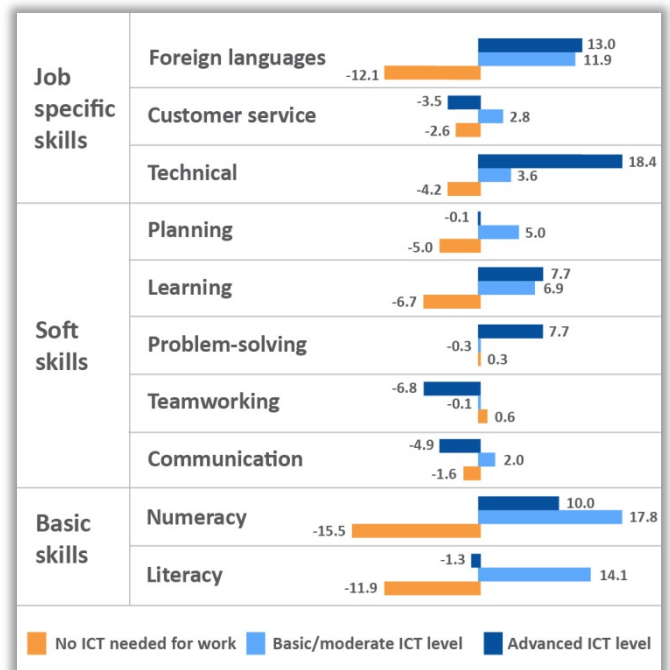
Cedefop’s skill forecasts also illustrate that, increasingly, jobs in the future will combine digital with technical, soft and behavioural skills. Jobs expected to decline in employment between now and 2025, such as skilled agricultural workers, crafts and related trades and clerks, rely more on routine tasks (Figure 4). Those expected to grow, such as professionals in business, administration, ICT, science and engineering, are more likely to require advanced cognitive (literacy, numeracy, foreign languages, problem-solving, learning to learn) and non-cognitive (communication, planning, customer service) skills. Reflecting this, jobs expected to see employment growth will require higher-level general and vocational qualifications. But, overall, fewer jobs may require medium-level vocational qualifications due to sectoral restructuring, influenced by technologies.

Technological advance: not a zero sum game

Technological advance may be different this time in terms of the speed at which many, if not most, jobs are being transformed and in the level of skills required and how they need to be combined.

The need to complement digital skills with other technical and, importantly, personal and behavioural skills at work, suggests that people and technology are complementary. Technology can perform tasks and rapidly collect and synthesise data, but people must decide what the tasks should be and what the

FIGURE 3. COMPLEMENTARITY BETWEEN ICT AND NON-ICT SKILLS NEEDED FOR WORK, ADULT EMPLOYEES, EU-28



Source: Cedefop European skills and jobs survey.

data mean. As Picasso said, ‘Computers are stupid; they only know answers.’

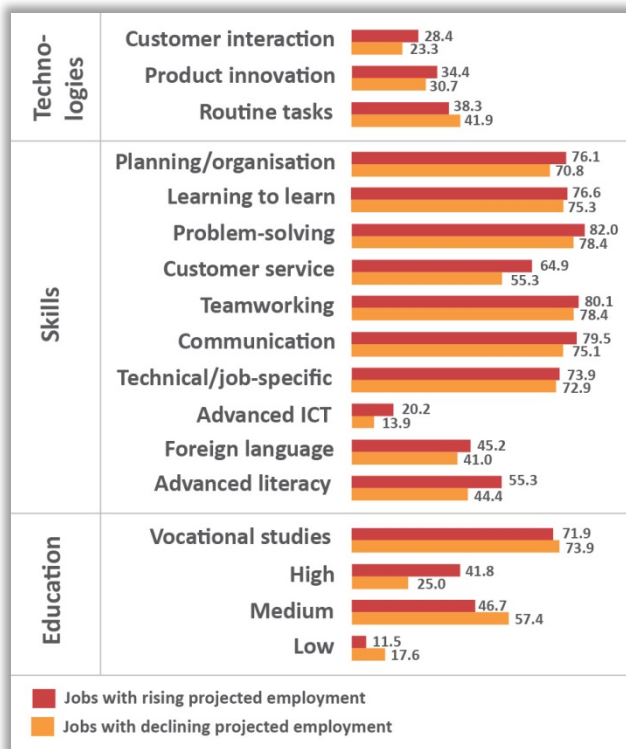
Technological advance is not a zero sum game, but widespread transformation of the world of work poses challenges to policy-makers, who need to help those adversely affected by technological disruption, particularly low-skilled people. Not every lorry driver will, or needs to, become a computer programmer. Perhaps in the future former drivers will use technology to guide and monitor self-driving vehicles or drones to deliver goods.

But driving to logistics is a step up. This places even greater emphasis on education and training systems to provide the combinations of skills required throughout working life. Earlier industrial revolutions helped develop education and training systems that focused on young people and initial learning. Technological change, however, will accelerate skill obsolescence, meaning that most future skills adjustment must take place in the workplace during adult life. Systems need to adapt; modularised and quicker training must become reality.

Policy responses

Changes are underway. EU Member States have for a while been integrating digital skills with other key

FIGURE 4. ANTICIPATED SKILL NEEDS DUE TO SECTORAL/JOB RESTRUCTURING, 2015-25, EU-28



Source: Cedefop European skills and jobs survey data superimposed on Cedefop skills forecasts.

competences in education and training curricula and programmes, including those for training teachers and trainers. Many Member States have national strategies to promote digital skills.

Technology is also changing how people learn, improving access for learners: massive online open courses, offering flexibility in terms of time and place, can increase adult participation in learning of all types, but several obstacles need to be overcome before learners can benefit fully from them.

Digital skills are among those most likely to be developed through non-formal and informal learning, for example, through practice at work and gaming during personal time. This is why promoting digital skill use in a greater share of EU workplaces, particularly among smaller-sized enterprises, is extremely important. Good jobs, which provide opportunities to learn, are essential for developing good skills.

The easier and more widespread validation of digital skills acquired through non-formal or informal learning would make them more visible and improve job prospects. ICT industry e-skills certifications are being

included in some national curricula and qualifications frameworks, but many online e-learning certificates issued by both private and public bodies are not widely recognised by employers. Training in digital skills, combined with other key competences, should be targeted at specific groups that are falling on the wrong side of the digital divide. This is an idea behind the European Commission’s New skills agenda, launched in 2016.

For all this to happen, new forms of partnerships are needed, such as the Digital skills and jobs coalition. Employers, social partners, learning institutions and governments (at various levels) need to work together to support vocational education and training (VET) of all types in digital and complementary skills. Such partnerships can stimulate investment in people as well as technology, sharing costs and expertise.

Vocational education and training has a key role to play. Cedefop’s opinion survey on VET in Europe found that while around 90% of both general and VET graduates were satisfied with the general skills they had developed, 87% of VET graduates were satisfied with the work-related skills they had acquired compared to 62% of graduates from general education.

History teaches that people and technology are compatible, but how technology affects employment depends on many factors. How to deploy technology and how to enable people to learn to get the best out of it, are decisions for governments, social partners, educators and learners. Technology does not decide how many jobs there are; how far technological progress translates into a jobless society will come down to human, rather than artificial, intelligence.