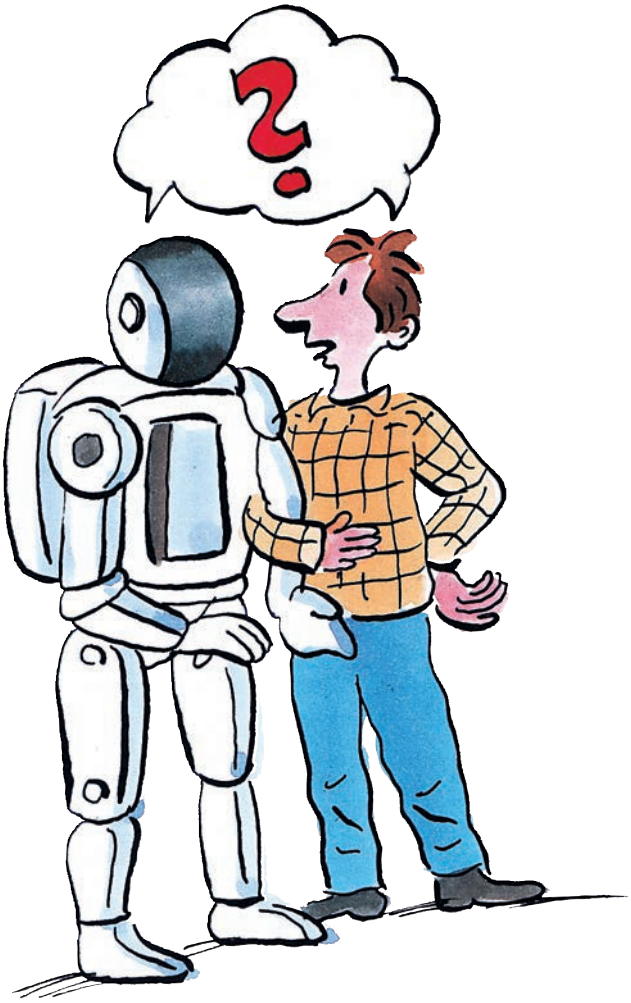
Digital World of Work



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CPS	Cyber-physical systems
DESI	Digital Economy and Society Index
DGB	Deutscher Gewerkschaftsbund (German Trade Union Confederation)
DSM	Digital Single Market
EC	European Commission
ETUC	European Trade Union Confederation
EU	European Union
EU-GDPR	EU General Data Protection Regulation
IAB	Institut für Arbeitsmarkt- und Berufsfoschung (Institute for Employment Research
I-DESI	International Digital Economy and Society Index
IHK	Industrie- und Handelskammer (Chamber of Industry and Commerce)
ICT	Information and communication technology
IT	Information technology
MOCC	Massive open online course
NEET	Not in Education, Employment or Training
NGO(s)	Non-governmental organisation(s)
OECD	Organisation for Economic Co-operation and Development
PIAAC	Programme for the International Assessment of Adult Competencies
SME	Small and medium-sized enterprises
STEM	Science, technology, engineering and mathematics
WEF	World Economic Forum
ZEW	Zentrum für Europäische Wirtschaftsforschung (Centre for European Economic Research)

Foreword

Dear Readers, Dear Friends,

We are in the middle of a digital revolution which is causing upheaval, especially in the world of work. This demands a great deal of the social partners and is extremely challenging, particularly for workers' organisations.

That is why we are delighted to provide those who represent workers' interests in times of digitalisation with an important tool in the shape of this publication.

In an academic-practical education project in the 2016/2017 education year, the European Centre for Workers' Questions (EZA), in conjunction with the research Institute for Advanced Studies (IHS) commissioned by the Österreichisches Zentrum für Arbeitnehmerbildung (ÖZA, Austrian Centre for Workers' Training), contributed academic findings on digitalisation and the labour market to the seminars of five education partners from the EZA network, and enhanced this knowledge with experience from the practice of workers' organisations.

This "Digital World of Work" research report is the result of the cross-fertilisation of academia and practice. It gives *inter alia* an insight into the most important digitalisation phenomena, describes the basic research into the possible employment effects, and explains the main academic theses and approaches.

But more than anything it gives recommendations from academic analysis – especially for the activity of workers' organisations.

We all know that the digital world of work currently being created will change a great deal – not only for workers, not only at the workplace. What is happening now will have a deep effect on society. And these changes will occupy us for a long time.

A thorough look at causes, interactions and consequences helps find the right paths and shape the future digital world of work. We hope this report helps the right decisions with lasting positive effects to be taken.

Sigrid Schraml
EZA Secretary-General

Executive Summary

Althought digitalisation entails huge societal and economic transformation, it also opens up opportunities to reshape society and the economy. The use of digital technologies results in job losses, with different sectors being affected differently – as well as a loss of occupations with a high proportion of standardised routine tasks. At the same time jobs will change and new ones will be created. This has an impact on the skills in demand in the labour market and calls for a rethink on basic and further training. The pressure on the low-skilled will increase further; the higher-skilled with specific ICT skills will continue to find good career opportunities.

The results of various international studies on digitalisation show the associated challenges for society, the economy and each and every individual. The forecasts for job losses in individual countries diverge starkly, depending on the methodological approach.

The report describes the impact of digitalisation on society and the labour markets in Europe, and reflects the feedback from participants attending education events carried out from April 2016 to March 2017 under the European Centre for Workers' Questions (EZA) "European Social Dialogue" education programme. Workers' organisations face considerable challenges to respond effectively to the new developments with the right strategies and measures. That is why options for action have been drawn up relating to the prevailing legal and financial conditions, and questions asked relating to the education system and the organisation of labour.

1 Process description

This research report is based on an academic paper on "Digitalisation of the world of work" drawn up by IHS in preparation for the EZA series of seminars and containing the contributions to the EZA education seminars' discussions, as well as edited secondary data from all manner of studies in recent years on the issue.[1]

The structure of this report is broken down into the following sections: the second chapter deals briefly with the challenges digitalisation poses to society. The primarily theoretical third part presents the results of international studies addressing impending job losses. Chapter 4 presents an overview of feedback from the seminars; chapter 5 describes the problems and challenges that have to be overcome. The final chapter 6 contains recommendations for action for workers' organisations.

Between June 2016 and February 2017, five seminars were held in various European countries, each within the context of an EZA series of seminars on "Digital world of work" in connection with the European social dialogue. Feedback from participants on the content of the seminar presentations is incorporated in this report.

1 Because data were gathered from different related studies, the study survey periods vary, as do the forecast periods for the figures published.

Figure 1: Overview of the seminars held

Date	Place	Seminar topic	Organisation
2/3 June 2016	Lisbon, Portugal	Providing workers with digital skills for the changing world of work: preparing workers and social partners for the future	CIFOTIE (Centro Internacional de Formação dos Trabalhadores da Indústria e Energia)
19-21 September 2016	Vienna, Austria	From „New Public Management“ to „New Public Governance“	EUROFEDOP (European Federation of Public Service Employees)
6/7 October 2016	Budapest, Hungary	A networked digital single market and the transformation of work	MOSZ (Munkástanácsok Országos Szövetsége)
2-4 November 2016	Milan, Italy	A networked digital single market and the transformation of work	FLC (Fondazione Luigi Clerici)
8-10 February 2017	St Julians, Malta	A networked digital single market and the transformation of work: What is the impact on consumers, workers and trade unions?	Krifa (Kristelig Fagbevægelse)

2 Digitalisation and society

2.1 A networked digital single market

In May 2015, the European Commission drew up the "Digital Single Market" (DSM) strategy with 16 initiatives intended to benefit companies, the public sector and customers. This strategy is based on the following three priorities, implemented at varying speeds:

- Better online access for consumers and companies to goods and services throughout Europe
- Creating the right conditions for prospering digital networks and services
- Optimum exhaustion of the growth potential of the European digital economy.[2]

The idea is for the digital single market to guarantee the future free movement of goods, persons, services and capital under fair conditions of competition and in accordance with strict standards of consumer and data protection. To enable the digital single market to become reality, the EU member states, the European Parliament and interest groups came up with a joint strategy aimed at overcoming the "analogue" single market, allowing "the digital economy [...] [to] expand markets and foster foster better services at better prices, offer more choice and create new sources of employment".[3] It is evident that accompanying measures by various stakeholders are required. In any case, the European trade unions are prepared to react to the challenges of a digital world of work.

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2 EC (2015): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Digital Single Market Strategy for Europe. COM (2015) 192 final. Brussels, 6 May205. See: http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1447773803386&uri=CELEX%3A52015DC0192 (January 2017).

3 EC (2015): ibid. p. 3

"Digitalisation of the economy and society is an important challenge for the European trade union movement. Digitalisation brings the fourth industrial revolution, which is about to change industry, services, markets, but also the world of labour in general (in public services, education, etc.). Digitalisation means opportunities as well as risks. Studies currently available on the future of work suggest that there will be winners and losers amongst workers. One of the risks is that digitalisation might become an additional driver of social and territorial inequalities."[4]

2.2 The Industrial Revolutions

The digitalisation of society throws up not only challenges in the integration of different population groups in the labour market, but – like all technical innovations – also social questions.

The first industrial revolution was initiated by the invention of the steam engine; this enabled large parts of the population to be better supplied with food and clothing (rail, steamships). On the other hand, these changes brought about a transition from the agricultural to the industrial society, with the consquence that large parts of the population moved into towns and cities as wage-earning factory workers, creating a new stratum there – the wage-earning proletariat.

At the beginning of the 20th century, electricity enabled assembly line production based on the division of labour. This technical innovation was first used in slaughterhouses and then by car manufacturer Ford.

4 European Trade Union Confederation (ETUC) (2016): Draft of an ETUC resolution on digitalisation: „towards fair digital work". 8-9 June 2016, p. 2f. See: https://www.etuc.org/documents/etuc-resolution-digitalisation-towards-fair-digital-work#.WlcqQK7ibIU (February 2017).

The third stage of automation in the early 1970s was initiated by electronics and information technologies.

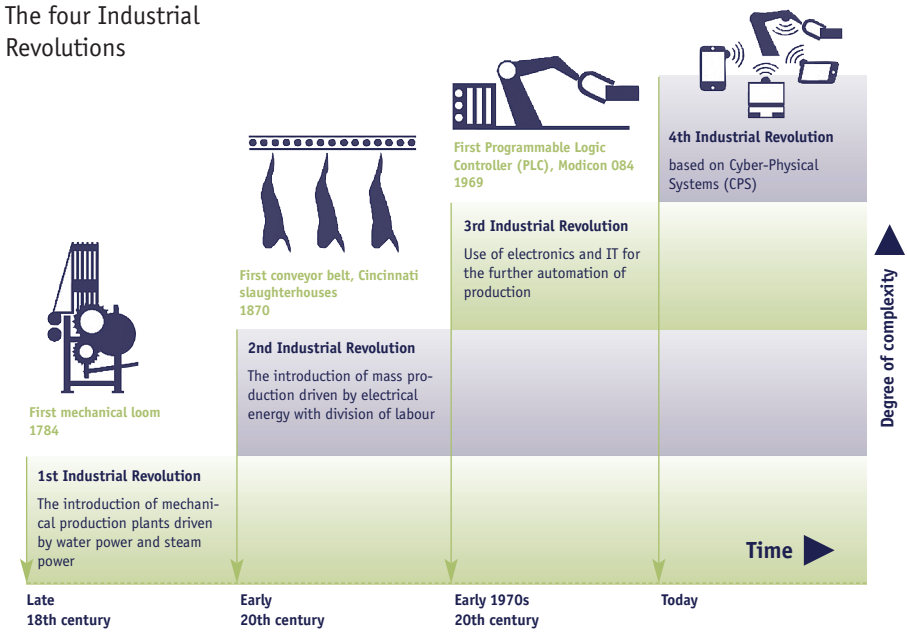
The latest stage is frequently referred to as Industry 4.0[5] and combines several levels in real-time communication. "In Industry 4.0, industrial production is now controlled decentrally and dynamically, interlinked via the Internet, mobile computers and cloud computing. Everything communicates: customers, companies, factories, machines and products are in direct contact and can exchange information and requirements."[6]

"The focus is on the application of cyber-physical systems (CPS), which equip materials, objects and devices with sensors and interlink them via the Internet. In this way there is a continuous exchange of information between plants and workpieces that merge into a smart factory. What is of crucial importance is the possibility of processing huge volumes of data (Big Data) in next to no time. This enables the integrated control of production and logistics in real time and over large distances."[7]

The online interconnection of several production sites and value-added chains indicates possibilities the future of the economy opens up and the resultant changes relating to jobs and working conditions.

5 Industry 4.0 is a term used in scientific communication and which was used, for instance, by the German federal government for a future project. See: http://www.hightech-strategie.de/de/Industrie-4-0-59.php (February 2017).
6 EnEff:Industrie. See: http://eneff-industrie.info/quickinfos/industrie-40/die-stufen-der-industrialisierung/ (February 2017).
7 Berlin Chamber of Industry and Commerce (IHK). See: https://www.ihk-berlin.de/produktmarken/branchen/industrie/Industrie-4_0/Was-ist-Industrie-4-0-/2698236 (February 2017)

Figure 2: The Industrial Revolutions



Source: Berlin Chamber of Industry and Commerce (IHK). See: https://www.ihk-berlin.de/blob/bihk24/produktmarken/branchen/industrie/downloads/2704772/6db893fd7b49f6a60c7676cae34825ae/Vier-Stufen-der-industriellen-Revolution-data.jpg (February 2017)

2.3 Big data, sharing economy, crowdworking

Big data

At present, there is no established scientific definition of the term "big data", it is a vague buzzword. According to a definition by Gartner[8] the "big" in big data refers to the three dimensions of high volume (scope, volume of data), high velocity (speed at which data are generated and transferred) and high variety (bandwidth of data types and sources).

And these changes triggered off by digitalisation bring about enormous technical storage possibilities. In 2000, three quarters of data in the world were still stored in analogue form. Today the figure is less than 1 percent.[9]

Crowdworking/crowdsourcing

In crowdsourcing or crowdworking[10], simple or now also high-quality work tasks are outsourced by companies and commissioned via online platforms; the service providers can perform these tasks at home on a PC.

According to the German Trade Union Confederation, back in September 2015 there were already some 2,300 crowdsourcing platforms worldwide.[11] One of the largest providers of services of different kinds is the "Freelancer.com" platform, which now has more than 22 million users and advertises almost 11 million jobs.[12]

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8 Gartner IT Glossary: "Big Data is high volume, high velocity and/or high variety information assets that demand cost effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation." See: http://www.gartner.com/it-glossary/big-data (February 2017).

9 Mayer-Schönburger, V. (2016): "Digitalisierung im Öffentlichen Dienst", in: GÖD (ed.) (2016): Digitalisierung im Öffentlichen Dienst. Chancen, Herausforderungen, Trends. Vienna, p. 18

10 The term crowdworking is coined from the words ‚crowd' and ‚outsourcing'.

11 Suchy, O. (DGB-Bundesvorstand) (September, 2015): Digitalisierung der Arbeitswelt. Chancen und Risiken. Politische Gestaltungsansätze. See: http://www.tbs-rheinlandpfalz.de/aktuell/download/Tagung_Arbeit_4_0/Arbeit_40_Oliver_Suchy_Digitalisierung_der_Arbeitswelt.pdf (February 2017).

12 See: www.freelancer.com (February 2017).

The sharing economy

"The term of sharing economy means the systematic lending of items and the sharing of rooms and spaces, especially by individuals and interest groups. Its focus is on collaborative consumption."[13] Resources are shared or exchanged via portals and internet forums. Cars can be shared via car-sharing companies, as can secondhand books, overnight stays and accommodation, e.g. through companies like Airbnb, driving services through companies like Uber etc.

According to a study by Frost and Sullivan Consultants from 2012, more than 200 car-sharing services are forecast for the EU in 2020, numbering some 240,000 vehicles and about 15 million users.[14]

The figures for private providers of rooms are similar: "By 2013, three million guests had already booked ten million nights in 33,000 towns and cities and 192 countries through Airbnb."[15] According to German statistics portal Statista, 30 million guests visited 34,000 towns and cities in 190 countries through Airbnb.[16]

2.4 Opportunities and challenges

Jeremy Rifkin addressed the issue of the sharing economy in its early stage. In his book entitled "The Age of Access: The New Culture of Hypercapitalism" he discussed the emerging developments as follows: "The very thought of leaving markets and the exchange of property behind – of advancing a con-

13 Springer Gabler Verlag (ed.) (2017): Gabler Wirtschaftslexikon, Stichwort: Sharing Economy, see: http://wirtschaftslexikon.gabler.de/Archiv/688938792/sharing-economy-v6.html (February 2017).

14 Frost and Sullivan Research Service (2012): Business Models and Opportunities in the European Traditional and Peer-to-Peer Carsharing Market (M813). See: http://www.frost.com/c/10046/sublib/display-report.do?id=M813-01-00-00-00 (February 2017).

15 Rifkin, J. (2014): The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism. Basingstoke.

16 Statista Deutschland. See: https://de.statista.com/statistik/daten/studie/419494/umfrage/globaler-ueberblick-von-airbnb/ (February 2017).

ceptual change in the structuring of human relationships away from ownership and toward access – is as inconceivable for many people today as the enclosure and privatization of land and labor into property relations must have been more than half a millennium ago. [...] It is likely that for a growing number of enterprises and consumers, the very idea of ownership will seem limited, even old-fashioned, twenty-five years from now."[17]

The essence of the sharing economy can be seen on a small scale in friends and neighbours helping one another – without any financial consideration. The rapid growth of the internet has enabled similar interests to merge beyond national borders and across large distances. Services are being offered worldwide on internet portals.

The evident advantages are that resources are being spared, for instance in the multi-use of items or fewer CO2 emissions, as is the case of car sharing, with the number of vehicles on the roads being reduced demonstrably.[18]

The disadvantages for the community and individuals can be seen in the following questions relating to every internet platform offering services worldwide: What about the concentration of economic clout? Who pays what taxes where? How is quality assured and who is liable for what?

These questions cross sectoral boundaries. In principle, it is possible to outsource any work that can be done on a computer, rendering it "suitable for crowdsourcing". This enables providers to minimise fixed costs (office space, full-time employees), at the expense of sustainable jobs.

17 Rifkin, J. (2007): The Age of Access: The New Culture of Hypercapitalism. Los Angeles, 2001, p. 14.

18 "A study of 11 leading car-sharing enterprises found that 80 percent oft he members sampled who owned a car before car-sharing sold it after joining the network. Of the households that still owned cars, the number of vehicles owned dropped drom 0.47 vehicles per household to 0,24 vehicles per household after joining a car-share club." See: Rifkin, J. (2014): Zero Marginal Cost Society. Ibid, p. 227.

Altogether it is about questions relating to changes in working conditions brought about by greater international digital networking, about data protection and copyright issues, about the skilling of workers, and ultimately about the funding of social security systems combined with budget challenges and issues of corporate taxation.

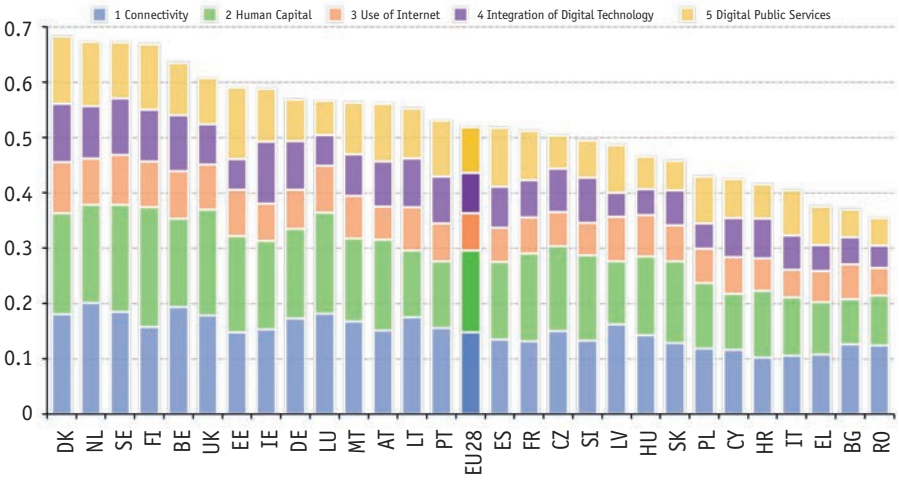
The above issues indicate a huge potential for change, the scope of which it is very hard to estimate at present. And the speed with which corresponding developments take effect can scarcely be predicted. That is why attempts are currently being made on a political level in Europe to gather measurable data on the degree of the provision and use of digital technology. In this context, indicators are being drawn up on a national and international level to measure the status quo of the respective degree of digitalisation. The following chapter presents the latest data documenting the ranking of the individual EU countries.

2.5 Digital Economy and Society Index (DESI)

In this connection, since 2014 the EU Commission has published an index[19] whose aim is to show the efficiency and development of the EU member states with regard to digitalisation. The DESI comprises five dimensions for measuring the countries' progress in relation to digital technology. The index records the five dimensions of connectivity, human capital, use of internet, integration of digital technology in the business world, and digital public services. The figure below illustrates these five indicators in the form of national ranking and shows how advanced each EU member state is in the digitalisation process.

19 EC (February 2016): Press Release Database. See: http://europa.eu/rapid/press-release_MEMO-16-385_en.htm (March 2017)

Figure 3: Digital Economy and Society Index (DESI), 2016



Source: EC (2016): Digital Single Market. Digital Economy and Society. See: https://ec.europa.eu/digital-single-market/en/desi (February 2017); the majority of the data are from 2015; each score is between 0 and 1 – higher scores indicate better performance.

Altogether it is evident that Europe is making progress. In 2016, the EU as a whole achieved a score of 0.52; an improvement on the previous year (score in 2015: 0.50). The individual countries are developing at different speeds in different sectors.

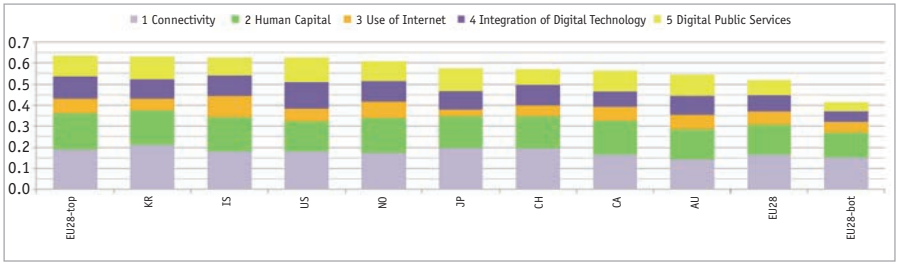
The individual EU member states were pooled in clusters based on their performance in 2016. There are individual nations that achieved particularly rapid progress and are above the EU average: these are Austria, Germany, Estonia, Malta, the Netherlands and Portugal, the "Running Ahead" cluster. Next there are states that are likewise above the EU average but achieved

slower growth: Belgium, Denmark, Finland, Ireland, Lithuania, Luxembourg, Sweden and the United Kingdom. They are in the "Lagging Ahead" cluster.

Some countries are below the average, but "Catching Up" quickly: Spain, Croatia, Italy, Latvia, Romania and Slovenia. And there are states below the EU median whose development last year in turn was below the average ("Falling Behind"): Bulgaria, Cyprus, the Czech Republic, Greece, France, Hungary, Poland and Slovakia.[20]

Besides the DESI, which represents EU member states, there is a second calculation method: the international DESI (I-DESI). It compares overall EU performance and that of the individual EU countries with the results from other states. Although the structures of DESI and I-DESI are comparable, the individual indicators differ.

Figure 4: International Digital Economy and Society Index (I-DESI), 2015



Source: EC (2016): International Digital Economy and Society Index (I-DESI). See: https://ec.europa.eu/digital-single-market/en/news/2016-i-desi-report (February 2017)

20 EC (2016): Digital Single Market. Digital Economy and Society. See: https://ec.europa.eu/digital-single-market/en/desi (February 2017).

Overall, the leaders in the EU (EU-28 top) - like Sweden, Denmark and Finland - also lead in the I-DESI. They are closely followed by Korea, Iceland and the USA. Norway, Japan, Switzerland, Canada and Australia are next in the ranking and likewise above the EU average (EU-28). In the three indicators “Use of internet”, “Human capital” and “Integration of digital technology in business life”, the EU member states top the I-DESI; for “Connectivity” and “Digital public services”, the EU states still need to catch up in the international comparison. In general, the challenge for the EU is to close the gap between its individual member states.

3 Digitalisation of the labour market

3.1 In general – impact on employment, change in the work landscape

There are numerous study results of the most diverse quality on "Digitalisation of the world of work". The perspectives from which the digital transformation is examined vary depending on who commissioned the study, which institute carried it out, and what analytical method was used. As a result, there is a large range of forecast job losses.

The study designs differ not only with regard to the method used and the job losses deduced therefrom, but also in terms of the forecast periods. They refer to different time periods in which occupations/employees/tasks can/could be replaced by automation or digitalisation in coming years.

The forecasts are based on different models; of course, it is not possible to take intervening variables into account – especially for periods well into the future. Irrespective of the individual studies, though, one thing seems certain: digitalisation in the labour market will increase more and more, and many of today's occupations, or more precisely tasks, will be replaced or aided at least in part by computers or will disappear. Whether the forecasts and forecast periods are stringently consistent is questionable, but the revolution is already underway.

The conclusion of all the forecasts is: there is no doubt the digitalisation processes will change the world of labour in the near future. In some sectors these processes are already well advanced. Whereas it is predominantly blue-collar jobs that are currently affected by digitalisation, jobs in the white-collar sector will also be hit by the automation processes in future.

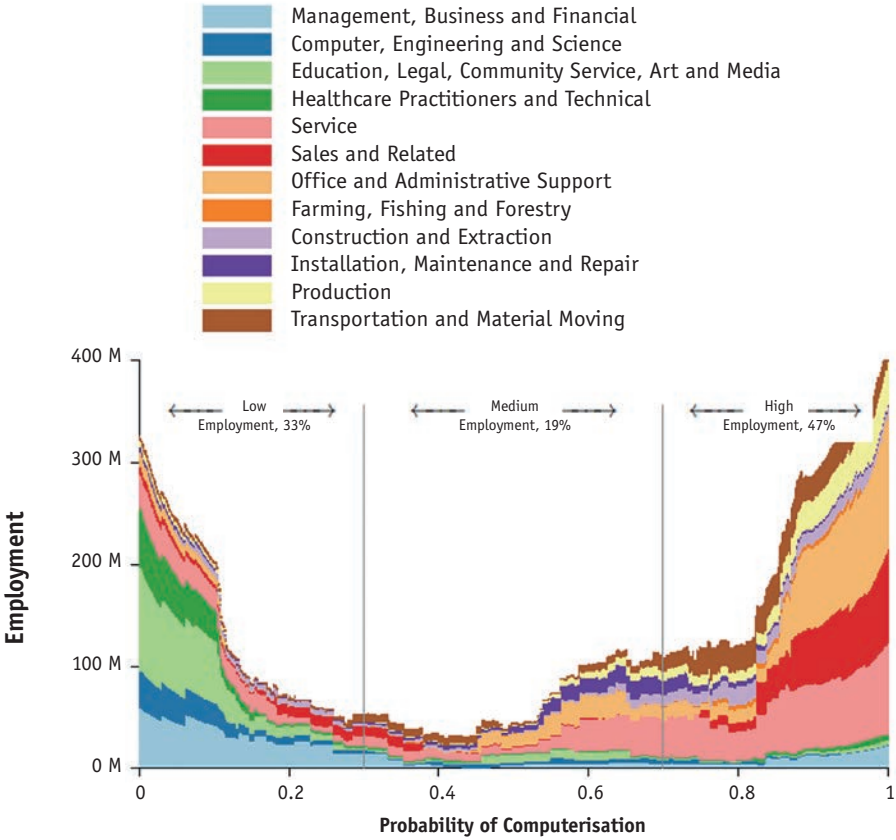
3.2 International studies – impact on employment

3.2.1 Frey & Osborne, 2013 (forecast job losses, USA)

The best-known study, the first in a plethora of studies that followed it, is by Frey/Osborne[21] (economists at Oxford University) from 2013. This work is based on experts' assessments and analysis of labour market data, and relates to the susceptibility of occupations in the USA to automation.

21 Frey, C. B. / Osborne, M. A. (2013): The future of employment: How susceptible are jobs to computerization. See: http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf (January 2017).

Figure 5: Employees in economic sectors and the probability of their being replaced by computers



Source: Frey, C. B. / Osborne, M. A. (2013): The future of employment: How susceptible are jobs to computerization, p. 37. (The distribution of BLS 2010 occupational employment over the probability of computerization, along with the share in low, medium and high probability categories. Note that the total area under all curves is equal to total US employment).

The above-mentioned study estimated the probability of automation for each of 702 occupations in the USA: there were groups with a low (30%), medium (50%) and high risk of being replaced (70%). The core message was: according to Frey and Osborne, within the next 20 years 47 percent – almost one in two employed Americans – will be exposed to a high risk (over 70%) of losing their job through automation and digitalisation.

According to the study, the automation of occupations will take place in two waves: in the first wave (within 10 to 20 years) the 47 percent of occupations addressed may be successively replaced by computers. After that, human work will be replaced by machines at a slower rate, all down to technical bottlenecks; this affects occupations with a medium risk of being replaced.

In a second time-lagged wave of automation, once technical bottlenecks have been overcome, those working in occupations with a low probability of automation will be facing this issue. This will affect the remaining 33% of employees.

In a related analysis, the authors compare the probability of automation of occupations with the wages and skills of the employees in a particular occupation. The result: the probability of automation of an occupation is lower, the higher the pay and level of education. Hence automation could predominantly affect employees with a low level of education and low earnings. This is what the authors have to say about the sectors and occupations affected, which are illustrated in the above graph:

"According to our estimate, 47 percent of total US employment is in the high risk category, meaning that associated occupations are potentially automatable over some unspecified number of years, perhaps a decade or two. [...] In the first wave, we find that most workers in transportation and

logistics occupations, together with the bulk of office and administrative support workers, and labour in production occupations, are likely to be substituted by computer capital. [...] the automation of transportation and logistics occupations is in line with the technological developments documented in the literature. [...] More surprising, at first sight, is that a substantial share of employment in services, [...] [where most jobs have been created in the US over the past decades (Autor and Dorn, 2013] exhibit high probabilities of computerisation."[22]

3.2.2 Bowles, 2014 (probability of computerisation of jobs in the EU)

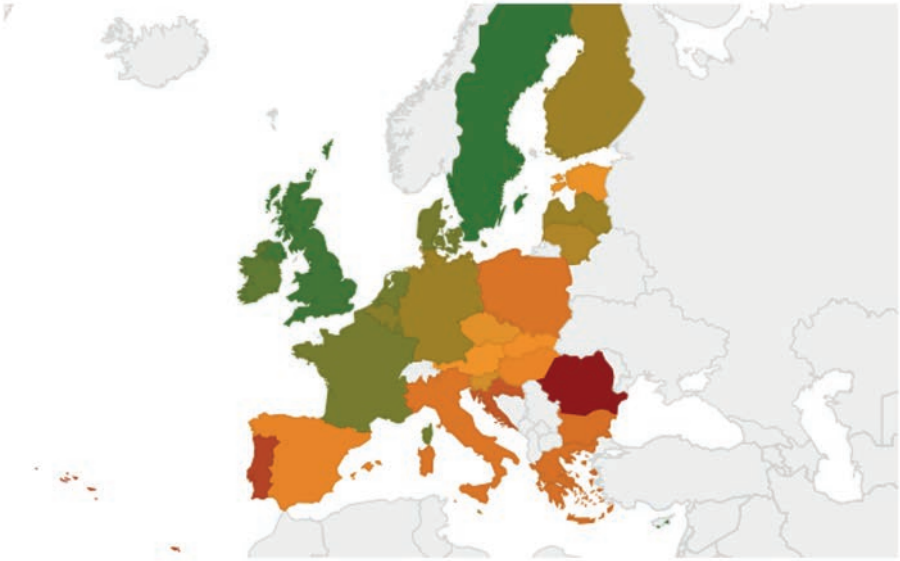
A study by economist Jeremy Bowles from the London School of Economics, the methodology of which is based on the work of Frey and Osborne, produces even more dramatic results for Europe: in the European Union, on average 54 percent of jobs are at risk in the next twenty years.[23]

Thus between 46.7 percent (Sweden), 47.2 percent (Great Britain) and 61.9 percent (Romania) of jobs in the 28 EU member states are threatened by the technological leap in development. In Bowles' calculation, the data for Portugal are similar to those of Romania. In Portugal 59 percent of today's jobs are at risk of being lost.

22 Frey, C. B./Osborne, M. A. (2013): The future of employment: How susceptible are jobs to computerization, p. 44f.

23 Bowles, J. (2014): The computerization of European Jobs. Brueghel, Brussels. See: http://bruegel.org/nc/blog/detail/article/1394-the-computerisation-of-european-jobs/; http://bruegel.org/2014/07/chart-of-the-week-54-of-eu-jobs-at-risk-of-computerisation/ (January 2017),

Figure 6: EU-28 potential risk of job losses



Source: Bruegel calculations based on Frey & Osborne (2013), ILO, EU Labour Force Survey. See: http://bruegel.org/2014/07/chart-of-the-week-54-of-eu-jobs-at-risk-of-computerisation/; the countries marked in red are at greater risk than those marked in lighter colours (range of values: 46.69 to 61.93), (January 2017).

Figure 7: Risk of computerisation after Bowles in EU member states

EU states	Risk of computerisation in %	EU states	Risk of computerisation in %
Austria	54.10	Latvia	51.08
Belgium	50.38	Lithuania	51.85
Bulgaria	56.56	Luxembourg	49.60
Croatia	57.91	Malta	51.27
Czech Republic	53.65	Netherlands	49.50
Denmark	49.54	Poland	56.29
Estonia	53.94	Portugal	58.94
Finland	51.13	Romania	61.93
France	49.54	Slovakia	54.70
Germany	51.12	Slovenia	53.19
Greece	56.47	Spain	55.32
Hungary	55.34	Sweden	46.69
Ireland	48.51	United Kingdom	47.17
Italy	56.18		

Source: IHS illustration after Bowles. See: http://bruegel.org/2014/07/chart-of-the-week-54-of-eu-jobs-at-risk-of-computerisation/ (January 2017)

3.2.3 Different methodological approaches – "occupation-based" vs. "task-based"

Based on the Frey/Osborne-Studie published in 2013, similar studies were carried out in Europe.[24] The researchers came to results similar to those of their peers in the USA.[25] Researchers at the Centre for European Economic Research (ZEW) developed this methodology further and opted for an alternative approach, whereby the focus was on tasks and not on occupations. They analysed how specific tasks in a specific occupation can be replaced by computerisation.[26] In their analysis, the predicted threats for employees were far fewer.

The ZEW researchers analysed tasks using the "Programme for the International Assessment of Adult Competencies" (PIAAC). The results show that employees in occupations that can easily be automated often carry out analytical or interactive tasks at the same time that are difficult to computerise. In interviews, managers say that they "frequently carry out a high percentage of all analytical tasks (54%) and a high percentage of all interactive (65%) tasks."[27] From this, the authors Frey/Osborne (2013) deduce a very low probability of computerisation for executive staff (15%).

24 Bonin, H. / Gregory, T. / Zierahn, U. (2015): Übertragung der Studie von Frey/Osborne (2013) auf Deutschland. (ZEW-Kurzexpertise, 57). See: http://ftp.zew.de/pub/zew-docs/gutachten/Kurzexpertise_BMAS_ZEW2015.pdf (January 2017); Pajarinen, M. / Rouvinen, P. (2014): Computerization Threatens One Third of Finnish Employment, ETLA Brief 22, 13 Jan. 2014. See: https://www.etla.fi/wp-content/uploads/ETLA-Muistio-Brief-22.pdf. (January 2017). Schattorie J. / de Jong, A. / Fransen, M. / Vennemann, B. (2014): De impact van automatisering op de Nederlandse Arbeidsmarkt, Deloitte. See: http://www2.deloitte.com/content/dam/Deloitte/nl/Documents/deloitte-analytics/deloitte-nl-data-analytics-impact-van-automatisering-op-de-nl-arbeidsmarkt.pdf. (January 2017).

25 According to the Frey/Osborne method, in Germany some 42 percent of employees work in occupations that have a high probability of being computerised within two decades.

26 By the same method, relating to tasks, in a direct comparison between Germany/USA the figure for employees affected by computerisation would be 9% in the USA and 12% for Germany. Bonin, H. / Gregory, T. / Zierahn, U. (2015): ibid, foreword.

27 ZEW News (July/August, 2015): Chance statt Bedrohung – die Digitalisierung wird die Zukunft der Arbeit verändern. Mannhein, p. 2; see: http://ftp.zew.de/pub/zew-docs/zn/zn0715.pdf (March 2017).

This also applies to office staff, for they likewise frequently carry out analytical tasks that are difficult to automate (about 30%). However, Frey and Osborne predict a 85-percent probability of computerisation for them.[28] According to ZEW authors, therefore, the "occupation-based approach" overestimates the potential for computerising many occupations. Also, country-specific differences in task profiles within groups of occupations are not given enough consideration or are underestimated. See the results in 3.2.4.

Why the predicted job losses in the ZEW study are not as high as they are in studies by other authors can be summarised as follows:

- Overestimation of technical potential by robotics experts
- Equation of potential for automation and effects on employment
- Inadequate consideration of the creation of new jobs

There are also semantic incongruities: for instance, Frey and Osborne do not explicitly write "that the occupations which in their estimation are automatable will actually be automated. However, they interpret their probability of automation not only in the sense of probability of these occupations being automated, but also in the sense that the corresponding jobs are at risk."[29] In this way they equate potential for automation with the risk of actual automation. Although the results worked out by the ZEW authors likewise indicate a markedly high potential for automation in low-skilled and low-income groups of workers,[30] the expected potential does not have to result in an actual loss of jobs in every case by a long chalk.

28 ZEW News. ibid.

29 ZEW-Kurzexpertise (2015): ibid, p. 6.

30 For people in Germany with only primary and elementary schooling, the figures relating to the risk of automation are 80% versus 18% for people with a PhD. The risk of automation for employees with the lowest level of income (<10%) is about 60%; for employees with the highest level of income (90%-100%) the figure is about 20%. These correlations were measured for both Germany and the USA.

In their expertise published in 2015, the ZEW authors summarised thus: "Consequently the probability of automation must not be misunderstood as the probability that jobs will be replaced by machines in the future. Rather it indicates which employees frequently carry out tasks that could potentially be automated. The challenge for these workers is to adapt to the technological change. For this to succeed, employees, companies and policy-makers must invest in skilling the workforce. In this way, on-the-job training measures and the promotion of lifelong learning help prepare employees for more complex tasks at work and in coping with new machinery."[31]

So far, knowledge of correlations between automation, change in professions, job losses and job creation has only been inadequately researched. There would have to be more exact data from companies permitting forecasts in relation to existing potential and actual use of technologies, and subsequently in relation to employment and income.[32]

3.2.4 ZEW/OECD, 2016 – risk of automation in the OECD area

In 2016, the abovementioned team of researchers adopted a new methodological approach. Instead of the "occupation-based approach" they opted for a "task-based approach".

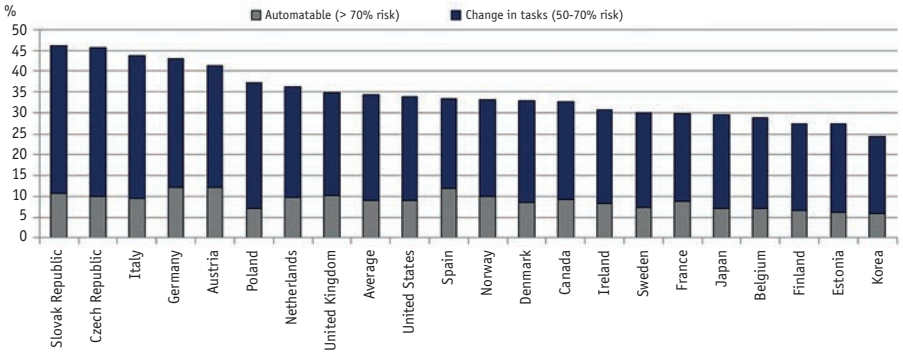
The background to this is that even occupations with a high risk of automation often involve a large number of tasks that will be difficult to automate in the future, as already stated in the previous sub-chapter. The researchers explain their method as follows:

"Firstly, we estimate the job automatability of jobs for 21 OECD countries based on a task-based approach. In contrast to other studies, we take into

31 ZEW News, ibid, p. 2.
32 ZEW-Kurzexpertise (2015): ibid.

account the heterogeneity of workers' tasks within occupations. Overall, we find that, on average across the 21 OECD countries, 9% of jobs are automatable. The threat from technological advances thus seems much less pronounced, compared to the occupation-based approach. We further find heterogeneities across OECD countries. For instance, while the share of automatable jobs is 6% in Korea, the corresponding share is 12% in Austria..."[33]

Figure 8: Number of workers in occupations at a high and medium risk of automation



Note: Data for the United Kingdom corresponds to England and Northern Ireland. Data for Belgium corresponds to the Flemish Community.

Source: OECD (2016): Policy Brief on the Future of Work. Automation and Independent Work in a Digital Economy; www.oecd.org/employment/future-of-work.htm; (January 2017).

33 Arntz, M. / Gregory, Z. / Zierahn, U. (2016): "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", in: OECD Social, Employment and Migration Working Papers, No. 189, OECD Publishing, Paris, p. 4. See: http://www.oecd-ilibrary.org/social-issues-migration-health/the-risk-of-automation-for-jobs-in-oecd-countries_5jlz9h56dvq7-en?crawler=true (March 2017).

The above chart refers to the calculated percentages of workers in occupations at a high risk of being automated (over 70%) and a medium risk (50%-70%). Germany, Austria and Spain have the highest proportions of automatable jobs (12% each). They are followed by the EU member states of Slovakia (11%), United Kingdom, the Czech Republic, the Netherlands and Italy (10% each). This contrasts with the EU countries Estonia (6%), Finland and Belgium (7% each).[34]

The calculated differences in relation to automation in the individual OECD countries are due to the fact, for instance, that in the past there were differences in levels of investment in ICT, workplace organisation is more or less communication-intensive, and levels of education differ.

3.3 The role of education in digitalisation

3.3.1 Employment rates and specialist discipline on the OECD level

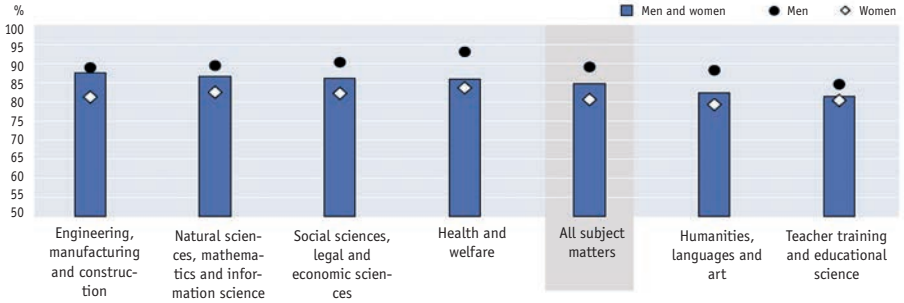
The level of education and integration in the labour market are closely related. This correlation will emerge even more sharply in the course of advancing digitalisation.

However, the employment rates point to a correlation with the chosen field of study (tertiary eduction) in which the student graduated. The employment rates for graduates in the fields of engineering, manufacturing and construction as well as natural sciences, mathematics and informatics are high compared to the employment rates of graduates in the fields of education (teacher training, educational sciences), the humanities, languages and art.

34 The figures refer to a probability of automation of >70%.

The chart below outlines the results for the employment rates for male and female graduates from the tertiary sector in the OECD area, both overall – across all fields of study – and also split into specialist disciplines.
The employment rate for all fields of study and for men and women together is 85%. Men tend to achieve higher employment rates (89%) than women (81%); this correlation is found in every specialist discipline, chiefly because the inactivity rates among women are higher than those of men.

Figure 9: Employment rates of adult graduated from the tertiary sector by field of study and gender (2012/2015), OECD countries



Source: OECD (ed.) (2016): Education at a glance, p. 119, Table 5.3; Employment rates of tertiary-educated 25-64-year-olds, by field of study. See: https://www.oecd.org/berlin/publikationen/bildung-auf-einen-blick.htm (January 2017), (https://www.keepeek.com//Digital-Asset-Management/oecd/education/education-at-a-glance-2017_eag-2017-en#page119 – for English version).

The gender-specific difference in employment rates is most pronounced in the "Health and welfare" sector; the least in the "Education" sector (teacher training and educational science".

For both genders the employment rates are high in the disciplines of "Engineering, manufacturing and construction" as well as in "Natural Sciences, mathematics and informatics". At the other end of the scale, we find the arts and humanities.

Although for years politicians and economists have pointed to the correlation between educational choice and opportunities in the labour market, relatively little changes in this area. The proportion of male university graduates in the fields of engineering, manufacturing and construction is 31%, for female graduates the proportion is about 7%. On the other hand, the gender ratio in the education disciplines is the reverse: 18% female graduates as opposed to only 7% male graduates.[35]

The growing demand for highly educated employees possessing technical and natural science skills will further exacerbate the mismatch between skills supply and demand in the future.

3.3.2 ICT specialists in Europe

On an EU level, data on ICT skills of employees are being gathered in connection with the digitalisation of the world of work. In 2015, there were just under 8 million employees in the EU working in ICT.

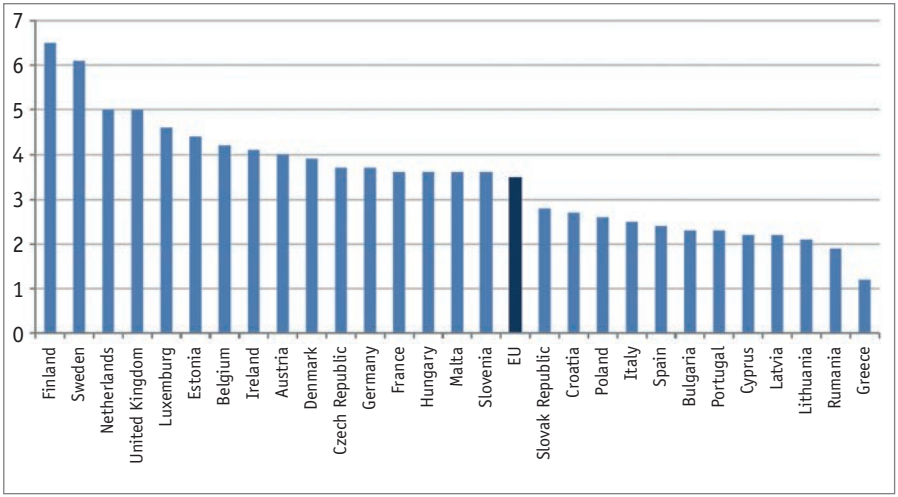
This figure has risen continually in recent years, viz. between 2011 and 2015 by almost 1.5 million people and proportionally – in relation to total employment – from 3.0% (in 2011) to 3.5% (in 2015).[36]

The following chart shows the distribution in individual EU countries:

35 OECD (ed.) (2016): Education at a glance, ibid.

36 Eurostat Press Centre (9/2016): nearly one and a half million additional ICT specialists employed in the EU in the last 5 years. See: http://ec.europa.eu/eurostat/documents/2995521/7711518/9-25102016-AP-DE.pdf/a44a4265-7935-4111-a537-8dfc0e4611a4 (March 2017).

Figure 10: Proportion of ICT specialists in Europe, 2015 (in % of total employment)



Source: Eurostat Press Centre (9/2016), ibid. Data: isoc_sks_itspt (updated 21.12.2016).

In absolute terms, in the United Kingdom there are about 1.54 million people working as ICT specialists, in Germany 1.47 million, and in France 0.95 million. In 2015, these three EU nations alone accounted for more than half of all ICT specialists employed in the EU; more than eight out of ten ICT specialists in the EU were male (84%), and six out of ten ICT specialists (61%) in the EU had an academic degree.

The picture of distribution by country is the following: Finland reported 6.5% ICT specialists in the total employment figure, Sweden 6.1%, the Netherlands and the United Kingdom 5.0% each – those are the countries with the highest figures in this sector. They are followed by Luxembourg

(4.6%), Estonia (4.4%), Belgium (4.2%), Ireland (4.1%) and Austria (4.0%), featuring among the better placed in the country ranking.

Denmark (3.9%), the Czech Republic (3.7%), Germany (3.7%) and France, Hungary, Malta and Slovenia, each with 3.6%, are all above the EU average of 3.5%. At the lower end of the scale are Greece (1.2%), Romania (1.9%) and Lithuania (2.1%) – there is a need here to catch up in taking measures in basic and further training.

3.4 Future skills/competencies in working life

With regards to professions, the task profiles as well as the skills and competencies required from employees are brought to the fore. There are already surveys and studies on this.

Figure 11 below shows the shifts in skills/competencies in demand in 2015 and 2020 in the labour market. The World Economic Forum (WEF) authors[37] listed eight identical skills, only the ranking changes. Complex problem solving is still top in 2020. Critical thinking and above all creativity will be more valued in the future, negotiation skills are becoming less relevant. The attributes active listening and quality control have generally disappeared in the 2020 list.

Emotional intelligence and cognitive flexibility are named as additional skills required in the labour market of the future. The WEF authors point out that these are only provisional forecasts; here, too, there is a need for more in-depth analyses of the labour market in order to furnish robust predictions.

37 WEF (2016): The Future of Jobs. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. See: http://reports.weforum.org/future-of-jobs-2016/ (März 2017);
The statements are based on an extensive survey conducted among approx. 370 globally operating organisations from different economic sectors (Chief Human Resources Officers and executives were asked for their opinion).

Figure 11: The skills/competencies in demand in the labour market – a comparison between the years 2015 and 2020

2020		2015	
1	Complex problem solving	1	Complex problem solving
2	Critical thinking	2	Cordinating with others
3	Creativity	3	People management
4	People management	4	Critical thinking
5	Coordinating with others	5	Negotiation
6	Emotional intelligence	6	Quality control
7	Judgment and decision-making	7	Service orientation
8	Service orientation	8	Judgment and decision-making
9	Negotiation	9	Active listening
10	Cognitive flexibility	10	Creativity

Source: WEF (2016): ibid. See: https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution/ (March 2017).

Even if the latest study results do not confirm the originally predicted higher job losses due to digitalisation processes, there is still a huge structural change in the labour market to be managed. There is increasing demand for IT and teaching professions, whereas it is most likely occupations in the manufacturing sector which permit considerable use of machinery that seem to be affected by workforce cuts.

The study results available mainly indicate that overall work is becoming physically less strenuous but mentally more demanding. The trend is towards highly-skilled tasks with an academic degree at the expense of simple manual tasks.[38]

From the perspective of companies, studies for the German labour market show that in the future greater value will be placed "primarily on process know-how as well as on an interdisciplinary way of working and multidisciplinary skills"; "social skills (e.g. in customer management) or creativity, i.e. skills in which people still have a comparative advantage over machines", will be in demand.[39]

38 Arntz, M. et. al. (2016c): Arbeitswelt 4.0 – Stand der Digitalisierung in Deutschland: Dienstleister haben die Nase vorn. IAB-Kurzbericht 23/2016. See: http://doku.iab.de/kurzber/2016/kb2216.pdf (March 2017).

39 Arntz, M. et. al. (2016): Tätigkeitswandel und Weiterbildungsbedarf in der digitalen Transformation. Studie des ZEW und des IAB im Auftrag der Deutschen Akademie der Technikwissenschaften, Mannheim; quoted from: ZEW policy brief, November (2016): Herausforderungen der Digitalisierung für die Zukunft der Arbeitswelt, Mannheim, p. 5. See: http://ftp.zew.de/pub/zew-docs/policybrief/pb08-16.pdf (March 2017).

4 Feedback from the participants

This chapter contains selected opinions and feedback from the participants in the five seminars held in Austria, Italy, Malta, Portugal and Hungary. It includes a cursory overview and focuses on digitalisation and its impact on society and the labour market.

During the seminars there were lively discussions on opportunities and challenges thrown up by advancing digitalisation. Speakers and participants exchanged opinions and considered measures and approaches for overcoming the future challenges. Whereas some issues and problems were (quite) similar for every country, others had more regional relevance. Despite individual differences of opinion, there was general agreement on an urgent need to come up with sustainable solutions for all European countries with regard to digitalisation.

Given the large number of presentations, contributions and discussions in the seminars, a list of all the topics discussed and specific characteristics would go beyond the scope of this chapter. Nevertheless, there were several issues that cropped up time and again in the discussions and were classified for every country and by a large number of participants as highly relevant. They were summarised under the topic groups below, which of course cannot reproduce each and every contribution. The aim is to present the key trains of thought of the seminars.

Main topics discussed in the five seminars:

– Reality and importance of the issue of "digitalisation": The seminar-goers were agreed that digitalisation – the so-called "Fourth Industrial Revolution" – had resulted in and would continue to result in fundamental changes both in work processes and in everyday life. Digitalisation was an

unstoppable, irreversible, global and very complex social phenomenon affecting society as a whole. The impact of digitalisation is manifold and affects among others companies/organisations, the education system, the labour market, and the individual in his/her entire social environment.

– Opportunities and risks of digitalisation: The participants pointed out numerous opportunities and risks of digitalisation. On the one hand, digitalisation is associated with progress, growth, employment, flexibility and the elimination of hazardous or unpopular jobs; on the other hand, the blurring of work and leisure (teleworking, deregulation of working hours: working on the go/at the weekend, availability at any time etc.) is putting the balance between life and work, workers' health and private/professional identity at risk. Many workers (low-skilled workers in particular) are threatened with the loss of their job, as it is cheaper to use new technologies than human beings. The risk of losing their job threatened employees not only in the private sector but also in the public sector – as discussed during the seminar in Vienna. Another disadvantage for employees was that progressive digitalisation was enabling and increasing comprehensive monitoring and the misuse of personal data. Potential cyber crimes like hacking, data espionage etc. represented major security challenges for companies. Moreover, digitalisation could result in the exclusion of individual population groups, such as the elderly or the disabled (digital gap). There were reports on this from, for instance, Mediterranean countries like Portugal, Italy and Croatia, where internet use was very low among the older population, sceptical to fearful of new technologies. Participants recognised that progressive digitalisation could also benefit social integration, particularly in the USA, where for instance doctors provided online consultations for people no longer (very) mobile.

The new form of work that is **"crowdworking"** is increasingly superseding traditional, regulated work contracts and causing an increase in

atypical/precarious employment (with no social security or pension scheme, with little influence on the work situation, with poor contractual working conditions, with means of livelihood at risk, as often poorly paid/underpaid etc.). In some cases the people affected are forced into self-employment and have to work very flexibly for online platforms in global competition. At the seminar in Milan, a young, well-educated software developer working as a crowdworker related his own positive experience. For him, crowdworking had chiefly advantages: he worked from home and so did not have to spend time travelling to work, could work anywhere in the world, and appreciated the very flexible working hours. In his opinion the crucial factor was delivering work on time. It was of no interest to the employer where the work was done and how long it took to do. But it all went very quickly, though, and you had to be disciplined and undergo further training time and again at home (online, via e-learning platforms: low costs, big benefit). The question was, though, whether he would still find crowdworking attractive in 20 or 30 years. Those sceptical of crowdworking feel the opportunities are mainly for employers, as it gives them cheap access to know-how.[40]

Although the **"Sharing Economy"** phenomenon (which for instance during the World Expo in Italy resulted in a huge rise in overnight accommodation options bookable through Airbnb) is usually less expensive for the user, it has to be viewed critically in that through it taxes are often not paid at all or not paid in full.

– Development of professions: The subject of the development of professions was discussed a great deal in the seminars. In summary it can be said that some professions are expected to disappear completely, especially where repetitive work is being automated and human beings are replaced by digital technology (in accountancy by automated transactions, in banking by

40 An example of an online market for crowdworking was also presented at the FLC seminar. See: https://www.mturk.com/mturk/welcome (March 2017).

online banking, in the postal sector by digital correspondence etc.).
In many professions, tasks are changing, and new professions are created. The participants named recently created new professions as digital animators, e-teachers for disabled people, developers of e-training programmes, internet lawyers, e-managers (e.g. in companies and schools).

– Mismatch between skills supply and demand: The structure of the labour market has changed dramatically, and there is often a mismatch between skills supply and demand. Despite high unemployment figures, there are many vacancies that cannot be filled because the requisite skills are lacking. In concrete terms, it is currently difficult to fill the following highly skilled posts in the ICT sector: software analysts and developers, IT managers, app developers, (ICT) security experts, web developers, system analysts, engineers. Owing to the great demand for these occupations, there is competition for the best brains. The salaries and other incentives (such as free use of sports facilities, free lunch, extra insurance) are high. Employers want to avoid a further rise in labour costs and so are interested in many people receiving good training in ICT. There are reports from Spain, Portugal and other countries that on the one hand there are many highly-qualified young graduates and on the other hand companies looking for staff but not finding any with the (digital and/or very specific) skills required, as this know-how is not imparted either in schools or at universities. The criticism was that co-operation and exchange between educational institutions and companies were largely lacking, hence requirements were unclear. In this respect, the dual training system was highlighted as positive, as it establishes a link between schools and companies. The call was for training courses that prepare people for the labour market ("basic and further training for employability"). Employers and employees have to change; employers are frequently too demanding; (future) employees often do not fully realise the labour market requirements.[41] The (ever widening) gap between the labour

41 It was also pointed out repeatedly, though, that education systems should not be guided only by companies, as a broad education is important.

market requirements and the existing training of jobseekers should be closed, there being a need for suitable (vocational) basic and further training, (re-)skilling, guidance and advice/coaching (especially for youngsters, to smoothen the transition from education and training to the labour market). Job advertisements via online platforms can assist the job search/matching of job requirements and skills), as demonstrated at the seminar in Milan.[42]

– Lifelong learning as a matter of course: Everyone rated lifelong learning as very important. Learning should already commence in pre-school, and after schooling or university education there was a need for ongoing training (e.g. in the digital sector – especially for older employees, as they are more likely to lose their job owing to a lack of digital skills). Knowledge becomes obsolete very quickly and employees must adapt very quickly. Each individual should take the initiative to change, to be proactive, mobile and flexible.

– What skills will be required in the future, too? This question was examined in particular during the seminars in Lisbon, Budapest, Milan and Malta. It was agreed that there would still be demand for cognitive, demanding tasks (e.g. management, controlling), as well as unique craftsmanship. The following technological skills were identified as being very important: digital skills, ICT skills (programming, Cloud computing etc.), and statistical analyses of large databases (data mining). Especially in the seminar organised by FLC, it was stressed that despite the importance of these "hard skills", "soft skills" like social skills, interpersonal skills, creativity and mutual learning should not be forgotten, as they were essential in working life.

– STEM[43] subjects not so popular, should be made more attractive: Despite the large demand for STEM graduates in the labour market and good career

42 "Italian Labour Market Digital Monitor – Discover Jobs on the Web." See: www.wollybi.com
43 Schience, technology, engineering and mathematics.

prospects, their number is relatively small throughout Europe, especially among women. The reasons stated for the low proportion of women were: stereotypes, cultural aspects (women prefer to study humanities and are reticent when it comes to the use of robots), a lack of care services for children or the elderly, a lack of role models; an unbalanced gender ratio makes it unattractive for a minority to study these subjects and afterwards work in these areas. The influence of parents in career choice was pointed out at the seminar in Budapest: for instance, parents in Southeast Asia would have nothing against their child working in the IT sector; in Hungary parents preferred their children to opt for "traditional", "safe" (always in demand) professions with a good reputation such as lawyer, doctor, veterinarian, dentist. In some cases, programming workshops for women and girls are being offered to make the STEM subjects more attractive to women and reduce the digital gap between men and women.

– Adapting education systems is essential: Education is gaining in importance in the digital world of work – in the future, digital skills will also be required for low-skilled tasks. "The digital transformation begins (at the latest) in school" – many participants said, and so they called for schools[44] to adjust to this. In their opinion, schools are often not furnished with up-to-date technical equipment. Yet even if tablets and visualisation technologies are used in schools, the teaching and learning with them is usually traditional. Profound changes are essential – in teaching approaches (with an impact on curricula), in the basic and further training of teachers particularly in the digital sector, in the role and perspectives of teachers etc. People would have to be prepared for the new system; it was not just a question of infrastructure. Lessons should no longer be by disciplines, but by topics (as already practised in Finland). This multidisciplinary approach was graphically presented to the seminar-goers in Milan using the example of "baking a

44 This applies to all educational institutions right up to universities.

Sachertorte" (chocolate cake). The trainees had to take into account cultural/baking method/linguistic aspects etc.

The following were presented as positive French examples of innovative schools in digitalisation:

- "École Supérieure du Digital": it is aimed at young people who are not in education, employment or training (NEETs). The objective is to give rapid access to employment. The deciding criterion for admission is the applicants' motivation. The school aims to promote autonomy and co-operation.

- "École 42": an open school for young people aged between 18 and 30 years passionate about and interested in programming, but with no formal diploma. It is open 24 hours a day and free of charge. Creativity counts. Learning by doing is the principle.

According to the participants, what was important and ought to be taught in schools more than anything was creativity, logical thinking, critical thinking, evaluating information, problem-oriented and problem-solving skills, entrepreneurial thinking, lateral thinking, new ways of thinking, and literacy in new technologies. New, improved teaching methods should be used. For example, programming can be learnt playfully using a computer[45] – learning should also be fun. What is more, the computer can be personalised for disabled people, for instance, increasing equal opportunities (inclusive approach). In this case, however, teachers must have extremely good digital skills.

With all these technological changes, parents and teachers alike ought to be included, as the changes entail risks and dangers (e.g. cybermobbing in

45 This was demonstrated live during the seminar in Milan using the Minecraft Cloud platform (https://minecraft.net/de/), which can also be used by teachers in schools on a tablet.

social media). It is also a matter of the socialisation of young people. What do so-called (virtual) "friends" mean in social media, what do real friends mean?

– Growing up with digital technologies does not necessarily mean mastering them: Youngsters accept new technologies faster, master some tools, and make above-average use of social media. However, de facto it must also be said that being a digital "native" does not automatically mean having digital skills. This was established and discussed at the seminar in Lisbon in particular. Many young people have very reduced critical faculties and cannot recognise untrue information. More has to be done to create an information-literate generation. At present, use is generally geared to consumption – and not to professional use. Often young people lack professional skills, for instance they cannot accomplish work tasks (e.g. in Excel), although they claim they know how to use the tool. This may explain in part why many youngsters find it tough in the labour market.

– National digitalisation programmes: Some EU countries have drawn up national digitalisation programmes, such as Portugal with the "Strategy and Action Plan for Digital Jobs 2015-2020", which contains concrete initiatives[46], and Hungary with the "National Programme for Digital Success", whose central pillars are basic and further training, lifelong learning, easier internet access for all, digitalisation in companies, especially SMEs, and promoting digital start-ups. The measures proposed are intended to be of use both to companies and individuals. The degree of digitalisation of SMEs is often low compared to large companies (often they have no homepage, no online shop etc.), there is a need to catch up – not just in Hungary, but also in many European countries where the overwhelming majority of firms are SMEs.

46 See: http://www.empregabilidadedigital.pt/sites/default/files/brochura_cped_en.pdf (March 2017).

– Tax and social security systems must take the circumstances of digitalisation into account. Generally speaking, participants were agreed that work should be taxed less and capital more. The value-added chain ought to be seen in a new light, and taxes paid where the revenue is generated. In the sharing economy, often no taxes are paid in the country in which the service is performed, and this was felt to be unfair. A possible solution proposed for a lack of social security etc. in the case of crowdworking, was that platforms should be declared to be employers who are obliged to pay social security contributions. As it is a matter of competitiveness, a common European solution for the digital world of work is called for.

– Legal aspects: Consumer, worker and data protection ought to be guaranteed by corresponding legislation, tax evasion made more difficult. A new legal international or at least European framework has to be created for the digital world of work, on the one hand quickly (as the phenomena are already ubiquitous) and on the other cautiously, since it seems very hard to regulate digitalisation.

– Migration and digitalisation: In Portugal many "digital natives" have emigrated, as they have been headhunted from richer countries. The aim is to keep this know-how in Portugal in future and to use it there. Highly-skilled people are also emigrating from Hungary and Slovakia. But there is already the opposite trend, as they are returning, for there are good job offers in their own country and the government is backing this process. Maltese firms employ software developers abroad (e.g. in Macedonia), as they are cheaper there – if people can work from anywhere there is less emigration. On the one hand people from Ukraine are emigrating to Denmark; on the other hand, jobs are coming back from China and Eastern Europe, as total costs in Denmark are now lower owing to the use of robots. The digital labour market is open to everyone, but it is difficult/impossible to compete with low-wage countries (such as India).

– After visiting parts of the **Audi Hungary factory in Györ** during the seminar in Budapest, representatives of the trade union and the works council were available for further information and a discussion on **digitalisation in the automobile industry**. The industrial relations were described as very good. Because tasks are complex, only skilled workers who can operate robots are taken on. Basic and further training during working hours is very important, as there are constant innovations. Most of the workers are young and able to use new technologies well. Further vocational training in this area is available for older employees if needed. The work itself has become easier for the workers because of the new robots. Besides automated work, manual work is still being done, at least for the time being. In future, in particular jobs for low-skilled workers (such as transporting parts within the factory) could be lost owing to the increasing use of robots. On the one hand, the participants' impressions were positive: automation is helpful for the workers, as strenuous and dangerous work is done by robots; many employees are unionised; working conditions are relatively good; everything is well organised. On the other hand, negative aspects were also evident: the work done by people in some areas is currently still of a higher quality than that done by robots, but that could change in future owing to the increasingly optimized technologies and result in greater job losses. Questions that arose were: What is it like to work together with a robot? How does the worker view his own work performance? Does the fact that a robot is consistently efficient, is never sick, and does not need any breaks (except for repair and servicing times) cause work-related stress? What challenges does this throw up for health and safety at work?

– At the Krifa seminar in Malta, a Dutch trade union representative presented a pilot project of an **online community for trade union work**. The main reasons given for its use were to recruit new (especially young) members, to provide information on trade unions' objectives and tasks, to convey a collective attitude, to facilitate communication (exchange and gathering of

ideas, e.g. through discussion forums, blogs). The use of this online platform was illustrated with the "collective bargaining" process, which was thus rendered transparent. Many areas of the online platform can be accessed both by members and by non-members. It is necessary to be a member, though, to make use of advice services and other services.

In every seminar there was discussion on what **challenges workers' organisations faced through digitalisation**. The topics ranged from worker protection to the target groups of trade union work. There is a summary of recommendations for action to workers' organisations in this regard in chapter 6.

5 Description of the challenges

The big challenge is combining the digital world with the physical world, and this calls for a positive, proactive approach and European co-operation. Focusing on workers and the workers' organisations representing them, the question arises as to what the current problems and key challenges are in connection with the rapidly progressing digitalisation.

– Societal challenges

With all these technological changes, there are challenges for society as a whole. Here are examples of questions this throws up:

– How do young people become socialised: more through virtual counterparts or real friends?

– To what extent are population groups that do not use digital media excluded?

– What about solidarity in times of increasing individualisation?

– What does the migration of "digital natives" and "brain drain" mean for the respective countries of origin and destination?

– What impact does competition with low-wage countries have in the digital labour market open to all?

– Not everything that is technically feasible ought to be put into practice – who sets what limits to the advancing digitalisation? Do the new technologies serve mankind, do they promote a good life and increase job satisfaction, or do they dehumanise society as a whole?

– What other ethical questions face a society increasingly pervaded by digital technologies?

– How can a further drifting apart/polarisation of the highly/low-skilled, people with very good/bad jobs or rich and poor be prevented?

– How can social security systems continue to be funded in the future and social unrest avoided?

– How can work be more fairly valued and distributed? Will there be a job in the labour market for every jobseeker?

– How can social justice be ensured? Is the redistribution of income, e.g. through an unconditional basic income, a suitable solution? How could such a basic income be funded?

– Mismatch between skills offered and required in the labour market

The structure of the labour market has changed immensely. Often there is a mismatch between skills supply and demand. Throughout Europe, besides the large number of unemployed there are also many posts that cannot be filled because the skills required are lacking. The challenges in this area are to promote co-operation and exchange between educational institutions and employers and to create curricula that prepare (potential) workers for the labour market and equip them with the skills it requires. Workers themselves should be aware of the situation on the labour market and take the initiative – individuals also have responsibility for their own working life. To assist them, access to advice should be guaranteed. The gender gap, particularly in STEM subjects, should be reduced. The many (technological) innovations make knowledge obsolete very quickly, which is why there is an ongoing need for basic and further training. Often older people are not as good at

using new technologies as younger people are, so further vocational training in this area is very important for them. Employers should provide basic and further training (i.e. organised and funded by them, and possible for the employee to do during working hours) and not shift reponsibility for this onto the individual. General conditions must be created for lifelong learning, as well as paid time off and social security in these periods.

– Further development of the education system

The skills required in the labour market are changing, so the challenge is to further develop education policy and the education provided by the state accordingly. Investments in contemporary technical infrastructure like tablets and visualisation technologies are the prerequisite for this. What is crucial, though, is that the teaching and learning processes with these technical aids should not be traditional. Approaches to teaching (with an impact on curricula), the basic and further training of teachers (especially in the digital domain) and teachers' role(s) and perspectives must be further developed. Lessons should no longer be by disciplines, but by topics (multidisciplinary approach). The following are important and should be taught more than anything: creativity, analytical thinking, critical thinking, lateral thinking, new ways of thinking, information and problem-solving skills, entrepreneurial thinking, using new technologies, digital (professional) skills.

– Protection and representation of workers

As some professions will probably disappear completely, unemployment will increase particularly in the sectors concerned (e.g. banking and manufacturing). For some (especially older) workers, it will be very hard to find another job. The new forms of work (such as crowdworking) are resulting in an increase in atypical employment and self-employment, often not chosen voluntarily but pursued for lack of any other employment options. This entails numerous social disadvantages: poor contractual working conditions,

undefined working hours, no social security, a need for high flexibility, few further training and career options, a lack of access to loans, wage dumping. Many achievements over recent decades are being called into question by the new forms of work. The challenge is to counter the appreciable social regression.

– Health and safety at work

Digitalisation is changing work-related processes and the way of working. Instead of working together with a colleague, it is becoming more common to have to "work together" with a robot or machine. This has implications for workers: how does the employee feel about himself/herself, his/her own work contribution? What are the interpersonal relations? The fact that a robot's efficiency is consistent, that it is never sick and never needs a break (except for repairs and maintenance), plus the reduction in interpersonal relations at work, can result in work-related stress, identity crises and a loss of self-esteem.

Crowdworkers, who work from home for global employers, are often put under great pressure: they frequently work for relatively low hourly wages, with little social security and tight deadlines, allowing for no sickness and causing fear for their livelihood. The blurring of work and leisure time can result in an unhealthy mix of work and private life and become a health risk.

– Legal and financial framework

Digitalisation has created economic sectors in which neither laws nor regulations apply. There is, for instance, no legislation for the sharing economy to prevent tax evasion or avoidance. With crowdworking, social security contributions are often not paid at all or are paid to an inadequate extent. The absence of a legal framework is putting the current tax and welfare systems at risk. Insufficient data protection is enabling the comprehensive monito-

ring of employees and the misuse of personal data. The co-determination rights of workplace employee representatives have not been adapted to the digital world of work.

A new legal framework with comprehensive safeguards for workers/consumers has to be created for the digital world of work. This must be constantly adapted to rapidly changing circumstances.

– Organisational development of workers' organisations

Some workers' organisations are still making inadequate use of new technologies. The challenges for the future are to use digital media:

– In their daily work, e.g. providing information and assistance by means of web-based systems or promote exchange and communication through discussion forums.

– To recruit and reach new target groups (e.g. young people and workers in SMEs). Trade unions are generally well established in large companies, less so in small and medium-sized firms. Young people use traditional media less and are not addressed by them. At times the sense and benefit of trade unions for themselves and society as a whole can be conveyed only with difficulty, and they frequently claim to be able to represent themselves well. To some extent they perceive trade unions as inflexible and barely capable of change. Using digital media could be an opportunity for reaching young people better.

– For collaboration with other parts of society (currently this is inadequate in some cases), since digitalisation is not only to be found in the world of work, but also affects practically every other sphere of life.

6 Recommendations for action for workers' organisations

There is a great deal for workers' organisations to do in relation to the digitalisation of the world of work. It is important for them to be positive in their approach, to play an active role, to grasp opportunities, to regulate and control the unstoppable technical development. The aim is for minimum standards to be introduced and observed both on an EU and a national level. The negative effects of digitalisation should be limited and cushioned by appropriate action from workers' organisations. The commitment of workers' organisations is particularly required in the following areas of activity.

6.1 Description of areas of activity

– Co-operation between the stakeholders

Co-operation between the most diverse stakeholders such as the EU, governments, workers' organisations, companies, education and research institutions, and non-governmental organisations (NGOs) is required to achieve sustainable solutions.

In this context, social dialogue – in the sense of a social partnership in which employers and employees work together – is very important, and should be further encouraged. Workers' organisations ought to recognise at an early stage signs of changes with an impact on workers' interests, and address proposals and recommendations on the impact of digitalisation and on dealing with it to the EU and to national governments.

– Commitment in societal issues

A consequence of advancing digitalisation is societal and ethical questions to which answers will have to be found. For instance, workers' organisations should advocate:

– Reducing the digital gap between different population groups. As many as possible should have access to the digital world.

– Preventing a further drifting apart/polarisation of the highly/low-skilled, people with very good/bad jobs, rich and poor.

– Stopping the use of new digital technologies dehumanising the world of work, and making sure that man and not the machine controls the world of work and society. Not everything that is technically feasible ought to be used. Limits must be set to digitalisation.

– Continuing to fund security systems in the future and preventing social unrest.

– Ensuring social justice by valuing and distributing work more fairly or restributing income (for example, unconditional basic income).

– Mismatch between skills offered and required in the labour market

Because of the existing mismatch between skills supply and demand in the labour market, workers' organisations should champion collaboration and exchange between educational and training institutions and employers to clarify what skills are in demand now/will be in the future, and what education and training courses ought to be created in order to prepare (potential) employees for the labour market. To increase the proportion of STEM gradua-

tes, workers' organisations should be committed to making these subjects more attractive – particularly to women – and to dismantling existing obstacles (image, a lack of care facilities etc.).

The task of workers' organisations is to make workers aware of upcoming changes, to give information about developments, and to guarantee advice.

The commitment of workers' organisations in the context of basic and further training and of creating suitable general conditions for lifelong learning should be reinforced. They should champion supporting basic and further training measures for people affected by digitalisation (particularly older people) so that they remain employable or become employable again.

– Further development of the education system

Workers' organisations should advocate schools being provided with modern technical equipment, approaches to teaching, curricula, the basic and further training of teachers (especially in the digital area) and the role and perspectives of teachers being further developed, and lessons being topic-oriented (multidisciplinary approach) in future. The enshrining of digital education, media skills and new skilling methods (e.g. Massive Open Online Courses - MOCCs) in basic education and in vocational training should be supported.

– Protection and representation of workers

Workers' organisations should play a greater part in change management processes, such as the extensive use of new technologies, because these new technologies entail advantages and disadvantages for workers. In general, this means ensuring and reinforcing institutionalised co-determination rights with regard to the organisation of work. As work processes are beco-

ming increasingly taken over by software programs or work being allocated by such programs, there must be a guarantee that the social dimension is not lost. Computers are unable to perceive humans in the work process as individuals who need work breaks and holidays, also have support and care duties in their private life parallel to their working life, and sometimes also fall sick.

To prevent regression with regard to the social dimension, workers' organisations should increasingly focus their activities on working conditions, fair pay, and questions of social security and further training. In this, the concept of "decent work", which guarantees human dignity, fair income and responsibility for the environment, should be the guiding principle.

– Health and safety at work

Workers' organisations should champion health and safety at work, because the removal of the boundaries between work and leisure, the blurring of professional and private identity, working together with machines/robots has become a health and safety risk (a safety risk, in that fear of losing one's job or livelihood can arise). Health measures that help prevent work-related stress, identity crises and a loss of self-esteem, and enable work-private life balance, should be supported. Such measures could be: identify psycho-social health risks related to the digital transformation, and introduce appropriate workplace measures or put forward regulations for health protection in a digital world of work.

– Legal and financial framework

Workers' organisations should advocate comprehensive statutory (international or at least European) safeguards that are adapted to changing circumstances on an ongoing basis: protection of consumers, workers and data (to

prevent extensive monitoring and the misuse of workers' and consumers' personal data). For example, the following legislation is affected: EU labour law (stipulating minimum standards of working conditions, the information and consultation of workers), the EU General Data Protection Regulation (EU-GDPR)[47], EU Directive on Consumer Rights, European copyright law.

Laws must be passed that prevent tax avoidance and evasion by companies (e.g. in the sharing economy) and ensure that the applicable social security contributions (e.g. also in the case of crowdworking) are paid. A legal framework must be created that ensures that the current tax and welfare systems are not jeopardised.

The works council's co-determination rights must be adapted to digital developments.

– Organisational devevelopment of workers' organisations

New technologies are used only to a limited extent in some workers' organisations. Greater use of digital media (e.g. by means of a web-based system) could make daily work easier, facilitate exchange and communication, and offer support.

Workers' organisations should press ahead with recruiting and reaching new target groups (young workers, workers in SMEs). Using digital media could also be beneficial in this respect. Through social media or platforms, potential members could be addressed, contacts established, existing contacts with members cultivated, and the image of workers' organisations be promoted (currently perceived primarily by younger people as rather inflexible and outmoded).

47 It is expected to be applicable throughout Europe from the second quarter of 2018 and is to standardise the right to use personal data or information. See: https://www.datenschutz-grundverordnung.eu/ and http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R0679 (March 2017)

Workers' organisations should commit themselves more to collaborating with other parts of society, since digitalisation is not only to be found in the world of work, but also affects practically every other sphere of life.

6.2 Summary: Recommendations for workers' organisations

Based on the different areas of activity, here follows a summary of recommendations for action for workers' organisations:

Topic	Recommendation(s) for action
Co-operation between the stakeholders	
Co-operation	Collaboration between governments, the EU, companies, workers' organisations, education and research institutions, and NGOs should be intensified.
Social dialogue	Co-operation between employers and employees should be further encouraged.
Societal issues	
Digital gap	Measures should be proposed that enable as many people as possible to have access to the digital world, thus reducing the digital gap between different population groups.
Polarisation, social unrest, social justice	Strategies should be developed on how to prevent the drifting apart of the highly/low-skilled, people with very good/poor jobs, rich and poor, in order to ensure social peace. To ensure social justice, proposals are important on how work can be

	valued and distributed more fairly, and how income can be redistributed, e.g. through an unconditional basic income.
Dehumanisation of the world of work	Limits must be set to digitalisation, because not everything that is technically feasible should be used.
Mismatch between skills offered and required	
Skills demand (in future)	Promotion of the collaboration and exchange between educational and training institutions and employers to counter the current mismatch between supply and demand in the labour market.
STEM subjects	Measures that increase the proportion of STEM graduates should be supported. In particular, these subjects should be made more attractive to women by dismantling existing obstacles (e.g. unappealing image of these subjects; lack of care facilities).
Basic and further training, lifelong learning	Commitment to basic and further training should be reinforced, suitable general conditions for lifelong learning created.
Information, advice	Information should be given on emerging developments in the labour market, and access to advice guaranteed.

Further development of the education system	
Technical equipment	Commitment to modern technical equipment for educational institutions.
Approaches to teaching	Approaches to teaching – and resultant curricula, the need for basic and further training, role(s) and perspectives of teachers – should be further developed. For instance, digital education, media skills and the use of new pedagogical methods ought to be enshrined in basic education and vocational training. A topic-oriented, multidisciplinary approach should be encouraged.
Protection and representation of workers	
Change management processes	Strong involvement in change management processes, particularly representing workers who lose their job through advancing digitalisation or whose job is severely affected by it.
Social regression	Social regression caused by the new forms of work resulting from digitalisation must be countered. The focus should be on fair pay and working conditions, further training, and social security. The concept of "decent work" should be pursued.

Health and safety at work	
Removal of the boundaries between work and leisure, blurring of professional and private identity, "working together" with machines, fear of losing one's job	Health measures that help prevent work-related stress, identity crises and loss of self-esteem, and that enable work-life balance should be supported.
Legal and financial framework	
Legal safeguards	Champion comprehensive statutory safeguards, such as consumer, worker and data protection.
Tax legislation and fiscal regulations	Ensure that laws are passed and fiscal regulations enacted that prevent tax avoidance and evasion, and guarantee that the applicable social security contributions are paid. The funding of social security systems should be ensured. The key questions for trade unions are: – Where is **value created** and where does the money go to? – How is the **profit** from work input and production facilities input fairly distributed? – How is the **funding** of social security systems guaranteed for the future?
Works council law	The works council's co-determination rights should be adapted to digital developments.

Organisational development of workers' organisations	
Digital media	Greater use of digital media to: – make daily work easier; – promote exchange and communication; – offer support; – reach and recruit new target groups (young workers, workers in SMEs); – improve image.
Extended collaboration	Encourage collaboration with other parts of society

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