

IBA Global Employment Institute



Artificial Intelligence and Robotics and Their Impact on the Workplace

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Prepared by:

Gerlind Wisskirchen

Blandine Thibault Biacabe

Ulrich Bormann

Annemarie Muntz

Gunda Niehaus

Guillermo Jiménez Soler

Beatrice von Brauchitsch



Foreword

The IBA Global Employment Institute (GEI) was formed in early 2010 for the purpose of developing a global and strategic approach to the main legal issues regarding human resources for multinationals and worldwide institutions. In addition to regularly updating existing reports, the advisory board publishes new reports concerning current legal issues every year.

This year, the advisory board presents its first report on 'Artificial Intelligence and Robotics and Their Impact on the Workplace'. The Working Group, coordinated by GEI Vice-Chair for Multinationals Gerlind Wisskirchen, focuses on future trends concerning the impact of intelligent systems on the labour market (Parts A and B) and some corresponding legal problems (Parts C to J).

Artificial intelligence (AI) will have a fundamental impact on the global labour market in the next few years. Therefore, the authors discuss legal, economic and business issues, such as changes in the future labour market and in company structures, impact on working time, remuneration and on the working environment, new forms of employment and the impact on labour relations.

Will intelligent algorithms and production robots lead to mass unemployment? By way of some examples, the authors show how AI will change the world of work fundamentally. In addition to companies, employees, lawyers and society, educational systems and legislators are also facing the task of meeting the new challenges that result from constantly advancing technology.

Please note that it is not the intention or purpose of the IBA Global Employment Institute's report to describe the law on any particular topic; its aim is to illustrate certain changes and trends on the future labour market. References to a particular law are neither intended to be a description or summary of that law nor should they be relied upon as a statement of the law or treated as legal advice. Before taking any action, readers should obtain appropriate legal advice.

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A. Introduction: Basics and Definition of Terms

Modern information technologies and the advent of machines powered by artificial intelligence (AI) have already strongly influenced the world of work in the 21st century. Computers, algorithms and software simplify everyday tasks, and it is impossible to imagine how most of our life could be managed without them. However, is it also impossible to imagine how most process steps could be managed without human force? The information economy characterised by exponential growth replaces the mass production industry based on economy of scales.

When we transfer the experience of the past to the future, disturbing questions arise: what will the future world of work look like and how long will it take to get there? Will the future world of work be a world where humans spend less time earning their livelihood? Alternatively, are mass unemployment, mass poverty and social distortions also a possible scenario for the new world, a world where robots, intelligent systems and algorithms play an increasingly central role?¹ What is the future role of a legal framework that is mainly based on a 20th century industry setting? What is already clear and certain is that new technical developments will have a fundamental impact on the global labour market within the next few years, not just on industrial jobs but on the core of human tasks in the service sector that are considered 'untouchable'. Economic structures, working relationships, job profiles and well-established working time and remuneration models will undergo major changes.

In addition to companies, employees and societies, education systems and legislators are also facing the task of meeting the new challenges resulting from constantly advancing technology. Legislators are already lagging behind and the gap between reality and legal framework is growing. While the digitalisation of the labour market has a widespread impact on intellectual property, information technology, product liability, competition and labour and employment laws, this report is meant to also provide an overview of the fundamental transformation of the labour market, the organisation of work and the specific consequences for employment relationships. Additionally, labour and data privacy protection issues are to be considered. For this purpose, it is first necessary to define a few basic terms.

I. What is artificial intelligence?

The name behind the idea of AI is John McCarthy, who began research on the subject in 1955 and assumed that each aspect of learning and other domains of intelligence can be described so precisely that they can be simulated by a machine.²

1 See: www.spiegel.de/wirtschaft/soziales/arbeitsmarkt-der-zukunft-die-jobfresser-kommen-a-1105032.html (last accessed on 3 August 2016).

2 See: www.spiegel.de/netzwelt/web/john-mccarthy-der-vater-der-rechner-cloud-ist-tot-a-793795.html (last accessed on 11 February 2016).

Even the terms 'artificial intelligence' and 'intelligent human behaviour' are not clearly defined, however.

Artificial intelligence describes the work processes of machines that would require intelligence if performed by humans. The term 'artificial intelligence' thus means 'investigating intelligent problem-solving behaviour and creating intelligent computer systems'.³

There are two kinds of artificial intelligence:

- *Weak artificial intelligence*: The computer is merely an instrument for investigating cognitive processes – the computer simulates intelligence.
- *Strong artificial intelligence*: The processes in the computer are intellectual, self-learning processes. Computers can 'understand' by means of the right software/programming and are able to optimise their own behaviour on the basis of their former behaviour and their experience.⁴ This includes automatic networking with other machines, which leads to a dramatic scaling effect.

II. Economic fields of artificial intelligence

In general, the economic use of AI can be separated into five categories:⁵

- **Deep learning**
This is machine learning based on a set of algorithms that attempt to model high-level abstractions in data. Unlike human workers, the machines are connected the whole time. If one machine makes a mistake, all autonomous systems will keep this in mind and will avoid the same mistake the next time. Over the long run, intelligent machines will win against every human expert.
- **Robotisation**
Since the 19th century, production robots have been replacing employees because of the advancement in technology. They work more precisely than humans and cost less. Creative solutions like 3D printers and the self-learning ability of these production robots will replace human workers.
- **Dematerialisation**
Thanks to automatic data recording and data processing, traditional 'back-office' activities are no longer in demand. Autonomous software will collect necessary information and send it to the employee who needs it.

3 See: <http://wirtschaftslexikon.gabler.de/Archiv/74650/kuenstliche-intelligenz-ki-v12.html> (last accessed on 11 February 2016).

4 www2.cs.uni-paderborn.de/cs/ag-klbue/de/courses/ss05/gwbs/ai-intro-ss05-slides.ps.nup.pdf (last accessed on 11 February 2016).

5 Dettmer, Hesse, Jung, Müller and Schulz, 'Mensch gegen Maschine' (3 September 2016) *Der Spiegel* p 10 ff.

Additionally, dematerialisation leads to the phenomenon that traditional physical products are becoming software, for example, CDs or DVDs are being replaced by streaming services. The replacement of traditional event tickets, travel tickets or hard cash will be the next steps, due to the enhanced possibility of contactless payment by smartphone.

- **Gig economy**

A rise in self-employment is typical for the new generation of employees. The gig economy is usually understood to include chiefly two forms of work: 'crowdworking' and 'work on-demand via apps' organised networking platforms.⁶ There are more and more independent contractors for individual tasks that companies advertise on online platforms (eg, 'Amazon Mechanical Turk'). Traditional employment relationships are becoming less common. Many workers are performing different jobs for different clients.

- **Autonomous driving**

Vehicles have the power for self-governance using sensors and navigating without human input. Taxi and truck drivers will become obsolete. The same applies to stock managers and postal carriers if the delivery is distributed by delivery drones in the future.

III. The 'second machine age' or the 'internet of things' – the fourth industrial revolution

AI will lead to a redefinition and a disruption of service models and products. While the technical development leads primarily to an efficiency enhancement in the production sectors, new creative and disruptive service models will revolutionise the service sector. These are adapted with the support of big data analyses at the individual requirements of the client and not at the needs of a company.

INDUSTRY 1.0: INDUSTRIALISATION

Industry 1.0 is known as the beginning of the industrial age, around 1800. For the first time, goods and services were produced by machines. Besides the first railways, coal mining and heavy industry, the steam engine was the essential invention of the first industrial revolution; steam engines replaced many employees, which led to social unrest. At the end of the 18th century, steam engines were introduced for the first time in factories in the UK; they were a great driving force for industrialisation, since they provided energy at any location for any purpose.⁷

INDUSTRY 2.0: ELECTRIFICATION

The second industrial revolution began at the beginning of electrification at the end of the 19th century. The equivalent of the steam engine in the first industrial revolution was the assembly line, which was first used in the automotive industry.

6 See: www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/publication/wcms_443267.pdf p1 (last accessed on 26 September 2016).

7 See: www.lmis.de/im-wandel-der-zeit-von-industrie-1-0-bis-4-0 (last accessed on 11 February 2016).

It helped accelerate and automate production processes. The term Industry 2.0 is characterised by separate steps being executed by workers specialised in respective areas. Serial production was born. At the same time, automatically manufactured goods were transported to different continents for the first time. This was aided by the beginning of aviation.⁸

INDUSTRY 3.0: DIGITALISATION

The third industrial revolution began in the 1970s and was distinguished by IT and further automation through electronics. When personal computers and the internet took hold in working life, it meant global access to information and automation of working steps. Human labour was replaced by machines in serial production. A process that was intensified in the context of Industry 4.0 was already in the offing at that time.⁹

INDUSTRY 4.0

The term Industry 4.0 means in essence the technical integration of cyber physical systems (CPS) into production and logistics and the use of the 'internet of things' (connection between everyday objects)¹⁰ and services in (industrial) processes – including the consequences for a new creation of value, business models as well as downstream services and work organisation.¹¹ CPS refers to the network connections between humans, machines, products, objects and ICT (information and communication technology) systems.¹² Within the next five years, it is expected that over 50 billion connected machines will exist throughout the world. The introduction of AI in the service sector distinguishes the fourth industrial revolution from the third.

Particularly in the field of industrial production, the term 'automatisation' is characterised essentially by four elements:¹³

- First, production is *controlled by machines*. Owing to the use of intelligent machines, production processes will be fully automated in the future, and humans will be used as a production factor only in individual cases. The so-called 'smart factory', a production facility with few or without humans, is representative of this.
- Second, *real-time production* is a core feature of Industry 4.0. An intelligent machine calculates the optimal utilisation capacity of the production facility.

8 See: www.lmis.de/im-wandel-der-zeit-von-industrie-1-0-bis-4-0 (last accessed on 11 February 2016).

9 *Ibid.*

10 Stiemerling, "'Künstliche Intelligenz" – Automatisierung geistiger Arbeit, Big Data und das Internet der Dinge' (2015) *Computer und Recht* 762 ff.

11 Forschungsunion and acatech, 'Deutschlands Zukunft als Produktionsstandort sichern: Umsetzungsempfehlung für das Zukunftsprojekt Industrie 4.0' (2013) Promotorengruppe Kommunikation der Forschungsunion Wirtschaft – Wissenschaft.

12 'Industrie 4.0 und die Folgen für Arbeitsmarkt und Wirtschaft' (2015) *IAB Forschungsbericht 8/2015*, Institute for Employment Research, 12.

13 *Ibid.*, 13 f.

Lead times are short in the production process, and standstills, except those caused by technical defects, can be avoided. Within the value creation chain, the coordination of materials, information and goods is tailored exactly to demand. Stocks are kept to a minimum, but if materials needed for production fall below a certain level, the machine orders more. The same applies to finished products; the machine produces depending on incoming orders and general demand, thus reducing storage costs.

- The third element is the *decentralisation of production*. The machine is essentially self-organised. This includes a network of the manufacturing units. In addition to material planning, the handling of orders is also fully automated.
- The last element is the individualisation of production even down to a batch of one unit. The machine of the future will be able to respond, within certain limits, to individual customer requests. No adjustments to the machines by humans are required. As a result, changeover times are eliminated. The smart factory adds certain components or, in a context of optimum distribution throughout the entire process, adapts individual stages of production to correspond with customer requests. The term Industry 4.0 thus stands for the optimisation of components involved in the production process (machines, operating resources, software, etc) owing to their independent communication with one another via sensors and networks.¹⁴ This is supposed to reduce production costs, particularly in the area of staff planning, giving the company a better position in international competition.

Well-known examples from the field of robotics and AI are the so-called 'smart factories', driverless cars, delivery drones or 3D printers, which, based on an individual template, can produce highly complex things without changes in the production process or human action in any form being necessary.

Well-known service models are, for example, networking platforms like Facebook or Amazon Mechanical Turk, the economy-on-demand providers Uber and Airbnb, or sharing services, such as car sharing, Spotify and Netflix. Studies show that merely due to sharing services the turnover of the sector will grow twentyfold within the next ten years.

Old industry made progress by using economies of scale in an environment of mass production, but the new information economy lives on networking effects, leading to more monopolies.¹⁵

14 Sandro Panagl, 'Digitalisierung der Wirtschaft - Bedeutung Chancen und Herausforderungen' (2015) Austrian Economic Chambers 5.

15 See: www.bloomberg.com/news/videos/2016-05-20/forward-thinking-march-of-the-machines (last accessed on 2 November 2016).

B. The Impact of New Technology on the Labour Market

Both blue-collar and white-collar sectors will be affected. The faster the process of the division of labour and the more single working or process steps can be described in detail, the sooner employees can be replaced by intelligent algorithms. One third of current jobs requiring a bachelor's degree can be performed by machines or intelligent software in the future. Individual jobs will disappear completely, and new types of jobs will come into being. It must be noted in this regard, however, that no jobs will be lost abruptly. Instead, a gradual transition will take place, which has already commenced and differs from industry to industry and from company to company.¹⁶

I. Advantages of robotics and intelligent algorithms

Particularly in the industrial sectors in the Western high-labour cost countries, automation and use of production robots lead to considerable savings with regard to the cost of labour and products. While one production working hour costs the German automotive industry more than €40, the use of a robot costs between €5 and €8 per hour.¹⁷ A production robot is thus cheaper than a worker in China is.¹⁸ A further aspect is that a robot cannot become ill, have children or go on strike and is not entitled to annual leave.

An autonomous computer system does not depend on external factors meaning that it works reliably and constantly, 24/7, and it can work in danger zones.¹⁹ As a rule, its accuracy is greater than that of a human, and it cannot be distracted either by fatigue or by other external circumstances.²⁰ Work can be standardised and synchronised to a greater extent, resulting in an improvement in efficiency and a better control of performance and more transparency in the company.²¹ In the decision-making process, autonomous systems can be guided by objective standards, so decisions can be made unemotionally, on the basis of facts. Productivity gains have so far always led to an improvement of living circumstances for everybody. The same applies for intelligent algorithms.

16 Brzeski and Burk, 'Die Roboter kommen, Folgen der Automatisierung für den deutschen Arbeitsmarkt' (2015) *ING DiBa* 1.

17 See: www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robots-redefine-competitiveness/ (last accessed on 3 August 2016).

18 Krischke and Schmidt, 'Kollege Roboter' (2015) 38/2015 *Focus Magazin* 66.

19 See: www.faz.net/aktuell/wirtschaft/fuehrung-und-digitalisierung-mein-chef-der-roboter-14165244.html (last accessed on 8 April 2016).

20 Haag, 'Kollaboratives Arbeiten mit Robotern – Visionen und realistische Perspektive' in Botthof and Hartmann (eds), *Zukunft der Arbeit in Industrie 4.0* (2015) 63.

21 Maschke and Werner, 'Arbeiten 4.0 – Diskurs und Praxis in Betriebsvereinbarungen' (October 2015) Hans Böckler Stiftung, Report No 14, 9.

The advantage for employees is that they have to do less manual or hard work; repetitive, monotonous work can be performed by autonomous systems. The same applies for typical back-office activities in the service sector: algorithms will collect data automatically, they will transfer data from purchasers' to sellers' systems, and they will find solutions for clients' problems. Once an interface between the sellers' and the purchasers' system has been set up, employees are no longer required to manually enter data into an IT system.²² Employees might have more free time that they can use for creative activities or individual recreational activities.

Robots and intelligent machines can have not only supporting, but even life-saving functions. Examples are robots used in medical diagnostics, which have high accuracy, or for the assessment of dangerous objects using remote control and integrated camera systems. These make it possible, for example, to defuse a bomb without a human having to come close to it. The 'Robo Gas Inspector',²³ an inspection robot equipped with remote gas sensing technology, can inspect technical facilities even in hard-to-reach areas without putting humans at risk, for example, to detect leaks in above-ground and underground gas pipelines.

II. A global phenomenon

While the trends of automation and digitalisation continue to develop in developed countries, the question arises as to whether this is also happening to the same extent in developing countries. According to a 2016 study by the World Economic Forum, technically highly equipped countries such as Switzerland, the Netherlands, Singapore, Qatar or the US are considered to be particularly well prepared for the fourth industrial revolution.²⁴ Since July 2016, the Netherlands is the first country that has a nationwide internet of things, allowing the connection of more intelligent technical devices than the inhabitants of the small country.²⁵

What is relevant for each country in this respect is the degree of its technological development and the technological skills of young people who will shape the future of the labour market. Young people in developing countries are optimistic with regard to their professional future. They have more confidence in their own ability than many young people in developed countries. Many developing countries, however, face the problem that only those employees who have already gained substantial IT knowledge show an interest in and a willingness to improve their technological skills.²⁶ A great advantage in a number of developing countries is that more women are having access to education. In the UAE, for example,

22 See: www.spiegel.de/karriere/roboter-im-job-werde-ich-bald-wegdigitalisiert-a-1119061.html (last accessed on 2 November 2016).

23 German Federal Ministry for Economic Affairs and Technology, 'Mensch-Technik-Interaktion' (2013) 3 *Autonomik Bericht* 18.

24 www3.weforum.org/docs/Media/GCR15/WEF_GCR2015-2016_NR_DE.pdf (last accessed on 15 February 2016).

25 See: <http://newatlas.com/netherlands-nationwide-iot-network/44134/> (last accessed on 28 September 2016).

26 See: http://images.experienceinfosys.com/Web/Infosys/%7B6139fde3-3fa4-42aa-83db-ca38e78b51e6%7D_Infosys-Amplifying-Human-Potential.pdf (last accessed on 18 February 2016).

most of the university graduates are female. Particularly in economic systems that were originally dominated by men, the opening up of labour markets was a great opportunity for highly qualified female professionals. Women are more likely to have better developed 'soft skills' which makes them an important talent pool – especially in developing countries.²⁷

Low-labour-cost countries, such as China, India and Bangladesh, are still benefiting from their surplus of low-skilled workers, while Western companies are still outsourcing their production to these countries. If, however, these companies decide to produce in their countries of origin in the future, using production robots and only a few workers, the surplus of low-skilled workers might turn into a curse for these developing countries.²⁸ A good example of this problem is the clothing industry, in which clothing is still often produced by hand in low-labour-cost countries such as Bangladesh or Thailand, although the work could easily be done by machines because much of it is routine. The question is how to integrate the great number of unskilled production workers into a structurally difficult labour market that depends on foreign investment.

Another problem for developing countries such as India, Thailand or China is the lack of social security systems. Possible mass unemployment could lead to human catastrophes and a wave of migration.²⁹ Accordingly, the same rule applies to developing countries as to developed countries: jobs with low or medium qualification requirements will be eliminated in the end.³⁰ The only difference is that in developing countries there will be more routine jobs with lower or medium qualification requirements. About 47 per cent of total US employment is at risk, whereas 70 per cent of total employment in Thailand or India is at risk.³¹

In many sectors, the implementation of (partly) autonomous systems requires too much of an investment at present, compared to the existing labour costs.³² In addition, companies operating in developing countries have to promote their appropriate systems in order to improve their productivity and attractiveness vis-à-vis their competitors and remain competitive in the long run. At the same time, (production) robots are becoming less expensive year by year. Replacing human manual labour with robots makes economic sense in low-labour-cost countries when the cost of human labour becomes 15 per cent higher than the cost of robotic labour.³³ This will happen in countries such as Mexico by 2025, according to a study by the Boston Consulting Group. Chinese companies are already starting to build factories where robots will replace 90 per cent of human workers.³⁴

27 International Organization of Employers, 'Brief on Understanding the Future of Work' (6 July 2016) 18.

28 UBS, 'Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution' (January 2016) 24 ff.

29 'Automat trifft Armut' (15 July 2016) 135 *Handelsblatt News am Abend* 6.

30 'Jeder zehnte Arbeitsplatz durch Roboter gefährdet' (19 May 2016) 115 *Frankfurter Allgemeine Zeitung* 20.

31 See n29 above.

32 See: www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robots-redefine-competitiveness (last accessed on 3 August 2016).

33 *Ibid* (last accessed on 3 August 2016).

34 See: www.spiegel.de/wirtschaft/soziales/arbeitsmarkt-der-zukunft-die-jobfresser-kommen-a-1105032.html (last accessed on 3 August 2016).

It must therefore be assumed that in most developing countries, markets for autonomous IT systems will be opened up with a delay of a few years. The driving force will most likely be international companies, which will integrate their common systems in all production facilities around the world. In future, companies will locate where they can most easily find suitable highly qualified employees for monitoring and generating AI. If developing countries thus can provide qualified staff in the technological sector, it can be assumed that developing countries will also be able to profit from technological change.³⁵

1. Potential losers of the fourth industrial revolution

For a long time, the BRIC countries (Brazil, Russia, India and China) were considered the beacon of hope for the global economy. Owing to an increased mining of raw materials and the outsourcing of numerous Western branches of industry to low-labour-cost countries, investors expect long-term yields. However, demand for raw materials is currently very low, so Brazil and Russia are becoming less attractive. With the technical development of production robots, many companies producing in low-labour-cost countries will relocate their production sector to the countries where they originally came from.³⁶

The developing countries in Central and South America will also not profit from the trend of the fourth industrial revolution. It is to be feared that these countries – like the North African countries and Indonesia – are not equipped to face automation and digitalisation due to the lack of education of much of the population, lack of investment in a (digital) infrastructure and lack of legal framework.³⁷

Further complicating the matter is the rising birth rate in the North African and Arabic countries, which will lead to high rates of youth unemployment. For every older employee in Uganda, Mali or Nigeria, seven younger employees will enter the badly structured national labour market.³⁸ In these countries, only 40 per cent of the younger generation is in employment, and most of these jobs are low-paid jobs without social security in the third sector.³⁹ It does not come as a surprise that many youths – especially those who are better educated – would like to leave their countries to migrate to Western developed countries. Legal frameworks, less corruption, more social security and a better infrastructure would be necessary to avoid the

35 See: www.alumniportal-deutschland.org/nachhaltigkeit/wirtschaft/artikel/wachstumsmotor-digitalisierung-industrie-4-0-ikt.html (last accessed on 17 February 2016).

36 See: www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robots-redefine-competitiveness (last accessed on 3 August 2016).

37 UBS, 'Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution' (January 2016) 24 ff.

38 'Die große Migrationswelle kommt noch' (8 August 2016) 183 *Frankfurter Allgemeine Zeitung* 18.

39 *Ibid.*

younger generation's migration wave. Additionally, better access to higher education and training opportunities – particularly for women – would be necessary to promote the competitiveness of these countries.⁴⁰

2. Potential winners of the fourth industrial revolution

The winners of the digital revolution are, on the other hand, likely to be the highly developed Asian countries with good education systems, such as Singapore, Hong Kong, Taiwan and South Korea.⁴¹ These countries – together with the Scandinavian countries – have been undertaking research and working to find digital solutions for complex issues for a long time. The digital interconnection of people in these countries is also very far advanced. The share of the population at risk of unemployment is about six per cent in these countries.⁴²

Finally, Western developed countries will profit from the relocation of the companies' production sectors when robotic production becomes cheaper than human production in low-labour-cost countries. This will create new jobs in these countries and destroy many routine jobs in the low-labour-cost countries.

Another positive trend can be seen for India and China, which are both considered very suitable candidates for participation in the digital revolution due to most of the population having a good command of English and IT skills. IT knowledge is taught in schools as a key qualification. It is, therefore, not surprising that Indian and Chinese professionals have more extensive computer knowledge than their French or English colleagues do.⁴³ Not only are salaries and wages lower in India, but also the number of better-qualified professionals is why, according to Forrester Research, 25,000 IT jobs are likely to be outsourced to India from the UK alone.⁴⁴ Like China, India is in the process of developing from simply being a low-labour-cost country into being a Western-orientated society whose population works mainly in the tertiary sector. As the most populated countries in the world, these two countries have a high level of consumer demand. Moreover, because of their rapidly growing cities, these developing countries need highly developed solutions in terms of logistics and environmental technologies, like the smart city, in order to increase the quality of life for city residents over the long term.

40 See: www3.weforum.org/docs/Media/GCR15/WEF_GCR2015-2016_NR_DE.pdf (last accessed on 15 February 2016).

41 See: www.sueddeutsche.de/wirtschaft/schwellenlaender-ticks-sind-die-neuen-brics-1.2844010 (last accessed on 15 February 2016).

42 'Jeder zehnte Arbeitsplatz durch Roboter gefährdet' (19 May 2016) 115 *Frankfurter Allgemeine Zeitung* 20.

43 See: www.experienceinfosys.com/humanpotential-infographic (last accessed on 18 February 2016).

44 See: www.zukunftsinstitut.de/artikel/die-neuerfindung-der-arbeitswelt/ (last accessed on 15 February 2016).

The digital world market leaders are based in Silicon Valley, California. In 2015, the top ten Silicon Valley startups created an annual turnover of approximately US\$600bn with information and communication services.⁴⁵ Additionally, the eight leading digital platforms – Alphabet, Amazon, Facebook, etc – due to their exponential growth show a significantly higher capital market value than the leading industrial companies (eg, General Electric, Siemens or Honeywell).⁴⁶ The rise of AI in the service sector, especially the gig-economy, can be illustrated by the example of Uber, which saw an increase in its market value from zero to US\$40bn in only six years.⁴⁷ Even though more than 80 per cent of the robots sold each year are deployed in Japan, South Korea, the US and Germany⁴⁸ and enhance productivity in the production sector, the new business models in the service sector are the digital future. With economic growth in this sector, the US will be particularly resistant to future economic crises. It is therefore not surprising that innovative countries like Switzerland, Germany, the US or Japan are rated best in the Global Competitiveness Index by the World Economic Forum.⁴⁹

In summary, it can be said that the increase of automation and digitalisation is a global concern that, due to the lack of financial possibilities in many developing countries, will initially be strongly focused on Western developed countries and Southeast Asia. These countries will be considered the winners of Industry 4.0 because of their technological head start and their creative service models.

III. Necessary skillset for employees

Owing to the great number of emerging multidisciplinary support alternatives due to AI and machines, the requirements for future employees will change. There will be hardly any need for employees who do simple and/or repetitive work. Already today, the number of factory workers is constantly decreasing, and humans are ever more becoming the control mechanism of the machine. The automotive industry, where many production steps are already fully automated, is the pioneer in this respect.

The lower the demand for workers, the higher will be the companies' demand for highly qualified employees. According to common belief, better education helps.⁵⁰

45 See: <http://bundestag.at/2015/wp-content/uploads/2015/09/kollmann-digital-leadership.pdf> (last accessed on 2 November 2016)

46 See: www.rolandberger.com/publications/publication_pdf/roland_berger_ief_plattformstudie_en_final.pdf (last accessed on 2 November 2016).

47 See n45 above.

48 See: www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robots-redefine-competitiveness (last accessed on 3 August 2016).

49 See: <http://reports.weforum.org/global-competitiveness-report-2015-2016/competitiveness-rankings> (last accessed on 15 February 2016).

50 'Automatisierung und Arbeitslosigkeit – Bürojobs sind stärker als andere bedroht' (15 March 2015) *Süddeutsche.de Digital* (last accessed on 29 December 2015).

Better education helps, however, only in certain circumstances. The additional qualification of an individual employee must be connected to the work in question. Additional qualifications as an accountant will be of little benefit for the individual employee, because – over time – there is a 98 per cent probability that the work of an accountant can be done by intelligent software.⁵¹

Creative people who are talented in mathematics and sciences are best qualified for the new labour market. Although not every future employee will be required to be an IT programmer, should have a fundamental grasp of analytical and technical matters. Employees should be able to form a unit with supporting machines and algorithms and to navigate the internet comfortably and move safely in social networks. To do this, it is necessary to know how the basic structures work. The employee should also, however, be able to examine machines and software critically. There is an increasing demand for employees who can work in strategic and complex areas as well. It is not necessary only to oversee machines, but also to coordinate them. The interfaces between humans and machines and the overlaps in the area of responsibility among the more flexible humans must also be coordinated. There is thus likewise an increasing demand for future executive staff with social and interdisciplinary competence.⁵² Employees must be able not only to communicate with other people, but also, if necessary, to lead them effectively and coordinate with them.

In addition, creativity and flexibility are becoming increasingly important. In the future, critical and problem-orientated thinking will be expected of employees as the most important requirement.⁵³ This requires sound judgment. The expectations with respect to availability will be higher for future employees. Flexible working hours and standby duties will be the rule and no longer an exception in the labour market. Employees will be required to focus not only on one main practice area, but also to take on several multifaceted, sometimes highly complex tasks as necessary, and also to perform as part of a team. Employees are increasingly expected to have non-formal qualifications. These include, for example, the ability to act independently, to build networks, to organise themselves and their teams with a focus on targets, and to think abstractly.

Special knowledge or a flair for high-quality craftsmanship will become less important, since this work is likely to be done by intelligent software or a machine.⁵⁴ Mere knowledge workers will no longer be required; the focus will rather be on how to find creative solutions to problems.⁵⁵ Deals will still be made between people in the future, even if the facts may be gathered beforehand by software.⁵⁶

51 Kriskke and Schmidt, 'Kollege Roboter' (12 September 2015) 38/2015 *Focus Magazin* 66.

52 Bochum, 'Gewerkschaftliche Positionen in Bezug auf "Industrie 4.0"' in Botthof/Hartmann (eds), *Zukunft der Arbeit in Industrie 4.0*, 36.

53 See: <http://reports.weforum.org/future-of-jobs-2016/shearable-infographics> (last accessed on 11 February 2016).

54 See n12 above, 14.

55 See: www.zukunftsinstitut.de/artikel/die-neuerfindung-der-arbeitswelt (last accessed on 15 February 2016).

56 Anderson, *The Future of Work? The Robot Takeover is Already Here* (2015) 27.

One of the most important requirements, however, will be creativity. As one can see from the examples of Tesla, Uber or Airbnb, innovations are created not only by established market participants, but also by visionary startups making a name for themselves with disruptive ideas.

IV. Necessary investments

Many investments will be necessary for companies to be able to ride the industrial wave 4.0. This applies not only to the IT sector, but equally to the development and procurement of new technical assistive machines. In addition, a multitude of (mostly external) service providers will be necessary to assist in the reorganisations. Moreover, governments must very quickly make provisions for a broad coverage of broadband internet in several countries.⁵⁷

In their investments, companies will focus more and more on sensor technology and IT services of any type in the years to come. In addition to newer electrical equipment of any type, these so-called equipment investments also include new production machines and their repair, installation and maintenance.⁵⁸ In the area of processing and extractive industries, these investments are of vital importance because in the long run, costs for material and personnel can be reduced only with the aid of these investments. Without this cost reduction, these companies will no longer be able to compete.

Apart from this, building investments are vital. In addition to the classic extension and conversion of a company's own production facility and workplace, this primarily concerns fast internet across the board, without which efficient communication is not possible either among humans or between human and machine. In the course of digitalisation, companies will change their focus and invest more in other areas. Seventy-one per cent of the CEOs of the worlds' biggest companies are sure that the next three years will be more important for the strategic orientation of their companies than the last 50 years.⁵⁹ Therefore, investments in technical devices and the focused use of AI are necessary in all branches.

1. Connection between different and independent computer systems, creation of intelligent communication channels

Many companies already use intelligent systems. Industry 4.0 will add still more systems, and it often turns out to be difficult in practice to connect these to the already established systems.⁶⁰ Normally, the systems do not stem from the same developer and they usually cover different

57 See n10 above.

58 See n54 above, 28.

59 'Bangen von der digitalen Zukunft' (26 June 2016) No 121 *Handelsblatt News am Abend* 3.

60 See: www.mckinsey.com/industries/high-tech/our-insights/digital-america-a-tale-of-the-haves-and-have-mores (last accessed on 1 April 2016).

ranges of tasks. In order to warrant an optimal operating procedure, the systems must, however, synchronise with each other and with their user. It is thus necessary to integrate the (partially) autonomous systems into the previous work organisation, which is a huge challenge for IT experts. Only if the machines are optimally synchronised with each other and with the human being operating them can an optimal added value chain be created (so-called 'augmented intelligence').⁶¹

A) REQUIREMENTS CONCERNING ARTIFICIAL INTELLIGENCE

High standards are set for the automatic systems and their certification. First, the system must be able to learn independently, that is, to optimise its own skills.⁶² This happens not only by the human programming individual production steps or demonstrating them to the system, but also by the IT system gathering experience during its work and independently implementing suggestions for improvement or even learning how to improve. This requires, in turn, that the programmer of the autonomous system understands both the employee's physical properties and the cognitive process in the context of the relevant tasks and accordingly makes use of this when programming the system.⁶³

The core element of artificial intelligence and a functioning production IT system is thus an interactive, lifelong process of learning from the human partner and responding to human needs.⁶⁴ Moreover, the robot must be able to draw up highly complex plans as needed by the customer and to produce them autonomously. It is vital that the IT system comes with comprehensive 'collective' intelligence and communicates with other devices and the human being. A production robot, in particular, is supposed to be designed in such a way that it has nearly human capabilities, for instance, fine motor skills, perception, adaptability and cognition. In order to achieve its full functionality, however, it must be programmed dynamically and rigidly.⁶⁵ The operating human must thus be able to adapt the system's functions to their individual needs if the system does not recognise them itself.

61 Barth, 'Digitale Konkurrenz' (April 2016) 19 *JUVE Rechtsmarkt* 24.

62 See n10 above.

63 See n23 above, 12.

64 See: www.spiegel.de/wirtschaft/soziales/arbeitsmarkt-der-zukunft-die-jobfresser-kommen-a-1105032.html (last accessed on 3 August 2016).

65 *Ibid.*

B) AT LEAST: SMART FACTORY

The target in this regard is the so-called 'smart factory'. A smart factory is characterised by the intelligent machine taking an active part in the production process. In this context, the machines exchange information and control themselves in real time, which causes the production to run fully automatically. The machine takes over the digital receipt of the incoming order, the – if necessary, individual – planning of the product, the request for required materials, the production as such, the handling of the order and even the shipment of the product. The human has only a supervisory function.⁶⁶ Most companies are still a long way from reaching this target, but there are many attempts in individual production areas to work towards achieving a smart factory situation. It must also be noted that the created interfaces open another gateway to the outside.⁶⁷ The manufacturers of the autonomous systems must, for example, protect their own know-how against potential hacker attacks, the customer itself and competitors with whose systems a connection is made under certain circumstances. It is therefore recommended that contractual precautions for the (restricted) use of data also be made in addition to the technical precautions.

V. Preparation of future workers by equipping them with the required skills

Many employees and trade unions are hostile towards intelligent IT systems, although AI is a phenomenon without which certain industries and services would be unthinkable. Many people, for instance, have got used to small robotic vacuum cleaners. In principle, there is no structural difference between this household aid and intelligent production system. Moreover, only 11 per cent of US employees assume that they will lose their jobs because of intelligent IT systems or production robots.⁶⁸ The biggest fear is of a plant closure as a consequence of mismanagement.

The reservations of the (representatives of the) employees are primarily associated with the fear of massive job cutbacks. The machine costs money only once and pays for itself, whereas labour costs are a major, recurring expenditure for a company. The machine or the algorithm carries out its work with a precision and reliability that a human cannot achieve. Humans can thus be considered inferior to machines in a competitive situation. The situation is aggravated by science fiction blockbusters and single industrial accidents with robots that cast a poor light on

66 See n52 above, 35.

67 See: http://presse.cms-hs.net/pdf/1602/20160208MarktUndMittelstand_M2M_Interview.pdf (last accessed on 9 February 2016).

68 See: www.pewinternet.org/2016/03/10/public-predictions-for-the-future-of-workforce-automation 5 (last accessed on 30 March 2016).

the robot systems. It is the responsibility of governments and companies, however, to create general acceptance, and this will be possible after a certain time period; for example, 25 per cent of people can presently imagine being cared for by a robot when they are old.⁶⁹

Employers must proceed sensitively and gradually when introducing new systems. They should establish clear rules for handling the machines and specify relevant hierarchies, for example, that the machine has only an assistive and not a replacing function, and the power to make decisions still lies with the human being as before and not vice-versa. Employees should be involved in the development and the process of change at an early stage in order to grow accustomed to the new technology themselves.⁷⁰

VI. Adaptation of the education system is necessary

In order to be able to meet the above-mentioned standards set for Industry 4.0, future employees must learn new key qualifications, but the educational system must also be adapted to these new framework conditions. There was agreement at the World Economic Forum 2016, for instance, that both schools and universities 'should not teach the world as it was, but as it will be'.⁷¹ New qualification strategies for individual countries are thus needed. They must encourage students' interest in subjects such as mathematics, information technology, science and technology when they are still in school, and teachers with digital competence must teach students how to think critically when using new media and help them to achieve a fundamental grasp of new digital and information devices.⁷²

Furthermore, increased use should be made of the design thinking method in order to encourage creative minds already at schools and universities. This method designates an integrated degree programme during which creative work at a company is accompanied by degree courses.⁷³ Adaptability is one of the major challenges humans' face, yet at the same time it can be a major strong point. The next generation of employees must learn to adapt quickly to the technical, social and digital change, because it is to be expected that even a 'fifth industrial revolution' will not be long in coming. Lifelong learning is the buzzword that applies not only to fully automated robots, but also to human beings! If an employee's field of work is automated, the employee must be able to reposition or to distance himself or herself from the machine by individual skills.⁷⁴

69 Albers, Breuer, Fleischner and Gottschling, 'Mein Freund, der Roboter' (2015) 41/2015 *Focus* 78 ff.

70 IG Metall Robotik-Fachtagung, 'Die neuen Roboter kommen – der Mensch bleibt' (2015).

71 See: www.faz.net/aktuell/wirtschaft/weltwirtschaftsforum/weltwirtschaftsforum-in-davos-das-ist-die-groesste-herausforderung-der-digitalisierung-14031777.html (last accessed on 25 January 2016).

72 Hadelor and Dross, 'ME Gesamtmetall EU-Informationen' (13 November 2015) 32/2015 *RS* 2.

73 See n21 above, 18.

74 See: www.computerwoche.de/a/die-elf-wichtigsten-soft-skills,1902818 (last accessed on 22 February 2016).

Besides tried and tested school subjects and degree courses, more new degree courses and occupations requiring vocational training based on imparting extensive skills in IT, communication and sciences must be created. This includes data processing occupations, in particular. Although previous degree courses such as classic information technology or business information technology include numerous elements of significant importance for Industry 4.0, they deal too superficially with some aspects owing to their great variety, whereas other aspects are superfluous for the intended work.

For example, 'industrial cognitive science' and 'automation bionics' are suggested as innovative degree courses that deal mainly with researching and optimising the interaction between robot systems and employees.⁷⁵ In addition to the area of robotics, extended degree courses in the area of big data will be necessary. Employers' demand for data artists and data scientists or big data developers is rapidly increasing. The main subjects for the professional field of data science include researching data of all types and their structures. Uniform education in this area is, however, still not available.⁷⁶ Governments are responsible not only for making education possible, but also for focusing young people's interests on technical and IT jobs at an early age. This will increase the number of graduates in the long run.⁷⁷

Ultimately, neither the 'tried and tested' nor the 'new' degree courses may focus solely on imparting specific technical knowledge. The employees of the future must, for instance, be given an understanding of the possibilities of technical aids. This applies, however, not only to theoretical background, but also to practical applications and thus handling the technical aids. US investors do not expect the new generation of employees to be technical geniuses, but employees should always be willing to learn new skills.⁷⁸ A lifelong learning progress characterises the new labour market, which is changing rapidly because of technical development. The challenge for schools and universities is to teach the employees 'soft skills' that are becoming more important than ever, such as the ability to work in a team and to accept criticism, assertiveness, reliability, social and communicative skills and good time management. Learning 'soft skills' will prepare employees optimally for the future labour market: 'To Switch the Skills, Switch the Schools.'⁷⁹

75 See n52 above, 40 f.

76 See: www.pwc.de/de/prozessoptimierung/assets/pwc-big-data-bedeutung-nutzen-mehrwert.pdf, 27f (last accessed on 31 March 2016).

77 See n14 above, 19.

78 See: www.rolandberger.com/publications/publication_pdf/roland_berger_amcham_business_barometer_2.pdf, 8 (last accessed on 22 September 2016).

79 Brynjolfsson and McAfee, *The Second Machine Age* (2014) Chapter 12: 'Learning to Race with Machines: Recommendations for Individuals'.

VII. New job structures

About 47 per cent of total US employment is at risk, read the catch line in the report by Frey/Osborne in 2013.⁸⁰ Consistent with this is that according to a survey by Pew Research Center, 65 percent of US citizens expect that within 50 years a robot or an intelligent algorithm will be doing their work.⁸¹ Experts hold vastly different opinions with regard to the dramatic impact of the changes in the job structures. Others claim that, thanks to digitalisation and automatisisation, many employees whose jobs are at high risk will not be replaced completely, even if the technical advances would allow a replacement.⁸²

Not every specific occupation will be replaced by the work of machines in general, but it is certain that some individual occupational activities will be performed by machines. For example, the risk of being replaced by a robot is 87 per cent for a bartender.⁸³ Already today, it is technically feasible that a robotic machine could mix drinks, send the clients' orders directly to the kitchen, receive complaints and accept the clients' money. Nevertheless, the atmosphere in the bar or in the restaurants will no longer be the same. Because of the lack of acceptance by potential clients and the high acquisition costs, it is definite that 87 per cent of all bartenders will not lose their jobs in the next few years.

Small and medium-sized companies, in particular, are likely to shy away from technical devices because of the high acquisition costs and the lack of highly qualified specialists who can handle the new systems.⁸⁴ In view of the occupational work structure and the legal, technical, ethnical and social barriers, only nine to 12 per cent of total US and German employment will be at high risk of being completely replaced.⁸⁵ Nonetheless, we can be confident that the performance of several occupational activities by machines will ultimately cost some jobs. Other studies expect that AI and robotics are not just job killers; the eliminated jobs will be compensated for, more or less, by newly created jobs.⁸⁶ For example, the German government assumes that digitalisation and automatisisation will create about 390,000 new jobs in the third sector over the next ten years in Germany.⁸⁷

What can be safely predicted is the continuous movement of employees into the third service sector. However, even in this service sector the transition will be gradual. For example, consider the following questions that might be put to service-sector employees. Do you perform less repetitive routine activities? Do

80 Frey and Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerization* (2013) 1.

81 See: www.pewinternet.org/2016/03/10/public-predictions-for-the-future-of-workforce-automation, 3 (last accessed on 30 March 2016).

82 Bonin, Gregory and Zierahn, *Übertragung der Studie von Frey/Osborne auf Deutschland* (2015) 18.

83 See n16 above, 6.

84 See n82 above, 21.

85 *Ibid*, at 14.

86 See: www.rolandberger.com/publications/publication_pdf/roland_berger_amcham_business_barometer_2.pdf, 15 (last accessed on 22 September 2016).

87 See: www.buendnis-fuer-industrie.de/unsere-themen/digitalisierung (last accessed on 26 April 2016).

you create individual solutions or do you merely reproduce existing knowledge? Do you perform individual tasks that other colleagues cannot perform? Is your employer unable to buy your skills without problems from a cheaper external service provider?⁸⁸ Employees, who can answer these questions with yes, should not worry about their jobs being performed by intelligent algorithms.

However, we have to recognise that no one does a job that is completely safe.⁸⁹ However, the potential digitalisation of their jobs is likely to be reduced for employees with a PhD or a master's degree (only 18 per cent in total).⁹⁰

1. Creation of new types of jobs

A) DATA SCIENTIST

One example of a newly created job is that of the data scientist.⁹¹ The task is to structure huge data volumes collected by big data analyses. This includes the research of both the data and their structure or origin, to supplement incomplete data sets and to create links between abstract data sets. Big data developers, by contrast, deal with the set-up, processing and storage of huge unstructured data volumes in companies, whereas data artists are primarily responsible for the graphic presentation and editing of data volumes.⁹²

The data scientist role has been in existence only for a few years and will gain importance in the future. On the basis of statistical calculations using probability theories, this new occupational group will draw up forecasts. Comprehensive IT knowledge is vital for this complex task. This includes the relevant programming languages and writing complex programming codes. In addition, a data scientist must be familiar with the business processes of the company in order to be able to create reasonable links. Therefore, basic knowledge of business administration, economics, stochastics and marketing is vital. In addition to this comprehensive knowledge, interpersonal qualities are also required. A data scientist must be able to adapt their services to the expectations of customers or the employer and to communicate.

88 See: www.spiegel.de/karriere/roboter-im-job-werde-ich-bald-wegdigitalisiert-a-1119061.html (last accessed on 2 November 2016).

89 See: www.bloomberg.com/news/videos/2016-05-20/forward-thinking-march-of-the-machines (last accessed on 28 October 2016).

90 See: www.faz.net/aktuell/beruf-chance/arbeitswelt/koennen-computer-aerzte-anwaelte-und-wirtschaftspruefer-ersetzen-14282103.html (last accessed on 18 June 2016).

91 See n76 above.

92 Cornerstone, *Big Data in HR* (2013).

B) CROWDWORKER

A field of work of growing significance is that of crowdworkers. Crowdworkers are freelancers who offer their skills via their computers on online platforms. Crowdfunding is a symbol of a changing world of work for white-collar workers in the gig economy. This covers smaller tasks, such as writing product reviews, searching for phone numbers, and more comprehensive work, such as testing software, providing legal advice, ghostwriting or designing and programming a website.⁹³ These bigger and more meaningful tasks are regularly summarised under the term 'crowdsourcing'.⁹⁴ Currently, in developed Western countries, performance of simple tasks by crowdworking is only a way to earn a small additional income.⁹⁵ However, this is likely to change with higher demand for freelancers to provide services outside traditional employment structures in the next few years. The internet can be also used for marketing purposes. Especially in the context of legal services, initial assessments by lawyers or even package deals for legal questions at cost-efficient prices can be achieved through crowdworking. Examples of this are the American platforms 'Avvo' or 'LegalZoom', on which one-sixth of US lawyers presently offer their services.⁹⁶

AA) ADVANTAGES

Freelance and independent providers benefit in that they can work at any time and from any place. Thanks to the internet, borders and time differences no longer play a role. The individual crowdworker moves on from one order to the next, according to his or her individual needs and free from any constraints. Freelancers thus represent the typical worker in Industry 4.0.

A distinction must be made between crowdworkers who take on small auxiliary jobs using their smartphones and qualified freelancers. The qualified freelancers are usually well paid; the platform is only one way to acquire new clients, whereas for the usually less-well-paid crowdworkers, the platforms are the only way to obtain their jobs, for example, writing product descriptions, doing simple research or participating

93 Reiter, 'Das Internet steckt voller Jobs für Designer und Programmierer, die schnell und billig arbeiten. Wie verändert das die Arbeitswelt?' (2014) 47 *DIE ZEIT*.

94 See: n6 above, 2.

95 See n5 above.

96 See: www.avvo.com (last accessed on 3 March 2016); Deutscher Anwalt Verein, *Anwaltsblatt* (March 2016) 3 225 ff.

in representative surveys.⁹⁷ These newly created 'mini jobs' are particularly popular in developing countries and with young people. The working equipment is the smartphone and the prerequisite is an existing internet connection. Prior knowledge or specific education is not required, as a rule. The hourly wage is not comparable with the minimum wage in the Western world, but by local standards in developing countries, the hourly wage is sometimes even above average. The job assignments are mostly very short and simple, so they are done within five to ten minutes. Owing to the simplicity of the jobs, no pressure is exerted on these clickworkers; instead, the job is shared by several workers.

BB) DISADVANTAGES

Despite such flexibility and popularity with companies and individual crowdworkers, nonetheless crowdworking involves risks for crowdworkers.⁹⁸ As a consequence of their status as freelancers, companies might not hire the individuals on a permanent basis. Furthermore, they may only pay workers if they actually do jobs for the company. Also, viewed from the freelancers' perspective they may be 'losing' protection against unfair dismissal or the benefit of continued payment of remuneration during sickness. However, this does beg the question whether 'employee' or 'worker' legal rights apply to such freelancers. One factor that might prove telling in answering that question is the circumstances of the platform.

The platform's rating and feedback systems are very important for the individual crowdworker to obtain new orders. But, for example, if the crowdworker receives orders from only one platform, this dependence on the one platform might convince a court that the crowdworker is in law an employee of the platform and so entitled to relevant employee rights such as sick pay.⁹⁹

Owing to the digitalisation and internationalisation of online platforms on which crowdworkers and clickworkers offer their services, the choice of applicable law is usually uncertain. For example, is the law of the country applicable

97 Uffmann, 'Möglichkeiten und Grenzen erfolgsabhängiger Vergütung' (2016) 39 *Industrie 4.0 als Herausforderung des Arbeitsrechts ZAAR Schriftenreihe* 39.

98 See: www.faz.net/aktuell/feuilleton/debatten/die-digital-debatte/politik-in-der-digitalen-welt/online-arbeit-auf-abruf-wer-schuetzt-die-clickworker-12852614.html (last accessed on 4 March 2016).

99 Kocher and Hensel, 'Herausforderungen des Arbeitsrechts durch digitale Plattformen – ein neuer Koordinationsmodus von Erwerbsarbeit' (2016) *NZA* 984 ff.

where the order is placed, received or performed? Determining which is applicable is very relevant because it may decide many important questions. For example, what is the legal status of the crowdworker? Do minimum levels of remuneration and benefits apply? What tax regime and what social security and welfare rules are applicable?¹⁰⁰ Some experts demand that companies should implement a system of self-regulation and introduce a certain level of minimum working standards. It is said some companies use this form of work as an opportunity to pay less than the minimum wage applying in the country from which the order is placed.

On certain online platforms, such as the US provider Amazon 'Mechanical Turk', the average hourly wage is US\$1.25,¹⁰¹ whereas other providers offer up to US\$3 per hour. Highly qualified freelancers in the IT sector are paid more, however. They can achieve hourly wages that are comparable to the standard salary for permanent employees. Some ask: why are these workers then not directly employed on a permanent basis? Unions accuse such companies of unfairly outsourcing. One charge is that such companies are 'wrongly' seeking to evade paying social security contributions for the employee-like crowdworkers.¹⁰²

Furthermore, it is contended by some that digitalisation and the growth of crowdworkers will eventually destroy high-wage structures in Western countries. The argument is that the wide range of freelancers from developing countries will lead to a decreasing demand for Western freelancers and ultimately to decreased remuneration for their individual tasks. On the other hand, it is said that qualified freelancers from developing countries will obtain higher payments for their work because Western companies usually pay more than local companies in developing countries. The net result would be a global change in payment structures taking place due to digitalisation: namely remuneration in Western countries will decline while the wages in developing countries will rise.

100 'The On-Demand Economy and the Impact on Employment Law' (September 2016) *International Bar Association Employment & Industrial Relations Law* 31.

101 See: www.faz.net/aktuell/feuilleton/debatten/die-digital-debatte/politik-in-der-digitalen-welt/online-arbeit-auf-abruf-wer-schuetzt-die-clickworker-12852614.html (last accessed on 4 March 2016).

102 See n72 above.

cc) POSSIBLE SOLUTIONS

Ultimately, the example of crowdworking makes it obvious that if the political goal is to have certain minimum labour law standards across the platform-economy then these must be introduced on an international level.¹⁰³ One example of such a minimum standard is the Sharing Economy Act in Italy, which requires digital platforms to create a 'business policy' regarding the users' sales conditions. Alternatively, under the Spanish Royal Legislative Decree No 8/2015, freelancers such as crowdworkers are obligated to participate in the national social security system.¹⁰⁴ The largest crowdworker platform Upwork offers health insurance. If policy makers are going to influence standards in this labour market then they need to act soon.

c) SIMPLE PHYSICAL WORK

New high-end jobs will be created, but there will be an increase in the low-wage, non-routine sector as well. There are positive spill-over effects from high-tech employment to low-tech employment, especially in the form of in-person services. Creating one high-tech job will create between 2.5 to 4.4 other jobs in the local area, mostly in low-skilled and medium-skilled in-person services.¹⁰⁵ These non-routine manual occupations are service jobs, such as janitors, gardeners, manicurists or home health aides.¹⁰⁶

2. Jobs to be eliminated

A) HIGH-ROUTINE OCCUPATIONS

Jobs that will be mentioned only in the past tense in some decades from now are, for example, accountant, court clerk or desk officer at fiscal authorities. Owing to the high level of routine in their performance, these jobs will mainly be done independently by software. Almost every job where an employee sits in front of a computer screen and processes and interprets data is at high risk.¹⁰⁷ According to a study by ING-Diba conducted in 2015, the probability of the relevant job being eliminated is

103 Benner, 'Die Digitalisierung lässt uns wenig Zeit' (25 April 2016) 96 *Frankfurter Allgemeine Zeitung* 20.

104 See: www.portal21.de/PORTAL21/Navigation/Laender/Spanien/Dienstleistungen/pflichtversicherung.html#1337158 (last accessed on 26 August 2016).

105 Goos, Konings and Rademakers, 'Future of Work in the Digital Age: Evidence from OECD countries' (19 February 2016) 11 ff.

106 Jaimovich and Siu, *The Trend Is the Cycle: Job Polarization and Jobless Recoveries* (2012) 8 ff.

107 See n5 above.

89 per cent.¹⁰⁸ As of 2022, for example, tax returns are supposed to be digitally processed in most Western countries.¹⁰⁹ The form will be completed online and analysed by the computer. It is intended that tax officers will no longer examine the tax returns of dependent employees, as has been common practice in the US for quite some time.¹¹⁰ They will no longer have to check receipts, as is usual today. Humans will only make random checks and process special cases individually. As a result of the simplification of the tax returns, there is a 72 per cent probability that the job of assistant tax consultant will be eliminated.¹¹¹

B) SIMPLE PHYSICAL WORK/MANUAL WORK

In the future, simple work mostly carried out by mere physical strength will be increasingly, but never completely, performed by machines. The decisive criterion remains the level of routine.¹¹² The efficient use of a machine rather than a human employee is possible only if the process can be made independent and is repeated with certain regularity. Many supplier operations have thus been planning already for some time to eliminate many jobs in production and have the work performed by robots. Minimum wages in the lower wage sector may also be a reason to use robots.¹¹³ The affected employees could be transferred to other positions within the company. For example, they might perform distribution, IT and creative research tasks. It is acknowledged that even in low-labour-cost countries, such as China, traditional factory workers are gradually being replaced by robots.¹¹⁴ Whether it will be possible to retrain traditional assembly line workers to be IT experts or account managers is a different matter.

C) DISMISSAL OF EMPLOYEES AS A RESULT OF DIGITALISATION

If retraining the employees is out of the question (eg, the employees working in those jobs will not be able to be trained for a highly qualified job because of their own lack of ability concerning digitalisation) or if the technical reorganisation will reduce the number of employees to such extent that not all employees can be

108 See n16 above, 4.

109 See: www.sueddeutsche.de/geld/aenderung-von-an-steuererklaerung-wird-digital-1.2772956 (last accessed on 24 February 2016).

110 See n79 above, Chapter 9.

111 See n16 above, 4.

112 See n106 above.

113 'Der Cheeseburger vom Roboter' (31 May 2016) 124 *Frankfurter Allgemeine Zeitung* 17.

114 'Automat trifft Armut' (15 July 2016) 135 *Handelsblatt News am Abend* 6.

retrained, collective redundancies in the fields of work listed above, by way of example, will be the inevitable consequence. The ability to effect such collective redundancies may be constrained by labour law but the rules vary from country to country. For example, there is generally a high level of protection for employees in Europe because both employee representative bodies and labour authorities must be informed and consulted in advance. By contrast, the principle of 'hire and fire' applies in other countries such as the US or China. In these countries, no special reason for dismissal is required, but sometimes individual laws can be an obstacle to a dismissal without cause only in exceptional cases (eg, membership in a trade union or the Anti-Discrimination Act in the US).¹¹⁵

3. Jobs in demand

A) IT MANAGEMENT AND SCIENCE

IT and science professions, in particular, as well as media science and humanistic professions, will initially benefit from the increase in investments and the associated growth in the area of Industry 4.0. The probability of jobs being eliminated in the area of the sciences (physics, biology, information technology and chemistry) is ten per cent. In addition to executive employees (11 per cent), the prospects are similarly good for physicians (only one per cent), which is due to the ageing European population.¹¹⁶ In the next ten years, the IT service sector will experience the greatest boom. Typically, high-paying occupations are corporate managers, physical, mathematical, and engineering professionals, life science and health professionals, in other words, typical jobs related to science, technology, engineering and mathematics (STEM) that can be found in parts of both manufacturing and services.¹¹⁷ These high-paying occupations will not be eliminated; on the contrary, the number of employees in those occupations will rise. Afterwards, the teaching, legal and advisory professions will participate in the gains caused by the numerous reorganisations and technical upgrades.

B) TEACHING PROFESSIONS

The sector 'teaching professions' covers not only the areas of school, university and vocational training, but in particular, possibilities of

¹¹⁵ Wisskirchen, 'Arbeitsrecht USA 2015' (2015) *Schriftenreihe International* 53 ff.

¹¹⁶ See n16 above, 4.

¹¹⁷ See n105 above, 4.

further and advanced training for adults.¹¹⁸ This professional group benefits from the need of companies to spend more money on the education of employees and the achievement of further key qualifications for new and existing employees.¹¹⁹ The number of young professionals with a university degree is already increasing year by year. The range of additional qualifications up to internationally acknowledged degrees is also increasing, so even the individual employee is under pressure to obtain additional degrees in order to stand out against well-educated colleagues. There is a general trend towards more education. More education leads to more jobs for teachers even if there are fewer attendance seminars, more webinars and more online workshops for Generation Y.¹²⁰

C) HUMANISTIC, SOCIAL SCIENCE, MEDIA SCIENCE AND ARTISTIC PROFESSIONS

Creative professions have benefited in all respects in recent decades, and humans in these professions will not be replaced by machines in the future either. Whether they are superstars with their music, artists with their works or authors and actors with their literary or cinematic works,¹²¹ or simply humanities and media scholars, increasing demand is forecast for their professions. In the future, the end user will still demand creative entertainment options and graphically appealing presentations. Since there is no routine involved, these professions can hardly be performed by intelligent software. The same applies to the socio-scientific communicative sector or to professions with an emotional component. Communication with other people will always come directly from people. It is true that communication increasingly takes place in social networks, but they too must be maintained and technically equipped. This is the central challenge of Industry 4.0, as is the development of ever new, technically versed business models.

D) SPECIAL CASES: LAWYERS

Even if the risk of being replaced by intelligent software or a machine is low for members of the legal profession (three to five per cent), the following examples show that technical development is taking place also in this sector. In addition to the financial and insurance sectors

118 See n12 above, 36.

119 *Ibid*, 46.

120 Felder, 'Industrie 4.0- Hype oder Herausforderung?' (2 April 2016) *HR Performance Businesspartner für Personalverantwortliche* 23.

121 See n79 above, Chapter 10.

that are deemed technically well-equipped¹²² and in which financial services have already been assessed using computer simulations and analyses for years, intelligent software can also conquer the legal market and optimise work habits. Studies conclude that the legal profession is at risk to a lower degree than other jobs in the financial sector because of the personal relationships with clients and the creativity needed to draft new legislature and contract clauses.

Nevertheless, this profession is not safe from Industry 4.0 either, and further technical development is necessary. An intelligent algorithm went through the European Court of Human Rights' decisions and found patterns in the text. Having learned from these cases, the algorithm was able to predict the outcome of other cases with 79 per cent accuracy.¹²³ In addition to common online databases and automatic time recording, the acceleration of work with regard to reviewing contracts is a central topic. For example, reviewing contracts or entering contracts in a database is often a nuisance for lawyers and leads to high costs for the client. In order to reduce the lawyers' work and save money for clients, software developers and lawyers are working on intelligent systems for reviewing contracts, called optical character recognition (OCR).¹²⁴ Such software allows patent, contract and other lawyers to perform a preliminary review of legal documents. The system can present the overall structure on the basis of language analyses without a lawyer having read the document. The software is also able to automatically create a graphic presentation of the data gained by it.¹²⁵

As an alternative, software can automatically review specific clauses on the basis of rendered decisions. In problematic sections of text, the system submits the clause to the lawyer for individual review. Therefore, the lawyer must review only the problematic clauses, whereas the routine review of unproblematic clauses is carried out by the software.¹²⁶

It is also worth mentioning the EU Alternative and Online Dispute Resolution (ODR) Regulation¹²⁷ by way of which online dispute resolution for online purchases is to be introduced. This has already been common practice for years at eBay and PayPal

122 n60 above.

123 See: www.irishtimes.com/business/technology/artificial-intelligence-judges-court-cases-with-79-accuracy-1.2842492 (last accessed on 27 October 2016).

124 See n10 above.

125 See n80 above, 17.

126 See: www.lto.de/recht/kanzleien-unternehmen/k/lega-tech-zukunftsmusik-grosskanzleien-it-basierte-rechtsberatung-1 (last accessed on 25 November 2015).

127 No 524/2013/EU: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0524&from=DE> (last accessed on 14 March 2016).

through the system 'Modria'.¹²⁸ To this end, the complainant must fill out a complaint form, then receives a corresponding proposal for resolution from the system.

In many sectors, fixed amounts for the provision of a certain service have been customary for a long time. Examples are finder's fees or fixed service fees at banks. A fixed price for legal services is rare, however. In most countries, payment is rendered on the basis of an individually agreed hourly rate. In some countries, the lawyer is paid also on the basis of the value at issue. Within the framework of digital working, it has become common practice to negotiate fixed prices also in the legal services sector. Fixed prices are offered not only to companies that have a particular interest in financial certainty for their balance sheet reserves; this has already become prevalent also in the private sector.¹²⁹ That fixed prices can be specified is made possible by the ongoing digitalisation. More and more legal work is carried out by algorithms; this applies, in particular, to routine work, such as reviewing an employment contract, registering a trademark or making divorce papers available.¹³⁰

Algorithms not only make the work easier for lawyers, but also allow them to offer fixed prices. It is therefore logical that according to a study conducted by Deloitte, 100,000 jobs in the English legal sector will be automated in the next 20 years.¹³¹ Moreover, it can be observed that more and more companies are working with on fees. Private clients also want to have a better overview of the lawyers' fees, so more and more law firms are forced to offer fixed prices and to invest in digital innovations because of the pressure from their clients and increased competition.¹³²

E) DOCTORS AND NURSING STAFF

Like lawyers, doctors and nursing staff are far from being replaced. However, in this sector too, technical possibilities can lead to staff reduction.¹³³ In some cases, machines are able to work faster, more accurately, and more efficiently than the best humans. It will no longer be possible to imagine hospitals without robots in the future. Their tasks will be, for example, to move people out of their

128 See: <https://webgate.ec.europa.eu/odr/main/index.cfm?consumer-question1=Y&consumer-question2=Y&consumer-question3=Y&complaintType=3&event=main.complaints.new> (last accessed on 3 March 2016).

129 See: <https://legalbase.de/> (last accessed on 30 March 2016).

130 See: www.legalzoom.com/personal/marriage-and-divorce/divorce-overview.html (last accessed on 30 March 2016).

131 See: <https://www.ft.com/content/c8ef3f62-ea9c-11e5-888e-2eadd5fbc4a4> (last accessed on 30 March 2016).

132 See n61 above, 25 ff.

133 See: www.faz.net/aktuell/beruf-chance/arbeitswelt/koennen-computer-aerzte-anwaelte-und-wirtschaftspruefer-ersetzen-14282103.html (last accessed on 18 June 2016).

wheelchairs or their beds or even help the doctors to perform surgery on people. Additionally, software technology based on artificial intelligence, called 'Watson Health', will help doctors to diagnose various illnesses by reconciling patient data with medical knowledge collected in a cloud.¹³⁴ Finally, the demographic change, at least in Western Europe, will lead to an increase of jobs in this sector because the population is constantly ageing and modern medicine is one reason for this.

4. Inequality in the 'new' job market

Moreover, the gap between rich and poor will continue to grow, which will inevitably lead to social unrest that will be a 'danger for the growth of the economy'.¹³⁵ As a result, wage differences will become more obvious than ever, despite established minimum wages in many countries, such as the US, Germany, France or the UK. Owing to increasing digitalisation and the streamlining of jobs that this entails, there will be fewer possibilities for well-paid work in the low- and medium-wage sectors.¹³⁶ Many people will end up unemployed, whereas highly qualified, creative and ambitious professionals will increase their wealth. When one compares the distribution of wealth in the OECD countries in the years from 1985 to 2013, one sees that this trend has already begun.¹³⁷

The agricultural sector can be seen as an example of this; change has begun and this will only increase. Thus, thanks to automatic irrigation systems, intelligent harvesting and transporting machines, the demand for foreign harvest hands and helpers is decreasing. By contrast, the need for technically versed employees who regularly check and repair the machines is increasing at large agricultural businesses. Mere physical strength will be needed less and less. The trend can be seen that high-labour-cost countries will rise even more. Their dependence on cheaper workers from abroad will also continue to decline. This will in turn result in an oversupply of cheap workers in the relevant low-labour-cost countries.

A similar phenomenon can be discerned in the medium-wage sector. In this sector, routine jobs will be eliminated, with the result that a huge number of employees will – at least temporarily – drift into unemployment. It is assumed that in the OECD countries alone, a total of approximately seven million jobs will be eliminated in the next five years. Compared to the current situation, however, only approximately

134 *Ibid.*

135 See: www.heise.de/newsticker/meldung/Weltwirtschaftsforum-Mehr-Gestaltungswillen-fuer-Digitalisierung-und-4-industrielle-Revolution-3079851.html (last accessed on 12 February 2016).

136 'Automation and Independent Work in a Digital Economy' (May 2016) *OECD Policy Brief on the Future of Work* 4.

137 See n56 above, 7ff.

two million 'new' jobs will be created.¹³⁸ In addition to combating unemployment among young people, the integration of five million people into the 'New Labour Market 4.0' is the greatest challenge for governments, employee representatives and companies.¹³⁹

5. Integration of untrained workers in the 'new' job market

The integration of untrained workers will be a huge problem in the future, because in addition to the number of university graduates, the number of people without completed vocational training or school education will increase.¹⁴⁰ Additionally, the number of immigrants in the Western highly developed countries will rise.¹⁴¹ Whereas many auxiliary jobs are now performed by untrained workers, students or trainees on the basis of marginal employment, it is to be assumed that the demand for these jobs will decline massively in a technically modernised establishment. The integration of these workers into the new digital labour market is practically impossible. The number of workers who carry out the simplest auxiliary or production jobs within the framework of their full-time work will also be reduced because of the introduction of robots.¹⁴² For many people, the technical innovations will therefore result in a serious threat to their professional livelihood.

A) ENTITLEMENT TO UNCONDITIONAL BASIC INCOME

The central follow-up question is how social security systems will compensate for the elimination of these jobs and who will ultimately pay the costs. The companies will share the costs in part by bearing the costs for retraining and by making severance payments in the event of dismissals. Many people will not be able to retrain for another position for physical or cognitive reasons. These people will become long-term unemployed and will have to be supported by the state. The high financial pressure on social welfare systems will be a central problem.¹⁴³

While some demand a revolution in the European social security systems by establishing an unconditional basic income for all

138 See: <http://reports.weforum.org/future-of-jobs-2016/shearable-infographics> (last accessed on 9 February 2016).

139 See n27 above, 14.

140 See n12 above, 49.

141 See n38 above.

142 See n113 above.

143 Bertelsmann Stiftung, *Auf dem Weg zum Arbeitsmarkt 4.0? Mögliche Auswirkungen der Digitalisierung auf Arbeit und Beschäftigung in Deutschland bis 2030* (2016) 41.

people,¹⁴⁴ others reject this idea – sometimes designated as ‘communistically outdated’ – from the outset.¹⁴⁵ It is said by proponents that the positive aspect of this idea is that money and prosperity for all will secure social peace, whereas unemployment caused by machines might ultimately turn into frustration or even civil disobedience. Another positive aspect of an unconditional basic income would be the deregulation of many legal aspects of labour and social laws (eg, unemployment benefits and protection against unfair dismissal).

There are now discussions in Finland about starting a two-year test project regarding an unconditional basic income, since the economic crisis is persisting and the social security payments are high anyway.¹⁴⁶ For the first time, citizens of Switzerland were able to vote in a referendum concerning the introduction of an unconditional basic income (approximately US\$2,300 for adults and US\$500 for minors) in June 2016. The Swiss citizens voted against an unconditional basic income, but it is said the majority of Europeans would vote for an unconditional basic income, if they had the choice.¹⁴⁷ The Swiss citizens voted against the introduction of an unconditional basic income because they believed that too many citizens would stop working immediately, and that would lead to greater financial problems.¹⁴⁸

B) OTHER WAYS TO PROTECT VULNERABLE GROUPS OF WORKERS

As an alternative to the unconditional basic income, governments could introduce higher minimum social standards by revolutionising the progressive tax systems, distributing subsidies or vouchers or offering rewards/prizes. Alternatively, the US economist Richard Freeman proposes that employees should buy the robots that replace their jobs or should invest in the development of new IT systems.¹⁴⁹ The advantage these alternatives have over the unconditional basic income is that working is not rendered unattractive.

As a substitute, the state could reduce the maximum working hours by law so that existing jobs must be allocated to several employees. In this regard, a 30- or 35-hour week or

144 See: www.neopresse.com/politik/dach/warum-das-bedingungslose-grundeinkommen-vielversprechend-ist (last accessed on 23 March 2016).

145 See: www.forum-grundeinkommen.de/blog/vernetzte-industrie-bringt-hartz-40 (last accessed on 23 March 2016).

146 'Wie Finnland das Grundeinkommen testen will' (3 March 2016) 53 *Frankfurter Allgemeine Zeitung* 17.

147 See: www.spiegel.de/wirtschaft/soziales/grundeinkommen-zwei-von-drei-eu-buergern-wuerden-dafuer-stimmen-a-1093136.html (last accessed on 31 May 2016).

148 *Ibid.*

149 See n5 above.

a 4-day week could be considered.¹⁵⁰ An employment crisis can also be avoided by allowing working age populations to decline.¹⁵¹ However, the introduction of a 35-hour week has not resulted in an increase of jobs either in France or in the German metalworking industry. The evidence is that reduced working hours prevent only a rise in unemployment, but do not contribute to the reduction of existing unemployment.¹⁵²

Furthermore, the state, as lawmaker, is in a position to determine what jobs it wants to be performed exclusively by humans (eg, caring for babies). The state could introduce a kind of 'human quota' in any sector and they could decide what social and charitable work it wants to support and to what extent and whether it intends to introduce a 'made by humans' label or a tax for the use of machines.¹⁵³ Another alternative is the introduction of social security funds into which the industries – such as the oil industry in Alaska – must pay or into which the operators of smart factories could pay in a few decades.¹⁵⁴

Government subsidies for innovative startups in the founding phase are particularly suitable for this purpose. The modernisation of the economy can be driven forward only by new ideas entering the market. Jobs can be created only if these ideas are not torpedoed by state bureaucracy or financial difficulties in the founding phase, because only then can the economy exploit its full potential for adaptation.¹⁵⁵

It goes without saying that none of the envisaged proposals offer any guarantee that the issues addressed here will be managed in an economically tenable and socially 'fair' manner. They are only ideas that the lawmakers must think about in the decades to come.

150 See: www.faz.net/aktuell/wirtschaft/fruehaufsteher/china-testet-die-viereinhalb-tage-woche-14167064.html (last accessed on 8 April 2016).

151 The Federation of International Employers, 'The rise and rise of the shorter work week' (14 April 2016) *Latest News* 1.

152 See: <http://diepresse.com/home/wirtschaft/oekonomenstimme/1354584/Warum-die-30StundenWoche-keine-Arbeitsplaetze-schafft> (last accessed on 14 March 2016).

153 Becker, 'Koch oder Kellner in der Arbeitswelt 4.0 – Wie arbeiten wir in der vernetzten Arbeitswelt der Zukunft?' (3 May 2016) *HR Performance- Businesspartner für Personalverantwortliche* 62.

154 See n79 above, Chapter 14, 'Long-Term Recommendations'.

155 See n14 above, 17.

VIII. Labour relations: possible implications for union activities and collective bargaining aspects

The fourth industrial revolution does not involve only fundamental technical and economic changes; the role of humans within the world of work is also subject to constant change. All over the world, employee organisations have realised that new challenges are in store for employees from all professional and social classes because of robotics and the computerisation of the workplace. In the future, strategic thinking and permanent flexibility will increasingly be expected of employees. Employee representatives are unlikely to stand idly by in view of the upcoming innovations; they can be expected to demand there be a balance between the elimination of old jobs and the creation of new jobs.

Unions can be expected to pay particular attention that no 'lost generation' is left behind, and that change takes place gradually with sufficient options for further training, advanced training and retraining.¹⁵⁶ This will be difficult because of the fact that employees have to work longer before receiving their pensions. Instead of dismissing existing employees and hiring new employees for the more creative jobs, the employee representatives might exert their influence in order to work towards specific retraining courses being made available.¹⁵⁷ This applies particularly with regard to older employees who are often of vital importance for most companies due to their many years of professional experience and who must adapt to the latest technical conditions in order to benefit equally from these technical innovations.

Unions and employee representatives will not be able to save every job. Rather than firing – especially older – employees, partial retirement rules might be an opportunity.¹⁵⁸ In addition, the unions will have to bid adieu to their classic clientele of industrial workers and look for new member groups in the service sector and among better-qualified employees.¹⁵⁹ In many countries (especially in Southern Europe or Northern Africa), the unemployment rate among young adults is very high. Due to the lack of alternatives, many young employees are working in less well paid 'crowdworking mini jobs' outside social security systems, which could lead to poverty risks.¹⁶⁰ Unions are likely to focus on this generation, and fight for 'fair' working conditions and consultation rights for independent contractors as well.

1. Industry 4.0 from the union viewpoint – the human at the centre

It is likely that employee representatives will seek to avoid modern Taylorism in which machines assume the control and planning of all work processes. In such a scenario, an employee's only task would be to follow

156 See: https://innovation-gute-arbeit.verdi.de/++file++540998f5ba949b358400004e/download/138.1411_digit_arbeit_RZ3_web.pdf, S.25 (last accessed on 31 March 2016).

157 'Wenn Computer statt Menschen die Autos bauen' (29 August 2016) 201 *Frankfurter Allgemeine Zeitung* 18.

158 *Ibid.*

159 See n27 above, 12.

160 *Ibid.*

the instructions of a robot. It would be possible from all points of view, including the technical and legal points of view,¹⁶¹ for robots to give work assignments to human employees. The employee would perform dreary work – always of the same type – for the robot, which would consist only of monitoring single work procedures and servicing the machines from time to time. Such a development would carry the risk of promoting monotonous work and at the same time preventing the retraining and advanced training of certain employee groups.¹⁶² The consequence would be a wide gap between the salaries and education of well-educated employees and those of less-educated employees, which, in turn, would result in social tensions. Unions would also fear an increase in low-paid work.

Instead of a machine-focused development, union representatives might strive for man-machine interaction. They might support the aim of improving the creation of value by employing humans and machines. This improvement ensues from lower production costs and better-educated employees. Trade unions emphasise, however, that humans must play the leading part within the processes.¹⁶³ They also demand that the use of the creative leeway that opens up due to the possibility of interconnected work that is no longer linked to a particular place or time will have the favourable effect of an extended autonomy of gainfully employed individuals in choosing their place and time of work and of an improved work-life balance. In addition, unions demand a minimisation of burdens and stress for employees, for example, by way of a statutory right to 'be offline'. Their goal is to maintain the working capacity and the physical and mental health of gainfully employed individuals for the long term.¹⁶⁴

In order to strengthen employee interests effectively during the digital change, unions will demand active participation in the discussion concerning the second machine age. In addition to the development of model collective agreements, unions are likely to want to participate in agreeing the direction science and research is taking the future workplace.¹⁶⁵ This is not only about new rights for which they need to be consulted on and informed of in regards to the use of intelligent systems, but also about long-term models showing how workplaces can be designed so that they can be preserved and modernised.

In addition, this is said to be about how 'right-sizing' or streamlining gains can be 'equitably' distributed. 'Equitable' distribution means that

161 Dzida, 'Wearables am Arbeitsplatz – Wie tragbare Computersysteme Einzug in die Betriebe erhalten' (2016) *ArbRB* 146.

162 See n103 above.

163 See n70 above.

164 See: www.verdi.de/++file++540ef2c46f68445a5b000080/download/Brosch%C3%BCre_Digitalisierung-und-Dienstleistungen.pdf, 17 (last accessed on 23 March 2016).

165 Dr Constanze Kurz, 'Industrie 4.0 verändert die Arbeitswelt' in *Gegenblende – Das gewerkschaftliche Debattenmagazin* (2013).

not only individual countries, but also companies, in particular, invest in their employees in order to avoid social conflicts. Supporters of this view suggest collective agreements are a tool to achieve this. They say low-skilled workers require special protection and thus special support from unions and employee representatives.¹⁶⁶ The argument is that these workers will be most affected by right-sizing processes to the effect that a collaborative cooperation of employee representatives and employers is required to prevent dismissals.¹⁶⁷

2. Advanced training necessary

Within the framework of digital change, a work organisation that allows employees, regular advanced training plays an increasingly important role. In order to help employees to keep up with the current technical standards, further training in the area of 'digital literacy' will be required at regular intervals. This so-called digital literacy ranges from a basic theoretical knowledge of how computers and communication devices are designed and work via a fundamental knowledge of how to use them to the ability to navigate and express oneself in online communities.¹⁶⁸

It is flanked by information literacy, thus the ability to deal with information in a targeted, autonomous, responsible and efficient manner.¹⁶⁹ In addition, it will no longer be possible to imagine the world of employment without educational leave. Such a right to paid educational leave is established by law in some European countries and will become increasingly important in the area of lifelong learning. If companies expect their employees to become more educated and have higher qualifications, it seems inevitable that they must also give the employees the opportunity to obtain these qualifications – even outside the framework of internal advanced training.

From an entrepreneurial perspective, regular advanced training of a company's own employees can be said to be important because a lack of education might cause employees to lack motivation. Moreover, it is contended that education and knowledge transfer counteract a 'social downgrading' of employee groups.¹⁷⁰ Furthermore, the companies are indirectly forced to provide retraining and advanced training to their employees because people have to work longer and longer. Specialists for changing customer needs are needed particularly in the service sector.

166 See: www.verdi.de/++file++540ef2c46f68445a5b000080/download/Brosch%C3%BCre_Digitalisierung-und-Dienstleistungen.pdf, 17 (last accessed on 23 March 2016).

167 See n21 above.

168 German Federal Ministry of Labour and Social Affairs, *Grünbuch-Arbeit weiter denken* (2015) 61.

169 *Ibid.*

170 See n165 above.

Union and employee representatives are asking for better educational training for employees, but what training is necessary in addition to IT training? Analyses of the jobs that will become automated in the next few years are therefore required in every individual company.¹⁷¹ Based on such analyses, employees can become qualified individually to perform other work. There is no general need for a special kind of education.

Volkswagen announced, for example, that one out of ten administrative jobs will be rationalised in the next few years. The challenge for the employee representatives will be to integrate these employees in the modern labour market and to transfer them to other jobs within the company group in order to keep their promise that no employee will be fired because of operating conditions.¹⁷²

3. Challenges for employee representatives

The effect of increasing digitalisation is that work can be performed from any place. The absence of fixed integration in an establishment encourages the weakening of employee representative bodies and will further reduce the number of members of unions. As a result of the increasing number of 'distance workers', individual employees will be unlikely to have the same opportunities to negotiate better working conditions.¹⁷³ Unions, for example, see in the increasing digitalisation of the world of work the risk of unstable working conditions. The preservation of current standards in terms of social security, employment protection, minimum wage and, where applicable, employee participation has top priority for the unions in Europe.¹⁷⁴

The work of unions and employee representative bodies is made more difficult because there is often no direct contact between the employees, whose interests are to be protected, and the negotiating partners. This makes it harder for the latter to detect problems in an establishment. The intellectual challenge of employee representatives will also become higher. Employee representatives must deal with technical details to which any right to be consulted and informed refers.

In Europe at least, many rights of the employee representatives to be consulted and informed will be eliminated due to the changes in the world of work. Examples of this are dirt and danger payments or work with regard to which works councils are involved in many EU countries. If robots increasingly carry out such tasks in the future, this category of the right to be consulted will no longer exist as a potential leverage against the

171 See n157 above.

172 *Ibid.*

173 See n27 above, 25.

174 See n72 above, 2.

employer representatives. To find out, among other things, whether the European minimum regulations concerning co-determination (employee participation) are sufficient to solve the problems of the future world of work, the European Commission started in 2015 a 'first and second phase consultation' of social partners (works councils and unions) regarding a consolidation of the EU directives on information and consultation of workers.¹⁷⁵ This includes the question as to whether the Commission should launch an initiative to revise or recast the EU Directive (98/59/EC) on collective redundancies, the EU Directive (2001/23/EC) on transfers of undertakings and the EU Directive (2002/14/EC) establishing a general framework for informing and consulting employees.

If the number of employees is reduced by using more and more autonomous systems, third-party workers and the possibility of outsourcing certain services, the required threshold figures (eg, 1,000 employees for establishing a European Works Council) will no longer be reached. At present, the number of relocations (outsourcing) to low-labour-cost countries is still rising. This leads to the situation that the companies' core workforce, which is represented by the unions and works councils, is thinning out.¹⁷⁶ Owing to the flexibility of the employees and the international integration of companies, the connecting factor for consultation within the company or cooperation with employee representatives as such is changing. Thus, the question arises: who is to be regarded as relevant for thresholds or consultation? Is it only the permanent workforce or also temporary workers and crowdworkers?¹⁷⁷ It can be expected that works councils and unions will claim the right to represent all workers in a company regardless of the type of their contracts.¹⁷⁸

Under the 'old' German laws, trade unions and works councils represent only (permanent) employees, and only (permanent) employees are forced to pay social security tax/contributions. These regulations reflect common practice in the 1970s.¹⁷⁹ As a consequence of this, German lawmakers will consider as many workers as possible to be employees in order to guarantee minimum social standards and will not be willing to accept a model of independent contractors.¹⁸⁰ The above-mentioned Spanish law and the Italian law (discussed later) are going in a different direction. The lawmakers are introducing new forms of atypical work, are creating tax systems and

175 See: <http://ec.europa.eu/social/keyDocuments.jsp?type=50&policyArea=0&subCategory=0&country=0&year=0&advSearchKey=&mode=advancedSubmit&langId=en> (last accessed on 1 September 2016).

176 See: www.arbeitenviennull.de/fileadmin/Downloads/Dokumentation_WS_5.pdf (last accessed on 29 September 2016).

177 See n120 above, 23.

178 See: www.bund-verlag.de/zeitschriften/arbeitsrecht-im-betrieb/aktuelles/praxiswissen/20150924_menschengerechte-arbeit.php (last accessed on 22 September 2016).

179 Allen & Overy, 'New forms of employment: the legal challenges' (2015) *The Big Think* (series) 7.

180 *Ibid.*

are forcing independent contractors to pay social security tax, too.¹⁸¹ In addition, they have to think about representation models for these new forms of atypical work. Therefore, unions will want to create new discussion channels for new types of jobs. At present, the majority of employees are not associated with a union, which leads to a certain legitimacy deficit.¹⁸² However, unions remain the main actors in the representation of employees' interests, even though union membership is low.

4. Changes in the structure of unions

Central questions arise about the issues of what representative bodies are responsible for the employees, to what extent and how the employee representative bodies are made up in particular cases. New business models have an effect on business plans and the companies' organization. If the unions and the employee representatives wish to continue to stand up for the employees' interests, they will have to change their own structures as well.¹⁸³

The increased use of virtual platforms, social media and other IT tools offers new opportunities for employees to communicate collectively. These tools are free. Why would an employee pay for union membership if they can communicate with other employees for free and if the pressure exerted on the employers by media sometimes helps the employees to solve their problems? It is said this will unavoidably lead to less union activism.¹⁸⁴ It is to be expected that unions will want to represent or to protect new forms of 'workers', too – regardless of their form of employment. If so, they will have to use more social media, for example, and have to fight for the social interests of 'younger generations' in order to address them. That will be a key way to justify the unions' exceptional position in the labour world of the future.

The majority of labour regulations (eg, laws governing working hours, occupational safety laws or the laws concerning employee representatives or trade unions) are based on the old concept of labour from the last century.¹⁸⁵ Some argue unions are not only supposed to represent traditional workers but that they should expand their spheres of influence to crowdworkers and highly qualified freelancers. The same applies to employee representatives. An example of cooperation and the unions' adaptation to the new form of employment is the platform 'FairCrowdWork'.¹⁸⁶ The website was created by

181 See: www.portal21.de/PORTAL21/Navigation/Laender/Spanien/Dienstleistungen/pflichtversicherung.html#1337158 (last accessed on 26 August 2016).

182 'In der Legitimationsfalle' (29 June 2016) 123 *Handelsblatt News am Abend* 5.

183 See n27 above, 12.

184 *Ibid*, 26.

185 See: www.hrperformance-online.de/news/eine-neue-rolle-fuer-gewerkschaften-in-der-digitalen-arbeitswelt (last accessed on 11 May 2016).

186 See: www.faircrowdwork.org (last accessed on 26 September 2016).

the German union IG Metall, and its aim is to evaluate the working conditions on crowdworking platforms.

The structures of companies are changing along with their virtual working groups and far-reaching digital cross-linking. This will lead to an underrepresentation of dependent workers. Only the 'old core workforce' is represented, while the 'younger generation' is situated outside countries with strong representation laws or is not integrated in the company. Thus, some lawmakers might decide to create new forms of employee representative bodies that are no longer linked to the old definition of a company or employment. The strengthening of European works councils or group works councils could be a first step. Their right to have a say is very restricted at the moment. Another way to represent freelancers is to link employee representative bodies' structures to the status of dependent freelancers who work primarily for a company or a company group.

Even if highly qualified freelancers do not depend on union protection against inhuman working conditions anymore, some say the new forms of the labour market (more independent contractors in the service sector) need a dialogue among politicians, company representatives, unions and independent contractors.¹⁸⁷ Before globalisation, unions had to limit the downward spiral of wages and had to fight for better working conditions for the workers. During Industry 4.0 or the 'second machine age', some will argue that they should push for the use of better robotics and a comprehensive faster internet, instead of protecting work in its traditional sense.¹⁸⁸ Because of this, older employees in particular would have more time to learn new skills, and learning new skills is the best way to safeguard jobs in the age of digitalisation.¹⁸⁹

Finally, lawmakers will have to introduce new forms of employee representation structures if they intend to preserve the rights of employee representative bodies so that they are consulted and informed.¹⁹⁰

187 *Ibid.*

188 See: http://sethgodin.typepad.com/seths_blog/2015/03/labor-unions-in-a-post-industrial-age.html (last accessed on 11 May 2016).

189 See: www.martinlennartz.de/braucht-die-neue-arbeitswelt-gewerkschaften (last accessed on 11 May 2016).

190 See: https://innovation-gute-arbeit.verdi.de/++file++540998f5ba949b358400004e/download/138.1411_digit_arbeit_RZ3_web.pdf, S.24 (last accessed on 23 March 2016).

C. Impact on the Organisation of Work

For economic reasons, numerous jobs will be carried out by intelligent software or machines rather than by humans in the future. The differentiation made in this regard will not be so much between physical and cognitive work, but primarily between routine and non-routine work.¹⁹¹

I. Creating new structures in the company

The established companies, in particular, will have to think about whether they are able to satisfy the new requirements of the market. More than 40 per cent of the CEOs of companies operating worldwide assume that there will be significant changes in their companies in the next three years.¹⁹² One company or another will – like the aluminium industry in the US – have to redefine its focus of operations because of the lack of demand for their products. This also includes the creation of new business structures.

1. In-house organisation

In the future, in addition to the traditional division of a company into departments such as sales, supply chain, production, research and development (R&D) and finance, it will be the IT department that will gain considerable importance. Under certain circumstances, this will require internal reorganisation, because a differentiation must be made between data analysts and traditional IT specialists. The results of data analysts and data scientists are indispensable for many other departments, so an interface must be established that ensures that information is passed on without delay to the offices responsible internally, if possible.¹⁹³ Ultimately, the area of big data will acquire more importance.

But it is not only the departments that will have to be better connected. Companies will have to focus on their core competencies and will outsource other work in a cost-effective manner.¹⁹⁴ That includes production and services. A professional connection between companies and their external providers – not only within the company – will be a basis for success in the digital world. Especially in big companies, the number of different levels has to be reduced; smaller organisational charts are necessary.¹⁹⁵ Every unit between the working group and the person who makes the final

191 See n106 above, 7 ff.

192 'Bangen vor der digitalen Zukunft' (27 June 2016) 121 *Handelsblatt News am Abend* 3.

193 See n60 above.

194 See n27 above, 7.

195 <http://bundestag.at/2015/wp-content/uploads/2015/09/kollmann-digital-leadership.pdf> (last accessed on 28 September 2016).

decision costs a lot of time and money and so may have to be eliminated.¹⁹⁶ The divisions need to be flexible and independent to react quickly to the customers' interests in Industry 4.0.

The internet of things offers a direct connection between the computers of the customer and its suppliers or service providers.¹⁹⁷ An old pyramidal hierarchy level is no longer capable of satisfying the needs relating to this flexibility. A possibility could be the change in leadership in a certain working group if another employee has better technical knowledge in the special domain.¹⁹⁸

2. Changes at individual working places

Not only the in-house organisation, but also the single working place will be the target of numerous changes. Cloud computing allows access to internal data from everywhere, while digitalisation enhances the use of automatic data processing and makes it easier to make quick decisions.¹⁹⁹ The cross-linking of single employees by new technologies allows easier communication and enables a better exchange of information. Therefore, the relevant facts necessary to make decisions and the results of big data analyses are collected by the right contact person. This leads to more autonomy of the individual employee. This form of dematerialisation saves a lot of time that employees could use for other tasks.

As already mentioned, intelligent assistant systems can simplify or even perform a part of the employees' daily work. This applies to individual physical and cognitive working steps to the same extent.²⁰⁰ Especially for onerous activities, the automatisisation of working steps is a benefit for employees. Sometimes, an effective collaboration with a robot or a system is possible only if the employee is trained. As a result of the technical development, such training can be flexible with respect to place and time ('Training 4.0').

3. Virtual working groups

In a study published by the Academy of Management, the authors describe a virtual team as a 'group of people who work independently with shared purpose across space, time, and organization boundaries, using technology

196 Schüller, 'Wandel gestalten statt verwalten' (2 April 2016) *HR Performance Businesspartner für Personalverantwortliche* 26.

197 Giersberg, 'Die Revolution rollt' (25 April 2016) 96 *Frankfurter Allgemeine Zeitung* 17.

198 See n196 above, 27.

199 See: www.uni-regensburg.de/rechtswissenschaft/buengerliches-recht/arbeitsrecht/medien/4._pr__sentation_landestagung_pollert.pdf (last accessed on 29 September 2016).

200 *Ibid.*

to communicate and collaborate'.²⁰¹ As such, virtual teams allow organisations to bring together people with the best expertise, regardless of where they live.²⁰²

The advantages of such working groups are that information comes directly and is compiled and reflectively considered supra-regionally by experts in the field. Since the integrated employees are interconnected, it is to be assumed that information can quickly be procured because an uncomplicated exchange of information is possible at any time. The cross-border expertise and the good connection of the employees thus leads to optimal work products.²⁰³ Furthermore, it is to be assumed that the employees in question can share the work, so a suitable substitute is available if an employee is ill. The employees no longer have to work together at the same time and at the same place in order to exchange information relevant to work or to coordinate processes.²⁰⁴ Consequently, it is possible to work in an effective and coordinated manner, even when the work is performed in different time zones.

It must be noted, however, that members of a virtual working group very often have no personal contact with their direct colleagues. Particularly in the case of home office work, communication is possible only via technical devices, which can lead to the isolation of the employees and to less creative ideas. Moreover, cooperation works better if the members are able to communicate seamlessly with each other both in terms of language and content. As a side effect of these new working groups, the hierarchy level in the company will change.²⁰⁵

4. Matrix structures

The increased interconnection and internationalisation of companies changes not only the traditional internal company structures, but also the need for the establishment of cross-company and cross-border units. Many companies already use so-called matrix structures today. They are characterised by the technical supervision and the disciplinary supervision of the employee being treated separately.²⁰⁶ As a rule, the authority to give technical and related instructions is given to different individuals who are not employed within the same establishment or the same company. This means that supervision structures that are independent from the employing company can be introduced within a group with cross-border activities.

201 See: <http://managementhelp.org/groups/virtual/defined.pdf> (last accessed on 2 November 2016).

202 See: www.mindtools.com/pages/article/working-virtual-team.htm (last accessed on 2 March 2016).

203 See n97 above, 42.

204 See n143 above, 19.

205 See n120 above, 23.

206 Braun and Wisskirchen, *Konzernarbeitsrecht Handbuch* (2016) 198.

Increasing digitalisation makes this possible. Owing to the interconnection of individual companies, such unitary structures usually result in increased productivity due to improved communication and exchange of knowledge. Moreover, group standards can be enforced more easily across countries.²⁰⁷

Depending on the content of the relevant contractual provision, the disadvantage of a matrix structure is that the integration of an individual employee into an establishment no longer plays any role. In Europe, this can lead to representation of the employee by several bodies, a right to participate in several internal bonus schemes and to an increased protection against unfair dismissal for the employee. With regard to some internationally operating groups, the question arises as to what national law governs the employment contract.²⁰⁸ Even if private international law provides some solutions, the legal uncertainty should be counteracted in advance by way of a governing law clause in employment contracts.²⁰⁹

5. International collective labour agreements

Parallel to the creation of matrix structures, some predict the introduction of harmonised collective labour agreements by internationally operating groups. The goal would be to establish uniform rules for all employees worldwide, for example, with regard to working hours, advanced training options or business trips, in order to create a level playing field. As simple as this idea may sound, its implementation will be complicated. Although there are binding agreements under international law regarding fundamental issues, such as the prohibition of child labour, forced labour or compliance with unitary standards with regard to occupational safety, the addressees of such agreements are generally only countries, for example, for International Labour Organisation (ILO) standards.²¹⁰

There is no harmonised collective labour law either on the international or European level. This is due to the different systems of national labour law. In some countries, certain topics are unregulated by labour law, whereas a regulation by collective agreement would be invalid in other countries because of corresponding statutory regulations. There is thus a great degree of legal uncertainty for companies, which is why only transnational collective agreements (TCAs) come into consideration as instruments for regulating group-wide issues.²¹¹ However, there are no binding, quasi-statutory provisions but only minimum standards can be specified by way of these TCAs. The valid implementation of the TCAs depends on national law.

207 Kort, 'Matrix-Strukturen und Betriebsverfassungsrecht' (2013) *NZA* 1318 ff.

208 See n27 above, 21.

209 Wisskirchen and Bissels, 'Arbeitsrechtliche Probleme bei "Matrix-Strukturen"' (2007) *Der Betrieb* 340 ff.

210 See n206 above, 561.

211 *Ibid*, 550.

6. Outsourcing of jobs

The increasing globalisation and digitalisation of society and the huge range of services offered by independent contractors on the internet render it easier for companies to relocate fields of activity or service sectors to other regions (outsourcing). In addition to production facilities, call centres or warehouses are situated in low-labour cost countries or weaker economic areas. Awarding contracts for software and programming services to foreign freelancers is also a typical example of growing outsourcing practice in the digital sector. In the US, for example, there are about 1.5 million jobs that have disappeared in the production sector because of the cheaper production possibilities in China.²¹² Another form of outsourcing or a 'special virtual working group' is joint ventures. Globalisation results in stronger operational and strategic cooperation between two competitors, even if that leads to the disclosure of their core competences.²¹³

However, it is not only the bigger companies that are responsible for outsourcing jobs. Employees will ask for more autonomy and will be focused on many different career paths – sometimes in very different branches or countries – rather than having a 9-to-5 job.²¹⁴ The global trend is that Work 4.0 will take place outside traditional employment structures with a rise in self-employment.²¹⁵ Highly qualified young employees, in particular, like their independence and will focus their work on the development of creative solutions for a changing client base. The digital worker of tomorrow will no longer want to work in hierarchically structured companies and to do the same work every day. They will be less dependent on only one employer.²¹⁶ The previously described range of all kinds of independent services will lead to another problem: what legal system is applicable in cross-border cases? Private international law has some solutions, such as that the applicable jurisdiction is the place where the service is provided or where the 'employer's' permanent address or the worker's residence is.²¹⁷ International courts of arbitration are a good way to avoid problems such as that of jurisdiction or the long duration of legal proceedings.

One huge problem with the 'gig', 'sharing' or 'work-on-demand' culture, however, is the sharing of the economic risk between employer and employee. In the past, in some countries it was customary that the risk was borne primarily by the employer. If there is not enough work or if the employee stays at home because they are sick, the employee must be paid at least until the termination of the employment relationship. The same applies to any poor performance

212 See: www.ddorn.net/papers/Autor-Dorn-Hanson-ChinaShock.pdf (last accessed on 4 March 2016).

213 See n153 above 62.

214 See n27 above, 9.

215 See n136 above, 3.

216 See n27 above, 12.

217 *Ibid*, 21.

by an employee. The costs for the social security tax (contributions) for the employees may be shared between employers and employees, too. In Western developed countries like Germany or France, these incidental salary costs are very high and a reason why some companies will avoid traditional employment in the future. In Italy, for example, the 'Jobs Act' that came into force in 2015 is introducing greater flexibility and lower costs for standard employment to avoid outsourcing and to achieve a certain increase in the number of freelancers who are not protected by social security systems.²¹⁸

These risks are not shared in this way in the work-on-demand culture. The independent workers generally become responsible for their own social security in the future.²¹⁹ For example, such an external service provider who is too ill to work does not have to be paid, but simply does not receive any newer orders. The entrepreneurial risk has thus shifted in the direction of the freelancer. However, the award of contracts to independent contractors is a legitimate expression of a modern economy, which has certain advantages for both parties.²²⁰

II. Changes in working environment caused by introduction of artificial intelligence systems

Whereas autonomous systems are still far away in some sectors, assistive robots and partially autonomous systems are already state-of-the-art technology in many industrial production plants. The pioneer in respect of robot density in the industrial sector is South Korea. In South Korea, there are 437 robots for every 10,000 employees in the processing industry, while Japan (323) and Germany (282) rank second and third.²²¹

1. Up to now: spatial separation between humans and robots

A central issue when dealing with autonomous systems is occupational safety. For this reason, previous work with production robots has been characterised by safety fences and safety zones. For example, there are corresponding standards both in Europe and in the US that prescribe safety zones for insurance law reasons. In most cases, the robot performs tasks that are highly hazardous for humans or those that are simple and require great strength. In fact, human and machine do not usually work together because humans are allowed access only when the robot is switched off or the robot automatically switches itself off when humans approach it.²²²

218 'New technology and new forms of atypical work: "crowdsourcing" and the challenges and risks for multinationals' (September 2016) 26(2) International Bar Association Employment & Industrial Relations Law 28.

219 See n27 above, 3.

220 Greiner, 'Werkvertrag und Arbeitnehmerüberlassung – Abgrenzungsfragen und aktuelle Rechtspolitik' (2013) *NZA* 697, 703.

221 See: www.vdma.org/article/-/articleview/8453283 (last accessed on 15 February 2016).

222 See n20 above, 61.

2. Up to now: robots working alone with human clients

In the 'Henn-na Hotel' in Sasebo, Japan, 'actroids' are used. Actroids are humanoid robots, that is, robots with a human likeness. In addition to receiving and serving the guests, they are also responsible for cleaning the rooms, carrying the luggage and, since 2016, preparing the food. The robots are able to respond to the needs of the guests in three languages. So far, the use of actroids is a culminating point in the interaction between human and robot. Over the long term, the plan is to replace up to 90 per cent of the employees by using robots in hotel operations. As evidenced by numerous CCTV cameras, the human's only remaining task is to intervene if problems arise or to stem safety risks.²²³

3. Outlook: robots work next to human workers and support them

In the near future, humans and robots will work together in the production sector. Only with the help of assistive robots can production be fully optimised.²²⁴

A) DIRECT COOPERATION BETWEEN HUMAN AND MACHINE

The robots' 'invasion' of the human environment will thus become the rule, because robots are intended to assist humans. The safety concerns are overcome by the fact that intelligent robots are able to foresee human errors and, thanks to their sensors, switch off automatically in hazardous situations.²²⁵

As can be concluded from the hotel pilot project in Japan, robots are already able to assume assistive functions and to work together with humans. This will be particularly important in the nursing care sector. Whereas many people refuse to be nursed by a robot for ethical reasons, it is assumed in practice that it won't be possible to imagine hospitals without nursing robots in the future. Their tasks are, for example, to move people out of their wheelchairs or beds or to help blind people find their way.

B) SIMPLIFYING THE WORK OF EMPLOYEES

Assistive robots can relieve human beings from particularly strenuous tasks, giving them more time for interpersonal communication in the best case.²²⁶ Furthermore, the employee's health is protected if there

223 See: www.zeit.de/2015/35/roboer-henn-na-hotel-japan-nagasaki (last accessed on 29 January 2016).

224 See: <http://nytimes.com/2014/06/17/upshot/danger-robots-working.html> (last accessed on 18 February 2016).

225 See n20 above, 61.

226 See n69 above.

are fewer strenuous movements, so the use of intelligent systems can be desirable also from an employee perspective. Since these physically strenuous routine tasks are eliminated, it will be possible to reduce illness-related absences of employees or early retirement because of physical health problems not only in the nursing care sector, but also in other sectors.²²⁷ Tasks that entail risks can also be assumed by machines, so the frequency of accidents at work will decrease. Moreover, less strenuous physical and cognitive work will enable employees to perform other work more accurately and more efficiently. Additionally, the participation of AI and robotics will create more opportunities for more varieties of people to do more varieties of work.²²⁸

C) EMPLOYEES NEED TO LEARN TECHNICAL SKILLS

Before a company uses intelligent systems, it must familiarise employees with the system. Depending on the complexity of the system, this includes introducing employees to the basic technical construction. Employees must internalise this in order to be able to exploit the full value of the system. Moreover, an assistive technical machine must be adapted or adapt itself to needs of humans, meaning that a company should make allowances for needed improvement that does not usually become apparent until it is put into use at the specific workplace. Harmony between an operator and an assistive technical machine is best if the operator can adjust the machine to their own needs, which usually requires, however, that the employee deals with the assistive system in advance.²²⁹

D) INTELLIGENT SYSTEMS ALLOW A BETTER INTEGRATION OF OLDER AND SEVERELY DISABLED PERSONS

Auxiliary robots and intelligent IT systems can also be applied to integrate old, ill or disabled people into the world of work. Individually adapted assistive robots facilitate not only a better integration into the specific position, but also the prevention of several employees sharing a position and early retirement. Therefore, using auxiliary systems not only leads to an efficiency gain for the company, but also strengthens the relevant employees' appreciation of themselves, because they can increasingly realise their potential in professional life as they can now work in fields that were previously closed to them.²³⁰ As a consequence, intelligent systems actively contribute to a better inclusion in the establishment.

227 Börkircher and Armbrorst, 'Digitalisierung, Industrie und Arbeit 4.0 – Herausforderungen für Unternehmen, Beschäftigte und Betriebspartner' (2016) 4 *Personalpraxis und Recht* 86.

228 Tyson, 'Technology and the workplace: artificial intelligence and robots in the 21st century workplace' (April 2016) 26(1) *Employment & Industrial Relations Law* 27.

229 Kärcher, 'Alternative Wege in die Industrie 4.0 – Möglichkeiten und Grenzen' in Botthof and Hartmann (eds), *Zukunft der Arbeit in Industrie 4.0* (2015) 56.

230 See n168 above, 46.

4. Limits to the use of intelligent systems

A) NO INDEPENDENT DECISION

So far, robots have primarily assistive functions. They support humans in individual production steps or even answer employees' questions. Intelligent chatbots can grow from little helpers to all-round workplace assistants.²³¹ If one believes numerous technical pioneers such as Bill Gates, Elon Musk or Stephen Hawking, however, human intelligence will be outshone by AI within 15 years.²³² If the development continues like this, it is to be assumed that in the near future, it will no longer be the human who makes the decisions, but the robot with its AI. If robots make the essential decisions and outdo the humans in their jobs, this might change the general positive attitude towards Industry 4.0.²³³

The state of development to date is, however, that humans still have the full power to make decisions and that only assistive functions are assigned to robots, at least in the processing industry. The question is whether the decision-making power of robots would be advantageous. Unlike many human beings, an autonomous system does not make its decisions on the basis of instinct, but on the basis of purely objective criteria. A robot announces the decision free of emotion, so there will be fewer misunderstandings in communication. Still, leaving the power to make decisions with humans has the decisive advantage of promoting the social acceptance of the systems in the establishment. What is relevant, however, is the content of the decision.

B) NO KILLING ROBOTS

A no-go area in the science of AI is research into intelligent weapon systems that open fire without a human decision having been made. In this context, current radio-controlled weapons like the drones used by the US armed forces must be differentiated from intelligent systems equipped with sensors that provide support in target selection and target acquisition.²³⁴ The consequences of malfunctions of such machines are immense, so it is all the more desirable that not only the US, but also the United Nations discusses a ban on autonomous weapon systems.

231 See: www.technologyreview.com/s/602068/the-hr-person-at-your-next-job-may-actually-be-a-bot/ (last accessed on 5 August 2016).

232 See n56 above, 14 ff.

233 See: www.buendnis-fuer-industrie.de/unsere-themen/digitalisierung (last accessed on 26 April 2016).

234 See: www.heise.de/newsticker/meldung/Weltwirtschaftsforum-Experten-warnen-vor-intelligenten-Waffensystemen-3081670.html (last accessed on 12 February 2016).

C) NO USE OF MACHINES IN DIFFICULT DOMAINS OR PRODUCTION STEPS THAT CAN CURRENTLY NOT BE REPLACED BY ENGINES FOR TECHNICAL REASONS

Another limit in the area of production robots and autonomous systems is the current state of the art. There are still complicated technical work steps that cannot be taken over by a machine or the takeover of which by a machine would be inefficient. Innovation can be regarded as another limit for the development of intelligent systems. There is no autonomous system that can be programmed to the effect that it independently develops innovative ideas and does creative research. Although needs can be analysed using big data, the development of ideas is still up to humans.

5. Artificial intelligence using the example of autonomous driving

A major project, in which not only the international automotive industry but also the large data processing companies are involved, is autonomous driving. The goal is to develop a fully automated system that moves the vehicle on public streets and roads more safely and without human intervention, because the main cause of accidents in road traffic are excessive speed, not enough distance between vehicles, overtired drivers or individual errors made by the driver.

A) AUTONOMOUS DRIVING: UP TO NOW

Currently, there has been the partially automated driving of cars (driverless cars) in Silicon Valley and on the German Autobahn A9, and the existence of individual technical aids such as parking assist systems or distance meters or lane departure warning systems in trucks. In previous projects, the front-seat passenger is still given a control function in Europe. The human must be able at any time to take over the driving of the car from the autopilot. The previous state of the development is characterised by a multitude of International Organization for Standards (ISO) guidelines and national standards, at least in Europe, some of which require high technical standards of the system.

In addition to private use, driverless motor vehicles are already used in factories. This applies particularly to self-driving forklifts in warehouses. In addition, self-driving motor vehicles transport work materials, shipping containers or employees on the business premises, but they often follow track guidance.²³⁵

235 See: autonomik.de/documents/2013-04-10_SaLaA_Hannover_Messe.pdf, 4 (last accessed on 4 March 2016).

It will be possible in the long term to eliminate the position of warehouse clerks thanks to intelligent sorting machines and fully automated packing machines. The system will register and store newly incoming goods, while another system will take the relevant goods from the warehouse to fulfil orders. The registration also makes it possible to order new goods automatically if stocks fall below a certain minimum level and the goods are selling quite well. After the goods or the required materials have left the warehouse, they can be transported by safe autonomous logistics and transportation vehicles in outdoor areas (abbreviated in German to 'SaLSA').²³⁶ For safety reasons, humans and autonomous systems have usually been separated in previous projects. As an alternative, the system moves at very low speed so that no accidents can occur. The low speed, however, is highly detrimental to efficiency. The longer the distances to be covered on the business premises, the less efficient the use of autonomous systems.

B) AUTONOMOUS DRIVING: POSSIBLE TARGET

In order to create an autonomous transport system that is independent of the controlling front-seat passenger, huge data volumes are required which must be analysed, processed and implemented by the system. A data volume of approximately 300 gigabytes²³⁷ per hour is assumed. This data include, for example, camera images and messages from the sensors that show the system the existence of obstacles and enable it to track potentially dangerous objects. Traffic signs must also be recognised, and their instructions must be followed. Moreover, the system must be capable of foreseeing both human errors and machine failures in order to be able to respond to the risks of road traffic in an appropriately foresighted way. The system must learn independently. The greatest challenge for the system, however, will be to warrant its functioning in the long run.

After the development of a driverless car driving at normal speed, the development of autonomous transportation vehicles would be the logical next or parallel development stage; in other words, a 'driverless truck' that transports goods to the customer on public streets and roads independently. The advantages are obvious: cost saving of up to 28 per cent²³⁸ as logistics will become cheaper, more reliable and more flexible. The system drives autonomously, at least on freeways and later on in cities, too. It does not need to take breaks, is available day and night, does not tire and does not fail

236 See: www.autonomik.de/de/index.php (last accessed on 2 March 2016).

237 Lüdemann, 'Connected Cars – Das vernetzte Auto nimmt Fahrt auf, der Datenschutz bleibt zurück' (2015) *SD* 247 ff.

238 See: www.spiegel.de/wirtschaft/unternehmen/autonome-lkw-in-zehn-jahren-werden-keine-fahrer-mehr-benoetigt-a-1112566.html (last accessed on 28 September 2016).

as often as humans fall ill or are absent. Furthermore, the system is safer – apart from single minor accidents. Since motor vehicles will be driven by fully automated systems in the future, jobs such as truck, taxi or forklift drivers will be eliminated in the long run. The likelihood that these drivers will lose their jobs is about 90 per cent.²³⁹ The developers of these connected trucks (eg, Daimler) are sure that the technical changes that will take place in the next ten years will be more dramatic than the technical advancements over the last 50 or 60 years.²⁴⁰

C) ROAD TRAFFIC – LEGAL APPROVAL

In general, the approval for use on the road and on business premises, as a partially public area,²⁴¹ is governed by the legal systems of the individual countries. This is different within a closed area like a warehouse, where only the national occupational health and safety regulations must be complied with. The legal systems for public approval, however, are mostly based on the Vienna Convention on Road Traffic of 1968 as a framework agreement under international law.²⁴² The Convention takes the principle as a basis that every vehicle has a driver with full responsibility who can permanently control it. In this connection, the principle of controllability of the vehicle is the basis for its approval. With regard to whether a design can be approved, the UNECE Regulation – and in Europe a Directive²⁴³ – applies, according to which all systems that increase road safety can generally be approved if the driver of the car still remains in control. According to current legislation, no fully automated cars, much less fully automated trucks, are permitted on public streets and roads in most countries, but the Vienna Convention has actually provided for special approvals for horse-drawn carriages and, since March 2014, also for autonomous systems, as long as they can be switched off by the driver.²⁴⁴

It is thus necessary to reform the relevant laws, as is shown by the example of the discussion paper introduced by the contracting states Belgium and Sweden. According to this paper, autonomous systems

239 See n16 above, 4.

240 See: www.spiegel.de/wirtschaft/unternehmen/autonome-lkw-in-zehn-jahren-werden-keine-fahrer-mehr-benoetigt-a-1112566.html (last accessed on 28 September 2016).

241 See: www.autonomik.de/documents/AN_Band_2_Recht_bf_130325.pdf, 13 (last accessed on 2 March 2016).

242 See: www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011542 (last accessed on 14 March 2016).

243 Directive 2007/46/EC: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2007L0046:20110224:DE:PDF> (last accessed on 14 March 2016).

244 See: www.spiegel.de/wirtschaft/unternehmen/autonome-lkw-in-zehn-jahren-werden-keine-fahrer-mehr-benoetigt-a-1112566.html (last accessed on 26 September 2016).

are to be treated as equal to human drivers, which would simplify the issues of both approval and liability.²⁴⁵ Similar tendencies can also be noticed in the US. For example, the Federal Motor Vehicle Safety Standard,²⁴⁶ relevant for the registration of autonomous vehicles, does not contain any explicit prohibitions. A specific approval, however, is the responsibility of the individual states and so far has only been granted by the states of Nevada, California and Florida.²⁴⁷ Germany and the US are the market leaders concerning the development of autonomous driving. In contrast to the US, European laws prevent the further development of autonomous driving on public roads, even if there are some exceptions for research vehicles.²⁴⁸ Once again, restrictive older regulations are holding back technical progress in this area and are leading to a competitive disadvantage for European countries.

D) INSURABILITY AND LIABILITY

The liability issues may become an insurmountable obstacle to the introduction of fully automated driving. So far, the responsibility of the driver is assumed in most cases, whereas the manufacturer is liable only for product defects. In addition, the vehicle owners are subject to special owner's liability, particularly in European countries. If the driver no longer actively participates, however, the question arises as to whether damage can still be attributed to the driver or the owner of the car at all or whether only the manufacturer of the system can be held liable.

It could thus be considered to refer to rules applicable to other automated areas. Such an area is aviation, where autopilots have been considerably involved in the transport of air passengers for quite some time now. An internationally recognised legal basis for the approval of aircraft can be found in the Certification Specifications for Large Aeroplanes CS-25.²⁴⁹ In essence, the requirement for approval is that the pilot can take over the control at any time, which means that it is to be assumed that the pilot, and thus the employer, is also responsible under liability law. The same applies to automated streetcars or automated forklifts with regard to which the operator evades the liability issue by strictly separating passengers or employees and the machine.²⁵⁰ Therefore, it is not possible to apply the liability rules from other automated areas to automated driving.

245 Bodungen and Hoffmann, 'Belgien und Schweden schlagen vor: Das Fahrsystem soll Fahrer werden!' (2015) *NZV* 521 ff.

246 See: www.nhtsa.gov/cars/rules/import/FMVSS (last accessed on 14 March 2016).

247 Lutz, Tang and Lienkamp, 'Die rechtliche Situation von teleoperierten und autonomen Fahrzeugen' (2013) *NZV* 57 ff.

248 See: www.zeit.de/mobilitaet/2016-07/bundesregierung-alexander-dobrindt-autonomes-fahren-gesetz (last accessed on 28 September 2016).

249 http://easa.europa.eu/system/files/dfu/CS-25_Amdt%203_19.09.07_Consolidated%20version.pdf (last accessed on 26 February 2016).

250 See n247 above.

International liability standards with clear rules are thus needed. For example, liability can be transferred to the manufacturer, a pro rata distribution of the liability between the end user and the manufacturer of the autonomous system can be specified, or a black box such as in a plane can be installed in a system in order to find out who was responsible for the defect.²⁵¹ As an alternative, it can also be laid down such as in the driver's licence that the fully responsible front-seat passenger sitting next to the driver must bear the full liability alone, whereas the student driver – being the intelligent system in the case of autonomous driving – is disregarded under liability law.²⁵²

Based on the principles of current legislation, it would seem that strict liability of the operator and tortious liability of the manufacturer of the autonomous system will be applied in most countries (eg, the US, Germany and the UK). Here the ground for the operator's liability is that the operator uses the autonomous system and bears an overriding overall responsibility.²⁵³ As far as compensation claims against the vehicle owner are concerned, one answer is there will usually be no fault on the owner's part if the system fails technically, because the system will control the car. However, if that is so, this will result in incalculable liability risks for the manufacturers of the systems and would ultimately also raise the issue of whether such a system is insurable.²⁵⁴ On the other hand, the question arises for the vehicle owner as to how they can insure against software errors. Perhaps the vehicle owner will in the future be able to purchase third-party liability insurance that permits teleoperation. New fields of business could thus arise for insurance companies.

E) ADDITIONAL LEGAL ASPECTS

As is the case with big data analyses, the huge data volume brings the risk of creating a transparent driver or a transparent employee if the motor vehicle is used for business purposes. Movement, conduct and personality profiles of the driver or of the front-seat passenger of a fully automated system can be derived from these data.

Moreover, the question of the rights of the employee representatives to be consulted arises. In most European countries, employee representatives have a right to be consulted whenever there is a safety risk or an environmental risk, thus when contact with an employee is to be expected. It seems inevitable that driverless vehicles used on business premises will come into contact with employees.

251 See: www.br.de/themen/wissen/autonomes-fahren-auto-automatisierung-haftung-100.html (last accessed on 2 March 2016).

252 Schrader, 'Haftungsrechtlicher Begriff des Fahrzeugführers bei zunehmender Automatisierung von Kraftfahrzeugen' (2015) *NJW* 3537 ff.

253 See: www.autonomik.de/documents/AN_Band_2_Recht_bf_130325.pdf, 7 ff (last accessed on 2 March 2016).

254 Jänich, Schrader and Reck, 'Rechtsprobleme des autonomen Fahrens' (2015) *NZV* 313 ff.

D. Health and Safety Issues

I. Risk management and policies concerning the use of new technology

Risk analyses must be carried out in advance in a company in order to protect employees when they work with robots. In addition, the so-called Machinery Directive²⁵⁵ sets a minimum standard that all machine products in Europe must meet. Among other things, the Directive provides for a manufacturer's risk assessment for any machine. The term machinery is defined as: an assembly, fitted with or intended to be fitted with a drive system other than directly applied human or animal effort, consisting of linked parts, at least one of which moves, that are joined together for a specific application. Thus robots are 'machinery' for the purposes of the Directive.

The machinery may not be put into operation until a safety briefing relating to the individual workplace of the employee working with the machinery has taken place. It is also recommended to regulate the use of the systems by establishing policies. If technical difficulties with the system occur, these discrepancies must also be included by the manufacturer of the machinery in its risk assessment.

II. Use of robots – safety issues

Not only production faults, but also software faults can come into consideration as potential safety hazards relating to autonomous systems and assistant robots. Moreover, unforeseen risks can be expected to appear at any time. A distinction should be made between the risks for the actual end product and the risks for the humans working with the robot. It will be necessary to train employees in both cases. They will have to become one with the new system. Humans must have confidence in the system, but should not blindly depend on it.

III. Employees' need for vigilance – new risks due to new technology

The use of (partly) autonomous systems in the establishment leads to numerous safety hazards that can end in an accident at work, because when an automatic procedure has been put in motion, it is difficult to stop it. Even if the procedure is interrupted, it cannot be ruled out that all of the risks have been averted. New, individual risks that were not foreseeable either by the relevant operators or by the autonomous system can, for instance, arise because of the uncontrolled interruption of a procedure.

255 Directive 2006/42/EG: <http://eur-lex.europa.eu/legal-content/de/ALL?uri=CELEX&3A32006L0042> (last accessed on 18 February 2016).

There have, for example, been cases in the US in which an employee suffered serious injuries resulting in death because of the shut-off of the system. Such cases include the dropping of an employee after a colleague flipped the emergency switch or the crushing of an employee after they restarted the machinery.²⁵⁶ The number of deaths caused by robots in the US over the past 30 years is 33 employees.²⁵⁷ So, an average of one death caused by a robot per year out of approximately 2,000 accidents at work per year in the US,²⁵⁸ which equates to 0.0005 per cent.

Since most accidents at work are caused by a lack of coordination between the human operator and the assistive system²⁵⁹ or human error (improper operation), it is essential to meet (inter)national safety standards. Many European companies use the EU standards as minimum requirements, and these are also used in other countries that do not have any such codified safety standards. Effective protection of occupational health and safety is characterised by regular risk assessments and the training of first aiders, evacuation assistants and regular employee instruction. In addition, whether the rules are followed must be checked regularly by plant officers or the supervisor. Furthermore, depending on the sector, preventive examinations and the avoidance of certain hazardous substances for dangerous jobs and consultations with experts are advisable. This should be summarised in policies, the content of which must be adapted to the individual circumstances of the local site and must be checked by the relevant officers. Otherwise, high penalties for companies that violate safety regulations could be the consequence.

It is advisable to be guided by best practice, which goes beyond the wording of the relevant statutes (if any), in order to be able to prove if needed that the company has dealt with the safety concerns. It is important to respond to the individual risks. Whether the risk originates from intelligent machines, the working environment, other people or hazardous substances is irrelevant. The main cause for all accidents at work is human negligence. For this reason, the subject of safety at work must be brought home to each employee over and over again.

IV. Employers' need for vigilance – new risks for products due to new technology

The example of Toyota's blocking accelerator pedals, which led to numerous deaths in the US, shows what can happen when humans rely too much on the system. Toyota probably works more with automatic systems than any other company in the automotive industry. The human supervisor must, however, know

256 See n224 above.

257 *Ibid.*

258 See: <https://books.google.de/books?id=ick-gVYY8C4C&pg=PA85&lpg=PA85&dq=t%C3%B6dliche+betrieb+sunf%C3%A4lle+amerika&source=bl&ots=OJRACbdpXn&sig=Efq8gAxUS1YMZ3bna1iD8UNWbB0&hl=de&sa=X&ved=0ahUKEwi1mvLyzYHLAhUGYA4KHdaJBDUQ6AEIlzAA#v=onepage&q=t%C3%B6dliche%20betriebsunf%C3%A4lle%20amerika&f=false> (last accessed on 18 February 2016).

259 See n23 above, 12.

what the robot is doing in order to recognise its mistakes.²⁶⁰ For this reason, it is all the more important that the employee protects not only themselves from the highly developed machinery, but also protects the product from the risks of automation. Precise details concerning the production process and knowledge about the machinery is needed for this. This knowledge comprises not only mechanical skills, but also knowledge of the software, in particular. Erroneously programmed software, whether due to an error in programming or an error in use, can lead to a concatenation of errors that can ultimately also become a great risk for the product or the service.

V. Need for health and safety regulations to keep up with technological progress

To make productive dealings with safe production and assistance robots possible, safety and insurance law standards must usually be adapted to the current state-of-the-art technology. In many countries, standards apply that still stem from a time when autonomous systems were regarded as science fiction. These standards prevent the potential of technical development from being achieved in these countries. An efficient, coordinated cooperation between humans and machinery therefore does not take place. It is not easy to find the right mixture that gives companies enough room for innovation, but at the same time serves the purpose of providing effective protection for employees. The European Machinery Directive, however, is a good example of how product standards can be harmonised across borders.

VI. Opinion of employee representatives

Many employee representatives at the establishment level hold the view that, due to digitalisation, many dangerous tasks previously performed by employees can be transferred to robots. For this reason, they welcome digitalisation as regards safety at work, but will try to ensure that not all employees are replaced by robots. The human worker must remain central to work. Robots have to be adapted to human needs and not the other way around.²⁶¹ It must be recognised at the same time that many employee representatives at the establishment level have numerous consultation and information rights as regards occupational safety and thus also with regard to the use of autonomous systems.

260 See: www.spiegel.de/wirtschaft/unternehmen/toyota-muss-in-den-usa-milliardenstrafe-zahlen-a-959680.html (last accessed on 18 February 2016).

261 See: www.bund-verlag.de/zeitschriften/arbeitsrecht-im-betrieb/aktuelles/praxiswissen/20150924_menschengerechte-arbeit.php (last accessed on 21 May 2016).

E. Impact on Working Time

Working time rules have been established in various countries in order to protect the health and safety of employees or to warrant pay for overtime work. These vary from country to country. One of the things that all of the systems have in common is that they are faced with fundamental reforms within the framework of digitalisation and automation.

I. Different working time regulations

1. EU Working Time Directive

The EU Working Time Directive²⁶² requires EU Member States to ensure that all employees have the following rights:

- A limitation of weekly working hours to an average of 48 hours, including overtime.
- A minimum daily rest period of 11 consecutive hours per 24-hour period.
- A rest break during working hours if the working day exceeds six hours.
- A minimum uninterrupted rest period of 24 hours plus the 11-hour daily rest for each seven-day period.
- Paid annual leave of at least four weeks per year.
- Special rules for night work; for example, the normal hours of work for night workers may not exceed an average of eight hours in any 24-hour period.
- Night workers whose work involves special hazards or heavy physical or mental strain may not work more than eight hours in any period of 24 hours.
- Night workers have a right to free health assessment and under certain circumstances to be transferred to day work.
- Special rules are also set out in the Directive for the working hours of employees in certain sectors. These are, for example, doctors in training, offshore work, workers onboard fishing vessels or workers concerned with the carriage of passengers on regular urban transport services.²⁶³

262 Directive 2003/88/EC: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0088&from=DE> (last accessed on 13 March 2016).

263 <http://ec.europa.eu/social/main.jsp?catId=706&intPagelId=205&langId=de> (last accessed on 25 January 2016).

- Different rules are possible for national holidays and Sundays. For example, there is a general prohibition of work on Sundays in Germany, whereas work on Sundays is customary in France. Spain has the most national holidays.
- Depending on the EU Member State, deviations are possible (eg, there is a waiver relating to the maximum working hours' rule in the UK by way of an 'opt-out' declaration).

2. Japan: Working Time Act, Working Standard Act

1. MAXIMUM WORKING HOURS

- The maximum working hours are eight hours per day.
- It is generally prohibited to exceed 40 hours per week.
- An increase of working hours is possible if the employer concludes a written agreement with the trade union representing the majority of the workers or the relevant employee representative body (so-called '36 Agreement') and reports this to the inspection agency for labour standards.
- Any overtime must be remunerated separately.
- Certain working time models may be implemented in order to provide flexibility, which are usually regulated on the basis of a works agreement.

2. REST BREAKS

- At least 45 minutes for a working day exceeding six hours.
- At least 60 minutes for a working day exceeding eight hours.

3. REST PERIODS

- One day of rest per week or four free days in four weeks.

4. WORK ON WEEKENDS AND HOLIDAYS

- Sundays and holidays do not have to be days of rest.

5. NIGHT WORK

- Special remuneration must be paid for night work from 22:00 to 05:00.

6. ANNUAL LEAVE

- Ten days' minimum annual leave.
- The prerequisite is a length of employment of six months and performance of work on at least 80 per cent of the scheduled working days.
- An increase of the minimum leave entitlement, up to 20 days in proportion to the years of employment, is also provided for.²⁶⁴

3. United States: Fair Labor Standards Act

1. MAXIMUM WORKING HOURS

- There is no maximum daily working time.
- The Fair Labor Standards Act (FLSA) provides, in general, for a 40-hour working week, but it can be extended.
- Working time includes: travel time as part of principal activity, breaks of up to 20 minutes and waiting time or on-call time at the workplace.
- Work done outside working hours is not considered working if it does not take longer than ten minutes ('ten-minute de minimis benchmark').

2. LEAVE

- Not regulated by law; granting of leave is at the discretion of the employer.
- According to a survey taken in 2015, 71.1 per cent of 1,500 surveyed employees did not take more than ten days' leave the previous year.
- It is up to the employer whether to continue to pay wages during the employee's leave; statutory rules concerning remuneration must be followed in some states.
- In addition, so-called vacation policies are established by the companies in order to provide uniform rules regarding leave (eg, 'use it or lose it' rules).²⁶⁵

²⁶⁴ See: www.anwalt.de/rechtstipps/uebersicht-zum-arbeitsrecht-in-japan_056517.html (last accessed on 2 March 2016).

²⁶⁵ See n115 above, 24 f.

3. OTHER PARTICULARITIES

- No maximum daily working time and thus also no rest periods between working days.
- The FLSA provides for remuneration where the 40-hour week is exceeded. Only so-called 'non-exempts', workers with low-level positions within the company and industrial employees are entitled to such overtime pay.
- Additional pay for work at night, on weekends and on holidays is not provided for by law, but a 'premium pay' has become established for such working hours.²⁶⁶

II. Volume of working hours and availability

The breakdown of boundaries for working time means that both employers and employees have leeway to organise working hours. A complete breakdown of boundaries in terms of time would remove the obligation to keep traditional working hours.²⁶⁷

The employer, who may freely specify the content, place and time of the employee's performance of work, generally has the right to decide on the scheduling of working hours as long as the terms of employment are not specified elsewhere, for example, in an employment contract or a collective bargaining agreement.

If both the volume and the scheduling of the working hours are specified elsewhere, the employer may not demand that the employee must be available outside the stipulated hours or perform work on call. On the other hand, the employee may not reorganise their working hours flexibly if an explicit agreement is in place. The employer would have to allow this or would have to have tolerated it over a longer period of time.

If, however, there is no rule and the employer does not exercise its right to decide, the employee will be free to manage the scheduling of working hours, particularly if variable working time models are applied. To benefit from the advantages of Work 4.0, employees and employers might either not conclude specific agreements on the scheduling of working hours, or expressly agree on the flexible management of working hours.²⁶⁸ With regard to the flexible management of working hours within Industry 4.0, the US FLSA is considered to be especially flexible and might possibly serve as a model in other regions. The employees there do not have to pay attention to rest periods and maximum daily working hours, but at the same time are

266 See: www.dol.gov/whd/regs/statutes/FairLaborStandAct.pdf (last accessed on 2 November 2016, 8:45 am).

267 Bissels, Domke and Wisskirchen, 'BlackBerry & Co: Was ist heute Arbeitszeit?' (2010) *Der Betrieb* 2053 f.

268 Bissels and Meyer-Michaelis, 'Arbeiten 4.0 – Arbeitsrechtliche Aspekte einer zeitlich-örtlichen Entgrenzung der Tätigkeit' (2015) *Der Betrieb* 2331 ff.

protected by maximum weekly working hours; this rule can be disregarded, however, if the parties agree on this. With such a flexible regulation, employers can react to short-term fluctuations in the number of orders.²⁶⁹

III. Development of working-time flexibility based on private needs

Working life has to date been characterised worldwide by rigid standard working hours: employees were present in the establishment or in the office and worked there for a certain number of hours. The working day ended when the employees left the establishment after eight or ten hours of work. In the Work 4.0 era, employees take their work home with them in the form of smartphones, laptops, tablets and email. Critics claim that this makes it impossible to 'disconnect' from work, which damages employees' health and psyche over the long term.²⁷⁰ Additionally, self-determined working time can lead to higher motivation, increased health and more productivity with regard to the individual employee.²⁷¹ Even though there are some employees who prefer fixed and clear working times without the obligation or possibility to take work home, the majority of employees hope for more flexibility concerning their individual working time and would use flexible working time models. In some cases, slightly postponing the daily start of work could facilitate the employee's whole day, for example if they can take another train, can adapt their start of work to the opening hours of the daycare facility for children or can participate in a morning sport activity or an advanced training programme.

A possibility to prevent these negative results may be the six-hour day in Sweden. Innovative employers report that the shorter workdays improve the productivity of employees.²⁷² New vistas are opened: thanks to digital innovations, families, especially, are able to adapt work and leisure time more flexibly to their own needs, which is said to lead to a better work-life balance. Supporters say this will cause employees to be more satisfied and motivated and will reduce stress and illness.²⁷³ However, employers can set core times to ensure that personal meetings can take place with all employees. Furthermore, women who are currently not working would profit from flexible working hours and working places, which could particularly enable them to work part-time from home. Such options would help to bring them back into the workforce.²⁷⁴

From now on, some parents would be able to spend more time with their children if, for example, they leave the office at noon and work from home in the evenings when their children have gone to bed. Especially for women, this

269 Nölke and Stumpp, 'Arbeiten 4.0-Potenziale ausschöpfen' (2016) 3 *Personalpraxis und Recht* 57 f.

270 Bauschke, 'Arbeitsrecht 4.0 – Eine kurze Bestandsaufnahme aus aktuellem Anlass' (2016) *öAT* 225.

271 German Federal Ministry of Labour and Social Affairs, *Weißbuch – Arbeiten 4.0* 119.

272 See n151 above, 1.

273 'Ohne Grenzen Arbeiten' in *Vigo – gesundes Unternehmen* (2016) 2/16 5.

274 See: www.accenture.com/us-en/gender-equality-research-2016 (last accessed on 22 September 2016).

form of flexitime work is very attractive.²⁷⁵ Work 4.0 also means considerable time savings for a single employee who can use the time saved because he or she does not have to travel to work for personal and professional purposes. The European Commission announced in its work programme that it would present a package of measures to address the challenges of work-life balance faced by working parents and caregivers in 2016.²⁷⁶ The European Commission will facilitate work-life balance and provide incentives for offering equal employment opportunities to women and men. By enhancing women's participation in the labour market, this initiative would contribute to the Commission's priorities on jobs and growth, in the context of demographic challenges.²⁷⁷

The breakdown of the boundaries for working hours also makes it possible to implement working life models that benefit the work-life balance. It is not easy to create this balance in the 'rush hour of life'.²⁷⁸ Owing to the rise in the number of university graduates, the average age of employees beginning their working lives is increasing. They then also often want to start a family simultaneously within a short space of time.²⁷⁹ Working life is the space of time from entry into the world of work until retirement. These models make it possible for employees to focus more on their private lives during certain phases of their lives – in accordance with their individual needs.²⁸⁰ This can be achieved by implementing long-term working time accounts on which overtime can be collected over a longer period of time. By doing this, working hours can be reduced without loss of income. The so-called age-reduced working time model makes it possible to collect overtime in order to go into retirement earlier or to take a sabbatical in addition to taking normal leave.²⁸¹

The additional working hours can also be compensated for by money. This money can then make it possible to take a (temporary) sabbatical at a later time or to finance going into retirement at an earlier date.²⁸² These models are not risk-free. Companies can become insolvent, and under several national laws, social security is not guaranteed if the employee takes time off for longer without payment.²⁸³ Depending on the country, social security systems will have to be adapted.

275 See n168 above, 50.

276 See: <http://ec.europa.eu/social/keyDocuments.jsp?type=50&policyArea=0&subCategory=0&country=0&year=0&advSearchKey=&mode=advancedSubmit&langId=en> (last accessed on 1 September 2016).

277 <http://ec.europa.eu/social/keyDocuments.jsp?type=50&policyArea=0&subCategory=0&country=0&year=0&advSearchKey=&mode=advancedSubmit&langId=en> (last accessed on 1 September 2016).

278 See: www.dihk.de/branchen/handel/news?m=2016-03-14-interview-geisel (last accessed on 31 May 2016).

279 See n168 above, 20.

280 See n153 above, 62.

281 See n273 above, 5.

282 See n268 above; and Steffan, 'Arbeitszeit(recht) auf dem Weg zu 4.0' (2015) *NZA* 1409 ff.

283 See n273 above, 5.

IV. Development of working-time flexibility based on the requirements of new technologies

The regulating and further development of working time has had great significance already in the course of 'Work 3.0'. 'Work 3.0' is characterised by a comprehensive industrialisation. The breakdown of the boundaries for working time began when BlackBerry phones and remote access made it possible to work on the road or from home. That led to the 'always-on' work culture and to constant availability. At first, only executive employees and freelancers, who are not covered by working time regulations in most countries, had to be constantly available as a rule, but this gradually came to be the case for more employees without management responsibility. Digitalisation makes this possible. Regarding the question as to whether the employer or clients demand permanent reachability, 20 per cent of the questioned employees said they did. The highest demand for permanent reachability exists in the service sector, where the contract relationship is characterised by a relationship of trust (eg, lawyers, nursing care, management consultants and veterinarians).²⁸⁴ To counteract this trend, the French government has enacted a law, which will come into force in 2017, that gives employees the right to disconnect after finishing work ('le droit à la déconnexion').²⁸⁵

The progressive digitalisation and the increasing significance of the internet for the labour markets now play an important role in 'Work 4.0'. This also includes, however, the situation that internet customers expect comprehensive service and have ever more individual desires for products after closing time, at weekends or on national holidays. Owing to the possibility of constant availability, customers expect sellers or service providers to be available outside normal office hours.²⁸⁶

Nonetheless, 'Work 4.0' is geared more to the interests of the employees than 'Work 3.0' was. The reason for this is that highly qualified staff can be 'winners', since research, development, design, planning and organisation jobs are now in demand, whereas purely productive occupations are on the decline. Companies must lure these prospective employees (the so-called 'Generation Y'), unlike 20 or 30 years ago, not only by offering money, but also by offering attractive arrangements for a better work-life balance.²⁸⁷ The breakdown of boundaries for working time can be used positively by all employers. Such working time models can be adapted to fit personal needs much better than the previous standardised working time models.²⁸⁸

284 See n271 above, 79.

285 See: www.lesechos.fr/economie-france/social/0211255545049-le-droit-a-la-deconnexion-va-devoir-faire-ses-preuves-2024663.php (last accessed on 20 September 2016).

286 BDA, *Arbeitswelt 4.0 – Chancen nutzen, Herausforderungen meistern* (2015) 2, 7.

287 See: www.spiegel.de/karriere/berufsleben/arbeitszeit-einfuehrung-der-30-stunden-woche-und-elterngehdplus-a-966832.html (last accessed on 14 March 2016).

288 See n268 above, 2331 ff; Günther and Böglmüller, 'Arbeitsrecht 4.0 – Arbeitsrechtliche Herausforderungen in der vierten industriellen Revolution' (2015) NZA 1025 ff.

V. Social implications

The future world of work will require employees to be much more flexible. Ties to fixed places of work or to fixed working hours will be increasingly broken.

Intelligent machines and efficient logistics should make it possible to offer products and services that are tailor-made to each customer's desires. This can succeed only if the relevant employees are available at any time. A job that is one-sidedly tailored only to the customers' desires, requires the employee's constant availability and is perhaps performed only from home, will inevitably lead to the individual employee's isolation and separation from the social environment and can lead to health problems if the individual employee is overstrained at home. From the unions' perspective, policies and collective bargaining agreements that take this situation into account must be designed.²⁸⁹ It is not particularly surprising that unions and employee representatives demand that every employee be entitled to a claim against their employers for a flexible telework place, flexible working time and a right to be offline. Additionally, German work councils demand that policies regarding digital working have to make sure that availability and working from home does not lead to unpaid overtime.²⁹⁰

They will create policies and collective bargaining agreements to ensure that these forms of digital working are available to every employee and that employee representatives have certain control rights. Additionally, employers by law have to ensure compliance with health and safety regulations as well as working time regulations. Even if this can be difficult in the era of Working 4.0, employee representatives request more checks to protect employees from overwork, blurring boundaries between working and private time and health risks.²⁹¹ Another aspect of digital change is the incentive to take up a self-employed occupation as a service provider. From the union perspective, there is a risk that insecure employment relationships that can be terminated at any time might be entered into.²⁹² This particular insecurity is generated by the global availability of labour. If the workforce no longer has to be on site, any service provider anywhere in the work can provide services for customers. In addition to precarious employment relationships, this will lead to ever-decreasing wages. This phenomenon can be observed particularly among clickworkers, whose cause is increasingly supported by the unions, which demand social security on the European level for individuals who do employee-like work.²⁹³

289 See n72 above.

290 See: www.volkswagenag.com/content/vwcorp/info_center/de/news/2016/05/flexible_working.html (last accessed on 20 September 2016).

291 See n271 above, 119.

292 Bothhof and Bovenschulte (eds), *Das 'Internet der Dinge', Die Informatisierung der Arbeitswelt und des Alltags* (2009) 9 f.

293 See n72 above.

VI. New challenges for working hours

The new challenge is to reconcile the positive effect of flexibility on companies and staff with good employment conditions, despite the breakdown of boundaries. The traditional 9-to-5 working day is becoming less common because of working time and working place flexibility; 'Work 4.0 is no longer a place to go but a task to perform'.²⁹⁴ There are various new forms of work. However, the question will be: how do companies meet the demand for flexibility while navigating often restrictive and old regulations?²⁹⁵ The salient developments under Work 4.0 in terms of working time are:

1. Maximum working hours

In many countries, a change in the maximum working hours rule to a rule concerning maximum weekly working hours rather than maximum daily working hours is currently under consideration.²⁹⁶

This is in line with the current Directive of the European Parliament and the European Council concerning certain aspects of the organisation of working time, which does not specify maximum daily working hours, but chooses a minimum rest period of 11 hours within a 24-hour period. Nevertheless, European employees on average work 41.4 hours during a week even if a 35- to 40-hour week is provided by law in the individual countries.²⁹⁷ There are a lot of employees and employers who – voluntarily or not – use the maximum weekly working time of 48 hours. This should achieve the goal that both employees and employers have more leeway to establish innovative working-time models.

However, due to the focus on average hours, the maximum weekly working hours can be exceeded over a longer period. Rules could be established at the establishment level for such a case. Is it permissible to exceed the limits? If so, how are the hours compensated for? Could this be by transfer to a working time account or by remuneration? Should regular monitoring between employer and employee be carried out in order to respond to surplus working hours?

Traditional extra work, for which special rules are required, must be considered separately, however. Such extra work also includes night work, which is remunerated in most countries by allowances exceeding normal wages. If the trend is towards ever more flexible working time, the form of rigid night work commencing at a specific time of day will probably become

294 See n27 above, 8.

295 See n179 above, 1.

296 Grimm, 'Industrie 4.0 – Arbeiten 4.0 – Arbeitsrecht 4.0?' (2015) *ArbRB* 336.

297 <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=de&pcode=tps00071&plugin=1> (last accessed on 11 November 2016).

extinct. Extra pay will also no longer be appropriate within the framework of flexible working time.

The increasing use of mobile devices will make explicit statutory regulations for the definition of working time and rest periods necessary. The regular use of such devices will make compliance with the rest periods required in some countries almost impossible.²⁹⁸ How does one reconcile the goal of working time regulations to set a minimum rest period when interruption by a mobile device seems inevitable? Is every short response to an email to be considered an 'illegal' interruption to the rest period? Is it possible to narrow the definition of 'rest period' to reflect the reality of Work 4.0? Legislators could, for example, take smartphones out of the rest period, by arguing an answer to an email, SMS or WhatsApp message cannot jeopardise relaxation so greatly that the rest period must afterwards be restarted. Besides, rest periods cannot be controlled by the state just as the state cannot know the number of hours worked at home.

2. Minimum working hours

The so-called 'zero-hour contractors' are a cross between independent contractors and employees. Such contracts are also known as 'casual contracts' in the UK, for example, if the parties define no minimum working time.²⁹⁹ Zero-hour contracts are usually for 'piece work' or 'on-call' work, for example, for translation services. This means that for the employer, the workers are on call to work when you need them, you do not have to give them work, but they do not have to do work when you ask them to. Zero-hour contractors are entitled to statutory annual leave and the national minimum wage in the same way as regular workers in some countries.³⁰⁰ However, in most countries it is not possible to restrict an on call worker from accepting work from other employers. A zero-hour contract is a kind of framework contract between flexible contractors and an employer. The contractors are free to work for more than one employer at the same time. In this way the contractor may be regarded as having insurable employment in the sense that if one employer has no work, other employers may have work. However, it is obvious that this solution does not guarantee the same level of protection that a permanent employee has. On the other hand, recognising zero-hour contracts for what they are seems better than pretending that they are true self-employment.³⁰¹

298 See n296 above, 336 ff.

299 Dzida, 'Null-Stunden-Verträge Wie weit darf die Flexibilisierung der Arbeitszeit gehen?' (2016), *ArbRB* 19 ff.

300 See: www.gov.uk/contract-types-and-employer-responsibilities/zero-hour-contracts (last accessed 31 May 2016).

301 Dzida, 'Scheinselbstständigkeit 4.0 – Die "Uberisierung" verändert die Arbeitswelt' (7 November 2015) 232 *Frankfurter Allgemeine Zeitung* 16.

Even if zero-hour contractors earn less than regular employees, without this flexibility, opportunities for these individuals would be dramatically reduced, as is the case in continental European countries where rigid employment structures have resulted in staggeringly high levels of unemployment.³⁰² In some other European countries, zero-hour contracts are legally not possible or are possible only with certain limitations (eg, in Germany, a minimum of ten working hours per week must be guaranteed).³⁰³ Zero- or one-hour contracts are, however, a chance to integrate untrained workers, older people or even refugees into the labour market. Such a contract could be one of these flexible general conditions concerning labour law.³⁰⁴

3. Sunday and holiday work

At present, more than 40 per cent of European employees work – more or less – regularly on Saturdays and Sundays.³⁰⁵ Even in countries with a rigid permission with regard to Sunday and holiday work, lawmakers create new legal exemptions from time to time. With reference to demand-based production, it should also be possible in the future to allow short-term work on Sundays and holidays. For this to be possible, the protection against work on Sundays and holidays, which still applies in many countries, will have to be restricted. It is not absolutely necessary for work to be performed on such days in the establishment.³⁰⁶ Such a rule would not benefit only employers, but also the employees, who would in return be able to plan for leisure time during the week. Many holidays are based on traditional, religious circumstances. Owing to the increasing diversification of society in developed countries, however, for some employees, taking time off for religious holidays is not as important as say extending the annual holiday period.

The question as to whether one should forgo a general prohibition of work on Sundays and holidays thus arises. Such a model is in place in Japan, where it is not prohibited to work on Sundays and holidays,³⁰⁷ because each holiday lessens the competitiveness of a country as compared to a country in which there is no holiday, and more and more workers would prefer to work normally on such a day and be off work instead on another day. This applies particularly to members of other religions. As for working time, more flexible statutory rules are needed.

302 See: www.theguardian.com/uk-news/2015/sep/02/number-of-workers-on-zero-hours-contracts-up-by-19 (last accessed on 31 May 2016).

303 See n299 above, 19 ff.

304 See n301 above.

305 See n271 above, 74.

306 See n269 above, 59.

307 See: www.anwalt.de/rechtstipps/uebersicht-zum-arbeitsrecht-in-japan_056517.html (last accessed on 2 March 2016).

4. On-call work

The possibilities of on-call work, such as by means of mobile devices, will gain importance. In order to meet the worker's interests, an arrangement can be made that announces the work assignment in advance or guarantees a minimum of working hours.³⁰⁸ A long, rigid period – as under German law, for example – is not necessary for the protection of the worker since the time needed to prepare for an announced work assignment is significantly shorter because, depending on the service provided, travel to and from work is not necessary.³⁰⁹

5. Job sharing

Thanks to digital equipment, the job-sharing model discussed in the 1980s is again becoming attractive. To make working time more flexible, several workers share a position and agree on a mutual arrangement for their working hours.³¹⁰ The employer should then have the authority to issue instructions only if the employees do not communicate their schedule to the employer in due time. This requires a great deal of self-management and communicative competence. All job sharers must (as additional work) synchronise their work processes, discussions and problems, but this also makes it possible for part-time employees to do management work on a smaller scale. In some European jurisdictions (eg, Italy and the UK), the law stipulates that if one employee is not in the office, the other must step in.³¹¹ Ultimately, these old laws will create a certain limitation for the effective use of this model and have to be adapted to the needs of flexible employees.

6. Trust-based working hours

'Trust-based working hours' means that the employer forgoes monitoring working hours. Only the work product is relevant, and the employer's right to issue instructions is limited to the content of the work product.

This model originates from the comprehensive interconnection of areas of work. Access can be had to everything from everywhere in order to achieve the best possible work product. This increases the worker's personal flexibility, and the quality of the work increases automatically if the goal is only the work product.³¹²

308 Bauer and Heimann, 'Flexibel, motivierend und "all-inclusive" – Rechtssichere Vergütung von Führungskräften' (2014) *NZA-Beilage* 114 ff.

309 See n296 above, 336 ff.

310 See n269 above, 57.

311 See n179 above, 3.

312 See n273 above, 5.

Supervisors are expected to have many skills in this regard: they must place great trust in the workers and be able to agree with them on clear and realistic targets (meaning they need to be both a moderator and a motivator). The risk that this model poses is that these workers might put too much pressure on themselves, so extensive communication between workers and employers is necessary.

A statutory regulation of the trust-based working hours' model is preferable. One possibility would be, for example, to consider regulations concerning working time accounts that can fluctuate by up to three times the weekly working hours (positive and negative hours) and make it possible for workers to be responsible, to a certain degree, for managing their own time.

7. Home office/telework

Teleworking, as a combination of flexible working hours and mobile work (performance of work from any conceivable place in the world), is now demanded more often. For this reason, the Framework Agreement on Telework was implemented by EU Member States in 2005.³¹³ The place where telework is performed can thus be at the employee's own place of residence or at any other place.³¹⁴ Most teleworkers work from home, thereby making the home office the most frequently used form of teleworking. The organisation of the framework conditions is left up to the EU Member States. The Directive merely requires that 25 per cent of the working hours must be carried out at a place outside the company for the employee to be considered a 'teleworker'.³¹⁵ It can be regulated that the home office work must be carried out at one specific place. This decision is increasingly left up to the parties, however.

It is arguable that certain prerequisites with regard to the worker's home should usually be met, such as:

- A workplace in a separate room that satisfies the general requirements for workplaces should be available.
- Confidential data and information should be protected in such a way that no third party can inspect or access them.

One important question in this context is to what extent employers are responsible for the protection of their employees' safety and health at work outside their establishments. In principle, the employer will be subject to

313 <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:c10131&from=EN> (last accessed on 30 March 2016).

314 *Ibid.*

315 'Definition by the European Foundation for the Improvement of Living and Working Conditions' (2010).

the protection duties (at least under EU-derived national laws) insofar as the employer has influence on the worker's working environment, for example, with regard to the provision of mobile working devices. The employer must thus organise the work, also home or mobile office work, in such a way that a risk to the life or health of the worker is avoided to the greatest possible extent.³¹⁶ For this purpose, the company must carry out a risk assessment for the individual case. The assessment, in terms of social security law, of when an accident is to be considered an accident at work is also difficult. Here, a correlation with the insured activity is often difficult to determine, so a statutory rule could provide clarity in this regard.

One of the main advantages of home or mobile office work is that, for example, the time that is otherwise spent travelling to and from work can be used to work or for personal purposes. This contributes to the work-life balance.³¹⁷ That applies especially to employees living in structurally weak regions. In some cases, these employees have to leave their place of residence for better professional opportunities. Another advantage is that, especially in urban centres, costs for office space can be saved and employees can solve complex issues without interruption. The decoupling of working hours from traditional office hours also leads to more flexible customer service, and the workers appreciate this family-friendly working model. Moreover, this provides more employment opportunities for people with disabilities or for those who have to provide care for relatives. In the Netherlands, each employee has a statutory right, based on Industry 4.0, to the establishment of a home office since 1 July 2015.³¹⁸ To reject the request, the employer has to prove that operational reasons do not permit working from a home office.

On the other hand, not every job or every part of a job can be done at home. A home office makes no sense if the worker has a job without having their own responsibilities, or has no access to the necessary documents or tools. The same applies to jobs in the retail sector or the handcraft sector where the daily presence of the required workers is absolutely necessary and the core element of their individual work. Even if retail salespeople are a part of the service sector, their job cannot be performed from home in contrast to so many other jobs in this sector. A general right to perform work from home can lead to frustration for these employees and has to be rejected. Developing flexible solutions that do not exceed the boundaries of what is possible with regard to costs, the employers' organisation structures and technical possibilities is the challenge the working contract parties have to face.

316 See n288 above, 1025, 1029.

317 See: www.faz.net/aktuell/beruf-chance/arbeitswelt/zu-hause-arbeiten-die-deutschen-moegen-home-office-nicht-14262574.html (last accessed on 4 June 2016).

318 Schwiering and Zurel, 'Das Homeoffice in der Arbeitswelt 2.0' (2016) 1 ZD 21.

Therefore, flexible and individual agreements between worker and employer are necessary, especially if the worker is part of a virtual working group. In this case, core periods during which the working group has to be fit for work must be specified.³¹⁹ Otherwise, allowing a worker to work from home temporarily during parental leave or to work from home on several days of the week can be a way to satisfy the worker's and the employer's needs at the same time. The employer can set core times as well.

8. Desk sharing

The so-called 'hot desking' or 'desk sharing' model will be the workplace of the future for many employees. Because every worker will no longer be at the workplace during fixed office hours – owing to flexible working hours – it will be possible to save on workspace by providing one workplace for more than one worker. A worker will reserve their workplace in advance via IT systems (desk sharing booking systems). There will then be special offices for confidential talks with colleagues or customers.³²⁰

9. Employee sharing and interim management

These two forms of atypical work are commonly used in central European countries in order to obtain special knowledge in a short time. Interim management describes the activity of highly skilled experts who are hired temporarily for special tasks (eg, the representation of a company until a new director is found) or projects.³²¹ Employee sharing is an activity where an employee is jointly hired by a number of employers to work for a number of organisations, but in a permanent full-time capacity.³²² These forms of staffing services are good for companies if they have a personnel shortage because of illnesses or during peak periods. Alternatively, if the company has an individual non-recurring project and has no staff of its own with certain special knowledge, using external freelancers is a way to avoid having to engage a permanent employee.

The significantly higher short-term costs for an external expert are, in the long run, less expensive than the salary costs for permanent employees, especially if the company has no permanent need for the specialist. There are at least certain advantages for both parties: greater efficiency and lower costs for the employers and more variety in the freelancers' work and higher payment for the duration of the project.³²³ However, there are some legal risks concerning the contractual design. Interim management and shared

319 See n273 above, 5.

320 See n268 above, 2331 ff.

321 See n179 above, 3.

322 *Ibid.*

323 *Ibid.*, at 6.

employees should work for the company only on predefined projects during a foreseeable time period to prevent the integration of the freelancer into the company.

10. Family working time and other part-time solutions

This form of flexible work is intended for families. Both parents can reduce their working time to share their family responsibilities (eg, education of children or to care for close family members). In order to encourage mothers to stay in an employment relationship, experts are thinking about a claim against employers to reduce the working time of family members temporarily and certain wage-replacement benefits for employees paid by the government. The wage replacement can be based on the Austrian part-time work model for the purpose of offering employees individual training opportunities.³²⁴ Nevertheless, these part-time agreements should be limited because if the employee reduces their working time once, the employer cannot be forced to accept an employee's return to their old working time. Therefore, in some European countries, lawmakers are thinking about an extended 'right to come back' for part-time workers regardless of the reason why they have reduced their working time.³²⁵

11. Conclusion

In conclusion, it can be said that the 'how' of work will change radically and quickly in the course of Industry 4.0.³²⁶ Different types of part-time opportunities will become more and more popular – not only for female employees. In the software sector, in sales and for technicians with different areas of work, there is already a very strong focus on flexibility in terms of time. This trend to combine working life with private life is not only strengthened by constant availability and increasing globalisation, with tasks across different time zones, but reflects a generation of workers who increasingly focus on personal interests and not only on remuneration or career options. In order to create more jobs, on the one hand, and at the same time relieve existing employees of further-reaching duties on the other, it would seem sensible to give thought to alternative working time models. For example, Google is considering introducing a four-day week with a flexible 30-hour working week.³²⁷ Alternatively, Sweden is introducing a 30-hour week with a maximum six-hour day. The salary will be the same as for a 40-hour week. It is said this will lead to less illness and more productivity of the employees, but the cost for employers will rise.³²⁸

324 See n271 above, 103.

325 *Ibid*, 123.

326 See n179 above, 1.

327 See n56 above, 26.

328 See: www.n-tv.de/wirtschaft/Der-Sechs-Stunden-Arbeitstag-Fallbeispiele-aus-Schweden-article17785301.html (last accessed on 31 May 2016).

The onus is now not only on the companies, but also on the employee representatives. However, the main onus is on the national lawmakers, who must create a flexible framework for working in Industry 4.0. In this regard, 80 per cent of US investors are of the opinion that European, especially German, laws have to be deregulated and that the labour market should be opened for more specialists.³²⁹ Governments have to become more active and have to set flexible frameworks concerning the labour market and should promote the development of new business models.

On the other hand, US law offers better possibilities for new business models and allows flexible working time as well. The announced revision of the EU Working Time Directive³³⁰ will probably deal with the need for more flexibility. This revision is supposed to reconcile the interests of employers (eg, certain possibilities for control) and the interests of employees/workers (eg, more flexibility, social security and comprehensible wording). Finally, flexibility clauses in employment contracts and flexible working time are part of the self-determination of employees.³³¹

The creation of a flexible framework for working time is not always in the interests of the employees and the unions, as could be seen in France.³³² Employees and unions went on strike against the implementation of a new labour law during 2016. It could be said that, where a rigid 35-hour week applies, the need for reform was greatest in order not to miss the switchover to Industry 4.0. The now implemented labour law, applicable as of 2017, accepts the 35-hour week standard in general, but allows a 46-hour week for 12 weeks as an exception if this is agreed on in a works agreement.³³³

Even if unions and other employee representatives demand policies and other collective agreements regarding digital working,³³⁴ they ignore the fact that even collective regulations set by a union and not only laws can patronise the individual employee. Individual working time regulations between a single employee and an employer cannot be negotiated if the employer is bound by certain limits imposed by a collective agreement. This can lead to the same frustration level for an individual employee. Finally, everyone talks about better working conditions that are adapted to the employees' personal needs. But what difference does it make to an employee if a restrictive law or

329 See: www.rolandberger.com/publications/publication_pdf/roland_berger_amcham_business_barometer_2.pdf, 20 (last accessed on 22 September 2016).

330 <http://ec.europa.eu/social/main.jsp?catId=333&consultId=14&visib=0&furtherConsult=yes&langId=de&src=aspcu&typ=dl&cid=3854> (last accessed on 21 March 2016).

331 See: www.hrperformance-online.de/news/eine-neue-rolle-fuer-gewerkschaften-in-der-digitalen-arbeitswelt (last accessed on 11 May 2016).

332 See: www.faz.net/aktuell/beruf-chance/arbeitswelt/zu-hause-arbeiten-die-deutschen-moegen-home-office-nicht-14262574.html (last accessed on 4 June 2016).

333 See: www.journaldunet.com/management/ressources-humaines/1165976-loi-travail/ (last accessed on 20 September 2016).

334 See n271 above, 121.

a collective agreement with a lot of 'health protection' (eg, a regulation that email servers will be offline during the night) and 'gender' topics will be their 'corset'? They will not respect the collective agreement and will be frustrated to the same extent. Nevertheless, collective agreements or works agreements can provide frameworks but should be open to individual agreements between the contracting parties. Employers and employees have to agree on individual conditions for mobile working.

A potential solution for both parties – employers and employees/workers – could be a regulation that allows a deviation from the strict labour laws. Companies could try certain alternative working models or enable individual working time models in everyday practice. This deviation should be time-limited and earmarked, so that an evaluation could take place and the parties can use their freedom of design to respond to a change in the labour market or the individual needs of at least one party.³³⁵ These experiences in daily practice could be the basis for new legal frameworks.

335 Uffmann, 'Digitalisierung der Arbeitswelt' (2016) *NZA* 977 ff.

F. Impact on Remuneration

Owing to the changing, more flexible working hours and the assumption of additional duties, both employees and employers have a greater need for more flexible remuneration.

Moreover, an increasing wage polarisation as a consequence of digitalisation and automation and demographic changes poses a challenge for new remuneration structures.³³⁶ Wage polarisation means that when the demand for lower level and higher-level qualifications increases – relative to mid-level qualifications, as a result of technological progress – this can lead to a rise in wages at the top and bottom of the wage distribution relative to those in the middle, presumably as a result of collective bargaining agreements with stronger effect.³³⁷ This phenomenon can be observed particularly in the US, whereas wages still remain at the same level in most European countries.³³⁸ The polarisation of incomes can lead to frustration among those with mid-level skills.

I. Person-specific performance data collection in real time, digital collection

Data concerning the performance of employees in real time is possible because of increasing digitalisation. The workplaces of many employees no longer consist of paper, binders and pens, but of a personal computer, a laptop or a smartphone. The work can be accessed by anyone within the establishment, and the course of internet research is recorded within the company network. ‘Digital fingerprints’ are left everywhere. These new working materials make work easier and contribute substantially to the rise in productivity; at the same time, work is becoming ever more transparent. This transparency has the advantage for companies that it is easier for them to assess the performance of the individual employee on the basis of the technical work data.³³⁹

II. Driving force for qualitative change of performance-related remuneration

The question thus arises whether the individual remuneration structure should not be based on how productive the employee actually is. The incentive of performance-related remuneration is to increase the employee’s productivity. The motto is to work more effectively rather than just being present in the office. It is possible in the era of Work 4.0 to work at any time and at any place. This requires

336 See n27 above, 4.

337 See n168 above, 17.

338 See: www.manpowergroup.com/wps/wcm/connect/3f1fa392-c7f8-4e77-94f6-090c88430307/Human+Age+2+Future+Forces+at+Work.pdf?MOD=AJPERES 3 (last accessed on 30 March 2016).

339 See n97 above, 37.

a great deal of discipline on the part of the employee and has the advantage for the employer that the employee is more motivated to perform his or her work. At the same time, it poses the risk of a lack of control. The purpose of success-related remuneration, from the employer's point of view, is a 'direction-replacing' regulation on both levels in order to achieve improved performance and productivity.³⁴⁰ There are no clear borderlines between working time and private life. This means that not only the traditional working time model under which the employee received a certain fixed salary for a certain number of hours spent at the workplace, but also the working hours-related payment no longer applies.³⁴¹

An employee who, such as in France, has a 35-hour work week, from 0900 to 1700 with a one-hour lunch break, is not paid extra if they have a telephone call lasting one hour with their US line manager at 2100 to inform them about the current status of the project. If they have an employment contract stipulating a hitherto customary time wage system, and the employment contract provides that a certain amount of overtime is compensated for by their fixed salary, they do not receive any additional remuneration for that telephone call. If, on the other hand, flexible working hours, performance-related remuneration or project-related remuneration was agreed, the employee is remunerated appropriately for the telephone call with their line manager. The last alternative gives the employee the feeling that they receive remuneration for their constant availability and willingness to work, which will usually motivate them to process a few emails occasionally on the weekend or to complete the draft that they had already begun later on in the evening. It is also to be expected that having been given such freedom, the employee will deal with broader topics.

III. Limits of success-related remuneration

In principle, owing to the generally existing freedom of contract, no limits in the organisation of flexible remuneration structures apply. Depending on the country, however, bodies representing the interests of the workforce must be consulted with regarding the determination of wages. In some situations, however, the employee will not want variable remuneration. Models that provide for a relatively high fixed base salary with low bonuses are typical, especially in Europe, because of the employees' need for adequate financial security, and only these are allowed in many EU countries, whereas US remuneration models are characterised more by performance bonuses and lower base salaries. One can satisfy European employees' need for security with respect to salary and at the same time for flexible working hours, for example, by way of timeframes during which the employees must meet performance targets. At the same time, the employer extrapolates the remuneration on the basis of the timeframe, so the employee receives almost the same monthly salary.

340 *Ibid*, 50.

341 Greiner, 'Erfolgsbezogene Vergütungen im Arbeitsverhältnis – oder: der Arbeitsvertrag als spezieller Werkvertrag?' (2015) *Recht der Arbeit* 218.

Another problem of flexible remuneration can be the extra work if the employee, for example, works more than the maximum working hours in a week. The employee does not have to know the exact working hours, but they have to know 'what is actually ahead of them' to get their (success-related) remuneration.³⁴²

Another limit exists in most of developed countries in the form of a distinctive statutory minimum wage, which is not yet adapted to the needs of Industry 4.0. The connecting factor for the minimum wage in most countries is still the 'time wage'. On average, the minimum wage in most developed countries is just under US\$10 per hour.³⁴³ Collective bargaining agreements apply in many sectors as well. Ultimately, the employer must – regardless of the type of remuneration chosen – make sure that the employees' emoluments are above the respective minimum wage.³⁴⁴

Furthermore, incorrect drafting of flexible remuneration structures can violate the equal payment principle.³⁴⁵ In Germany, for example, a new law, applicable as of 2017, will obligate employers to pay an employee the same salary irrespective of sex for equal work on jobs requiring equal skill, effort and responsibility and performed under similar working conditions.³⁴⁶ However, the term 'equal work' is relatively vague.

Moreover, German law, like the comparable Californian Fair Pay Act applicable as of January 2016, makes it more difficult for employers to establish fair and legally compliant pay policies regarding the employees' performance.³⁴⁷ Even if the employer is able to demonstrate that the different wage is caused by factors other than sex (eg, education, experience, business necessity, longer length of employment or a shortage of skilled workers), an unequal payment may initially have the appearance of discrimination. The employer may be called upon to convince a court that this is not in fact discrimination. The biggest obstacle under German law is the obligation for bigger companies to have their payment policies approved by the Federal Anti-Discrimination Agency. This costs time and money. In general, such laws are the exact opposite of what the new labour market needs, even if gender equality is an important topic for society. Instead of these laws, lawmakers should trust the digital change. More and more rating of employers through online portals and by the media is generating pressure and thereby leading to a rethink in employers' philosophy concerning unequal payment.

342 See n308 above, 114.

343 www.boeckler.de/wsi-tarifarchiv_43610.htm (last accessed on 2 March 2016).

344 See n341 above.

345 See: www.lexology.com/library/detail.aspx?g=3db21296-e19c-4d20-9b3d-cdb5c8b0df02 (last accessed on 23 September 2016).

346 *Ibid.*

347 See: www.lexology.com/library/detail.aspx?g=d8eabf7e-84cc-4ae1-87e4-e8daf43202a7 (last accessed on 23 September 2016).

Variable remuneration systems are rarely used in developing countries. In such countries, many workers are paid only for the hours worked. There are often no far-reaching statutory regulations or minimum wage requirements, so the employer can influence the wage structure in most cases. The same applied to remuneration for extra work. Such work is not remunerated in many developing countries.

IV. Possibilities of success-related remuneration

In the future, the parties to employment contracts will agree more and more on performance-related remuneration.³⁴⁸ This can be seen as a 'win-win' situation. An employee who works a lot and effectively will receive more pay, whereas an employee who is less productive will cost less for the company. An employee who prefers to have more time for themselves can benefit from this, whereas the company saves money. In theory, this will lead to a 'fairer' distribution of wages within a company among top performers and low performers. In this case, the performance-related remuneration will depend on the change of the working time.³⁴⁹

The belief that an employee who works the most hours does the most for the company will recede. This situation can lead to a psychological burden for employees, especially if the performance-related remuneration makes up a large share of the total remuneration. Ultimately, both sides will nonetheless profit from pay based on performance in comparison with pay based on presence.

1. Several remuneration options

Wages can be agreed in individual agreements or in collective bargaining agreements. In some cases, wage groups and the rules for grouping are also regulated by law or are established by certain companies in internal policies. Irrespective of the specific type of agreement, the different wage forms³⁵⁰ are defined as follows:

- *Piece wages*: The entire remuneration or a major part of it depends on the number of units produced.
- *Payment in kind*: Payment in kind is understood to mean any form or remuneration that is not paid in money and is in addition to the usual remuneration. Payment in kind includes providing company cars for private use, providing company housing or room and board, granting staff discounts in a cafeteria, allowing tips to be kept or providing company pensions.

348 See n341 above.

349 See n308 above, 114.

350 Moll, *Münchener Anwaltshandbuch Arbeitsrecht* (3rd edn, 2012) s20 'Arten und Formen der Vergütung'.

- *Rewards*: A result or success relating to performance must be achieved. Rewards can be paid for the amount of work (reward for quantity) or the quality of the work product (reward for quality), meeting deadlines (reward for meeting deadlines) or saving material when working (reward for savings).
- *Performance-linked payment*: Performance-related remuneration (or parts of it, such as bonuses) means payments for which the employee's performance is measured and compared with a reference performance and for which the amount of the remuneration is determined directly on the basis of the ratio between the two.
- *Commission*: Commission is the employee's share of the value of transactions resulting from his or her work, which is expressed as a percentage. This is the traditional case of success-related remuneration in which remuneration is linked not only to performance, but also to success.
- *Profit-related bonus*: A profit-related bonus is the employee's success-based share in the company's business performance. Depending on the agreement, this can be linked to the profit shown on the commercial balance sheet, the distributed profit, the turnover, certain cost savings or defined production results. Hybrids occur relatively often in practice. For executive employees, profit sharing in the form of profit-related bonuses is frequent practice.
- *Target-based variable remuneration*: Employees are ever more frequently paid variable remuneration, the amount of which depends on the degree of their achievement of targets, in addition to or instead of parts of their fixed base salary. Remuneration systems using targets have the advantage that there is great leeway for a multitude of structuring options.
- *Employee shareholder*: Company shares are transferred with or without remuneration to an individual employee. In return, the employee waives some applicable rules that would protect them (eg, the right to defend against unfair dismissal or a minimum wage for several hours).³⁵¹
- *Annual bonuses*: A bonus is a special benefit provided by the employer on certain occasions (eg, Christmas, leave, company anniversaries and years of service awards etc).
- *Stock options*: When stock options are made available by the employer, the employee acquires an option to purchase a set number of shares in the share capital of a company (usually the employer) at a

351 See n355 above, 977 ff.

specified price at some time in the future. Restrictions can apply, such as meeting particular targets before the option can be exercised and a prohibition on selling or transferring the option. This does not place an obligation on the employee to buy the stock. More complicated option arrangements exist.

- *Extra work allowances:* Allowances are paid to remunerate an employee's special performance, to compensate for special difficulties or to mitigate social burdens. These include, for example, allowances for overtime, performance, night work and Sundays and holidays, for dirty work, for heat and for noise, for hazardous work and allowances for marriage, children and residential work.

2. Variations in different sectors

In other sectors in which copyright law plays a role, other alternative possibilities for remunerating the intellectual originator can be found:

- Paying the originator a percentage (of turnover/profit) if the product is marketed by the company itself.
- Paying the originator a percentage of the licence fees if the rights are sold to a third party.
- A fixed one-time payment in one lump sum.
- A lump sum remuneration depending on the number of copies sold.
- An advance payment and a guaranteed minimum fee.
- A combination of different alternatives.

3. Changes in remuneration options

The breakdown of boundaries in terms of place of work and working hours makes it difficult for the employer to check how many hours the employee actually worked. A linking factor for the time-wage system is absent, which makes this system unattractive for employee and employer. In the future, including for non-executive employees, elements of performance-linked payment will be found increasingly in the calculation of salary. In addition, employees will demand additional payments in kind, instead of raises, as part of their salary. Highly qualified employees, in particular, will change jobs more often and work in negotiations towards the implementation of innovative working time and remuneration models. The old 'job for life' model no longer suits the flexible members of Generation Y, who increasingly think of their own needs.³⁵²

352 See: www2.deloitte.com/global/en/pages/about-deloitte/articles/millennialsurvey.html (last accessed on 31 March 2016).

As employees change their employers regularly and freelancers change their working place regularly, non-compete clauses will become more and more important to protect the employers' business secrets and customer network.³⁵³ However, employers should be cautious in using such clauses, especially after terminating the employment relationship. For example, in some countries the employer is obliged to pay a high fee while the employees sit at home and cannot accept another job offer. Again, in some jurisdictions some clauses can be invalid because they are not transparent enough or deemed an unfair disadvantage for the employee. Because of these risks, employers should think carefully about the necessity of a non-compete clause for every employee and take appropriate legal advice.

Piece wages will become rarer because industrial robots will be used more and more in production. The same applies to extra work allowances. Owing to the outsourcing of ever more services to external providers, there will also be more lump sum payments for the provision of a specific service package. This becomes manifest in the IT sector or in connection with ghostwriters, for example.

V. Flexible structuring in response to volatility

The company can set targets within the framework of its authority to issue instructions to employees. Alternatively, individual target agreements can be concluded during appraisal interviews or set out in employment contracts.³⁵⁴ Depending on the type of target agreement, subsequent modifications to the targets are also possible, within certain limits.

The central issue for performance-related remuneration structures is not the type of agreement but how 'performance-related' is defined. For all alternatives, it is advisable to specify exactly what the linking factor for flexible remuneration is supposed to be: the achievement of an individual result or the achievement of a collective result. The achievement of certain 'soft' targets (eg, improving customer satisfaction) or the achievement of certain 'hard' key performance indicators (eg, the achievement of turnover thresholds) can be used as the basis, for example.³⁵⁵

With regard to the latter in particular, a distinction has to be made between the individual turnover achieved by a single employee, the turnover achieved by a department, the turnover achieved by the company and the turnover achieved by the group. A link to all parameters is possible.³⁵⁶ With regard to the latter linking factors, however, the question that arises in major companies is whether this

353 See n355 above, 977 ff.

354 See n97 above, 43.

355 *Ibid*, 52.

356 See n341 above 218 ff.

can still be described as performance focused because the influence of a single employee on the turnover of a group is usually relatively minor. The employee can be demotivated if the factor 'turnover of the company' results in an inadequate bonus for his or her individual performance.³⁵⁷ The employer also can reduce the companies' profit through investments if the bonus is adapted to this criterion. At the same time, this option offers employers the advantage that they have to pay only when financial resources are actually available.³⁵⁸ The factor 'turnover of the employer' leads to a transfer of the economic risk: the primary target is a transition to flexible remunerations in order to create a buffer for labour expenditure during a time of crisis.³⁵⁹

Whereas it is relatively easy to assess in cases involving fixed turnover thresholds whether an employee has achieved his or her target, many other (mostly qualitative) target agreements confront the involved parties with the question of whether the employee has achieved their target or not. The result is not assessed on the basis of objective criteria, but on the basis of subjective criteria, the achievement of which depends on the line manager's opinion. To avoid uncertainties like these, it is important, when describing performance-related wages, to specify – in addition to the targets – objective criteria on the basis of which the results can be checked. This has the advantage that one can analyse in what respect the employee must improve and in what respect the target agreement might have to be reconsidered. Moreover, important follow-up questions are how (sickness-related) absences, a partial achievement of targets due to changed circumstances (economic crises) and/or the premature exit of the employee affect the bonus policy.

VI. Company pension as part of remuneration

In many sectors, company pension options are common. These supplement the often poor retirement security provided by state systems and are part of the remuneration. It becomes complicated if the employee frequently changes jobs, because this creates a confusing patchwork made up of different retirement planning models.³⁶⁰ According to a 2016 survey by Deloitte, members of Generation Y will change jobs frequently.³⁶¹ Variety with regard to the places where they work and jobs, time-outs and more flexibility are more important to younger people than loyalty to their employer. In the European region, non-transparent retirement arrangements are thus being established in the individual EU Member States. The Netherlands and the UK, for example, have introduced tax-privileged pension accounts and are guided by the system used in the US. There, 401k accounts, to which employers can transfer pension amounts for

357 See n97 above, 43.

358 See n308 above, 114.

359 See n97 above, 43.

360 Quiring, 'Eine neue Arbeitswelt braucht ein EU-weites Kontenmodell' (March 2016) *Handelsblatt Journal* 7.

361 See n352 above.

their employees, are common.³⁶² These amounts are tax-free for the employees up to the time they are paid out as a retirement pension, and they are often part of the employees' salary. After switching to another job, the employee can choose whether to leave the saved amount in the previous account, transfer it to an account of the new employer or transfer it to an individual retirement account.

VII. Opinion of the employee representatives

Employee representatives and unions sometimes assume that there is no difference between 'good' and 'bad', higher-value and lower-value work. On this view 'work is work', so there has to be equal pay for equal work. Therefore, employee representatives are generally against variable remuneration and flexible working hours.³⁶³ They are primarily interested in social benefits for employees that are best guaranteed by way of base salaries that are as high as possible. The principle 'equal pay for equal work' should also be applied irrespective of gender or nationality. This is not obvious, however – even in Western developed countries – although it should be one of the most important aspects of the work of employee representatives. Additionally, some employee representatives think that flexible working time and permanent availability lead to more stress and burnout. They are concerned that digitalisation will lead to permanent unpaid overtime and more performance pressure for the individual employee.³⁶⁴ They say the arrangement of individual performance-related targets can be 'bad' for the employee because the employee cannot reach the employer's ambitious targets without working overtime.³⁶⁵

Therefore, their view is that working time checks are necessary to protect employees.³⁶⁶ In the European region, this basic assumption is underpinned by collective bargaining agreements in which employees are categorised in wage groups and are paid equally within these wage groups. Flexible remuneration structures are reserved for executive staff, who are usually not covered by collective bargaining agreements.

362 See: www.practicalmoneyskills.com/personalfinance/lifeevents/benefits/401k.php (last accessed on 31 March 2016).

363 See: www.martinlennartz.de/braucht-die-neue-arbeitswelt-gewerkschaften/ (last accessed on 11 May 2016).

364 See: www.bund-verlag.de/zeitschriften/arbeitsrecht-im-betrieb/aktuelles/praxiswissen/20150924_menschengerechte-arbeit.php (last accessed on 11 May 2016).

365 See: www.arbeitenviernull.de/fileadmin/Downloads/Dokumentation_WS_5.pdf (last accessed on 29 September 2016).

366 See: www.martinlennartz.de/braucht-die-neue-arbeitswelt-gewerkschaften/ (last accessed on 11 May 2016).

G. New Forms of Employment

I. Distinction between employee and independent contractor

The dividing lines between employees and independent contractors in the sector of digital work are disappearing more and more. This affects employees and employers due to increasing legal uncertainty.³⁶⁷ An employee is primarily characterised by the fact that they are subject to the authority of the employer to issue instructions regarding job assignment, working time and place of work.

- *Employee*: An individual who works part-time or full-time under a contract of employment, whether oral or written, express or implied, and has recognised rights and duties. Also called worker (although in some labour laws 'worker' is a broader concept than 'employee' such as including personal contracts for services, for example, taxi driver).³⁶⁸
- *Independent contractor*: A person who contracts to do work for another person according to their own processes and methods; the contractor is not subject to another's control except for what is specified in a mutually binding agreement for a specific job.³⁶⁹

As a result of Work 4.0, however, criteria with regard to the place of work that previously characterised independent contractors also apply to employees.³⁷⁰ Examples include:

- *Self-management as a core qualification*: Traditional contextual fields of work and work processes are disintegrating.
- *Digital inclusion*: Distance working also integrates social groups in the labour market that are not available for traditional employment relationships.
- *The challenge of a 'latte macchiato' workplace*:³⁷¹ The workplace is extending into the public space. Employees or freelance workers are no longer necessarily sitting in their offices, but in the café around the corner, and are working from their laptops. The workplace serves (almost) only the purpose of maintaining the social network with colleagues.
- *Leading from a distance*: Conversion from a focus on presence to a focus on results. The responsibility of executive employees is now to motivate, rather than control. The main challenge in this respect is to establish personal contact even through impersonal, technical channels.

367 See n27 above, 19.

368 See: www.businessdictionary.com/definition/employee.html#ixzz40Pz42YFK (last accessed on 2 March 2016).

369 See: <http://legal-dictionary.thefreedictionary.com/independent+contractor> (last accessed on 2 March 2016).

370 See n100 above, 26.

371 See: www.computerwoche.de/g/deutsche-telekom-universitaet-st-gallen-arbeit-4-0-25-thesen,112006,20#galleryHeadline (last accessed on 29 February 2016).

- *Work without limits:* Performance of work is possible around the globe, work having the same mobility as capital.
- *The border between professional life and private life become blurred:* The traditional places of work and fixed working hours are dissolving, which results in new organisational possibilities, but also new burdens for employees.

If the place of work, in addition to working time, becomes more flexible, and if employees are granted more powers for working independently, it becomes harder to distinguish between an employee and an external freelance worker or a worker provided by a third-party company.³⁷² It is difficult to make a distinction between independent contractors and some part-time workers, particularly marginal part-time workers.³⁷³ Whereas part-time workers have full employment rights in some countries (eg, protection against unfair dismissal, representation by a works council, paid leave, full unemployment benefits and maternity leave), independent contractors generally do not benefit from such social security, even if their weekly working hours are more than the marginal part-time workers' working hours. In some cases, independent contractors support a company in numerous projects over a long period, but these workers are not always classified as employees.

Some students who work on the basis of a marginal part-time (mini job) contract work mainly during their university vacation periods. Casual work, on the other hand, takes the form of work on demand for a varying income and varying working hours during the year.³⁷⁴ Nevertheless, these students, with their limited contracts, are classified as employees. External workers are usually – like employees – integrated into the company's operations.

II. Risk of wrongful classification

The additional costs that can be incurred if an independent contractor is classified as an employee can be up to 40 per cent. Traditional employment can become a 'business killer'.³⁷⁵ Specific work orders are thus also assigned by the company to 'temporary agency workers' and freelancers.

Regardless of the parties' description in the contract, the classification of the 'worker' depends upon the 'worker's' actual performance of work. Some external workers or freelancers are economically dependent on the work in the company group even if they have other clients, too. This can change from task to task. When an individual 'worker' is hired and fully preserves their autonomy in the execution of the task, their relationship could be reclassified as one of

³⁷² See n220 above, 697 ff.

³⁷³ See n6 above, 8.

³⁷⁴ *Ibid*, 7.

³⁷⁵ See n100 above, 27.

employment later.³⁷⁶ The more distinct this relationship between the external 'worker' and the company is, the more likely it is that European courts will assume the existence of an employment relationship between the parties even if there is no written employment contract.³⁷⁷ The severe consequence of this for the employer is that an external employee may under certain circumstances be entitled to social security payments and participation in the internal remuneration of a company and in elections of employee representatives or, in the event of dismissal, continued employment during dismissal proceedings – although the intention was to avoid this.³⁷⁸

Additionally, the wrongful classification of an employee as an independent contractor or temporary agency worker could lead to high penalties for the company. In some countries in the case of temporary agency work, the company providing the employee will have to pay penalties as well. Therefore, a wrongful classification of workers can be a big financial risk for companies. A US judge captured the issue graphically by saying what is happening is that a jury is being handed a square peg and will have to choose between two round holes: an employment relationship or a freelance relationship. The problem in the *Cotter v Lyft* case was, however, that 'the test the California courts have developed over the 20th century for classifying workers is not very helpful in addressing this 21st century problem'.³⁷⁹

III. Distinction between employers and third parties

Not only are the dividing lines between employees and independent contractors in the sector of digital work disappearing: the same applies to the differentiation between employers and clients as well. It is becoming more common that it is not just the employee's employer (as identified in the written contract of employment) who issues orders. A typical example is matrix structures for groups of companies, where it is not necessarily the employer who tells an employee what to do. Going further, the group of companies that include the employer is not always the borderline. In some cases, there are also clients or franchise-givers that have the power to define the individual employees' working conditions.³⁸⁰ Corporate social responsibility is such that a case where small companies to which certain legislation (eg, CRS-Directive 2014/95/EU or the UK Modern Slavery Act from 2015)³⁸¹ does not apply have to fulfil their clients' obligations as well.³⁸²

376 See n6 above, 12.

377 See n27 above, 19.

378 See n100 above, 28.

379 See: http://adapt.it/adapt-indice-a-z/wp-content/uploads/2015/06/Cotter_Lyft.pdf (last accessed on 30 September 2016).

380 See: www.arbeitsviernull.de/fileadmin/Downloads/Dokumentation_WS_5.pdf (last accessed on 30 September 2016).

381 See: www.legislation.gov.uk/ukpga/2015/30/contents/enacted.

382 See n355 above, 977 ff.

Another situation in which the distinction between employers and clients can be blurred is in the model of an employer grouping. Two varieties of this model demonstrate this. First, consider the case of employees employed by a platform or a joint venture. In this case, the employees will switch from one company to another. They work for every company connected to the platform that needs their special knowledge.³⁸³ Secondly, consider the case of a personnel leasing arrangement under which the employee is 'loaned out' to another if the legal employer currently does not have enough work for the special employee. This might seem a perfectly legitimate arrangement but the fact that the 'employer' has in reality become someone else leads to criticism (even pejoratively labelled as '21st century slavery' by some). Unsurprisingly, such personnel leasing is permissible only subject to considerable restriction in many European countries. Furthermore, the costs for the employees' accident insurance can rise.³⁸⁴ If the employees' employment contracts do not include an obligation to provide services for another company within the company group, personnel leasing will not be possible without their consent.

These two forms of 'Work 4.0' are good for saving full-time jobs for small and medium-sized companies that can then respond immediately to a changing order situation and can pool their know-how. On the other hand, there are risks for the employer. For example, there is the risk that the individual employee who works for, say, two companies might transfer knowledge acquired from one company to the other during the performance of their work to the detriment of the first company.

IV. Social security issues

The number of freelancers in major companies is increasing, however. They are mainly working in the service sector, particularly in the area of software and programming. In the US, there are about 53 million workers working in the freelance economy, without social security.³⁸⁵ The entrepreneurial risk has shifted in the direction of the freelancer and this can include aspects of social security.³⁸⁶ Generation Y, in particular, prefers a free form of employment. The demand for social security is no longer so high among well-educated freelancers. Nevertheless, freedom with regard to working hours, working place and the choice of clients is more important for younger people.³⁸⁷

Companies prefer an enhanced use of independent contractors, too. Permanent employees are very expensive for a company because they must be paid irrespective of their productivity and the work actually performed. This applies, in particular, to cases involving illness or maternity protection. For freelancers,

383 *Ibid.*

384 *Ibid.*

385 See n143 above, 7.

386 See n103 above.

387 See n153 above, 62, 63.

employers are generally not under this obligation. As a rule, the costs for their remuneration – however this may be provided – are usually higher, but savings can be made with regard to social security payments.³⁸⁸ If workers are found in foreign markets, the hourly wage or project-related remuneration is often even lower. In addition, the motivation of freelancers is higher, as a rule, because they wish to distinguish themselves with respect to the next contract to be awarded and work more efficiently because they are free to organise their working hours.

In Spain, for example, freelancers legally or economically dependent on a company group are treated as employees with regard to participation in the national social security systems, but remain freelancers with regard to taxes and working time flexibility.³⁸⁹ On the other hand, independent contractors do not participate in the compulsory national security systems in the UK. Workers and independent contractors are, however, covered by certain employment protection. These are the national minimum wage, protection against discrimination, working hours and annual leave.³⁹⁰ The German government will present a draft at the end of 2016 on how to respond to alternative forms of employment. The government is considering introducing a separate social security system for the numerous freelancers because the government expects that an absence of compulsory participation in a social security system will lead to social tensions and to an increased risk of poverty in old age.³⁹¹ It is said too many young workers do not care about their social security after retirement.

V. Liability among producers, employers and employees

The basic assumption is that under liability law, a natural or legal person is always responsible. As long as no 'e-person (electronic person)' exists, the robots' actions and declarations will be attributed to the employer or the producer.³⁹² With regard to the increased use of assistive robots in the industrial sector and the increased use of algorithms in the service sector, the question arises as to who is liable in each individual case if the linking factor for such liability is the autonomous IT system or an autonomous production robot: the employee who operated the system incorrectly, the producer if the system contains errors of any kind, or the employer who made the system available?

With regard to the external liability of employers towards their clients, the question arises whether an employee who operated an autonomous system incorrectly is liable. In principle, the causer of the damage, thus any party, can be liable. In most cases, the client will recover any damages from its supplier,

388 See n220 above, 697.

389 See: www.portal21.de/PORTAL21/Navigation/Laender/Spainien/Dienstleistungen/pflichtversicherung.html#1337158 (last accessed on 25 August 2016).

390 See n6 above, 20.

391 See n5 above.

392 Groß and Gressel, 'Entpersonalisierte Arbeitsverhältnisse als rechtliche Herausforderung – Wenn Roboter zu Kollegen und Vorgesetzten werden' (2016) *NZA* 990 ff.

thus the employer.³⁹³ In case of doubt, therefore, both employer and employee are liable: the employee because they made the error, and the employer because the error is attributed to the employer or because the employer failed to prevent the error.³⁹⁴ Of course, it is possible that the employer or the producer will have 'recourse liability'. In most cases involving a non-autonomous robot, the producer will ultimately be liable.

With regard to liability for autonomous systems, the current fault-based liability system is generally not perfect because the injured party bears the burden of proof. Some legal scholars argue for a liability system without fault for every robotic action because the employer enjoys certain benefits from the use of robots.³⁹⁵ Employers can take out insurance for every robotic action to cover their financial risks and can have recourse from the producer.

With regard to the liability of the employee, however, it must be noted that their share of the liability is generally in legal systems attributed to the employing company, since the employee was acting, after all, during the performance of their professional duties. This (graduated) release from liability is common, for example, in Brazil³⁹⁶ and most European countries, because passing on the liability amount – which, in some cases, is many times greater than the monthly salary of the employee, who is already working for the employer – would be unfair.³⁹⁷ At the same time, the employee's liability is limited in most cases if they did not cause the damage intentionally. In the situation where an employee is not working at an employing company but operated a machine incorrectly, there is a case to say that this should not to be assessed differently. In principle, it is possible to hold such an employee liable, in which case the damage is again attributed to the employing company.

The use of independent contractors is very different. There is no release from liability for the self-employed. If an independent contractor destroys the client's property during working time, the contractor generally has to pay full damages. For younger independent contractors, self-employment can be very risky indeed in several countries, especially without (adequate) personal liability insurance. Finally, the liability among the parties is one of the main criteria to distinguish between independent contractors, temporary agency workers and traditional employees. Where contracts for work and services are used, the liability between the parties, some say, should not be excluded in full. In Germany, for example, an exclusion of liability in a contract concerning the transfer of workers is an indicator for the wrongful use of contracts for work and services instead of temporary employment contracts. The legal consequences are penalties and the nullity of the contract for

393 *Ibid.*

394 See: www.autonomik.de/documents/AN_Band_2_Recht_bf_130325.pdf 12 (last accessed on 2 March 2016).

395 See n392 above.

396 See: [www.baymevbm.de/Redaktion-\(importiert-aus-CS\)/04_Downloads/Downloads_2011/1_Recht/1.2_Internationales-Recht/Schriftenreihe/SR_Brasilien_IS.pdf](http://www.baymevbm.de/Redaktion-(importiert-aus-CS)/04_Downloads/Downloads_2011/1_Recht/1.2_Internationales-Recht/Schriftenreihe/SR_Brasilien_IS.pdf), 54 (last accessed on 4 March 2016).

397 *Ibid.*, 86ff.

work and services.

Owing to the progressing digitalisation and automation, end products are becoming more comparable and of higher quality in both the production sector and the service sector. Damage therefore occurs less frequently. If, however, employees use technical aids incorrectly, this can result in damage to the machine itself and to the end product. The average amount of damage increases. In the area of employee liability, the graduated and limited employee liability practiced in most countries is one solution.

H. Data Privacy Protection and Confidentiality Issues

I. What is big data?

Machines can store ever-larger volumes of anonymised and unstructured data from a variety of sources, generated by humans and machines. The volume of stored data has been increasing almost exponentially since the invention of the internet. According to estimates, the worldwide data volume is expected to be more than 100 zettabytes (100,000,000,000,000,000,000,000 (or one sextillion bytes) in 2020, ten times the volume in 2006.³⁹⁸ This huge volume of data is called 'big data'. The industry expects many new insights, for example, with regard to marketing, customers and staff, from the evaluation and analysis of big data, as well as a boost in productivity and at the same time a reduction of labour costs. Additionally, big data and the internet of things create new disruptive purposes of AI.³⁹⁹

Stored data can be acquired from different sources. For example, it is collected during 'surfing' on the internet, during the use of social media and cloud computing, when contracts are concluded with authorities and private individuals, or during electronic payment transactions. Even sensitive data, such as information on health from health insurance or credit card data, is collected. In addition, economic and social statistics are included to complete data sets. They do not contain personal information, however. The data is anonymised and exists in an unstructured form so that in most countries, big data analysis does not violate applicable law.

II. Change in the philosophy of the company: using big data in economic devices

The focus is not on storage, however, but on the analysis of collected data. To date, fewer than half of companies exploit the potential of big data analysis,⁴⁰⁰ although big data analysis makes it possible to demonstrate correlations between the daily behaviour and the personality of customers. For the large digital leaders, the collected data is very important for seeing the new trends and creating new business models and optimising their own products based on these trends (the 'elephant effect').⁴⁰¹ They depend on the data, after all.

Examples of this are the 'Amazon Echo' and 'Google Home' boxes, which detect the consumer's voice to obtain relevant information on the consumers' individual

398 Bitkom, *Big Data im Praxiseinsatz – Szenarien, Beispiele, Effekte* (2012) 12.

399 See n10 above.

400 Priddat and West, 'Digitale Wirtschaft. Mit besonderem Blick auf die chemische Industrie' (2015) *BARC-Studie 'Hot Spot 6'*, 11.

401 See: <http://bundestag.at/2015/wp-content/uploads/2015/09/kollmann-digital-leadership.pdf> (last accessed on 28 September 2016).

needs, their preferences and other data.⁴⁰² Finally, the boxes offer simple solutions, such as a selection of pizza deliveries if the consumer says they are hungry. With the help of the box, the client can order the product they were talking about simply by using their voice.⁴⁰³ On the basis of data analysis, it is also possible for companies to set prices dynamically. On the basis of collected data, it is possible, for example, to draw conclusions about customers' price sensitivity.

On the other hand, Fintech startups are creating services that are redefining customers' expectations without data (the 'piranha effect').⁴⁰⁴ Purely technical processes can also be optimised by means of big data analyses. By linking and evaluating digital information, machines will be able to predict, analyse and even remedy software and hardware defects, which will help improve risk management. Internal data shows where internal communication or production is in need of improvement and where procedures can be enhanced.⁴⁰⁵ This makes it possible to optimise internal processes, which, in the long term, will result in increased profitability as a consequence of the company's cost reduction. Another great advantage of big data analysis is that it creates a clear basis for decisions.⁴⁰⁶ On the basis of a comprehensive analysis, it is possible to prepare the hard facts on a topic optimally, enabling the decision-maker to make purely rational decisions without spending a lot of time on research. An example of the effective and cost-saving use of big data is the news section on Facebook.⁴⁰⁷ Instead of 15 employees writing about things they are interested in, an intelligent algorithm chooses the 'trending topics' based on the users' preferences by means of big data analytics. The former editors' jobs are eliminated, and IT specialists update the algorithm and make sure that no topics like 'lunch' are published on Facebook.⁴⁰⁸

Big data has thus become an important part of all corporate development in all sectors and will be more important than ever in future, as shown by the rapid rise in the amount of collected data.

III. Change in the philosophy of the company: using big data in personal devices

Big data analysis is more than just an instrument to control the performance and conduct of employees. It is also possible to forecast employee behaviour on the basis of big data analysis. Not only data concerning individual employees, but

402 See: www.knowyourmobile.com/devices/google-home/23613/google-home-vs-amazon-echo-ai-coming-your-home (last accessed on 28 September 2016).

403 *Ibid.*

404 See n410 above.

405 See n27 above, 15.

406 'Computer kennen keinen Nasenfaktor, Wie Software die Arbeit von Personalmanagern übernimmt' (9/10 April 2016) 83 *Frankfurter Allgemeine Zeitung* C 1.

407 'Facebook tauscht Redakteure gegen Roboter aus' (29 August 2016) 201 *Frankfurter Allgemeine Zeitung* 18.

408 *Ibid.*

also concerning the staff as a whole or definable parts of it are included in the analysis. This makes it possible to make statements and even forecasts relating to the company as a whole or to the analysed units. Processes can be reviewed, optimised and developed.⁴⁰⁹ Besides traditional workplace data, relevant data includes previous appraisal reports, sales and distribution figures, completed projects, distinctions received, promotions, training and professional development programmes and examination results. The overall assumption is that big data analysis will lead to cost reductions of up to 60 per cent.⁴¹⁰

Furthermore, an analysis of the data relating to employees who have left the company makes it possible to conclude what situation in life or employment typically leads to an employee's resignation. This facilitates a forecast of future staffing needs. In addition, the reasons for above average staff turnover in certain areas can be ascertained.⁴¹¹ Individual appraisals and master data can be linked to information concerning the performance of departments, personnel flows and remuneration structures. Analysis facilitates conclusions regarding the conditions under which high potential employees are able to develop their abilities best. On this basis, it is possible to optimise organisation structures, training programmes and incentive systems, among other things. In order to adapt these operational needs, more flexible international laws will be necessary.

IV. Using big data for customer service

In the areas of trade or production, it is possible to improve staff planning by means of big data analysis. In the analysis, in addition to the daily turnover, a forecast regarding the delivery of goods to distribution centres and parameters that can be adjusted to an individual branch, such as opening hours, are included in the planning. The goods received, for example, have a significant impact on the staffing needs of a site. What is also essential for the planning of capacities is the period of time in which the forecast turnover should be achieved. In addition, all reliable data, including external data is included.⁴¹² This may be market days, holidays in a neighbouring country, online complaints or a construction site on the access road. In the future, even the weather report can be included, allowing conclusions to be drawn about the number of customers in certain sectors. An analysis thus contributes indirectly to the satisfaction of customers and employees because the weaknesses in the system are demonstrated to the responsible parties by independent sources on the basis of data analyses.⁴¹³

409 See n27 above, 15.

410 See n92 above.

411 See n406 above.

412 See n398 above.

413 *Ibid.*

V. Using big data for recruiting new employees

In addition to everyday work, the recruitment process can be optimised in a resource-saving manner on the basis of automatic data analysis, for example, by means of prior online surveys.⁴¹⁴ Online applications make it possible to pre-sort on the basis of the data. The recruiter can gain an impression on the basis of the relevant criteria (such as salary expectations, professional experience and qualifications). It is no longer necessary to compile the information in a manner requiring a considerable number of staff hours 'manually' or to discover it in an interview. Skills such as sales talent, ability to work in a team or analytical understanding are tested in advance by way of online questionnaires. The company may be able to assess on the basis of cultural assessments whether the employee will fit into the corporate culture. An argument against big data analysis in the recruitment process is, however, that unconventional thinkers who are also important for the corporate culture and success will fall out of the system and will not be invited to the interview or assessment centre. It is therefore advisable to adjust the questions to the respective job profile because it is possible to conduct a targeted search for unconventional thinkers. Another advantage of an automated recruitment process is that robots' decisions are based only on facts and not on emotions and sympathies, and this leads to transparency. No discrimination can occur if the robot uses only legally permissible questions in an interview.⁴¹⁵

VI. Legal data aspects

A differentiation must be made between the analysis of the data of employees and analysis of the data of third parties, such as customers. In general, big data is characterised by the data volumes being unstructured and anonymised. This renders the analyses unproblematic in terms of data protection law. Employee data not rendered anonymous, on the other hand, problematic because the employee can be 'reduced' to the data collected about them and the analysis can concern their private sphere.⁴¹⁶ For example, GPS data in a company car or an employee's health data allows for a more extensive supervision. This makes it possible to draw conclusions as to the private circumstances of the employees' lives and their private conduct. Consequently, the employer could look over the employee's shoulder both in private and in professional life (the buzzword here is 'transparent employee').⁴¹⁷ When big data is used internally in an individual case in a manner that complies with the law, however, the risk of a transparent employee is largely averted, because employers worldwide are not permitted to make use of all technically conceivable applications for legal reasons. Even if younger people tend

414 See: www.manpowergroup.com/wps/wcm/connect/3f1fa392-c7f8-4e77-94f6-090c88430307/Human+Age+2+Future+Forces+at+Work.pdf?MOD=AJPERES 6 (last accessed on 30 March 2016).

415 See n392 above.

416 Thüsing, *Beschäftigtendatenschutz und Compliance* (2014, Buch) s1 Margin No 9.

417 Littler, 'The Big Move Toward Big Data in Employment' (August 2015) 14.

to be more open to this than older generations, only 30 per cent of employees are familiar with this kind of monitoring.⁴¹⁸

1. Prohibition of automated data acquisition and unauthorised or improper use of data

Whether the use or storage of particular data is legally permissible varies from case to case. There are a multitude of different regulations in individual countries. The EU, Canada and Israel have a high level of data privacy protection. With respect to EU countries, the fact that storing and using personal data is generally prohibited unless a permissive rule provides otherwise or the data subject has given their consent makes this apparent. On the other hand, many developing countries, such as India or Pakistan, have not yet seen the necessity of statutory regulation. Data – for instance, of those from abroad that are stored in a cloud from these countries – is unprotected. Other countries, such as the US or China, have a rather low level of data privacy protection, which leads to a greater scope of action for the companies located there, but on the other hand also involves risks as to the confidentiality of one's own data. For example, strict guidelines regarding the storage of data apply to Chinese companies, but the data subject does not have any way to enforce their rights effectively.⁴¹⁹ It is therefore difficult, especially for internationally operating companies, to set up a uniform database and to establish internal guidelines for handling data globally. In case of doubt, a separate arrangement must be made for every country or every region.

2. New European standards, data privacy protection

The EU General Data Protection Regulation,⁴²⁰ applicable as of 2018, will introduce a uniform data privacy protection standard within the EU. It is doubtful whether this regulation will bring about legal certainty for the companies and data subjects because it contains numerous vague legal terms, and Member States are allowed to subject employee data to stricter rules. The content of the regulation makes it clear that it is based on the strict standards of individual European countries. The regulation provides that collecting personal data without a permissive rule is prohibited. The derogation rules, some of which are very far-reaching and indefinite, make it apparent, however, that EU lawmakers have recognised the economic problems and do not intend to provide any all-encompassing consumer protection. With regard to big data, the wording of the regulation in Article 6 b) is:

418 See n76 above.

419 See: www.zdnet.de/88142549/china-fuhrt-datenschutzregeln-fur-unternehmen-ein/ (last accessed on 21 January 2016).

420 REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679&from=DE> (last accessed on 20 May 2016).

'processing is necessary for the performance of a contract to which the data subject is party or in order to take steps at the request of the data subject prior to entering into a contract'. In the future, it will thus be easier to use big data within the company without a subsequent declaration of consent from each employee having to be obtained or without partially invalid declarations of consent being included in the employment contract.

In addition, it will be easier for users to access their data in the future. They may demand information from companies that collect data as to what data relating to them is stored, and they may have data changed and transferred to other providers. Besides this right to be provided with information, EU lawmakers have strengthened the user's right to be 'forgotten' to the effect that data put online can be effectively deleted. Another aspect of consumer protection is the duty of the companies to use understandable terms and conditions to the effect that the individual user knows for what purpose and to what extent their data is used.⁴²¹ As before, however, there is still the option, which most services have already made use of in their general terms and conditions, of obtaining the consent of the data subject. In the future, however, such consent is supposed to be valid only if the user is at least 16 years old, which will probably lead to numerous users registering under a false name or with a false date of birth.

Ultimately, this regulation will codify a high level of consumer protection within the EU that is weakened by exceptions, but leaves room for data-processing companies at the same time. The authors of the regulation succeed only to a limited extent in achieving a reasonable balance among the interests of the companies with regard to the use of big data. A new category 'pseudonymised data' is introduced. Unlike data rendered completely anonymous, data in this category allows the data of an unknown user to be interconnected. Although the data is not allocated to any particular person, connecting the data theoretically makes it possible for conclusions to be drawn concerning the pseudonym, so such use is permitted only within strict limitations.⁴²² Using big data will thus become easier without the privacy of individuals being invaded.

The US data privacy protection laws originate from a completely different fundamental conviction. They are not based on the general assumption that data is confidential, but provide for such data confidentiality only in individual cases (eg, with regard to health insurance and protection of minors using the internet). Unlike in most European countries, there is no independent data supervisory authority and no protection of the privacy of data established by law. The impact of the Patriot Act is also particularly called into question. This Act

421 See: www.datenschutzbeauftragter-info.de/eu-datenschutzgrundverordnung-das-sind-die-neuerungen (last accessed on 21 January 2016).

422 See: www.anwalt.de/rechtstipps/uebersicht-zum-arbeitsrecht-in-japan_056517.html (last accessed on 2 March 2016).

grants government agencies in the US an all-encompassing authority to collect and store data in certain cases.⁴²³ To put companies in the most efficient economic position possible, an approximation of the strict European data protection law to the rudimentary US regulations would be recommendable. Free and uncomplicated movement of data is indispensable for the future organisation of work and exchange of data within a group of companies.

3. Safe harbour

The fundamental differences in the understanding of data protection and the absence of possibilities for European citizens to seek judicial relief before US courts caused the European Court of Justice (ECJ) to declare the Safe Harbour treaty negotiated between the EU Commission and the US government in 2000 invalid.⁴²⁴ The treaty was supposed to enable companies having their registered offices in the EU to transfer personal data legally to US companies in that certified US companies were declared 'safe harbours' for European data. The data protection level was, however, not comparable to the European data protection level. Particularly with regard to the already mentioned General Data Protection Regulation, the levels of data protection in the US and in Europe are far apart. It is also not to be expected that the data privacy protection standards in the US will be adapted to the European standards.⁴²⁵

There are still alternative ways for companies to transfer data to the US; these include approval by the national data protection supervisory authorities of binding corporate rules (BCRs) within an internationally operating company or the standard contractual clauses specified by the EU Commission. Numerous data protection authorities have currently suspended the approval of BCRs. In addition, declarations of consent by the data subjects or works agreements, if only employee data are relevant, are also suitable. These alternatives, however, still involve a great risk for companies. Approvals may be refused, works agreements may not come about, binding corporate rules must be approved by the national data protection authorities and are hard to change, while courts can reject declarations of consent as inadmissible.

423 See: www.seniorbook.de/themen/kategorie/computer-und-technik/artikel/24986/auf-einen-blick-deutscher-und-us-datenschutz-im-vergleich (last accessed on 21 January 2016).

424 ECJ judgment rendered on 6 October 2016 – C-362/14.

425 See: www.spiegel.de/netzwelt/netzpolitik/datenschutz-in-den-usa-und-europa-a-849114.html (last accessed on 28 January 2016).

4. EU-US Privacy Shield

More data protection agreements will have to be concluded in the future in order to satisfy the requirements of digitalisation and interconnection of companies and to bring about legal certainty. The European Commission and the US government have recognised this, too, and have concluded a successor agreement to the Safe Harbour treaty, the EU-US Privacy Shield.⁴²⁶ This successor agreement allows a legal transfer of data across the Atlantic Ocean, the receiving companies undertaking to comply with the EU data protection rules and to protect the received personal data of third parties.

The new regulation now provides that the use and storage of personal data is authorised only as long as the use and storage serves the purpose of processing (principle of dedicated use of personal data).⁴²⁷ If an employee is no longer part of the company, collecting and saving personal data is no longer allowed. In contrast to the Safe Harbour treaty, compliance with these rules is intensively controlled by US authorities, and violations are punished. Moreover, the data subjects are entitled to be given information by US companies, and there will be an objective and independent ombudsperson at the US State Department whom affected EU citizens can contact. The mass surveillance of EU citizens by US authorities is to be prevented, with the exception of the usual special cases (fight against terrorism, national safety, etc). Both parties are supposed to jointly review annually whether the EU-US Privacy Shield functions correctly.⁴²⁸

The European Commission adopted the new regulation on 12 July 2016 as an adequate regulation for the monitoring of data protection standards.⁴²⁹ Even if the EU Member States did not reject the regulation, critics may appeal to the ECJ. Their criticism is that the data protection level is still not comparable to the European data protection level and that the promises given by the US – that the companies will be controlled – are insufficient.⁴³⁰ For the time being, since 1 August 2016, another alternative for data transfer to the US is available in addition to binding corporate rules and standard contractual clauses: the self-commitment of US companies under the EU-US Privacy Shield. US companies must register with the US Department of Commerce if they wish to transfer data under the EU-US Privacy Shield.

426 See: http://ec.europa.eu/justice/data-protection/files/factsheets/factsheet_eu-us_privacy_shield_en.pdf (last accessed on 4 March 2016).

427 See: http://europa.eu/rapid/press-release_IP-16-2461_de.htm (last accessed on 31 August 2016).

428 See: www.heise.de/newsticker/meldung/Privacy-Shield-EU-Kommission-veroeffentlicht-Text-fuer-loechrigen-Datenschutzschild-3120502.html (last accessed on 1 March 2016).

429 See n427 above.

430 See: www.heise.de/newsticker/meldung/EU-US-Datentransfer-EU-Mitgliedstaaten-stimmen-Privacy-Shield-zu-3262434.html (last accessed on 31 August 2016).

VII. Increasing economic value of personal data

For companies, data is not only an asset worth protecting, but is merchandise. Data is, for example, designated the 'oil of the future' now.⁴³¹ The demand for personal data is increasing, particularly from startup companies. As a rule, they are very interested in obtaining the data of potential customers in order to draw their attention to new products. The same applies to major companies, which send customers personalised advertising on the basis of their buying behaviour.

Furthermore, there are many companies whose sole business activity is collecting data and reselling them to other companies. The best examples of this are Facebook and Google. The deal is: service in return for data. Huge computing centres that analyse and redistribute masses of data are being established, particularly in the US. This requires an intelligent system that automatically creates links, sorts the data and provides the relevant employee with the data required for their work in edited form. This is a central challenge for the big data developers and big data scientists.

VIII. How to ensure confidential information is kept confidential

Employers wish to ensure that data is distributed within the company only to the relevant employees and is not lost during transfer. It is vital for industry that its data is protected from access by third parties, from governmental supervisory authorities (unless required by law) and from its own employees.⁴³² It is just such protection from ever-present supervision that constitutes a central challenge for companies' computer scientists and data technicians. The affected companies whose field of business depends on the use of data, especially, will have to make massive investments in a closed system. Currently, about 70 per cent of global companies' CEOs are concerned about the protection of business secrets against cyber-attacks.⁴³³

A special obligation applies in this regard, not only to third-party data obtained by means of big data analyses, but in particular to employee data. In this context, employers are obligated in many countries to protect the data relating to their employees from unauthorised access. It goes without saying that an IT security system is required that, if possible, should already correspond to future state-of-the-art technology. Other ways of securing the data include a restrictive access system and an adequate encryption of the data and the entire system. The IT sector faces the challenge of having to design and update a system with ingenious network and component security (eg, by way of a firewall or external access logs) on a regular basis. In addition, there is often a need to ensure that certain data

431 See: www.faz.net/aktuell/wirtschaft/netzwirtschaft/was-taugt-die-eu-datenschutz-verordnung-13972055.html (last accessed on 21 January 2016).

432 'Industrie 4.0 bietet Cyberkriminellen Angriffsflächen' (26 April 2016) 97 *Frankfurter Allgemeine Zeitung* 19.

433 See n192 above.

is permanently deleted. This applies particularly to the disposal of old computers, because old hard disks can usually be recovered.⁴³⁴

A popular case concerning the use of proprietary software is the Juniper example. When third-party software is used, there is always a risk that a third party might read along or log in as needed. Unlike with open source programmes, companies are usually unable to view the source code of their software partners. In the case concerning Juniper power supply units, a 'backdoor' was hidden in its programming codes that allowed the US National Security Agency (NSA) access to millions of users' data.⁴³⁵

IX. Awareness campaign concerning the use of data

In this regard, it is not, as so often feared, data leaks or hacker attacks that pose the greatest risks, but the negligence of the companies' own employees. Typical cases are leaving forgotten papers on the copy machine in the office, reading confidential documents on public transportation or clicking on dubious links when using the office computer. Employees' awareness regarding the confidential handling of personal data entrusted to them has to be raised. This requires training courses, qualified data protection officers and compliance guidelines that show the employees the importance of data protection and the consequences of violations.⁴³⁶

1. Penalties for wrongful use of personal data

Whether governmental penalties are imposed or payment of damages is ordered as a consequence of misuse of personal data varies from country to country. Whereas Swiss or German law, for instance, provides for administrative fines for the companies and for criminal and civil law penalties for the persons acting unlawfully if data are improperly used, Chinese law primarily takes action against data dealers and punishes them by imprisonment.⁴³⁷ US law, by contrast, does not provide for any penalties because data privacy protection is regulated only in individual cases and mostly on a voluntary basis.

434 Handelsblatt Research Institute, *Datenschutz und Big Data – Ein Leitfaden für Unternehmen* (2015) 7 f.

435 See: www.heise.de/security/meldung/Schnueffelcode-in-Juniper-Netzgeraeten-Weitere-Erkenntnisse-und-Spekulationen-3051260.html (last accessed on 22 January 2016).

436 See n27 above, 9.

437 See: www.zdnet.de/88142549/china-fuhrt-datenschutzregeln-fur-unternehmen-ein (last accessed on 22 January 2016).

2. Increasing importance of collective bargaining and conclusion of works agreements in the field of data protection

In general, big data analysis is rendered anonymous and is not subject to any prohibition under data protection law. If, however, the individual data analysis in the company makes it possible to draw conclusions as to individual employees and if they are used for monitoring their performance or conduct, the questions that arise are whether the relevant data analysis is legally permissible and whether the employee representatives must be consulted. Furthermore, rights of the employee representatives to be provided with information about what (personal) data of the employees is recorded in what form and for what purpose must be respected.⁴³⁸

438 Zöll, 'Die IT-Betriebsvereinbarung' (May 2016) 3 *HR Performance – Businesspartner für Personalverantwortliche* 54 ff.

I. Use of Social Media, Private Email Accounts and the Internet

Owing to the progressing digitalisation and interconnection of employees, social media is an important factor within the company. Social media involves a change in internet culture to the effect that the user participates more actively in creating the programme content of the provider portal and uses the portal for private and business purposes.

I. Opportunities for companies using social media

Not only are numerous transactions concluded via the internet, but also numerous contacts and even employment contracts are made this way. In order to ride this wave, not only must the company be present on the internet, but also the individual employee, as the relevant contact in the company. Networking on sites such as LinkedIn, XING, Twitter or Facebook has become more important than ever.⁴³⁹ Like companies, many private persons have their own blogs or disseminate podcasts. In this regard, corporate interests and the private interests of the employee are often mixed, which results in an ambivalent situation for companies.

On the one hand, social media can be ideally used for marketing and recruiting purposes. Thanks to the personal connection of the individual person, one learns more about potential business partners and colleagues and can foster contacts in an easier and more time-saving way due to the distance of the web and a certain 'anonymity'. Social media is just as ideal for the exchange of information and for the dissemination of positive messages; so many companies even want their employees to deal with websites – in individual cases, even exclusively. In the areas of distribution, marketing and research and development, social networks are indispensable.

II. Risks for companies using social media

On the other hand, dealing with social media also involves risks. The internet never forgets, so negative statements or internal information that was not agreed on can only be retracted with difficulty. Further, the personal misconduct of an employee reflects on the company. Data security can also be a major problem, because employees use social media not only at work, but also privately, and sometimes do not effectively protect themselves against online attacks.⁴⁴⁰

Another problem is the loss of working time. If social media is permitted at work – even if enabled only for business purposes – it is hard to draw the line between

439 See: www.manpowergroup.com/wps/wcm/connect/3f1fa392-c7f8-4e77-94f6-090c88430307/Human+Age+2+Future+Forces+at+Work.pdf?MOD=AJPERES, 7 (last accessed on 1 April 2016).

440 See n432 above.

business and private use and even harder to monitor whether this line has been crossed. This, in turn, is due to data protection law, which has different scope from country to country. Under German law, for example, employers are not entitled to access private emails or postings without good cause. Also, the fundamental rights that are protected Europe-wide,⁴⁴¹ such as freedom to conduct a business (Article 16 of the Charter of Fundamental Rights of the European Union) and freedom of expression and information of the employer (Article 11 of the Charter of Fundamental Rights of the European Union), must be weighed against the employee's fundamental rights to protection of personal data (Article 8 of the Charter of Fundamental Rights of the European Union) and to respect for private and family life (Article 7 of the Charter of Fundamental Rights of the European Union). The more intimate the conversation, generally the higher the legal requirements regarding the purpose of the data elicitation by the employer. There must always be a specific reason for the data elicitation, because otherwise the relevant data protection regulations are violated.

Routine checks, without any reason, of statements (both private and professional) made by employee on social media platforms, are likely to be impermissible.⁴⁴² If, however, there are – like in the US – hardly any specific statutory data protection regulations, but only the guidelines companies impose on themselves, there is hardly any protection for employees from monitoring by their own employer.⁴⁴³ In such a country, control and the ensuing sanctions imposed by the employer will be generally permissible.

III. Internal guidelines for the use of social media

In order to achieve a balance between the foregoing interests of employers and employees in much of Europe, employers are required to regulate the use of social media, which is not specifically regulated by law, by unitary agreements. In this respect, the same rules apply to the use of social media as to the use of private email accounts and the internet for private purposes. In Europe, use of social media might be regulated uniformly by way of works agreements with the relevant competent employee representatives or in collective bargaining agreements with the relevant trade union.⁴⁴⁴ As an alternative, use of social media might be unilaterally specified by the employer (eg, by way of an internal policy).

Ultimately, private use at work can either be completely prohibited or be permitted to a certain extent or in general. Considering the individual companies in this context, European companies generally take a much more liberal stance than US companies. In US companies, the private use of Facebook, for example, is prohibited in approximately 70 per cent of cases, whereas a maximum of 40 per

441 See: www.europarl.europa.eu/charter/pdf/text_en.pdf (last accessed on 14 March 2016).

442 See n416 above, at s14 Margin No 37.

443 See: www.spiegel.de/netzwelt/netzpolitik/datenschutz-in-den-usa-und-europa-a-849114.html (last accessed on 28 January 2016).

444 See n438 above.

cent of employers in the Benelux countries deny their employees such use.⁴⁴⁵ This is different as far as the online and social media presence of the company is concerned. In this area, companies in the US are clearly more active than European companies. Of the 500 major US companies, 97 per cent have a LinkedIn account that is regularly updated. Moreover, the trend can be recognised that companies are blogging a little less, but the number of their fans is growing.⁴⁴⁶ The number of private users of social media is also higher than in Europe.

In Europe, the employer cannot obligate the individual employees to set up a Facebook profile for themselves because of their fundamental rights of informational self-determination and free development of their personality. This is not the case only where the employee works in the sales or public relations department and the platform in question is one that, like XING, is mainly used to foster business contacts and this is part of the employee's field of work as set out in their contract.⁴⁴⁷ In this case, however, the needs of the employee must be considered in the individual case; the employee is not obligated to make their personal data visible to everybody.

IV. Use of social media in private

Generally speaking, employers have little influence on the private use of social media profiles outside of working hours. Use cannot be prohibited in general, but can be restricted in some countries if there is a reference to work, the employee's position and if the employment relationship can be specifically impaired by the expected usage.⁴⁴⁸

The same generally applies to use outside the establishment. As a rule, neither the employer nor the parties to the works agreement are authorised to unilaterally regulate an employee's private sphere. However, this begs the question of what 'establishment' encompasses. For example, in much of Europe, the interpretation of 'establishment' does not necessarily have to be regarded in spatial terms, but can also be regarded in functional terms (ie, as a business operation). It follows that a reference to 'establishment' in a works agreement, might regulate the use of social media at the employee's home office if a connection with work exists.⁴⁴⁹ How to deal with customers and suppliers by means of social media can also be regulated in a works agreement, but probably not what private data the employee must provide in their social media profile and what data they need not provide.

445 See: www.absatzwirtschaft.de/deutsche-unternehmen-blockieren-social-media-anwendungen-seltener-als-us-amerikanische-16329 (last accessed on 28 January 2016).

446 See: www.umassd.edu/cmrsocialmediaresearch/2014fortune500andsocialmedia (last accessed on 28 January 2016).

447 See n416 above, s14 Margin No 51 ff.

448 Bissels, Lützel and Wisskirchen, 'Facebook, Twitter & Co: Das Web 2.0 als arbeitsrechtliches Problem' (2010) *Betriebsberater* 2,433 ff.

449 See n416 above, s14 Margin No 59.

V. Legal follow-up problems concerning social media

Like a breach of the compliance guidelines, a breach of the company policies regarding private use of the internet, social media and email can have far-reaching consequences for the individual employee. In addition to individual disciplinary measures, such as a (formal) warning, the employer can – depending on the severity of the breach – also issue a notice of dismissal or file a civil action for damage to reputation in response to the employee’s misconduct. Legal follow-up problems arise upon termination of employment. Can the employer demand that the exiting employee surrender or delete the profile? Is the employer entitled to view the content of the business correspondence and the collected customer data? Who is the intellectual owner of the collected data?

As is the case with the measures terminating the employment relationship, no universal statements can be made because individual principles are decisive in this area, depending on the country.

J. Bring Your Own Devices and Other Wearables in the Company

Technical innovations (eg, 'smart glasses', 'smart gloves' or 'GPS-supported wearable computer systems')⁴⁵⁰ lead to new possibilities concerning the performance of work, such as flexible working time and flexible working places. Therefore, the use of mobile devices anywhere and anytime is necessary. Cloud computing is the solution for this. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (eg, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.⁴⁵¹ With that technology, the use of the employees' mobile devices for operational purposes or the performance of home office work is relatively simple.

I. Opportunities

The advantages for employers and employees are obvious. In general, employers must have their employees work with materials that are suitable for professional use. In the digital age, laptops, smartphones and tablets are necessary to ensure that employees are constantly available. The employer has to pay for these mobile devices. Employees who are highly qualified with respect to technology, in particular, prefer to use their own devices and their preferred software instead of the companies' software and hardware. These devices can be individually configured, which increases the employees' productivity and leads to greater social acceptance. Moreover, carrying and using more than one mobile device – one personal and one for business – is annoying.⁴⁵²

The solution to improve the employers' image concerning the use of mobile devices might be quite simple: the employee can use their own devices for personal and business purposes ('bring your own devices'), and the employer saves the costs it would incur if it had to purchase these products, which are sometimes extremely high. Alternatively, the employee can choose their preferred device, and the employer buys it ('choose your own device').⁴⁵³

II. Legal problems

Although the use of 'bring your own devices' and the occupational use of other wearable devices might sound simple and the advantages for the employer and

450 See n161 above, 146.

451 See: <http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf> (last accessed on 13 May 2016).

452 See n288 above, 1025, 1030.

453 Wisskirchen and Schiller, 'Aktuelle Problemstellungen im Zusammenhang mit "Bring Your Own Device"' (2015) *Der Betrieb* 1163 ff.

the employee are significant at first sight, legal problems can arise. For example, data protection and employer liability issues. By connecting employees' own devices to the companies' network, the borderlines between personal data (eg, pictures of children or private meetings in an electronic diary) and company-related data (eg, business plans and business dates) become blurred. This can – depending on the data protection level – cause data protection problems for the employer.⁴⁵⁴ After all, the employer could unwittingly access the employees' private data.

On the other hand, other users of the employees' devices (eg, family or friends) could access company-related data or even business secrets. Using private wearable technical devices in the company can also be a risk for business secrets, even if the wearable device is set offline (eg, 'smart glasses'). As a rule, the employer should prohibit the use of personal wearable devices in the company because the employees' wearable devices cannot be monitored all the time.⁴⁵⁵ That is not the only risk for company-related data and business secrets. Normally, personal devices are more vulnerable when it comes to spy software than internal company networks.⁴⁵⁶ Another negative aspect for the employer can be the lack of legally enforceable control options (eg, preventing the use of company-related data after termination of the employment contract).⁴⁵⁷

However, liability issues can be problematical as well. Who is liable if the employee's device is stolen or damaged? Who is liable if the employee has no licences to use certain programs? Does the employer have to pay for the business use of the employee's devices? The reason for these questions is that the employer usually has to pay for the working materials, and if the employee uses their own devices, the risk shifts from the employer to the employee. A comparable problem is the use of a private car for business trips. In this case, the employer has to pay.

To solve these and other legal problems, internal policies for the use of the employees' own devices and the employers' smart devices or other individual regulations in the working contracts are necessary.⁴⁵⁸ In Europe, use is often regulated unitarily by way of works agreements with the relevant competent employee representatives.

454 *Ibid*, 1163, 1164.

455 See n161 above, 146, 148.

456 See n268 above, 2331, 2334.

457 See n416 above, s15 Margin No 27.

458 See n453 above, 1163, 1168.

K. Summary and Outlook

I. Artificial intelligence – risk or opportunity for the future of employment?

The question arises as to how to assess AI in the form of autonomous operating systems, production and auxiliary robots or self-driving cars from a labour law perspective.

1. Risks

For the staff of a company, AI will entail short-term disadvantages. In the low and medium qualification sectors primarily, several million jobs worldwide are under threat, and it is not at all certain that they can be regrouped to other areas. There may not be employment opportunities in other sectors for these employees because they lack sufficient training. Owing to the introduction of ever more new machines and intelligent IT systems, humans will become increasingly irrelevant for work processes. This may – like the feared shift into unemployment and the gap between rich and poor – lead to social conflicts.⁴⁵⁹ Even the most sophisticated system can make mistakes, whether these are inherent in the system itself or are caused by the performance of humans.

Creative solutions from employee representatives, national lawmakers and companies are required in order to manage the problems that will arise. For instance, the Italian Sharing Economy Act is a potential way to solve the new labour market's problems. A threshold of €10,000 per year will be fixed with a lower taxation rate of ten per cent.⁴⁶⁰ On the other hand, such new legal frameworks will create new jurisprudential questions, for example, concerning the distinction between a platform and real business or the definition of certain criteria to distinguish between 'on-demand workers' and 'traditional workers' in the service sector.⁴⁶¹

2. Opportunities

At the same time, AI opens new opportunities for companies and individuals. Humans are adaptable and will create new jobs.⁴⁶² The use of intelligent IT systems helps decrease the time required for the product or

459 See: www.faz.net/aktuell/beruf-chance/arbeitswelt/roboter-und-computer-als-chef-in-zukunft-14166415.html (last accessed on 8 April 2016).

460 See n27 above, 20.

461 *Ibid.*

462 See: www.faz.net/aktuell/wirtschaft/fuehrung-und-digitalisierung-mein-chef-der-roboter-14165244.html (last accessed on 8 April 2016).

the service, and the associated costs as well. The time saved, especially for dangerous work, can be used by human beings for other work or for leisure. AI should thus result in a growth of prosperity. This applies especially to high-wage countries where it is possible to produce at lower cost owing to production robots.⁴⁶³

Moreover, technical developments will lead to a situation in which older employees and employees with disabilities can be better integrated; while machines can perform dangerous work. Despite occasional gloomy forecasts, it can be expected that the greater part of jobs will be shifted to a different area of work.⁴⁶⁴ The new job models that will become common as a result of AI, digitalisation and the global integration of workers will be a chance for the younger generation to have more free time and to create an individual working atmosphere. Even if some of these new jobs (eg, crowdworking or some sharing-economy jobs) will mean a loss of tax revenue and social security, they will at least help to avoid unemployment.⁴⁶⁵

While in the past humans participated actively in production, they will now supervise it. In this sector, AI is thus to be considered an enhancement of the technical opportunities. The humans who become superfluous will make greater use of their time to develop and perform innovative services. They can focus solely on their core competence, this has meant adapting to the environment and learning.

II. Outlook

In the past, a major part of the population initially worked in the primary sector (production of raw materials, such as agriculture and mining). In the course of the first industrial revolution, this trend changed to the effect that a major part of the working population shifted to the secondary sector (manufacturing). From the World Wars until today, however, a trend towards the tertiary (service) sector has been observed. Today, for instance, 70 per cent of employees work in this sector.⁴⁶⁶ Some of the opinions expressed by authors mention fourth and fifth sectors. These sectors are supposed to include services requiring high intellectual standards or concerning recycling. Other authors subsume all information services under these sectors. It seems useful to retain the traditional division into three sectors, because however complex a service and research may be, it is still a service that is an activity in which a human uses their individual efforts to render a service for someone else.

463 See n12 above, 15.

464 See n268 above, 2 ff.

465 See n179 above, 10.

466 See: www.bpb.de/nachschlagen/zahlen-und-fakten/soziale-situation-in-deutschland/61694/erwerbstaetige-nach-wirtschaftszweigen (last accessed on 8 November 2016).

The question arises as to what sector these jobs can be shifted since automation and digitalisation jobs are being eliminated not only in the production sector but also in the service sector, as shown above. Therefore, the only alternative would appear to be the unemployment or targeted training of the affected individuals within the tertiary sector.⁴⁶⁷ Training is likely to make sense only in the area of IT. Not only employees, but also companies that have to date had little to do with IT and data processing in the form of big data will have to adapt to the technical innovations to remain competitive. The new labour market is rapidly approaching. Only the seller who first discovers, develops or even brings the new service model to the market will earn big profits.⁴⁶⁸ Moreover, because of the rapid technical development, the new and profitable services will become outdated very quickly as well. They will be replaced by other services, which will be based on the more developed services, and creative solutions will be found to serve the needs of the customers that are not served by the older service.

The situation of the global labour market should not be overdramatised, however. Keynes, the well-known economist, predicted a similar development of the labour market before the 'second industrial revolution' in 1930, for example. It has up to now always been possible to counterbalance the great wave of unemployment, despite crises and wars and a 'third industrial revolution', which has already passed, through new fields of work and the surplus of the production profits.⁴⁶⁹ As long as the rise of productivity, initiated by the introduction of AI and robotics, leads to a growth in orders and profit, employees will not be dismissed. For many employers, a smart factory without human employees is not an alternative.⁴⁷⁰

Experts disagree on when the fundamental effects of Industry 4.0 will become visible. Some economists expect appreciable changes within the next five years, while others emphasise that the phenomenon Industry 4.0 will be widespread only in 20 to 30 years. However, the technical change is already visible today. An example of this phenomenon is robots that are able to handle customers' complaints by talking to them on the telephone.⁴⁷¹ This requires – like simultaneous translation – a certain degree of intelligence.

An individual examination of the relevant sector, country and region will be necessary to make more precise statements.⁴⁷² The degree of automation in production, for example, in the automotive industry, the chemical industry or agriculture, is well advanced, whereas production in the clothing sector is still outsourced to low labour cost countries and is trailing far behind with regard to

467 See: www.bloomberg.com/news/videos/2016-05-20/forward-thinking-march-of-the-machines (last accessed on 2 November 2016).

468 See: <http://bundestag.at/2015/wp-content/uploads/2015/09/kollmann-digital-leadership.pdf> (last accessed on 28 September 2016).

469 See: www.heise.de/newsticker/meldung/Weltwirtschaftsforum-Roboter-und-Automatisierung-fuehren-zu-millionenfachem-Jobschwund-3074138.html (last accessed on 12 February 2016).

470 See n5 above.

471 *Ibid*, 10 ff.

472 Südekum, 'Die Gewinner und Verlierer der Globalisierung' (18 April 2016) *Frankfurter Allgemeine Zeitung* 18 ff.

automation. In the service sector, the IT, media, finance and insurance sectors are particularly well digitised, whereas the catering, construction and nursing sectors in the US are lagging behind.⁴⁷³ Different countries have different focuses with regard to research in the field of robotics. In the US, for example, research is being done mainly in the field of space robotics technology; in Japan in humanoid robots; and in Germany, the focus is on assembly robots.⁴⁷⁴ Depending on the sector, digitalisation and automation are considered a creeping process that has already started.

It is clear that both blue and white-collar sectors will be affected by a potential loss of jobs⁴⁷⁵ and that the digitalisation (and automation) of services is a global phenomenon. This phenomenon, however, is a far-reaching and diversified field of advisory services, particularly with regard to labour law. It would be desirable for the future laws, which will hopefully be secured at the international level by uniform standards, to be geared to the technological developments and the increased need for flexibility.

473 n60 above.

474 See n23 above, 9.

475 See: www.pewinternet.org/2016/03/10/public-predictions-for-the-future-of-workforce-automation, 5 (last accessed on 30 March 2016).

