EUnited Robotics
European Engineering Industries Association

Good Work Charter

of the European Robotics Industry

Preamble

Why this charter?
Robotics and automation technology give us countless opportunities for enabling good work and great job satisfaction on all levels. At the same time, the pace of change – driven by digitalization, globalization, ageing societies, and new business models – is increasing. To secure the benefits of these inspiring technologies, we need to actively manage the transition. The future of work is now.

Change is inevitable and an opportunity if actively shaped – without delay. To do this, the European robotics industry has developed this Good Work Charter. It identifies 10 major focus areas that need to be addressed. This will require a joint effort and should be seen as work in progress. With the Charter, the European robotics industry promotes and shapes the good work of the future and engages in an open dialogue with all stakeholders. It applies to manufacturers and developers of robotic systems as well as their users, i.e. the entire robotics community. It applies to robots used inside factories (industrial robots) and outside factories (professional service robots). In addition, it seeks to open a discussion with EU institutions, government authorities, schools and the education system, trade unions, international organizations, think tanks, research institutes, and the financial sector. Special attention is given to young people making educational and career choices.

Getting the facts straight
The public debate to date has largely focused on robotics and automation leading to job losses, although this has not materialized. Experience over the last two decades - as well as current research - suggests that fears of massive unemployment caused by automation are unfounded. In fact, for decades, automation and robotics have had significant positive impact on jobs. The current new wave of automation and its technologies, such as human-robot collaboration, assistance systems, wearables and AI, will accelerate this journey towards an improved quality of work. The main challenge is to manage this transition well as some jobs change, some jobs are lost, and others are newly created.

The question is, how we can ensure workers acquire the skills needed on the labour market. We need to develop strategies for reskilling people to help them adapt to a rapidly changing work environment. Life-long learning must become the new normal.

The European robotics sector will support robotics projects in schools, inspiring young people to focus on STEM subjects. We also understand that making robotics and automation technologies easy to use and more accessible to workers will play an important role in facilitating the transition process. Lastly, we see the increased use of robotics as key for prosperity and high living standards.

Content

10 Focus Areas to Shape the Future of Work

1

Working like Humans, Not like Machines

"In our work environment robots perform tasks that pose a high risk of injury to humans. With the robots, productivity has gone up and sick days have fallen. Work at the hot smelting furnaces was especially hard: each worker had to shift several tons of aluminium ingots per shift. Now we operate robots. They have not taken our jobs, but brought us great relief at work."

Janez Rupnik
LTH Castings, Slovenia

2

Humans in Command!

"The technical vision of an attractive working world is only possible with actively engaged individuals at the core. Only in this way can human and robot become a team."

Jörg Hofmann
President of IG Metall, Industrial Union of Metalworkers (Germany) and IndustriALL Global Union

3

Development of Skills

"We cannot predict the future, but we can prepare for a future that is increasingly unpredictable. Metaskills – the softer skills which are inherently human – are going to be key. Things like creativity, adaptability, empathy, collaborative working and critical thinking will never be replaced by robots."

Claire Gillespie
Digital Technologies Skills Manager at Skills Development Scotland

4

Inspire Young People for STEM

"With my robot activities, I've gained firsthand coding experience. It is great fun to design and build a robot with my team that performs tasks reliably and by itself on a playing field. Physics, math, computer science and engineering all come together in robotics – I like that a lot!"

Adriana
12 year-old junior high school student from Heidelberg, Germany

5

Inclusion and Participation

„All technologies, and in particular those that are data-driven, have the potential to project past inequalities into the future. It is therefore essential that the principles of inclusion and equality are built into the design and deployment of workplace technologies from the beginning."

Anna Thomas
Institute for the Future of Work (IFOW), UK

6

Creating Opportunities

„In my work environment I could see what a decisive role automation and robots play for safeguarding the competitiveness of industry. I realized this early on: learning how to program and operate robots has given my professional development a real boost."

Sascha Borm
Eberspächer Exhaust Technology GmbH, Global Manufacturing Engineering, Robotic Process Development

7

Human-Robot Collaboration and Fusion Skills

"Today's challenges must be met and overcome with innovations, particularly those that augment human capabilities and capacity. Human and machine collaboration is more critical than ever for organizations seeking to lead their industries."

Paul Daugherty
Group Chief Executive – Technology and CTO of Accenture, author of „Human + Machine"

8

Ease of Use

„When I had the opportunity to steer Lio (assistant robot) with the remote control on the mobile phone, I realized that this sort of intelligence is able to make everyday life easier for me. Used and developed carefully and wisely, that kind of technology has the potential to be of great benefit for future generations."

Philippe Amann
Young office worker with physical support needs

9

Sustainability

"Robotics and automation has helped to make photovoltaic the lowest cost energy source for a CO2-free electricity production over the past years."

Dr. Jutta Trube
Coordinator of ITRPV (International Technology Roadmap for Photovoltaic)

10

Tackling Demographic Change

"The retirement of the baby boomers and low birth rates will be affecting the labour force throughout Europe over the next 20 to 40 years. This unprecedented demographic change offers the opportunity to combine automation, job security, Good Work and prosperity in the context of global competition and digitization."

Dr. Cornelius Markert
Executive Director IGZA (Institute for the History and Future of Work), Germany

Executive Summary

In this Good Work Charter, the European robotics industry presents its vision of good work of the future and identifies 10 focus areas where action is needed now. The Charter applies to manufacturers and developers of robotic systems as well as their users, i.e. the entire robotics community. It applies to robots used inside factories (industrial robots) and outside factories (professional service robots). It seeks to open a dialogue with all stakeholders, including government authorities, European institutions, the education system, trade unions, international organizations, think tanks, research institutes and the financial sector. Robotics and automation technology provide countless opportunities for improving work. At the same time, digitalization, globalization, ageing societies, and new business models bring rapid change to the world of work: a transition that needs to be actively shaped and must put the human in the center.

Experience over the last two decades - as well as current research – suggests that fears of massive unemployment caused by automation are unfounded[1]. In fact, for decades, automation and robotics have had a significant positive impact on jobs.

The current new wave of automation and its technologies - such as human-robot collaboration, assistance systems, wearables and AI - can accelerate this journey towards an improved quality of work. The main challenge is to manage the transition well – making sure that people are not left behind – as some jobs change, some jobs are lost, and others are newly created.

Focus 1: Working like Humans, Not like Machines
Robots are very good for performing so-called “4D” jobs: tasks that are dull, dirty, dangerous or delicate. By doing so, they can relieve us of work that is not well suited for human nature. We need to further promote quality of and dignity in work - by making sure that people work like humans, not like machines and by leaving the dull and low-interaction work to the robots, which are able to do it 24/7.

Focus 2: Humans in Command!
As robots and humans interact more closely, the fundamental question is whether the robot will serve the worker, or the worker will serve the robot. Very clearly, robots must assist humans, not the other way around. The European robotics industry therefore advocates a “human-in-command approach” for the design of good, safe workplaces.

Focus 3: Development of Skills
The pace of technological change has left us with a skills gap. We must ensure that workers will be able to upskill to perform higher quality tasks. Advanced automation technology crucially depends on skilled human workers to operate it. Additional efforts are needed for continuous skills development – especially on-the-job.

Focus 4: Inspire Young People for STEM
We need engineers to tackle the challenges of the future, but not enough young people decide to go into STEM subjects (Science, Technology, Engineering, Maths). To change this, the European robotics industry will step up initiatives promoting STEM subjects among young people. The robotics sector is in a unique position to do so, as the robot is an iconic, relatable and fascinating piece of technology - ideally suited to spark interest in technology – in both girls and boys alike.

Focus 5: Inclusion and Participation
The increased use of robotics must lead to inclusion, not exclusion. Companies have been successful at including workers in the development of production systems and the improvement of working environments – drawing on their unique experience and creativity. Assistive robots (cobots) can help older workers to stay in their jobs longer by relieving them from strenuous tasks. Further examples include exoskeletons enabling paralyzed individuals to stand up from their wheelchair and walk again and the use of collaborative robots to ensure people with disabilities can work productively and side by side with able-bodied workers.

Focus 6: Creating Opportunities
As robots are getting easier to use and can even be programmed intuitively, the technology becomes much more accessible. A domain formerly reserved for a few highly skilled technical experts, now provides opportunities for everybody to start developing their robotics skills and professional perspectives. Thus, workers have more opportunities to take active roles and perform more advanced tasks. What's more, the new generation of robots provides numerous possibilities, especially for SMEs, to introduce new business models – also in the service sector.

Focus 7: Human-Robot Collaboration and Fusion Skills
Humans team up and interact ever-more closely with technology. This will fundamentally reshape work, rather than eliminate it. Robotics, automation, assistance systems and artificial intelligence allow us to completely reimagine processes, taking advantage of the complementary strengths of people and machines. In this way, humans must augment machines and machines must augment humans leading to vastly improved results.

Focus 8: Ease of Use
The robotics industry is working to further simplify the use of robots. This is democratizing robots making the technology accessible to all skill levels. We can lower the barriers for employees to start working with robots by providing intuitive communication, operating and programming interfaces.

Focus 9: Sustainability
The world's population is growing rapidly – therefore it is necessary to use resources efficiently. Intelligently automated production can make a decisive contribution to minimizing our consumption of energy and natural resources – moving towards a carbon-neutral economy. Flexible robotic systems pave the way for producing goods close to the customer.

Focus 10: Tackling Demographic Change
In most developed economies, low birth rates and the impending retirement of baby boomers will lead to massive shortages of labour in the next 10 to 20 years. This potentially limits GDP growth and therefore future prosperity. Increasing the use of robotics and automation can help solve the problem.

[1] Researchers Gregory, Salomons and Zierahn looked at automation impact on jobs in Europe and found that while automation displaces jobs, "it has simultaneously created new jobs through increased product demand, outweighing displacement effects and resulting in net employment growth." Terry Gregory, Anna Solomons, Ulrich Zierahn, CESifo Working Paper 7247: Racing With or Against the Machine? Evidence from Europe, page 1, September 2018

Outlook: Prosperity for Europeans
Robots increase productivity and competitiveness. In doing so, they strengthen the manufacturing and service sectors: a solid basis for a sound economy, high quality jobs and a prosperous and inclusive society. Growing GDP and labour productivity are prerequisites for rising incomes and a higher standard of living for society as a whole. The European robotics industry is therefore guided by the goals described in this Charter to provide advanced technologies for economic success, sustainable development and favourable working conditions.

Join our journey to create a human-centric future of work - by endorsing our Charter - starting today!

Contact us at:
robotics@eu-nited.net

About EUnited Robotics
EUnited Robotics is a sector of EUnited AISBL, the European Engineering Industries Association, and the voice of the European robotics industry. Our members are robot manufacturers, component suppliers, and system integrators creating a network of industry leaders. We aim to develop, advocate, and communicate topics of industrial relevance in order to support and strengthen global competitiveness of the European robotics sector. Moreover, we strive to raise awareness of robotics and related technologies among media and the public. EUnited Robotics communicates industry's perspective on relevant EU policies and funding issues. It also serves as liaison between industry decision-makers and the European Commission.

Robotics – a definition
In today's public debate, the term "robot" may mean anything from chatbots to driverless cars. In contrast, EUnited Robotics applies a narrower definition.

For us, the term generally refers to physical (or "embodied") devices that can be programmed to perform a variety of tasks, with some level of interaction with the environment, in an automated way.

Industrial robots are made for use in industrial automation applications, such as spot welding in car factories or for picking and placing workpieces.

Service robots perform tasks predominantly outside the scope of manufacturing applications. Service robots for personal use are aimed at non-commercial tasks (e.g. robotic vacuum cleaners for household use). Professional service robots are used for commercial tasks, such as delivery robots in hospitals, milking robots, surgical robots or fire-fighting robots. While remotely operated – or even autonomous - weapons are sometimes referred to as "robots" (e.g. armed drones), EUnited Robotics classifies them not as robots but as weapons. By contrast, disaster fighting robots, defusing robots and demining robots are included in the category of professional service robots.

It should be noted that the lines between industrial and professional service robots are getting increasingly blurred: Industrial robots can be used in professional service robot applications and service robots can perform important tasks in factories (e.g. professional cleaning systems and logistics robots).

The term robotics and automation is defined more widely, including further ***automation technologies, such as vision*** technology, assembly machines, automated handling devices and the necessary sensor, control and information technology.

This Good Work Charter refers to the use of industrial robots, professional service robots and related automation technologies.


UNITED COLORS OF BENETTON

1

Working like Humans, Not like Machines

Robots are very good for performing so-called “4D” jobs: tasks that are dull, dirty, dangerous or delicate. By doing so, they relieve us of work that is not well-suited to human nature. The emergence of industrial robotics since the 1970s has already freed workers from carrying out many of the dull, repetitive and low-interaction jobs. But we can further promote quality of and dignity in work - by making sure that people work like humans, not like machines. By leaving the dull, dirty, dangerous and delicate work to the robots, which are able to do it 24/7.

Regardless of the rapid advances in robotics and AI, people will not be outperformed by these technologies. Humans possess unique capabilities such as dexterity, flexibility, judgment, decision making, critical thinking, creativity, emotional intelligence and problem solving. Jobs performed by humans should draw on these capabilities.

By contrast, robots should be used for tasks that require no thought, little variation and high output, i.e. the necessary, but essentially dull, tasks. Robots are ideally suited to work in environments that are dirty, unsanitary or simply unpleasant. When jobs are hazardous, robots are certainly the best choice (e.g. for the inspection of oil platforms or defusing bombs). When job satisfaction and human dignity in the workplace are values to be held high, robots are a major tool to do so. A tool to be deployed in a human-centric way.

The European robotics industry will:

- Provide robotics solutions that relieve humans of dull, dirty, dangerous or delicate tasks.
- Provide hybrid solutions, in which people predominantly take on “human tasks” and robots predominantly take on “machine tasks”.
- Strive to develop technology that ensures the safety, quality and dignity in human work whilst bringing job satisfaction, human health and well-being to a new level.
- Respect privacy of employees especially in the design and deployment of systems that gather data.

Ideal work for humans	Ideal work for machines
Requiring dexterity	Requiring repeatability
High variance	High output with great precision
Requiring judgment/common sense	Can be programmed/standardized
High interaction	Low interaction
Creativity is of use	Results stay reliably within set parameters
In clean and healthy environments	In both clean as well as dirty/ hazardous environments

2

Humans in Command!

As robots and humans interact more closely, the question is often raised whether the robot will serve the worker, or the worker will serve the robot. Very clearly, robots and related technologies must assist humans, not the other way around. The European robotics industry therefore wholeheartedly advocates a "human-in-command" approach for the design of good, safe workplaces.

To create automation systems in which the human worker is reduced to following a set of narrowly defined instructions given by the robot would be a lost opportunity to make use of uniquely valuable human capabilities.

It is therefore the robot that needs to assist the worker, e.g. by bearing heavy weights, adding precision or taking over auxiliary tasks. Assistance systems (with or without robots) can relieve workers from stress, take over unergonomic tasks and increase the worker's productivity while reducing errors. Good assistance systems should be user-centric, upgrade jobs and ideally empower the users to perform higher-level tasks.

The European robotics industry will:

- Follow a human-in-command approach when designing robotics solutions in which the robots and humans interact, ensuring that the robot acts as an assistant to the human worker.
- Take this approach into account when integrating other technologies into the robotic solution, especially digital assistance systems, augmented/mixed reality, and AI technology.
- Defend this key principle in public discussions on ELSE[2] issues

[2] ELSE stands for ethical, legal and socio-economic factors.

3

Development of Skills

We are living in times of ever faster transformation, yet already face a growing “skills gap“. As the pace of change accelerates, we must intensify skills development and manage the transition towards real lifelong learning. This is necessary to ensure that workers will upskill as well as reskill to perform higher quality tasks and to allow for the deployment of advanced automation technology which relies on a dynamic workforce.

Skills development may be the most crucial task ahead of us. As the pace of technological and organizational change is increasing, more agility in skills development and faster adaptation to new requirements is needed. Current research suggests that the number of jobs created and the number of jobs lost is in balance (or even positive), leading to a stable level of employment. This is the good news.

But even if net employment is stable or even positive, a significant number of employees will be affected by the deployment of advanced technology, redesigned processes, automation of tasks and other disruptions.
As the pace of change increases, training and learning new skills must accelerate by the same measure. This necessity stems from different sources:

- More than ever, modern automation requires “humans to stay in the loop“ and to interact more closely with technology (some experts predicting the emergence of „fusion skills“ described in Focus 7). Without the necessary skilled labour force, the technology cannot live up to its full potential. A recent study[3] by the McKinsey Global Institute concludes “that the total number of jobs related to developing and deploying new technologies, i.e. automation-, IT-/AI-, and robotics-related applications, may grow to 20 to 50 million globally by 2030 - and that as many as 375 million workers globally will have to master fresh skills as their current jobs evolve alongside the rise of automation, robotics, AI, and the capable machines thereby enabled“.

- Some disruptions risk leaving workers behind while at the same time there is a general scarcity of skilled labour. The only reasonable solution will be to provide opportunities for the employees to acquire new skills that allow them to adapt to a changing environment and to further develop their qualifications, job security, and job satisfaction.

[3] Industrial robotics – Insights into the sector’s future growth dynamics, McKinsey & Company, July 2019, page 27.

Therefore, a new “learning culture“ (especially on-the-job) must be developed enabling people to upskill to higher quality jobs. Increasing the number of training hours alone will not be enough: a mental shift is required by employees and employers alike embracing the opportunities of continuous skills development. E-learning and distance learning provide good additional options to assist learning in a flexible way. The robotics sector also recognizes its responsibility: by developing technology that is easy to use and pleasant to work with and by developing training material, courses and facilities that truly empower workers, including those who believe they are too old or too far behind to learn completely new things.

The European robotics industry will:

- Foster robotics-related (re-)training and upskilling at a large scale by developing training materials and by offering a wide range of further training in academies operated by the robotics industry, including basic training in robot safety (“robot driver’s license”).

- Make robotics more accessible by increasing its user-friendliness.

- Explore new approaches for a closer collaboration between humans and robots, fusion skills and intuitive robot use through increased research and development.

- Raise end user’s awareness of the current and future scope of skills shortages and provide assistance to counteract the growing skills gap.

- Contribute to spreading a new learning culture that highlights opportunities for workers and employees at all levels.

New Collar Workers: Let's make the digital era an inclusive era!

"The future of work is one of the most urgent questions of the Fourth Industrial Revolution. Some jobs will go away, new ones will be created, and all jobs will be forever changed by emerging technologies and the advancement of artificial intelligence and robotics. While IBM and others are creating 16 million more highly skilled jobs by 2024 globally, we are challenged to find workers with the right technology skills to fill them. Many of these jobs do not necessarily require a four-year degree. We must ensure workers have the right mix of in-demand professional and technical skill sets for these "New Collar" jobs. Those skills can be learned through 21st century vocational training, innovative public education programs like P-TECH, which IBM pioneered, coding camps, professional certification programs and apprenticeships. P-TECH currently has 150,000 students in its pipeline and is present in 24 countries, including Ireland, the UK, France, Czech Republic, Italy and Poland. Students graduate with a no-cost associate degree in applied science, engineering, computers or other competitive STEM disciplines, along with the skills and knowledge they need to continue their studies or step easily into high-growth, "New Collar" jobs."

Martin Jetter, Senior Vice President and Chairman IBM Europe

4

Inspire Young People for STEM

We need to ensure that there are sufficient engineers to tackle the challenges of the future, but not enough young people decide to go into STEM subjects (Science, Technology, Engineering, Maths). To change this, the European robotics industry commits itself to step up initiatives promoting STEM subjects among young people. The robotics sector is in a unique position to do so, as the robot is an iconic, relatable and fascinating piece of technology - ideally suited to spark interest in technology.

Technology is key for tackling some of the biggest challenges humankind is facing. To provide for a rapidly growing population while preserving our planet's health is the biggest job ahead of us in the decades to come. To do it, we need engineers and scientists to come up with new and ingenious solutions. Unfortunately, the world is experiencing a skills gap in the workforce.

As automation and other advanced technologies are becoming more and more engrained in our workplaces and daily lives, we are running out of people that are equipped with the much-needed STEM skills: knowledge in Science, Technology, Engineering and Maths. To put it bluntly: If we do not succeed in inspiring more young people – especially girls - to choose education and careers in STEM subjects, we will be in trouble. We need scientists and engineers to build the future and we need a workforce that is equipped with STEM capabilities to effectively use and apply advanced technology. Such a workforce is also indispensable to ensure the competitiveness of the European economy and safeguard Europe's technological leadership.

The European robotics industry is therefore committed to stepping up efforts in inspiring young people to go for STEM subjects and careers. Engineers are aware that their profession is a deeply creative one as they "create" every day. Young people, by contrast, are less aware that engineering could be on top of a list of attractive creative jobs,

and therefore dismiss (or overlook) STEM career paths for themselves. This is where the robotics industry has a unique opportunity: At its core is the robot - an iconic, fascinating and universally applicable technology. It is technology we can all relate to because of its "anthropomorphic", or „human-resembling" traits: the robot gripper is easily associated with a human hand, an articulated robot comes across as something like a human arm. It is easy to see and understand what a robot is doing. This puts the robotics industry in a special position when it comes to STEM initiatives. It is the robotics industry that holds the very key to sparking an interest in technology – in both girls and boys alike. This also comes with the responsibility of putting robots to work not only in factories but in schools and other places where an interest in science and technology can be ignited.

Technology as a school subject

In addition to promoting robot projects in schools, the European robotics industry strongly advocates the introduction of "Technology" as a school subject across Europe. Europe's prosperity depends on a strong industrial core, digitalization will further accelerate technological progress, and global competition is increasing. Therefore, Technology should become a compulsory school subject.[4]

The European robotics industry will:

- Sponsor and coach robotics project groups in schools, including robotics challenges and collaborate with organisations promoting STEM education.
- Develop educational robots and robotics kits for schools. These educational robots should be attractive for children and fun to play and experiment with.
- Exchange best practices for promoting STEM subjects through robotics within the European Association EUnited.
- Cooperate with other stakeholders and organizations active in the promotion of STEM education for young people (e.g. Roberta, First Lego League, Smart Green Island Makeathon).
- Organise events and offer internships for young people in robot companies/factories.
- Collaborate with social media influencers to spark interest in technology.
- Seek active dialogue with authorities of the education system on regional, national, European and international level.

[4] A recent study by the VDMA in Germany analysed the curricula of schools in the 16 federal states of Germany and concluded that in all 16 states "the vast majority of young people can complete their schooling without ever coming into contact with a proven technical education." Technikunterricht in Deutschland, VDMA Bildung, September 2019.

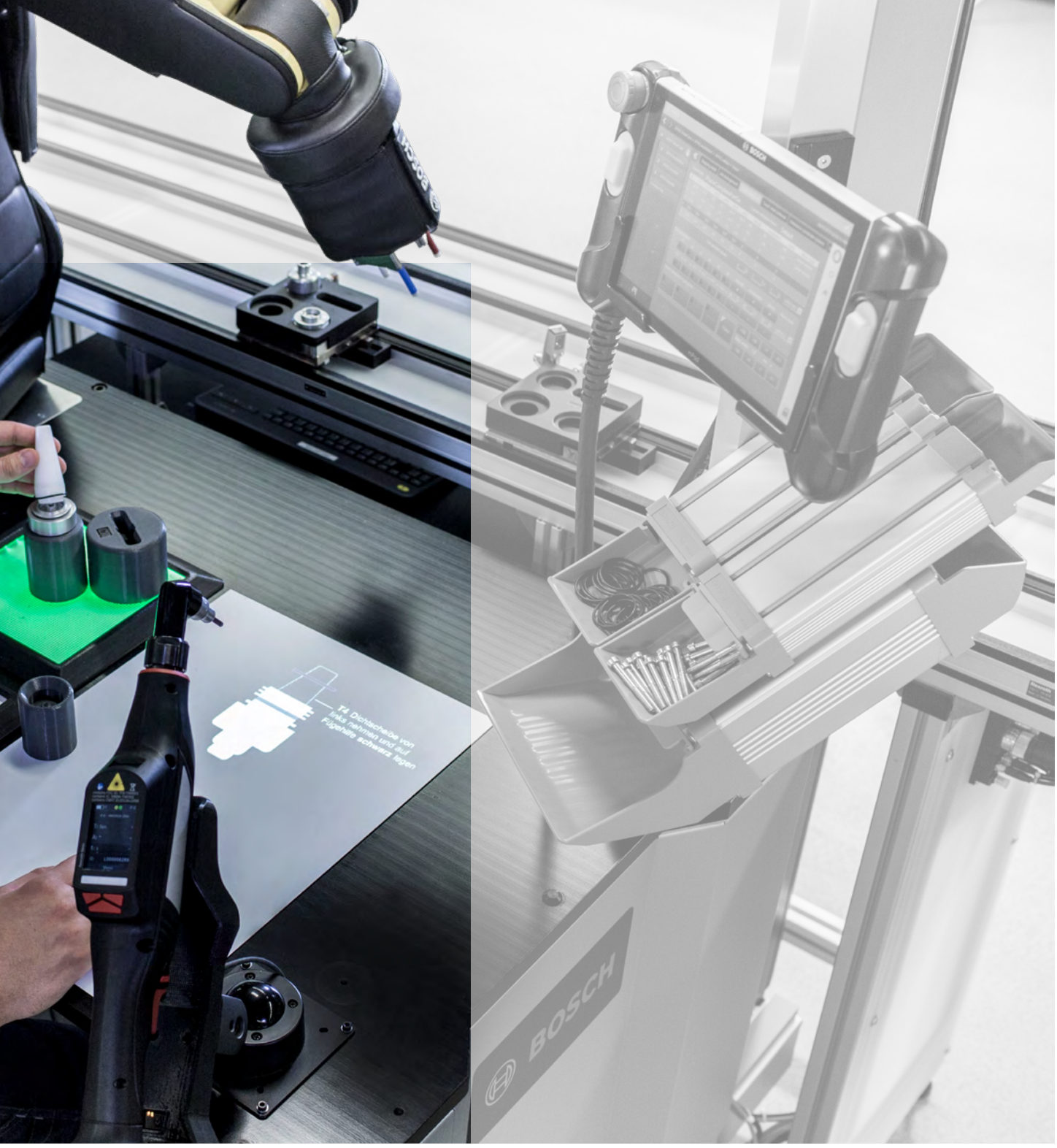
5

Inclusion and Participation

Robotics and automation has the potential to empower employees at all levels. Yet the OECD concludes that "training participation is lowest among those who need training the most, including the low-skilled, older adults"[5]. This is a lost opportunity and must be changed. But increasing inclusion and participation does not stop there.

Companies have been successful in including workers in the development of production systems and the improvement of work environments[6]. The people that do the job and work with automation tools often give the most valuable input – when asked!

[5] The Future of Work, OECD Employment Outlook 2019, page 20.
[6] For example, at its plant in Regensburg , the BMW Group has set up a so-called Innolab, where the employees contribute their ideas for process improvement and have them developed together with the experts on site. Source: "Wie BMW Industrie 4.0 mit den Mitarbeitern entwickelt", Produktion, 28 May 2019.



Assistive robots (cobots) can enable older workers to stay in their jobs longer. With a demographic shift threatening to hit many developed economies (see also: Focus 10 - Tackling Demographic Change), it is imperative to keep the workforce active and healthy in ergonomically favourable environments. Collaborative robotics can make a substantial contribution to this end. Exoskeletons such as ReWalk are allowing paralyzed individuals to stand up from their wheelchairs and walk again. The project AQUIAS[7] explores the use of collaborative robots to ensure people with disabilities can work productively and side by side with able-bodied workers. When it comes to inclusion, robotics has more to offer than is immediately apparent!

The European robotics industry will:

- Promote inclusion by providing training for empowering employees at all levels to operate, program or collaborate with robots.
- Place emphasis on developing user-centric automation systems, ideally involving users in their development and/or deployment.
- Provide automation solutions, especially collaborative/ assistive robotics, to enable workers to stay healthy and perform challenging tasks, safely, also at a higher age.
- Develop robotics technology for use in rehabilitation, enabling people to overcome the effects of physical disabilities.

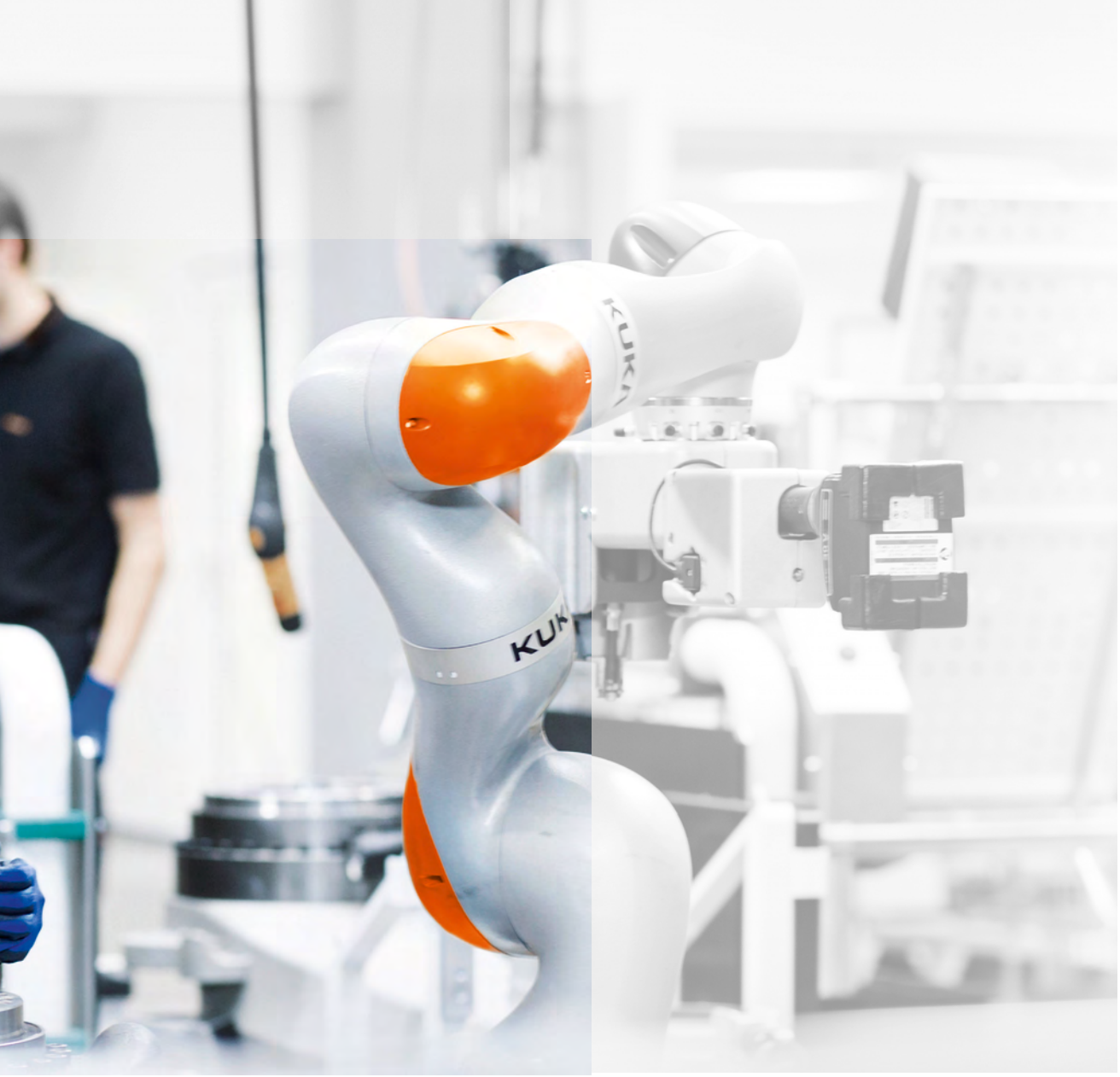
[7] www.aquias.de

6

Creating Opportunities

The introduction of robots and automation technologies can offer great opportunities for employees at all levels. As robots are getting easier to use and can even be programmed intuitively, the technology becomes much more accessible. Workers who embrace the technology and develop their robotics skills improve their professional perspectives. In addition to robots, other related technologies also enable workers to move on to perform more highly qualified tasks.

The concepts of Industry 4.0 (I4.0) and the Industrial Internet of Things (IIoT) define the smart factory of the future, in which all machines and automation devices are interconnected and directly communicate with each other. At the same time, the proponents of this new manufacturing paradigm postulate that people will be at the core of this new digital world. This raises several questions: How can “analog people” play a central part in such a “digital environment”? How are the roles of humans and machines distributed? What interfaces are there connecting humans to their digital surroundings in the smart factory?



The answer lies in new technologies that hold the promise to upgrade human work:

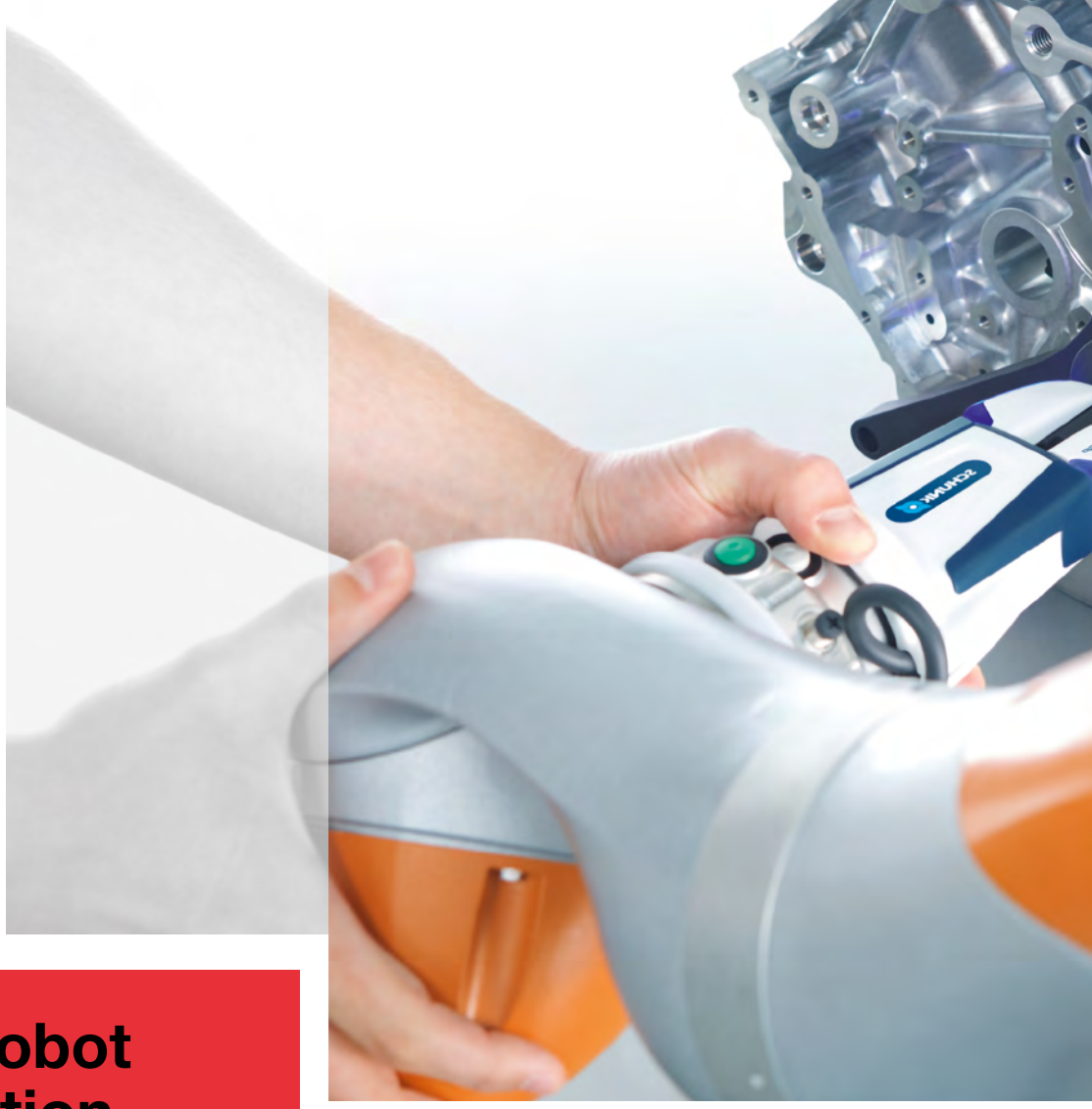
- Digital assistance systems combine the best of both worlds. Human dexterity, adaptiveness and judgment are combined with automated quality assurance and guidance. This approach also qualifies manual assembly to achieve true zero-defect quality for the first time.
- Intuitive interaction with machines replaces complicated operating instructions and advanced programming skills.
- Virtual, mixed and augmented reality, based on tablets and data glasses, enable workers to perform complex and highly qualified maintenance tasks.
- Humans and robots collaborate directly and safely, without protective barriers (see Focus 7).
- Wearables such as data gloves and smart wristbands assist workers and link them with the digital systems on the shop floor.
- Gamification uses the strategy of playfulness and computer games to engage workers in complex problem solving and optimization tasks.
- Handhelds are becoming universal communication, control and learning tools for workers on the shop floor. They can use these tools to maintain high productivity and quality levels, to perform troubleshooting tasks and to optimize processes.

What's more, the new generation of robots provides numerous possibilities also for companies to increase their flexibility and create new business models. Especially small and medium sized enterprises (SMEs) can seize new opportunities – in manufacturing as well as in the service sector.

The European robotics industry will:

- Develop automation systems and human-machine interfaces which promote workers having active roles and which upgrade lower-skilled employees to perform higher-skilled tasks.

7



Human-Robot Collaboration and Fusion Skills

Today's technology is closer to us than ever before allowing us to do new things in new ways. It has become an essential part of our everyday life. Our interaction with our smart devices has become second nature. This has not only fundamentally changed the way we live, it is also reshaping the way we work. Some experts even predict that this new closeness of humans and machines will give rise to a completely new class of „fusion skills".

With their lightning-fast movements, robots are extremely efficient. Traditionally, they work behind protective barriers, keeping the people in the factory safe from the steel arms' fast movements. The approach is a simple and effective one: the world of the robot and the world of the worker are kept apart. But robotics has now opened a new chapter: robots that work directly together with the worker in a shared workplace are now being installed. The robot becomes a "cobot" – a robotic co-worker or assistant (see illustration). New safety technology makes this direct human-robot collaboration (HRC) possible – without the need for safety fences. Sophisticated sensors give the robot the senses and perception it needs to act safely.

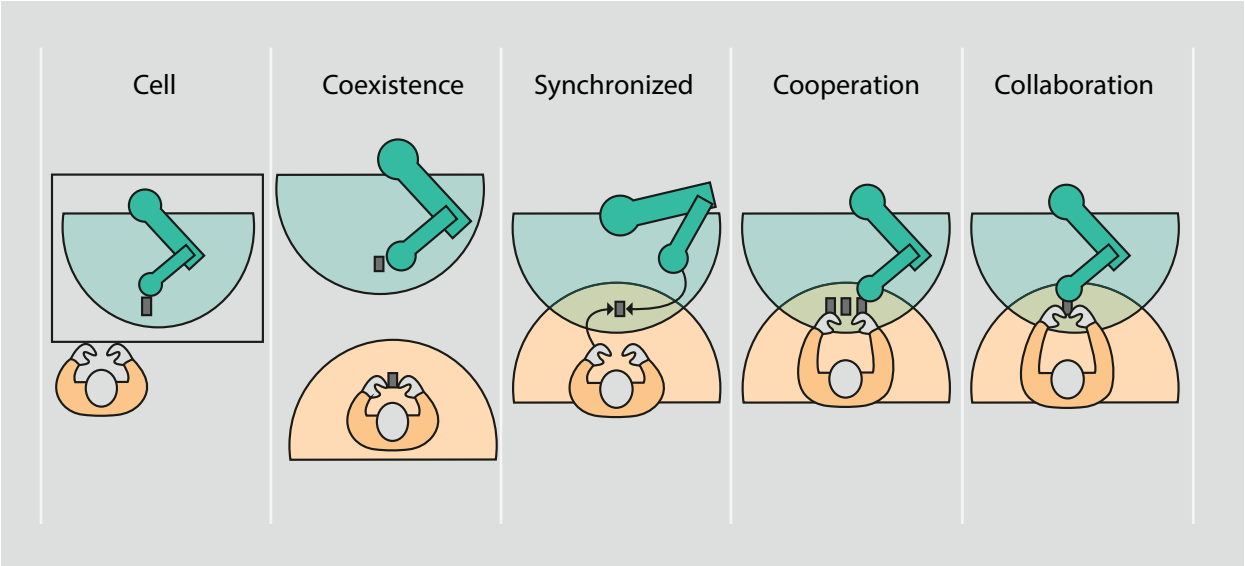
By definition, the cobot does not replace, but complement, the human worker. But why is it beneficial to combine robots and people so closely? Because certain human abilities are – and will remain – irreplaceable, e.g. fine motor skills, dexterity, flexibility and judgment, while robots have other strengths. They can make sure that the contact pressure remains constant when a rubber seal is being adhered, or they can hold heavy loads. HRC allows people and robots to work directly together and each to exploit their own strengths, resulting in a significant potential for optimizing production processes. At the same time, workplaces become more ergonomic.

But human-robot collaboration may just be the prelude to a more symbiotic partnership of people and machines in the future. Robotics, automation and artificial intelligence allow

us to completely reimagine processes taking advantage of the complementary strengths of people and machines. In this way, humans augment machines and machines augment humans with vastly improved results. In their groundbreaking work, Paul R. Daugherty and H. James Wilson[8] describe eight "fusion skills"[9] that will be essential for creating successful work environments and organizations in the future: skills that draw on the fusion of human and machine talents within a business process to create better outcomes than working independently.

The European robotics industry will:

- Invest in research and product development promoting closer collaboration between humans and technology, including human-robot collaboration, assistance systems, interface design, artificial intelligence and redesigning processes based on the concept of fusion skills.



An illustration of increasing levels of cooperation between human and robot from left (no cooperation) to right (full collaboration). Source: Fraunhofer IAO

[8] Human + Machine – Reimagining Work in the Age of AI, Paul R. Daugherty and H. James Wilson, Harvard Business Press, 2018
[9] These fusion skills are: rehumanizing time, responsible normalizing, judgment integration, intelligent interrogation, bot-based empowerment, holistic melding, reciprocal apprenticing and relentless reimagining.

8

Ease of Use

Robots have already become much easier to install, program and operate. The robotics industry is working to further simplify the use of robots. This is democratizing robotics: it is no longer only a domain for a select group of highly trained specialists and engineers. A trend which will accelerate in the years to come.

Focus 3 (Development of Skills) aims at qualifying people to use robots. Focus 8 (Ease of use) turns this approach around by qualifying the robots to be used by people with little or no formal training. There is no contradiction between these two approaches: both are necessary and complement each other. But how can robots become simple to use? Here are some examples:

- Take the robot by the hand: Rather than writing long lists of computer code to tell the robot how it should move, the worker presses a button at the robot arm, moves

the robot arm along the desired trajectory and releases the button. In so doing, the robot is programmed to perform a precise movement without the need to write any computer code. (Incidentally, this is quite comparable to a ballet class, in which the dance instructor gently moves the dancer's arm and body to demonstrate how the movement should be performed).

- Drag and drop instead of code: Interfaces on touch screens that look similar to what we know from our smartphones tear down barriers to programming robots. Instead of writing code, predefined modules can be dragged and dropped into place to tell the robot what to do and in what sequence.
- Social robotics, voice and gesture control: A more intuitive communication between the robot and the employee makes the use of robots more natural. Some robots indicate their operating state with symbolized faces on a display. A smiley face indicates that all processes are running smoothly, a neutral face indicates a possible slow down and a sad face warns of a problem. It is quite conceivable that workers will soon use voice commands and gestures to communicate with robots also in a factory environment. Humans will certainly communicate in this way with professional service robots.

The European robotics industry will:

- Further "democratize" robotics by making them easier to use, making robotics a tool that is accessible to all skill levels.
- Lower the barriers for workers and employees to start working with robots for the first time by providing intuitive communication, operating and programming interfaces.

9

Sustainability

The world's population is growing rapidly – therefore it is necessary to use resources efficiently. Intelligently automated production can make a decisive contribution to minimizing our consumption of energy and natural resources – moving to a carbon-neutral economy. In addition, automation can contribute to healthy and ergonomic workplaces with a high job satisfaction – by taking over the dull, dirty, dangerous or delicate tasks that need to be done (see also Focus 1, page 10).

For years, robotics has been increasing sustainability in many ways. The technology is having a major impact in making environmentally friendly products affordable. The economic viability of photovoltaics, for example, is largely due to cutting production costs through high automation levels. Robotics and automation also lead to more resource efficiency in the production process itself, e.g. by

Robots help produce rotor blades for wind turbines

avoiding scrap or optimizing processes. This is especially true in food and beverage production where the yield can be substantially increased through automation. The combination with AI (e.g. for deep learning-based predictive maintenance) will lead to further efficiency gains[10].
The robotics industry strives to further reduce the energy consumption of robots, by using energy efficient drives, smart stand-by modes and software to intelligently manage robot movements (e.g. by slowing the movement down whenever a faster movement is not needed)[11].
Flexible and easy-to-use robotic systems facilitate the competitive production of smaller batch sizes and of products customized to the local customer base. This paves the way for producing goods close to the customer thus reducing long-distance transport. Such local production has a substantially lower carbon footprint.

Contributions of robotics and automation to sustainability are by no means limited to cutting unit costs for high-volume products. The technology also has a substantial impact when used in concert with human capabilities, as we have seen: by preventing health risks for employees, by taking over boring and repetitive tasks, by upgrading and augmenting human work (e.g. by enabling manual assembly tasks to attain “zero defect” levels). Sustainability is multifaceted - covering economic, ecological and social aspects. And so is the potential of robotics and automation.

[10] One of the most promising applications of AI is for the improvement of OEE – the Overall Equipment Effectiveness – by monitoring equipment conditions across entire plants and predicting maintenance needs.
[11] An early example of this work is the VDMA Specification „Energy performance for industrial robots“ published in 2013: https://www.beuth.de/en/technical-rule/vdma-24608/197844344

The European robotics industry will:

- Continue to provide technology for producing goods sustainably (e.g. manufacturing with a low carbon footprint).
- Continue to provide technology for producing sustainable goods (e.g. making affordable solar panels).
- Provide solutions for competitive production close to the customer (eliminating long-distance shipping).
- Help improve work conditions, job satisfaction and health at the workplace.

A fundamental reshaping of finance in the making

Blackrock CEO Larry Fink's open letter[12] to CEOs around the globe in January 2020 drove home an important point: We are witnessing the beginning of a "fundamental reshaping of finance". The need to address climate change will put sustainability at the centre of investment decisions in the future.

He argues: "We believe that all investors, along with regulators, insurers, and the public, need a clearer picture of how companies are managing sustainability-related questions. This data should extend beyond climate to questions around how each company serves its full set of stakeholders, such as the diversity of its workforce, the sustainability of its supply chain, or how well it protects its customers' data. Each company's prospects for growth are inextricable from its ability to operate sustainably and serve its full set of stakeholders."

Robotics and the European Green Deal[13]

The European Green Deal - Europe's vision to make Europe climate neutral by 2050 - will also integrate sustainable development goals[14] (or SDGs).

Indeed, robotics and automation technology will be essential in contributing to Europe's green and digital transformation, which itself is a key enabler for reaching the objectives of the European Green Deal. According to the President of the European Commission, Ursula von der Leyen, "digitalisation will enable us to handle resources more effectively and more efficiently, because we will be able to calibrate everything precisely: water consumption, energy, all the precious resources of our planet".

Robotics and automation applications with the power to transform are being designed and invested in at an accelerating rate. For example, in relation to green energy production, robotics and automation have been essential for the production of large-scale photovoltaic panels. Robotics and automation will be vital for Europe's upcoming Circular Economy Action Plan (also part of the Green Deal) and will help to achieve the sustainable products policy by, for example, revolutionising recycling through deployment of robotics and vision technology to separate commingled recyclables from one another.

[12] www.blackrock.com/ch/individual/en/larry-fink-ceo-letter
[13] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf
[14] See The Good Work Charter and the UN Sustainable Development Goals (SDGs) on page 36.

10

Tackling Demographic Change

Due to demographic shifts, most developed economies are facing massive shortages of labour in the next decades. This will potentially limit GDP growth and therefore future prosperity. Over the next 20 years, the labour force in Germany alone is projected to shrink by about 10 million people[15] - a result of the retirement of baby boomers and low birth rates. Increasing the use of robotics and automation can help solve the problem.

An exoskeleton makes lifting heavy weights easier

Many experts see human-robot-collaboration, in particular, as a key solution to demographic shifts, reducing the strain on workers with physically demanding tasks, such as overhead assembly. Help from robots keeps these workers healthy, so they can continue working all the way through to retirement. Moreover, the first exoskeletons are currently being introduced in factories to relieve workers when lifting heavy weights, reducing strain on the lower back – an approach that may prove especially valuable for older workers. While robotics and automation can make a valuable contribution to counteracting problematic demographic shifts, it will not be able to solve the problem on its own. As we have seen time and again, increasing robot densities have not led per se to lower levels of employment. Therefore, a combination of measures – such as more automation, reskilling, attracting qualified workforce from abroad, increased participation of women in the workforce or raising retirement age – may be needed.

The European robotics industry will:

- Develop highly ergonomic robotics and automation solutions that can assist older workers in reducing work-related strain and health risks and extend their working lives.

[15] Marc Amlinger, Christian Kellermann, Cornelius Markert, Horst Neumann, Deutschland 2040: 10 Thesen zu Arbeitsmarkt und Rente, Demografie und Digitalisierung

Outlook: Prosperity for Europeans

Robots increase productivity and competitiveness. In doing so, they strengthen the manufacturing and service sectors: a solid basis for a sound economy, high-quality jobs and a prosperous and inclusive society. One of the most instructive studies quantifying this positive effect is “Robots at Work” by the Centre for Economic Performance at the London School of Economics[16]. In this study, Guy Michaels and Georg Graetz conclude that robot densification between 1993 and 2007 across 17 countries studied accounted for 10% of GDP growth.

But there are further positive effects that come with increased automation levels: Resources are used more sustainably. Easy-to-use robots empower people to do jobs that were previously reserved for technical specialists. New types of robots, e.g. in the service sector, will help us tackle some of the most urgent societal challenges, such as demographic shifts.

Robotics provides great opportunities to raise the standard of living for society as a whole and hence the potential to reduce inequality. The European robotics industry is guided by the objective of providing advanced technologies for economic success, sustainable development and favourable working conditions.

Join our journey to create a human-centric future of work.

Contact us at: robotics@eu-nited.net

[16] Graetz, Georg, and Guy Michaels. 2015. Robots Work. Centre for Economic Performance

“Europe sits at the juncture of two major forces shaping the future of work, the new challenges that COVID-19 has presented for all of us, impacting service industries and social interaction, and the transition to an increasingly automated and data driven economy, which has itself been accelerating since the lockdowns.

Both require changes in work arrangements that need to be worked out by employers, their workers and government. The adoption of new technologies provides opportunities to enhance productivity and boost incomes, delivering a prosperous future for all Europeans, but it also requires careful management of the transition. Employers can help by ensuring that their workers are equipped with the skills and knowledge to thrive in the new economy, whilst governments act to protect the livelihoods of those who are hit the hardest.”

Sir Christopher Pissarides
Regius Professor of Economics, London School of Economics
Co-Chair, Institute for the Future of Work (IFOW), UK
2010 Nobel Prize in Economics

The Good Work Charter and the UN Sustainable Development Goals (SDGs)

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand in hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The Good Work Charter of the European robotics industry recognises the strong connection of its own vision with many of the SDGs. Robotics use is well-suited to make substantial contributions especially to the following sustainable development goals:

SDG 3: Good Health and Well-being
(clean, safe and ergonomic workplaces, surgical and medical robots, robots in eldercare, rehabilitation robots)

SDG 4: Quality Education
(robots as a tool for STEM education and skills development)

SDG 5: Gender Equality
(placing emphasis on the inclusion of girls in robotics projects/contests in schools, robots taking over heavy lifting)

SDG 7: Affordable and Clean Energy
(lowering the production costs of renewable energy technologies to make them economically viable/ competitive, such as photovoltaics or wind turbines)

SDG 8: Decent Work and Economic Growth
(shaping good work of the future, e.g. through collaborative robotics or robots taking over dirty, dull, dangerous or delicate (“4D”) tasks)

SCG 9: Industry, Innovation and Infrastructure
(innovating industrial production and raising its competitiveness)

SDG 12: Responsible Consumption and Production
(energy-efficient production, resource-efficient production)

SDG 13: Climate Action
(production technology for affordable carbon-neutral mobility and competitively priced renewable energy)

SDG 14: Life below Water
(unmanned/autonomous underwater robots for monitoring and research, inspection of oil platforms)

SDG 15: Life on Land
(agricultural robots, precision farming, crop protection without pesticides)


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

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Coordination and project management: Fariba Khatami (EUnited Robotics) and Patrick Schwarzkopf (EUnited Robotics)

Recommended readings

- Skills 4.0 by Skills Development Scotland
  https://www.skillsdevelopmentscotland.co.uk/media/44684/skills-40_a-skills-model.pdf

- Good Work Charter by IFOW (Institute for the Future of Work)
  https://www.ifow.org/publications/the-ifow-good-work-charter

- „Human + Machine - Reimagining Work in the Age of AI“, Paul R. Daugherty and H. James Wilson, Harvard Business Press, 2018

Imprint

Contact
Do you have any questions regarding the Good Work Charter? Would you like to endorse the Good Work Charter? Feel free to contact us at: robotics@eu-nited.net

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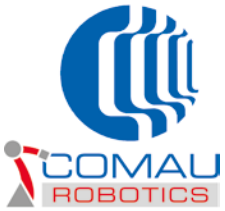

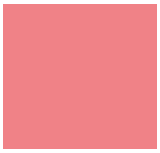

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