

Robotics + Automation



Strategy Paper

Leveraging Robotics and Automation for a Resilient and Competitive Europe





Leopard 1800

nickel workhorse

Shaping a prosperous future for Europe

Europe faces an era of unprecedented challenges, from geopolitical uncertainties and demographic shifts to the urgency of achieving carbon neutrality. These issues threaten its competitiveness, resilience, and sovereignty. With labour shortages looming and sustainability demands intensifying, Europe must act decisively to secure its future.

This paper explores how robotics and automation can play a pivotal role in overcoming these challenges, enabling economic growth, sustainability, and global leadership.

Big challenges for Europe

1. Eroding competitiveness

Europe faces a relentless loss of global competitiveness. Emerging economies, rapid technological advancements, and shifting trade dynamics threaten to relegate us to a secondary position on the world stage - a reality already evident in critical sectors like battery production, photovoltaics or microchips. These are also the findings from the Draghi Report¹ and Letta Report².

2. Resilience and sovereignty

In an interconnected world full of uncertainties, Europe must bolster its resilience to external shocks and reclaim its sovereignty. Dependence on external sources for critical technologies and resources exposes the continent to vulnerabilities that necessitate a recalibration of its approach towards innovation and self-sufficiency. Only a resilient Europe can be a strong Europe.

¹ Read the Draghi Report here: <https://bit.ly/3Dv7Wph>

² Read the Letta Report here: <https://bit.ly/3Dj1O3r>

3. Demographic decline

With an ageing population and workforce shortages on the rise, labour gaps are bound to aggravate in the coming decades and are projected to become a substantial threat to Europe's GDP growth and the supply security of essential services.

4. Carbon neutrality and sustainability

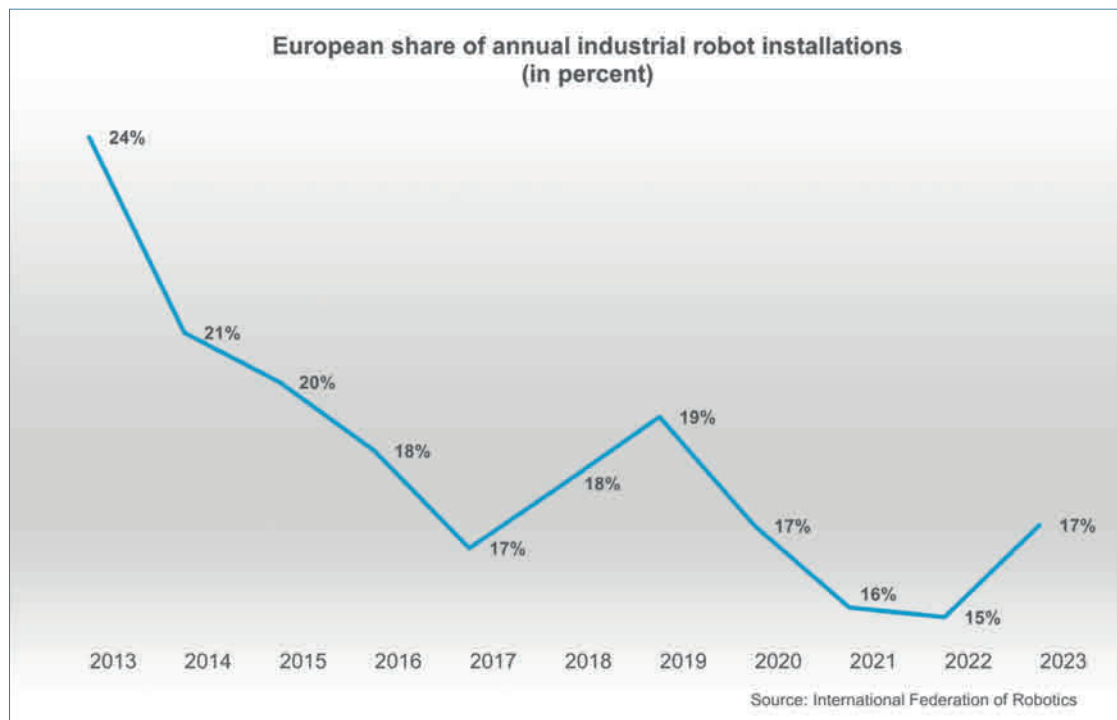
Europe's commitment to sustainability requires a comprehensive strategy that not only mitigates environmental impact but also positions the continent as a leader in clean and green technologies. Europe also needs to become a trailblazer of circular economy.

Robotics and automation – key enabling technology for Europe

This strategy paper discusses the transformative potential of robotics and automation, outlining actionable recommendations for policymakers to harness these technologies for the collective benefit of Europe. By strategically deploying these tools, Europe can address its immediate challenges and position itself as a global leader in the era of technological innovation and sustainable development.

Who we address

Policymakers across Europe including national governments and EU institutions. The strategy paper offers recommendations to strengthen competitiveness of the European economy and advance robotics and automation technologies. It spans industrial robotics, professional service robotics, machine vision, automated solutions, AI and related fields.



In the past decade, Europe's share of global industrial robot installations has decreased.

Focus 1:

Make robotics and automation a top policy priority

Every European country should have in place - or establish - a robust national robotics and automation program.

Focus 2:

Create and attract the world's best talent

Reignite curiosity and enthusiasm for science, technology, engineering, and mathematics (STEM) from an early age. Educational robots and “maker” labs in schools are ideal tools for it.

Focus 3:

Create incentives for automation

Boost investment in robotics and automation. Assist pioneering companies to introduce robotics and automation in areas where robots are underutilized but hold significant potential for the future, for example in agriculture, construction or healthcare.

Focus 4:

Put capital to work for innovation

Turn the tide in venture capital availability by updating the regulatory framework for institutional investors.

Focus 5:**Stay at the forefront of technological development**

Europe must regularly benchmark its progress in robotics and AI against developments in Asia and North America and create concrete national and European-wide technology roadmaps.

Focus 6:**Focus on economies of scale**

Europe's success not only depends on its technological excellence but on its ability to produce and bring innovations to the market at scale.

Focus 7:**Go for lean regulation**

To remain competitive, Europe must adopt a more streamlined and flexible approach to regulation that supports the rapid development and deployment of robotics and automation technologies. In addition, regulatory sandboxes can provide a good way forward.

Focus 8:**Create awareness for benefits of automation**

Foster a culture that embraces robotics and automation.

A commitment of the European robotics industry:**Let's make robotics accessible to all**

The European industry pioneers easy-to-use robotics. By lowering the barriers to programming and operating robots, the technology finds more widespread use.

Focus 1

Make robotics and automation a top policy priority

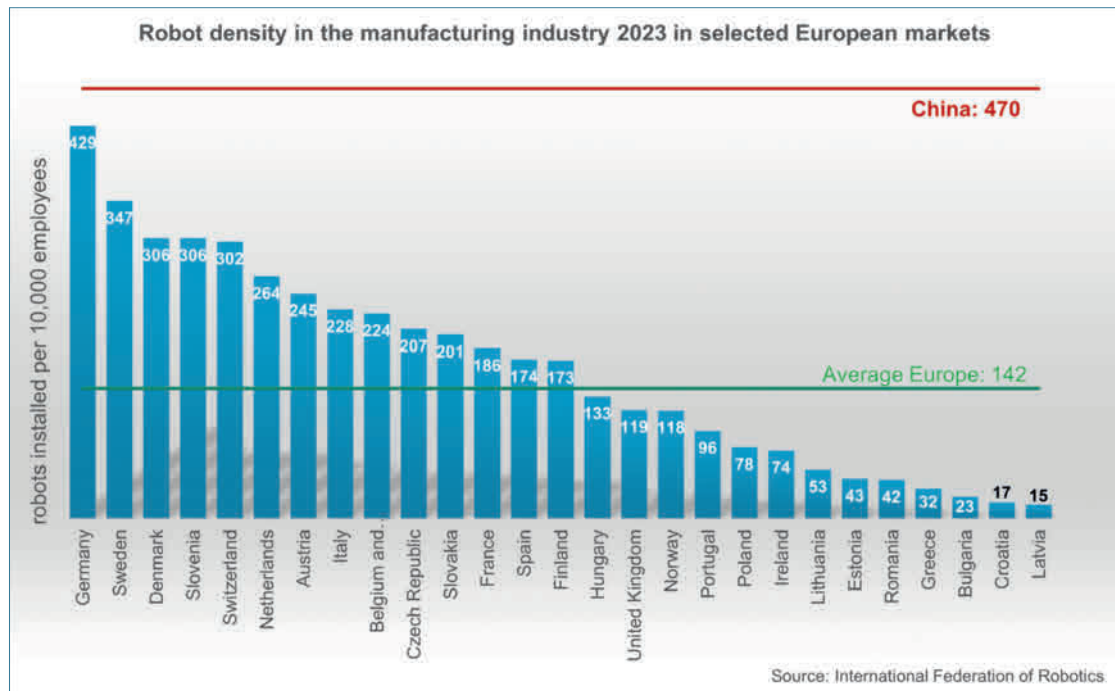
Robotics and automation stand out as key enablers that drive economic success, enhance competitiveness, and ensure a sustainable future. For Europe to maintain its position as a global leader and safeguard the prosperity of its citizens, it is essential to treat robotics and automation as top priority in the policy agendas of all European nations.

National robotics and automation strategies: A call for action

Every European country should have in place - or establish - a robust national robotics and automation program. These programs should not be mere policy statements but comprehensive strategies that set clear development targets and concrete measures to reach them. Such strategies can be embedded in more comprehensive innovation strategies and ideally align with EU programmes. Robotics and automation are foundational tools for achieving economic success and social prosperity. It is therefore highly recommended for every country to take a proactive stance and address this issue as top priority of its political agenda.

Immense disparities across Europe

Countries with low robot density* in particular, must urgently step up their efforts. The disparity in robot adoption across Europe risks creating an increasingly uneven playing field, where some nations advance rapidly while others stagnate or risk falling behind. It is important to close the gap and to recognize that regions with lower automation levels also have the greatest potential for transformation and growth.



*Robot density is an excellent measure of automation levels that allows us to compare robotization in countries of different sizes. It is defined as the number of industrial robots in use per 10,000 employees in the manufacturing sector. As this chart shows, the disparity of robot adoption across European nations is vast. While robot density is impacted by various factors - such as the level of industrialization, industry composition and labour costs – a high-robot density is key for economic and social prosperity.

Integrating robotics within broader policy areas

A national robotics and automation strategy must not operate in isolation. It should be synchronized with digital and cloud infrastructure projects. It should also be systematically linked and coordinated with other critical policy areas, such as agriculture, healthcare, space exploration, or education. For instance, in agriculture, field robotics and precision farming can revolutionize food production, increase efficiency and reduce environmental impact. In healthcare, lab automation and care robots can address the growing shortage of healthcare professionals and safeguard patient care. Space robotics and rovers can lead to new frontiers in space exploration, while educational robots can play a crucial role in enhancing the learning experience in STEM subjects, promoting inclusion and preparing the next generation for a technology-driven world.

Furthermore, the potential of robotics to advance the UN Sustainable Development Goals (SDGs) should be fully leveraged. Robotics can play a pivotal role in achieving these global objectives (see Appendix).

Robotics as a driver for climate neutrality and demographic resilience

A well-crafted robotics strategy is essential for Europe's successful transformation to climate neutrality. Automation technologies can significantly reduce energy consumption and waste, making production processes more sustainable. Additionally, robotics can help Europe tackle its demographic challenges. As the population ages and the workforce shrinks, robots can support workers and fill labor gaps, in the service industry as in manufacturing.

A European vision for the future

While national programs are crucial, they must be complemented by a cohesive European vision. Europe must not only safeguard but also grow its prosperity by leading the world in advanced manufacturing and by innovating the service sector. This vision should include coordinated efforts across member states to invest in research and development, move to a more pragmatic and innovation-oriented regulatory environment, and provide investment-friendly conditions.

Conclusion

Robotics and automation are critical to Europe's future. As such, they must become a top priority for all national governments in Europe and the European Union.



Focus 2

Create and attract the world's best talent

Europe's future depends on nurturing creativity and innovation through investments in education, skills development and talent acquisition. By taking the following steps, European governments can ensure the continent has the capability to remain a global leader in driving economic success and sustainability for generations to come.

Spark interest in STEM with robots at schools

Europe needs to reignite curiosity and enthusiasm for science, technology, engineering, and mathematics (STEM) from an early age – and the earlier the better. Educational robots and “maker” labs in schools are by far the best tools to generate interest in mathematics, physics, coding, artificial intelligence and technology in general. Schools applying robots in education have witnessed the tremendous positive impact this has on inclusion. Moreover, using robots early on is a success factor in winning over girls for STEM subjects and inspiring them for a subsequent career in engineering.

Schools should introduce a compulsory „Technology“ subject and ensure continuous instruction in at least two STEM subjects. To support this, schools across Europe must be equipped with modern technical resources, ideally offering workshops or labs equipped with educational robot kits where children and teenagers can unleash their creativity and build confidence in tech.



Offer more degree programs and vocational training in robotics and automation

Governments should support the expansion of degree programs in robotics and automation at universities and colleges, aiming to double the number of students by 2030. Vocational education institutions should be well equipped to develop robotics and automation skills. The European robotics and automation industry is committed to actively support education and training through apprenticeships, vocational education, scholarships and partnerships with educational institutions.

Lowering the barriers

As technology transforms the workplace, continuous training is vital. Governments and employers should offer ongoing development opportunities to help workers adapt and stay competitive. At the same time, artificial intelligence and intuitive human-machine interfaces enable ever closer cooperation between humans and robots, making robotics accessible to all: a development often referred to as “democratizing robotics”. Educational institutions should be appropriately equipped to help establish new career paths that leverage AI and robotics, allowing employees to grow and thrive in a changing work environment.

Win the war for talent

Europe’s quality of life offers a good starting position for attracting top global talent. Governments should create smart immigration policies with accelerated processes and reduced bureaucracy for skilled professionals. It is equally important to strengthen the attractiveness of Europe for our existing talent pool to avoid a brain drain of talents and entrepreneurs to other dynamic world regions.

Focus 3

Create incentives for automation

In the face of intensifying global competition and the need to strengthen Europe's production capabilities, national governments and Europe as a whole must take decisive action to boost investment in robotics and automation. Strategic incentives are essential for re-shoring production, enhancing competitiveness, and securing Europe's leadership in future technologies. Policymakers should take steps to encourage automation adoption, including tax incentives, streamlined funding, and targeted support for users pioneering robot adoption.

Addressing global production location competition

Europe is increasingly challenged by aggressive industrial policies launched in other countries – most prominently the Inflation Reduction Act in the United States and China's 5-Year-Plan for Robotics - which create substantial cost disadvantages for European manufacturers. This uneven playing field threatens Europe's competitiveness, particularly in scaling future technologies like fuel cells, batteries or photovoltaics. Without rapid policy responses to offset this impediment, Europe risks falling behind in manufacturing such critical technologies at scale.

Tax incentives for investments

Tax incentives, such as corporate tax offsets or full deduction of innovation investments in the first year, are examples of straightforward and effective tools³. These measures lower the upfront cost of automation, making it more accessible to businesses of all sizes, particularly small and medium-sized enterprises (SMEs).

Lowering the barriers for automation in pivotal sectors

In addition to general incentives, governments should directly target areas where robotics and automation are underutilized but hold significant potential. A targeted program could assist pioneering companies to co-develop novel robotics and automation applications in sectors like construction, agriculture, hospitality, retail and healthcare. By supporting early adopters in these fields, governments can drive innovation and efficiency in industries that are vital to Europe's future. One way of doing this is by introducing voucher schemes⁴ for SMEs and the skilled trades to lower the barriers for taking the first steps towards automation. Any funding schemes should be simple, easy to apply for, and straightforward to administer. Reducing bureaucratic hurdles will ensure that more companies, especially SMEs, can access government support, accelerating the adoption of automation technologies and scaling innovative products across Europe.

The Sectorial AI Testing and Experimentation Facilities (TEFs) under the Digital Europe Programme pursue similar goals and provide an excellent blueprint for boosting robotics adoption in selected sectors across Europe.

³ Examples are Italy's **Piano Transizione 5.0** which links incentives to green transformation goals and France's **Robot Start PME** which incentivizes SMEs to use robotics and automation.

⁴ A voucher scheme was developed in the European project ROBOT-NET (www.robott-net.eu).

Focus 4

Put capital to work for innovation

Europe needs to align its investments in AI and (humanoid) robotics with the formidable commitments made in the USA and China; failure to do so will consign the continent to the sidelines. While access to venture capital is usually available for the early phases of technological innovation, Europe falls short in securing the substantial investments required to transform great ideas into widely adopted, competitive products at scale. Therefore, boosting investments in robotics and automation must be part of InvestEU programme and a priority of the European Investment Bank (EIB).

Leverage savings of institutional investors

France's Tibi-initiative is Europe's outstanding success story in turning the tide in venture capital availability. It aimed to increase the financing capacity of technology companies by mobilizing the savings of institutional investors. In 2019 within the framework of Tibi 1, 21 French institutional partner investors committed to invest €6 billion between 2020 and 2022 in late-stage private equity funds and in publicly traded tech funds established in France (Global Tech). The French State acted as a „facilitator“ of this French finance marketplace initiative, through political support and coordination orchestrated by the French Treasury.

In 2023 Tibi 2 was launched. It aims to consolidate this achievement with an additional commitment of €7 billion from institutional investors. This new phase covers a broader scope: in addition to late-stage and publicly traded tech segments, an early-stage segment continues to feed the primary pool of technology startups and the financing of breakthrough innovation projects.

In the footsteps of France's TIBI initiative: Germany's WIN Initiative

In September 2024, the German government and numerous companies and associations signed a joint declaration of intent on the so-called WIN initiative (which stands for “Growth and Innovation Capital for Germany”). Through ten measures, the WIN initiative aims to improve the tax, legal and financial framework conditions in Germany so that young innovative companies can access private capital more easily. The target is to mobilize an additional 12 billion euros in venture capital by 2030.

Updating the regulatory framework for institutional investors is indispensable for mobilizing urgently needed additional venture capital.



Focus 5

Stay at the forefront of technological development

Europe has traditionally held a leading position in robotics and automation, but this dominance is under increasing threat. As global competition intensifies, Europe must take concerted action to remain at the cutting edge. This requires leveraging emerging technologies, especially in the realm of AI.

The AI revolution in robotics

AI, particularly Generative AI, is rapidly transforming robotics. A new generation of AI-driven robots is emerging, capable of learning from human behavior, imitating tasks, and operating autonomously. These advancements are set to revolutionize sectors such as hospitality, healthcare, and agriculture by enabling more adaptive service robots. Europe must ensure its industries capitalize on these innovations. As robots increasingly integrate AI with the physical world (“embodied AI”), the innovation cycles of robotics and AI are becoming deeply intertwined, with advances in one driving progress in the other. Europe must recognize the interconnection of robotics and AI and remain a leader in both fields.

Sustainable energy and automation

Europe’s leadership in the green energy sector is closely tied to its capabilities in automation. High-volume, high-productivity automation systems are essential for producing top-tier photovoltaic panels, batteries, fuel cells, and heat pumps at competitive prices. Without these systems, Europe risks falling behind in the race to lead the global transition to sustainable energy.

Data sharing and platform technologies

To maintain its edge in robotics and automation, Europe must prioritize data sharing and the development of cloud-edge infrastructure and platform technologies. These are the foundations of modern robotics, enabling faster innovation, real-time collaboration, and scalable solutions. Data space technology developed in Europe (e.g. Manufacturing-X, Factory-X) and the IPCEI⁵ Next Generation Cloud Infrastructures and Services (IPCEI-CIS) are paving the way for Europe's lead. It is imperative that Europe keeps up the momentum in these vital initiatives.

The need for benchmarking and strategic roadmaps

To maintain its competitive position, Europe must regularly benchmark its progress in robotics and AI against developments in Asia and North America and create concrete national and European-wide technology roadmaps.

⁵ IPCEI: Important Project of Common European Interest. See also <https://bit.ly/3VKYp3J>

Focus 6

Focus on economies of scale

Europe's success not only depends on its technological excellence but on its ability to produce and bring innovations to the market **at scale**.

Europe's strength in cutting-edge research must translate into market success

Europe boasts a fascinating research and innovation landscape and a bustling startup scene. Great ideas are constantly born in Europe. But success must eventually be measured as success in bringing these ideas to the market. In this respect, China has demonstrated that the real game may be in scaling innovations massively, thereby leveraging vast economies of scale and winning in the market with low price points and short delivery times. Well known examples are photovoltaics and lithium batteries.

Robotics: the race is on

Europe is strong in developing highly innovative professional service robots for a multitude of application fields – e.g. in agriculture, healthcare, hospitality. Their success will depend on ramping up the production in Europe to reach price-points that will be acceptable for new user groups. This is more difficult, if the domestic market is reluctant to adopt new robotics solutions (see also Focus 8) and initial demand remains low. High regulatory burdens and the lack of late-stage venture capital are also detrimental to a swift scaling of new products.

While Europe is well-positioned in the high-scale production of industrial robots, Chinese competitors are quickly catching up and are making a big push into the European market in this segment, too. Moreover, China has an immense domestic market for industrial robotics (about 50% of annual industrial robot installations go to China) which helps scale production in China. We can predict that soon competition in the industrial robotics segment will be largely about scaling production and low price-points.

Addressing global competition in humanoid robots

Massive investments are being made in humanoid robots, particularly in China, where a national strategy for humanoids exists, and in the US, where substantial venture capital is driving innovation. Europe must not lag behind in this critical area. It is essential that European humanoid technology moves beyond the labs and into scalable, competitively priced production. This requires a coordinated effort to ensure that Europe remains at the forefront of humanoid robotics as well.

Framework conditions for scaling

Policymakers in Europe need to think in terms of providing an environment that is not only conducive to innovation, but conducive to transferring such innovations into mass production in Europe.

The humanoid robotics race: where does Europe stand?

SPARC – running from 2014 to 2020 – and deemed “the largest civilian-funded robotics innovation programme” had a funding volume of €700 mn from the European Commission.

Compare it to one single Series B funding round by US humanoid robotics startup, Figure, in which the newcomer raised a stunning 675 million US dollars in 2024.

China has come up with a clear-cut strategy for building up a world-beating humanoid robotics industry at scale, and a comprehensive list of humanoid use cases the country foresees for the near future.

Experts may differ in their judgments about the necessity of walking robots, their feasibility in real-life applications and economic viability, but there is a boom in investments in humanoids in China and the USA.

While the debate largely focuses on the “legs” it should focus much more on the “torso”: the massive investments flowing into humanoid startups give rise to disruptive developments for the robotics industry:

- **How robots learn from imitating humans.**
- **How robots learn “generic skills” based on (generative) AI and foundation models.**
- **How robots become dexterous and develop previously unseen levels of eye-hand coordination.**
- **How robots understand humans and humans can simply talk to robots.**

These disruptive developments are largely created in the realm of humanoid robotics, and they are bound to “spill over” to more traditional robots and cobots (even stationary ones).

Therefore, Europe is well-advised to step up its game in the realm of humanoid robotics development.



Focus 7

Go for lean regulation

Europe's potential as a global leader in robotics and automation is at risk of being held back by an overly complex and burdensome regulatory framework. While regulations are essential for ensuring safety, quality, and fairness, they must be pragmatic and adapted to the realities of business. Currently, Europe's regulatory landscape risks stifling innovation, delaying market entry, and hindering the scaling of technology. To remain competitive, Europe must adopt a more streamlined and flexible approach to regulation.

The case for lean regulation

Europe's existing regulatory framework, for both industrial and professional service robots, often imposes excessive burdens on companies, many of which are startups and SMEs. These regulations can be slow, cumbersome, and out of sync with rapid technological progress. Additionally, they impede the adoption and scaling of robotics and automation solutions in Europe, giving competitors in other regions the upper hand. Lean regulation is essential for Europe to become faster and more responsive in the global markets. Wherever possible, approvals should be implemented via self-certification

Regulatory sandboxes: A practical solution

To further accelerate innovation, Europe should embrace the concept of regulatory sandboxes. These are controlled environments where new technologies and applications can be tested under real-world conditions with temporary regulatory flexibility. By allowing companies to trial their innovations in a safe but practical setting, regulatory sandboxes can help identify potential issues early on and speed up the path to full market entry. Article 57 of the AI Act on AI Regulatory Sandboxes - which asks every member state to establish at least one AI regulatory sandbox at national level - is a step in the right direction.

Harmonizing global standards

Another critical aspect of lean regulation is the harmonization of standards across global markets. Positive examples of global standards include ISO 10218 for industrial robotics and ISO 13482 for service robotics. These standards have proven effective in ensuring safety and quality while allowing for the global deployment of robotic technologies. Regional standards, on the other hand, are counterproductive and should be minimized, as they create barriers to market entry and limit the potential for scaling. Europe should expand its influence in international standardization bodies to ensure that its expertise and leadership are reflected in global standards.

Focus 8

Create awareness for benefits of automation

In the global race for technological leadership, Europe faces a critical challenge: fostering a culture that embraces robotics and automation. While societies in Asia, particularly Japan, South Korea and China, have long recognized the benefits of automation and integrated it into their industries and daily lives, Europeans have been more cautious. This hesitation places Europe at a competitive disadvantage. To secure its future, Europe must promote the benefits of automation and raise public awareness of its necessity.

Acceptance: The competitive edge of embracing automation

Societal attitudes depend on people's understanding of the impact of technologies. In this respect, robotics and automation have positive contributions to make:

Automation is crucial for **keeping production within Europe** and securing high quality jobs in a competitive manufacturing sector. Keeping production in Europe is also important as Europe seeks to **reduce dependency** on foreign production and increase supply security for crucial products and needs to close the productivity and innovation gaps identified in the Draghi Report.

Europe is facing a demographic shift as birth rates decline and the baby boomer generation retires. This leads to further workforce shortages which **jeopardize the growth potential of European GDP**. Automation offers a vital solution, filling gaps in the workforce and enhancing overall productivity. Robots can take on tasks that are physically demanding, repetitive, or dangerous, allowing **human workers to focus on more creative and strategic roles**.

Robots and people working hand in hand

As humans and robots work ever more closely together, the future of the technology lies in collaboration. **Collaborative robots**, or „cobots,“ are designed to work side by side with humans, enhancing their capabilities and creating safe and efficient workplaces.

Therefore, the European Robotics Industry strongly advocates for a human-centric approach to automation, as outlined in its Good Work Charter. Europe can harness the full potential of automation while **improving working conditions** for its people.

Policymakers, industry leaders, and educators must work together to inform the public about the benefits of automation. Public campaigns and educational initiatives are crucial for building a society that views technology as a partner rather than a threat.



The Good Work Charter of the European Robotics Industry defines 10 focus areas for a human-centric approach to robotics. Read it here:

www.vdma.org/goodworkcharter

A commitment of the European robotics industry:

Let's make robotics accessible to all

This chapter is not only a call to policymakers but also a commitment from the robotics and automation industry itself. The future of robotics must be inclusive⁶, allowing everyone to engage with and benefit from these technologies. To achieve this, we need to make robotics accessible to all, regardless of technical background or prior engineering experience.

Democratizing robotics

The concept of democratizing robotics is central to this vision. Thanks to advances in technology, robotics is no longer confined to specialists. The barriers to entry are lowering, making it easier for laypeople to program, install, and operate robots. For instance, no-code robotics enables users to program robots by using simple drag-and-drop interfaces or simply by physically guiding the robot to perform tasks. This makes robotics as intuitive as using a smartphone or playing a video game.

Communicating intuitively

With intuitive interfaces, operators will be able to interact with robots through natural language – just by speaking to them. This means that robotics becomes accessible to people from all walks of life, opening up opportunities for those who may not have formal technology or engineering backgrounds.

Opportunities for people

With easy-to-use robots, we create opportunities for personal growth and improved workplace quality. People should work with robots, not like robots. This shift offers career opportunities for individuals who might not have considered a future in technology, helping them thrive in their career path.

⁶ Germany's daaap.net is an initiative that has demonstrated the successful use of collaborative robots helping people with disabilities at their workplace. Educational robots have boosted the integration of refugee children in their school environments. The Roberta initiative proved that educational robot projects in schools are equally attractive to boys and girls (www.roberta-home.de).



Glossary

Automated Solutions is the sector that creates products and solutions for the handling and assembly of individual parts, e.g. assembly lines for making medical products, car parts or photovoltaic modules. A wide range of processes such as parts feeding, assembly, mounting, handling, joining, forming, measuring, testing, dosing and labelling are covered here.

Democratizing robotics: Making robotics technology accessible to all by lowering the barriers to entry. Intuitive programming and operating concepts allow people without prior engineering or technology expertise to work with robots, e.g. with simple drag-and-drop programming (no-code programming). The vision is to make robotics as intuitive to use as a smartphone.

Draghi Report: Former European Central Bank President Mario Draghi was tasked by the European Commission to prepare a report of his personal vision on the future of European competitiveness. By many, the report is seen as a wake-up call for Europe. Read the report here: <https://bit.ly/3Dv7Wph>

European Investment Bank (EIB): The European Investment Bank is the lending arm of the European Union. It is one of the biggest multilateral financial institutions in the world and one of the largest providers of climate finance. One of its eight core strategic priorities is “digitalization and technological innovation”.

Good Work Charter of the European Robotics Industry: A charter developed by the European robotics industry based on 10 key areas designed to promote and support a human-centric workplace as people and robots work ever more closely together. www.vdma.org/goodworkcharter

Humanoid robots are robots that resemble the shape of humans. In the stricter sense, humanoid robots are walking on two legs (“bipeds”), have two arms with flexible hands and a head. Often, robots on wheels that have a torso resembling that of humans are also referred to as humanoid robots. Humanoids usually use advanced AI, sensor and drive technology and demonstrate autonomous behaviour to a certain extent.

Industrial data spaces allow data to be shared while protecting the trust and data sovereignty of participants without the lock-in effects of traditional platform architectures. <https://internationaldataspaces.org/>

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

InvestEU: The InvestEU Programme supports sustainable investment, innovation and job creation in Europe. With the EU budget guarantee provided to international and national promotional banks, the InvestEU programme aims to trigger more than €372 billion in private investments to high EU policy priority areas.

IPCEI-CIS: (IPCEI Next Generation Cloud Infrastructure and Services) is the key digital policy project aimed at strengthening Europe's digital and technological sovereignty. 12 EU member states are currently working together to build an overarching "Cloud-Edge Continuum" that is not tied to individual providers. 3.5 bn euros are being made available for projects across Europe. bit.ly/3VKYp3J and www.8ra.com

Letta Report: Former Italian Prime Minister Enrico Letta's report recommending six reform measures to make the EU more competitive: <https://bit.ly/3Dj1O3r>

Machine Vision: As the „eye of the machine“, vision technology gives machines and robots the ability to see and interpret situations in a meaningful way. Cameras generate images, and software automatically evaluates them, e.g. for quality inspection, identification, production optimization.

Manufacturing-X: A data space for Industry 4.0. The aim is to establish a data ecosystem that allows trustworthy data exchange between companies based on open standards, offering companies digital sovereignty. <https://www.vdma.org/manufacturing-x>

Regulatory sandboxes allow the testing of innovative products and services under temporary regulatory exemptions. They are operated for a limited time and in a limited part of a sector or area. The purpose of regulatory sandboxes is to learn about the opportunities and risks that a particular innovation carries and to develop the right regulatory environment to accommodate it.

Robotics and Automation: Combination of the sub-sectors Machine Vision, Automated Solutions and Robotics.

Robot density: The number of industrial robots in use per 10,000 employees in the manufacturing sector. Robot densities for numerous countries and regions are provided by the International Federation of Robotics (IFR). It is a useful metric for comparing the automation levels of national economies of different sizes. www.ifr.org

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 in farms, surgical robots in hospitals or retail robots in department stores.

TEFs: Large-scale reference testing and experimentation facilities offering a combination of physical and virtual facilities, in which technology providers can get support to test their latest AI-based software and hardware technologies (including AI-powered robotics) in real-world environments. TEFs were created as part of the Digital Europe Programme. <https://bit.ly/4gNpPic>

Tibi-Initiative: Launched in 2019 in France, it aimed to increase the financing capacity of technology companies by mobilizing the savings of institutional investors. Tibi 1 mobilized more than 6 billion euros. Tibi 2 is set to mobilize another 7 billion euros. <https://bit.ly/3DTefmK>

WIN-Initiative: A joint declaration of intent signed by German government and numerous companies and associations. WIN stands for „Wachstums-und Innovationskapital für Deutschland“ (Growth and Innovation Capital for Germany). Through ten measures, the WIN initiative aims to improve the tax, legal and financial framework conditions in Germany. The target is to mobilize an additional 12 billion euros in venture capital by 2030.

<https://bit.ly/3WbqgKH>



Appendix

Robotics 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 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 2: Zero Hunger (agricultural robots, vertical farming, precision farming, automation in food production)

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 6: Clean Water and Sanitation (inspection and maintenance robots, UV disinfection robots)

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)

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

SDG 11: Sustainable Cities and Communities (robots used in waste management and recycling, circular economy)

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 (uncrewed/autonomous underwater robots for monitoring and research, inspection of oil platforms)

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



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