Shape the future with confidence

Why it's time to get ready for humanoid robots

November 2025

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The better the answer.
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Robots are getting better by the day – and in the coming years, they will be put to work in almost all areas of industry and services.

- **What different kinds of humanoid robots are there and why are they being developed at such a fast pace?**
- **How can humanoid robots be used in production and services?**
- **How can companies get ready for this transformation?**

Unusual participants at a half marathon in Beijing in spring 2025

Around 20 humanoid robots took to the starting line – for safety reasons in a separate lane – alongside the long-distance runners. Not all were up to the challenge; some fell over after a few meters. However, the victorious Tiangong Ultra crossed the finish line in two hours, 40 minutes, and 42 seconds. Prizes were also awarded for the best endurance, the best gait and the most innovative form.

Humanoid robot sprinters are still lagging behind human competitors in terms of speed. However, this area of robotics is evolving so rapidly that it is only a matter of time before machines will catch up with humans. This will happen not only in long-distance running, but in a variety of applications in the industrial and service sectors as well.

Rapid growth: millions could soon be in use

Analysts at Bank of America estimate that there will be 18,000 humanoid robots in prototype use this year. By 2030, that number is expected to reach one million, and five years later, it could be 10 times that amount.

> Analysts at Bank of America estimate that 10 million humanoid robots will be in service by 2035.

Rapid advancements in artificial intelligence (AI) in particular have given humanoid robotics a significant boost. Companies will face substantial changes once these human-like helpers are able to fill production and service roles. Given the current speed of development, it is crucial to get ready quickly and to consider issues such as infrastructure and change management early on. A humanoid robot does not necessarily have to sit behind your reception desk. However, to avoid being overtaken by developments and left behind by the competition, it makes sense to create the technical and regulatory conditions swiftly in order to reduce barriers for deployment.

> “Humanoid robots are designed for the messy, ever-changing, human-shaped world we live in – our first real shot at a general-purpose machine for the real world. They’ll take on dangerous, repetitive, and physically demanding tasks on the factory floor, freeing people for safer, higher-value work, and completely transforming industries such as manufacturing and automotive – where precision, adaptability, and resilience matter most. They use AI to solve complex industrial challenges and amplify human potential – but only if grounded in the principles of trust, value creation, and AI-ready data.
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> **Joe Depa**
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> EY Global Chief Innovation Officer

What are humanoid robots – and why are they becoming increasingly relevant?

What makes a robot humanoid? They are service robots that mimic human behavior and interact with humans and other machines. They are designed, for example, to replace human workers in monotonous, dangerous, or unsanitary work environments. While traditional industrial robots are primarily used in controlled, structured environments for clearly defined tasks, humanoid and smart multifunctional robots are designed to operate in dynamic, frequently unstructured contexts that require a high degree of adaptability and situational decision-making. These more complex work environments require special capabilities: Thanks to highly developed AI functionality these bots have sensory systems, motion control, and can interact with humans and other machines. This allows humanoid robots to perform a wide range of tasks. Typically, they can move either on wheels or on two legs.

Successful interaction of research fields

Interdisciplinary advancements, particularly in AI and the industrial metaverse, such as physical AI, are seeing the capabilities of robots edge ever closer to those of humans. Particularly transformative are foundation models: they enable machines not only to perform predefined tasks but also to process, interpret, and make decisions based on context-dependent information gleaned from their surroundings. Multimodal AI architectures that can simultaneously process text, images and sensor data are significantly enhancing the sensory perception and ability of robots to interact. Indeed, it is expected that in the future, robots will far surpass human capabilities in this respect.

A key driver of development in the field of robotics is the increasing manual dexterity of autonomous systems. Advances in this area are enabling robots to perform tasks that are more sophisticated than standardized movements. Additionally, technological advancements in data processing, such as realistic simulations, as well as more reliable and efficient charging technologies, are leading to significant improvements in the performance and versatility of modern robotic systems.

> A robotic hand developed at MIT can securely grasp and reorient 2,000 different objects of various sizes, shapes and materials.

Most humanoid robots are currently in the pilot or early commercialization stage. In the US, companies such as Agility Robotics, Apptronik, Boston Dynamics, Figure AI and Tesla[1] are spearheading the development with different technological approaches. The range extends from industrial co-workers to general-purpose service robots. At the same time, a dynamic ecosystem is emerging in China with companies such as AgiBot, Leju, Ubtech and Unitree[2], which are already showcasing functional prototypes and advanced series models. In Europe, the German company Neura Robotics[3] is blazing the trail. With a clear focus on cognitive capabilities, modular hardware and safe human-robot interaction, Neura has risen to become a global technology leader. German suppliers are also expanding into this segment and are playing a significant role in the value chain.

The applications for humanoid robots in manufacturing are endless

The first humanoid robots are already being put to work in productive manufacturing environments – for example, in pilot lines at selected industrial companies. In many industries, test runs are already underway. BMW, for instance, is currently testing how numerous robots can be used in manufacturing at its Spartanburg facility in the US. Experts therefore expect an accelerated timeline for the industrial rollout this year. The potential applications are manifold, but in the short to medium term, there will be a clear focus on activities in industry, production, logistics and warehousing – especially tasks that are physically demanding, repetitive or entail safety risks.

Robot dogs as a practical humanoid robot forerunner

The four-legged robot Spot from Boston Dynamics already demonstrates the potential of autonomous mobile systems in challenging operational environments. Spot is being deployed successfully for inspections and monitoring tasks in areas that are difficult to access or on dangerous terrain – for example, for reconnaissance after industrial accidents, detecting fires or identifying leaks in complex facilities. In contrast, humanoid robots are still being used predominantly in controlled pilot projects, usually in clearly demarcated zones. Continuous interaction with humans is currently limited due to safety concerns and regulatory hurdles.

Sources:
[1]Forbes; Bank of America; MIT
[2]Global Times
[3]Handelsblatt

Companies need to act now

For companies, these advancements mean that they should build experience and develop a target state to track the value contribution, make the right decisions and establish the necessary infrastructure. Why should the company early adopt humanoid robotics? Whereabouts in the company would this make sense? What strategic advantages or efficiency gains will be achieved?

A key aspect to consider is demographic change. Many industries are already bemoaning an acute shortage of skilled workers. An aging population and increasingly strict immigration rules are expected to exacerbate the problem even further. Robots can provide relief by taking over some of the tasks. In the future working world, the human workforce will channel its energies into more demanding and strategic issues.

The high prices currently paid for robots can appear daunting, and depending on the requirements, companies may need to make further investments in modernizing their infrastructure, which might even far exceed the costs of the robots themselves. Therefore, the infrastructure required for their operation must be carefully aligned with the target state and a phased implementation approach, although the acquisition costs of the robots will significantly decrease over time.

Rollout challenges

When calculating the payback period for such an investment, the robots themselves are a small item. Not to be overlooked are aspects such as cyber security, change management, regulations and political requirements, all of which need to be incorporated into the business case. Companies should also look closely into any potential supply chain dependency on non-European vendors and manufacturers and potentially opt for solution components that are made in Europe.

From today's perspective, robots as a service (RaaS) solutions are likely to present one of the greatest opportunities in the long term. Since a humanoid robot will be an extremely complex consumer item, it is expected that both product manufacturers as well as service providers will position themselves with new and innovative solutions.

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We offer:

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Assessing the strategic potential of humanoid robots

Companies should keep an eye on how this topic unfolds in their industry. Early deployment of humanoid robots can help to gain a decisive competitive edge. In-house expertise should be developed as soon as possible to find answers to strategic questions.

Future fields of application in which humanoid robots will play a role require a long-term strategy. In any case, a competent ecosystem will need to be created to initiate and guide you through the next steps of the transformation.

Summary

They are coming, and they are coming faster than expected. The combination with AI in particular has accelerated the development of humanoid robots. It is important for companies to stay on the ball, as machines will soon be making inroads into all areas of production and the service sector and shaking up the competition. Companies should develop a strategy as soon as possible and create the necessary conditions for their deployment.

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