Capgemini RESEARCH INSTITUTE

Physical AI

Taking human-robot collaboration to the next level

Make it real.

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Who should read this report and why?

This report is intended for senior executives shaping their organizations' approach to robotics and automation. It examines how physical AI is transforming robotics – from the capabilities it enables to the value it unlocks, the timelines for adoption, and the barriers that must be addressed to scale deployments safely and effectively. It will be particularly relevant to technology and innovation leaders (including chief technology officers, chief innovation officers, chief digital officers, and heads of AI or robotics), as well as manufacturing, supply chain, and logistics leaders responsible for robotics strategy and deployment.

As robotics expands into consumer-facing and service environments – such as healthcare, retail, hospitality, and entertainment – the report is also relevant to chief product officers, product strategists, and experience design leaders who are shaping interactions between people and intelligent machines.

In addition, the report provides practical guidance for CROs and safety or regulatory leaders preparing their organizations for wider robotics adoption – including implications for governance and risk oversight.

This report draws on a global survey of 1,678 senior executives across 15 industries, complemented by in-depth interviews with industry experts, robot manufacturers, foundation-model startups, technology providers, investors, and academics.

Please see the research methodology at the end of the report for more details.

We extend our sincere thanks to the many experts from industry and academia who shared their insights with us

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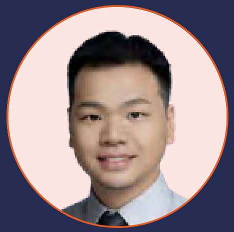

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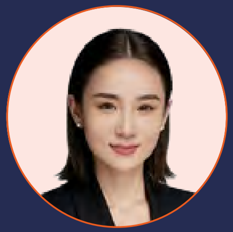

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Executive summary

Physical AI takes AI beyond screens into the real world – enabling machines to perceive, reason, and act autonomously. This report focuses on its application in robotics, where physical AI represents a fundamental shift: from robots that follow fixed, pre-programmed paths to robots that can generalize across tasks, perceive and navigate complex environments, make context-aware decisions, and adapt to real-world variation. This enables robots to function in far more diverse and dynamic environments, expanding their reach across nearly every major industry and unlocking solutions to problems earlier automation couldn't address.

"The last decade of AI was about information. The coming decade will be about action."

Rebecca Yeung

Strategic Advisor at Dexterity

Executive summary

Traditional robotics versus robotics powered by physical AI: A comparison

Traditional robotics	Key features	Physical AI-powered robotics
Limited perception – senses without interpretation	**Perception**	Perceives the environment through rich, multi-modal sensing (vision, depth, touch, audio) and interprets complex environments
Works only in structured* environments (consistent, predictable settings)	**Adaptability**	Operates in unstructured** environments (messy, variable, dynamic settings), including previously unseen situations
Has no real autonomy; follows pre-programmed instructions	**Autonomy**	Makes context-aware decisions in real time
No ongoing learning; behavior is static unless reprogrammed	**Learning capability**	Learns from demonstrations, simulations, and experience, improving performance over time without manual reprogramming
Designed for a single, specialized task	**Generalization**	Handles multiple scenarios on a single robot; generalizes learned skills to new tasks and unfamiliar situations
Robots operate independently with no knowledge sharing	**Collective learning**	Robots share skills and learnings across a fleet
Requires precise, coded commands	**Natural-language understanding**	Understands natural language instructions
Can execute assembly only in a strictly programmed manner; fails easily if presented with any slight deviation from programmed sequence	Example	*Capable of adapting autonomously to variation in assembly process and supports tailored assembly by adjusting dynamically to each unique product*

*Structured environments: Environments where the layout, tasks, and conditions are predictable and consistent, allowing robots to follow fixed paths and routines with little variation. Examples: assembly lines, controlled warehouse aisles.
**Unstructured environments: Environments that are variable and unpredictable, where robots must adapt to change and uncertainty. Examples: retail floors, hospitals, farms, construction sites.
For a more detailed description of physical AI, its application in robotics, and indicative industry use cases, please refer to the Appendix.

Source: Capgemini Research Institute analysis.

Executive summary

To understand the impact of physical AI on robotics and the value it can potentially unlock, this report draws on a global survey of 1,678 executives across 15 industries, complemented by in-depth interviews with experts across the physical AI and robotics ecosystem (please see the research methodology for more details).

Physical AI is at an inflection point

Multimodal foundation models are redefining robot intelligence by enabling generalization across tasks and environments. These advances are allowing robots to adapt to unfamiliar situations without task specific reprogramming, extending deployment into unstructured environments – messy, dynamic settings that earlier robotic systems could not handle. In parallel, advances in simulation are shortening robot training cycles, while an AI-robot-data flywheel is accelerating improvement with every real-world deployment. Combined with falling costs of key hardware components such as sensors, actuators, and electric motors, and commercial models such as robotics-as-a-service (RaaS), these shifts are lowering barriers to adoption. At the same time, demographic and economic pressures – including aging workforces and persistent labor shortages – are intensifying demand for robotic systems capable of taking on roles that are increasingly hard to staff. Record venture capital investment into physical AI and robotics is adding to the momentum behind these shifts.

A game-changer across multiple dimensions

Physical AI marks a step change from earlier automation. By enabling robots to interpret context, adapt in real time, and operate in unstructured environments, physical AI promotes them from passive tools to active collaborators in the workspace – opening the door to a reimagined work environment, in which humans, robots, and AI agents work in tandem. At the same time, physical AI allows robotics to scale as a shared intelligence platform, with learning and capabilities compounding across deployments. In doing so, physical AI extends the agentic paradigm into the real world, enabling robots to act as embodied AI agents capable of planning, orchestrating, and

Executive summary

executing complex physical tasks. Over two-thirds (67%) of executives view it as game-changing for their industry and most believe it will become a critical driver of competitiveness.

67%

of executives view physical AI as game-changing for their industry

Physical AI's value is multi-faceted. Executives expect the strongest gains in productivity, efficiency, and quality, alongside greater operational resilience and flexibility as adaptive robots help organizations manage volatility and reconfigure operations quickly. Physical AI also improves workplace safety and reduces physical strain, as robots increasingly take on hazardous and physically demanding tasks. Beyond operational impact, physical AI is opening new growth avenues: nearly four in ten executives expect new revenue opportunities, and 60% believe it will enable robotics in areas that were previously impossible or impractical. High-impact use cases span hazardous operations, micro-logistics, pick-and-place, and field inspection, alongside sector-specific applications such as dynamic assembly in manufacturing, healthcare and eldercare in the public sector, and disaster-damage assessment in insurance.

64%

of executives believe physical AI will become a critical driver of competitiveness

Executive summary

There is a growing imperative to adopt physical AI

Physical AI adoption is well underway: nearly eight in ten organizations (79%) are already engaging, with 27% deploying or scaling, and 65% expecting to reach scale within five years. The primary catalysts are structural: labor shortages (74%) and rising labor costs (69%). In the near-term, growth will come from familiar, proven form factors for task-specific applications. As foundation models mature and adoption deepens across industries, entirely new categories of robots are likely to emerge – purpose-built for varied environments, complex tasks, and new modes of human collaboration. Humanoids, despite substantial investment, remain a longer-term bet, as key challenges – including technical maturity (reliability and dexterity), safety, and cost-to-ROI viability – must still be addressed.

> **Near-term growth will come from established form factors for task-specific applications; as foundation models mature, new purpose-built robot categories are likely to emerge**

Scaling physical AI goes beyond technology – it also requires building safety, cybersecurity, regulatory, and operational readiness

In practice, scaling physical AI demands more than better algorithms – it requires rethinking how systems are engineered, secured, governed, and run. Today's systems do not yet meet the high reliability thresholds of industrial and other safety-critical settings, and dexterity remains limited. Progress is further slowed by data scarcity – real-world physical interaction data is scarce and costly to obtain. To keep people and assets safe while capability matures, safety must be enforced through deterministic mechanisms independent

Executive summary

of the AI layer. Further, as robot autonomy grows, cybersecurity exposure widens, requiring controls that prevent unauthorized access and manipulation. Regulatory frameworks lag the realities of autonomous physical action, leaving unresolved questions about accountability and acceptable risk. Operationally, enterprises must plan for hardware constraints, managing fleets at scale, strengthening data and AI governance, and reskilling workforces.

Humanoid robots inspire strong industry conviction – but scaled deployment remains a long-term bet

Two in three executives (67%) believe humanoids will ultimately transform their industry, citing their ability to operate in human-built environments and their potential as general-purpose systems; 53% are already investing or plan to invest. However, the conditions for scale are not yet in place. While 78% expect to deploy humanoids at scale eventually, average timelines extend to seven years, and only 30% see them becoming viable general-purpose workers within three to five years. Technology immaturity, high costs, uncertain ROI, and safety concerns remain significant barriers, compounded by a societal readiness gap, with 62% citing public acceptance as a critical hurdle.

67%

of executives believe humanoids will ultimately transform their industry

Executive summary

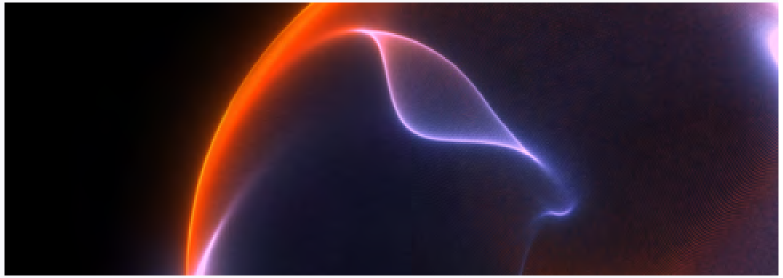
Recommendations: Actions to unlock the potential of physical AI

Physical AI adoption is a multi-year journey, but the technology is mature enough to deliver tangible value today.

Five priority actions:

1. **Build understanding:** Develop a clear view of what physical AI enables today – its capabilities, limits, and data-infrastructure requirements.
2. **Start with confidence-building use cases:** Begin with feasible, meaningful applications that build familiarity and confidence – such as dull, dirty, or dangerous tasks.
3. **Design through form exploration:** Iterate with multiple design concepts to assess how form shapes trust, interaction, and suitability for different tasks and environments, rather than defaulting to humanoids.
4. **Redesign workflows:** Rework processes for human–robot collaboration, with clear handovers, supervision, safety, and escalation.
5. **Scale via platforms:** Create a scalable architecture for reusable robot skills and fleet-level orchestration, to enable disciplined scaling beyond isolated pilots.

These actions must be anchored in trust – through clear safety, governance, and human-oversight guardrails – and supported by ongoing engagement with the physical AI ecosystem as technologies, standards, and regulations continue to evolve.



"Physical AI marks a shift from systems that describe the world to systems that can act within it. But we should stay clear-eyed. Robotics has a long history of overpromising, where early breakthroughs created expectations the technology could not yet meet. What is different today is not the hype, but the convergence of AI, data, and engineering maturity. The opportunity is real, provided we focus on what works at scale, and go beyond what looks impressive in demos."

Pascal Brier

Group Chief Innovation Officer, Capgemini

Physical AI–powered robotics in action

Physical AI robotic systems have potential applications across every major industry. The following examples highlight these applications in complex, dynamic, real-world environments.

Figure 1.

Examples of physical AI–powered robotic deployments

Industries	Illustrative cases
Warehousing and logistics	**Ultra**, a US-based industrial AI robotics company, has partnered with **Physical Intelligence**, a US-based startup developing general-purpose robotics foundation models, to deploy PI's π0.6 model on industrial robots operating in live warehouse environments. The model has been deployed for e-commerce order packing, a task that has historically been difficult to automate due to large variability in item types, deformable packaging materials, and multi-step manipulation that causes rule-based systems to fail. PI's robotic foundation model allows Ultra's robots to perceive, reason, and adapt in real time. Early deployments show Ultra's robots achieving gains in real-world autonomous performance, demonstrating how physical AI can unlock warehouse tasks previously considered non-automatable.[1] **FedEx** is partnering with US-based robotics startup **Dexterity** to pilot "superhumanoid"[2] robots for truck loading – one of the most complex and physically demanding tasks in logistics, as parcels vary widely in size, shape, and weight and arrive in unpredictable sequences. The robots autonomously interpret the incoming mix of parcels, and stack them into dense, stable walls. Using Dexterity's Foresight world model, they evaluate hundreds of possible placements for each item in milliseconds, predicting how each choice affects the integrity of the stack. This enables rapid handling of irregular items – where traditional automation struggles – while increasing throughput and reducing physical strain in high-volume operations.[3]
Manufacturing	**Foxconn** is partnering with **Intrinsic**, an **Alphabet**-owned company that develops AI models and software for robotics, to help realize the intelligent factory of the future. The collaboration targets electronics assembly – a fast-growing sector driven by the AI boom but still constrained by rigid automation and manual processes. The partnership aims to deliver a step change by shifting from product-specific automation that requires extensive reengineering across product generations to more general-purpose intelligent robotics. Initially, the collaboration will use Intrinsic's robotics foundation model to focus on critical use cases across assembly, inspection, machine tending, and logistics.[4]

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Industries	Illustrative cases
Construction	The construction industry faces mounting pressure from labor shortages and increasing demand for more efficient and sustainable building methods, while increasing constructing quality and safety. At the same time, construction sites are one of the most challenging environments for automation due to constantly changing terrain, layouts, and human activity. Australian robotics company **FBR's Hadrian X** addresses these constraints by automating one of the most labor-intensive tasks in construction: structural wall building. Hadrian X is an autonomous, mobile construction robot that uses a robotic arm mounted on a vehicle platform to place concrete blocks. The robot has been piloted on an active construction site in the US, and has demonstrated the ability to construct structural, load-bearing walls within a day.[5] **Boston Dynamics** and **FieldAI** are tackling a different bottleneck: site monitoring and inspection in construction environments. Construction sites are difficult to monitor consistently due to changing conditions and safety risks, making data collection labor-intensive and error-prone. The partnership combines Boston Dynamics' Spot quadruped robot with FieldAI's Field Foundation Models to enable autonomous inspection, mapping, and monitoring. Already deployed across multiple locations, the solution supports fleet-level autonomy and coordinated operation, and has delivered over 90% reductions in inspection and documentation time, earlier issue detection that reduces rework costs, and improved worker safety.[6]
Agriculture	Automation is becoming increasingly critical in agriculture as labor shortages intensify in many regions.[7] However, scaling automation in agriculture remains challenging due to the highly variable nature of farming environments – where lighting, terrain, and crop varieties differ widely across fields – and the reliance on heterogeneous fleets of machines, including tractors, harvesters, and sprayers. **TorqueAGI**, a US-based startup building foundation models for robotic autonomy, addresses these constraints with physics-informed AI foundation models that can handle dense foliage, irregular plant geometry, and multimodal perception, while operating across different machines. TorqueAGI is collaborating with **John Deere** to advance AI foundation models for the next generation of intelligent agricultural robots.[8]

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Industries	Illustrative cases
Healthcare/eldercare	**Wandercraft**, a France and US-based robotics company, is developing AI powered medical exoskeletons that enable people with spinal cord injuries, stroke, and other severe mobility impairments to stand and walk. Its latest device – the Personal Exoskeleton – is currently in clinical trials and is designed for everyday indoor and outdoor use. The device uses AI for balance and movement, adapting continuously in real time to support stable walking across varied surfaces such as concrete, carpet, and tile.[9] **ElliQ**, an AI-powered companion robot for older adults developed by Intuition Robotics, is being introduced to Japan through a partnership with Japanese trading company **Kanematsu Corp**. The collaboration targets Japan's rapidly aging population and the resulting shortage of caregivers and nursing home staff. ElliQ proactively supports older adults with everyday needs, including health management, preventive care, communication, monitoring, and social and cognitive activities.[10]
Energy	AI-enabled robots from US-based **Luminous Robotics** were used to help install nearly 500,000 solar panels at **ENGIE**'s 250 MW solar farm in Victoria, Australia. Luminous's LUMI robots autonomously lift and place panels onto mounting structures using AI-driven pick-and-place systems, while human crews complete final fastening. This reduces heavy manual labor, improves safety, and increases efficiency. The robots demonstrated a high degree of flexibility, operating effectively across a range of weather conditions. More broadly, automating solar construction is expected to lower costs and speed up construction, enabling larger scale solar developments, while reducing the need for human labor in remote and inhospitable outdoor environments.[11]

Sources: Information compiled from publicly available secondary sources.

A professor of robotics at a UK-based university says: *"Traditional robots are optimized to execute predefined motions, with limited understanding of intent or real world impact. Physical AI fundamentally changes this by enabling robots to perceive their surroundings and reason about context. In doing so, it opens up problem domains that have resisted automation for decades – precisely because they require understanding, not just execution."*

Evolution of robotic intelligence

The evolution of intelligence in robotics (at a glance)

1960s–1980s

Hard-coded automation

Robots execute fixed, pre-programmed motions, but with no awareness of their environment

1990s

Sensor-aware robots

Robots gain limited awareness of their surroundings, but decision-making is still rule-based

Early–mid 2000s

Pre-programmed autonomy

Robots operate independently in controlled settings (enabled by sensing combined with onboard software)

2010s

Domain-specific intelligent robots

Robots optimized for narrow tasks (enabled by advances in AI and perception)

Late 2010s–early 2020s

Learning-enabled robotics

Robots begin to learn from experience and simulation

Today

Physical AI era

Robots as adaptive, autonomous systems

Key milestones

1960s–1980s

- **Unimate (1961):** The first industrial robot, deployed on General Motors' assembly line
- Early industrial arms in automotive manufacturing
- PLC-driven automation and fixed production cells

1990s

- Vision-guided industrial robots
- Force-controlled arms for precision assembly
- Early mobile robots in warehouses and labs

Early–mid 2000s

- **ASIMO (2000):** Honda's humanoid robot demonstrated walking, balance, and basic interaction
- Early service robots in research and defense

2010s

- **Kiva robots (later Amazon Robotics):** Autonomous warehouse logistics
- Collaborative robots (cobots) on factory floors
- Surgical and inspection robots in healthcare and infrastructure

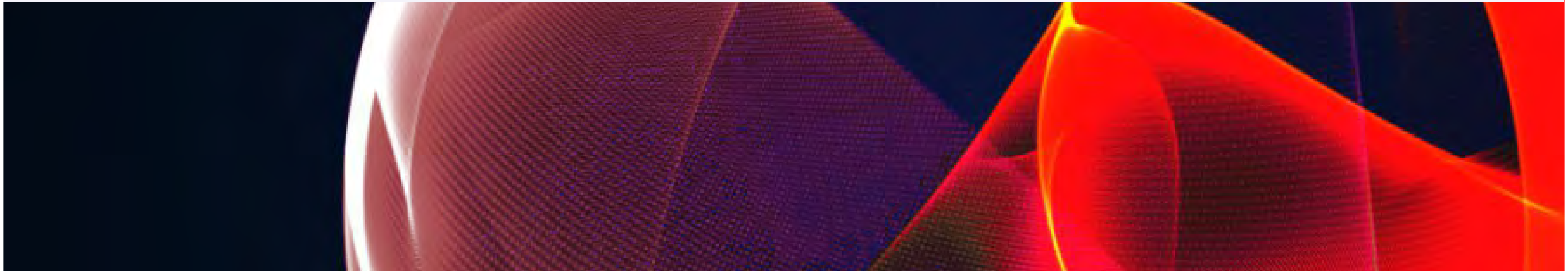
Late 2010s–early 2020s

- Deep learning for perception and manipulation
- Cloud-connected robot fleets
- Sim-to-real training pipelines

Today

- Robotic foundation models enabling generalization across tasks and the ability to operate in unstructured environments
- Multi-robot and AI agent orchestration
- Rapid progress in humanoid and general-purpose robots

Dr. Milad Malekzadeh, Co-Founder and Vice President AI at Neura Robotics, a Germany-based robotics firm, says: *"Physical AI will be used across virtually every type of context – from industrial settings to medical, home, and service environments. Progress is being driven not only by advances in individual models, but increasingly by platform approaches that make it easier to combine, reuse, and deploy intelligence across different robots and use cases."*



A discussion with

Deepu Talla,

VP and GM – Robotics & Edge AI, NVIDIA

What recent advances are driving the inflection point in physical AI?

In the last 12 to 24 months, two technologies have reached a meaningful level of maturity, bringing us into what I would call a golden age for physical AI and robotics. First, foundation models – now extending beyond language to vision and action – make it possible to move beyond brittle, task-specific systems toward more general-purpose robot brains. Second, advances in simulation. The gap between simulation and the real world has narrowed for many use cases, allowing robots to be trained and tested extensively in simulation. This is orders of magnitude faster, safer, and cheaper than real-world testing, compressing development cycles that once took years into hours or even minutes.

Why does physical AI represent such a significant economic opportunity?

The majority of global economic activity is tied to physical industries. Manufacturing, healthcare, smart cities, transportation, logistics and other physical domains together add up to somewhere between $50–80 trillion of GDP. Against that backdrop, as significant as digital AI is, physical AI represents a much larger economic opportunity. Demand for physical AI is driven by dangerous work and persistent labor shortages, particularly in repetitive, physically demanding, or hazardous roles. Robots can take on these roles, augmenting human capability and helping protect human life, which is why demand is especially high in industrial settings. In consumer contexts – likely further out – robots could also assist with everyday tasks, giving people back more time for other activities.

Which industries will see the impact of physical AI first?

Manufacturing and logistics represent both the greatest near-term need, driven by labor shortages, and the most solvable opportunities today: many tasks rely on locomotion and navigation that are already good enough, involve rigid objects that can be handled with simple grippers or suction, and allow safety to be handled by fencing robots away from humans or by slowing down or reducing torque when people are nearby. Fine-grained, dexterous manipulation remains a longer-term challenge, but many meaningful applications are already deployable today.

How does the agentic paradigm translate into the physical world of robots?

Industrial deployments will increasingly involve fleets of robots with different embodiments working together as part of a coordinated system. Within this model, each robot acts autonomously, while digital AI agents observe activity across robots, sensors, cameras, and safety systems to build situational awareness and orchestrate work. This orchestration is powered by a real-time digital twin – a physically accurate virtual replica of the entire facility, acting as the system's "world model". The role of humans shifts from step-by-step programming to defining higher-level goals and constraints, such as what needs to be achieved over an entire shift. Based on those goals, digital AI agents use the digital twin to run continuous "what-if" simulations, allowing them to plan, sequence, and coordinate tasks across the robot fleet in the virtual space before executing them in the physical world. This enables real-time adaption and work over longer horizons with reduced human intervention.

What are the main barriers to scaling physical AI?

Accuracy is the most important barrier, and the required level of accuracy varies by use case. Some applications can tolerate lower accuracy, while others – such as surgical robots – require extremely high thresholds. Safety is also critical and, again, use-case dependent. It can be addressed through mechanisms built into the robot, external safety systems such as geofencing, or a combination of both. Cost and return on investment are essential for scale. Design and user experience also matter, particularly for consumer robots.

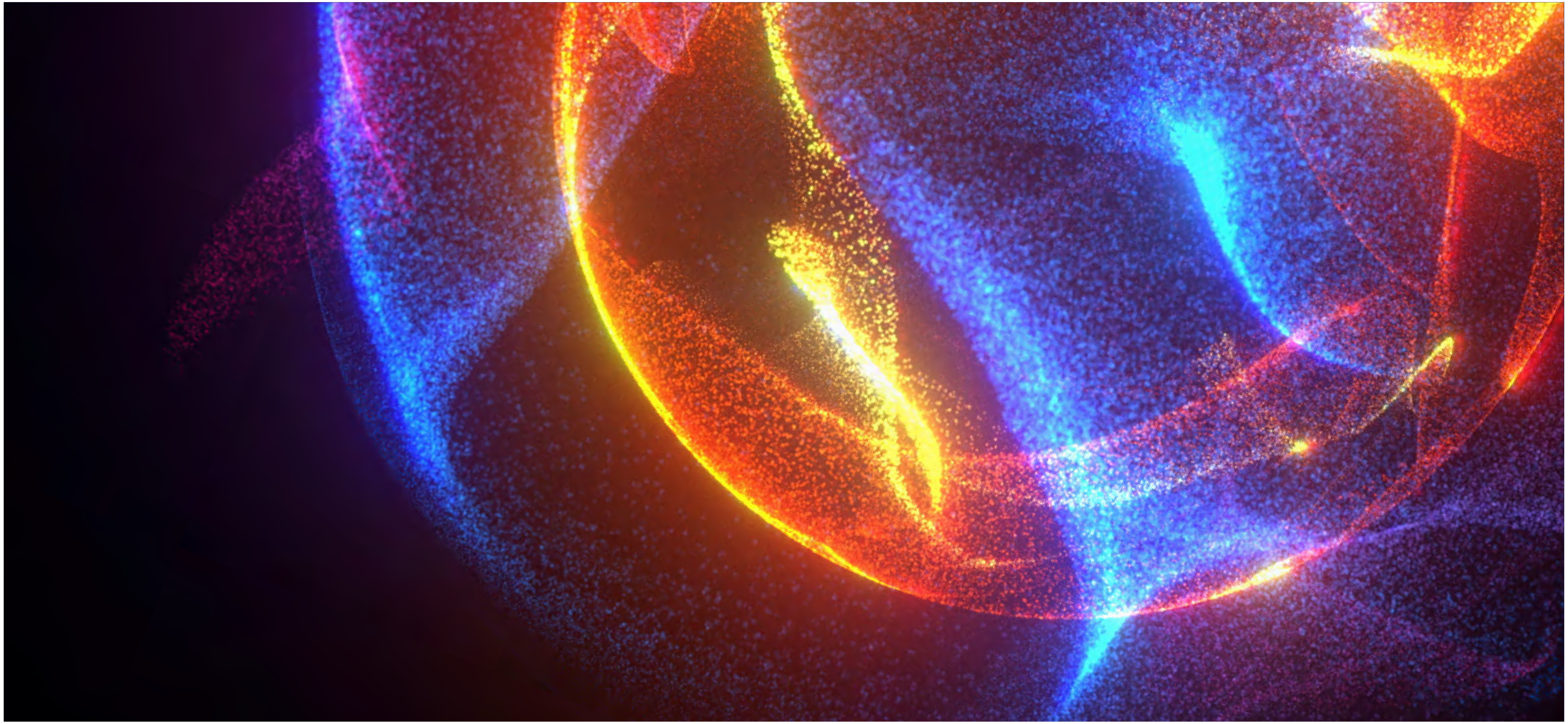
How should trust and ethical considerations guide the deployment of physical AI?

Trust starts with safety and accuracy, evaluated in the context of the specific use case. Once those thresholds are met, the next question is whether deployment is genuinely beneficial for humans and for society. Even when a robot is safe, accurate, and cost-effective, there may be situations where deployment is not appropriate for societal reasons. At the same time, many applications today involve work that is dangerous, monotonous, or repetitive. Ultimately, deployment requires balancing these considerations.

"Physical AI is where AI ambition meets atoms. AI now acts in the physical world alongside humans, complementing human judgment with machine precision. Machines anticipate risk, reduce strain, and unlock step changes in productivity and resilience. But scaling is not just code. It is trust engineered through safety, cybersecurity, governance, regulatory compliance, and workforce transformation. Leaders will build shared intelligence that compounds across sites. Success will be measured in safer work, resilient performance, and new sources of competitive advantage."

Alexandre Embry

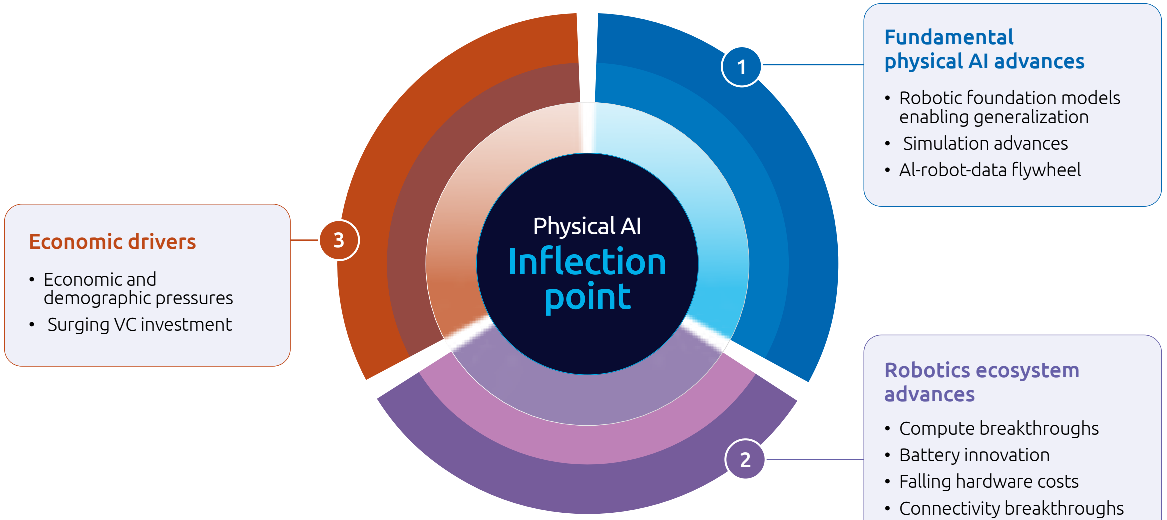
Vice President, CTIO, Head of the Capgemini AI Robotics and Experiences Lab, Capgemini



01 Why physical AI is at an inflection point

In 2026, physical AI has emerged as a defining theme in the global technology narrative, driven by a convergence of forces (see **Figure 2**). Deployments are already taking shape – particularly in manufacturing and logistics – generating real-world operational data that is fueling rapid iteration and technical progress. At the same time, market forces are converging, from rising operational pressures driven by labor shortages to surging venture investment, making this a pivotal moment for acceleration and scale.

Figure 2.
The converging technological and market forces driving the physical AI inflection point



Source: Capgemini Research Institute analysis.

Fundamental physical AI advances

Foundation models are redefining robot intelligence

For robots to operate autonomously in unpredictable, real-world settings, they require a far more substantive understanding of the physical world – its underlying physics, dynamics, and cause-and-effect structure. Historically, robotic systems have lacked this foundation. Earlier AI-driven approaches, including conventional vision systems, relied on discrete components for perception, planning, and control but lacked a unifying, generalizable, physics-aware model to integrate them. The result was a set of brittle architectures that failed in real-world conditions.

Real-world autonomy demands a far broader set of cognitive capabilities: the ability to interpret complex visual scenes, understand human instructions, reason toward goals, and anticipate the physical implications of actions. Large language models (LLMs) have significantly advanced reasoning and semantic understanding, but they cannot perceive or model the physical world.

A new class of multimodal and physics-aware AI models is emerging to close this gap and provide robots with the core intelligence required to operate in complex real-world environments.

Multimodal foundation models

Multimodal foundation models are large-scale AI systems trained across diverse data types – including images, text, audio, video, and tactile inputs – to strengthen contextual understanding and enable broader generalization across tasks. A wide set of actors, from large technology organizations and robotics startups to industry players building domain specific models, are developing these foundation models.

Vision-language-action (VLA) models

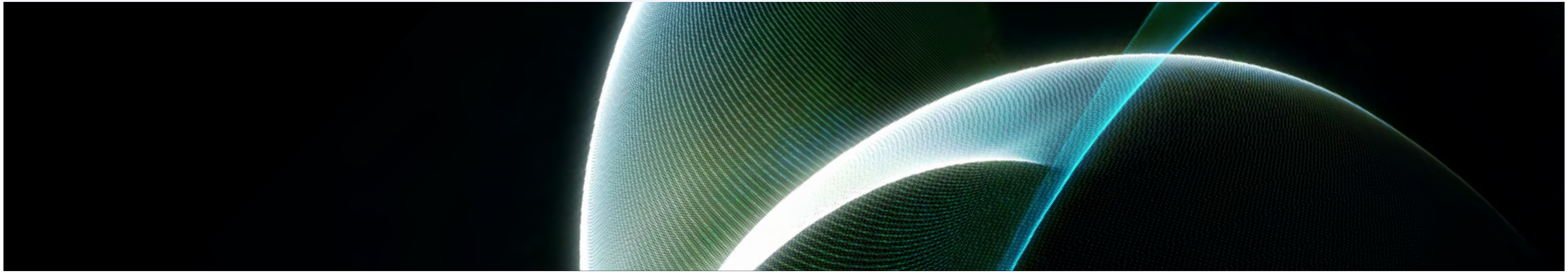
VLA models unify perception, language understanding, and motor control into a single architecture. By training on large-scale datasets spanning visual inputs, textual instructions, and action trajectories, VLA models are demonstrating early generalization across tasks and environments, with reliability remaining an active research challenge. Examples include NVIDIA's Isaac GR00T,[12] Google DeepMind's Gemini Robotics models,[13] and VLA models from robotics startups including Physical Intelligence, Skild AI, and TorqueAGI.[14] In addition, Hugging Face, an open-source AI platform, is developing LeRobot, an open-source library that provides ready-to-use datasets, reusable training pipelines, and pretrained models – including VLA models – to lower the practical barriers to training robots.[15]

World models

World models provide robots with predictive, physics aware reasoning. These systems learn internal representations of the physical world, enabling robots to anticipate outcomes, plan, and reason about physical interactions.

Examples include World Labs, founded by AI pioneer Fei Fei Li, which has raised over $1 billion in funding and has developed the Marble world model,[16] AMI Labs, a new venture co-founded by AI pioneer Yann LeCun, which has also raised over $1 billion in funding,[17] and Runway, an AI startup known for creative video generation, now expanding its world models into robotics.[18] In parallel, NVIDIA's Cosmos Platform provides a data and training pipeline designed to support the development and integration of world models as they emerge, illustrating how the broader industry is converging around this architectural layer.[19]

Dr. Ashutosh Saxena, Founder and CEO, TorqueAGI, a US-based robotics startup, says: *"A single foundation model can now power many robots, enabling true cross-embodiment intelligence without rebuilding AI for every task, skill, and robot form factor. Development effort is shared across robots, and the model becomes more powerful as it learns from each deployment. Over the next five years, this will reduce the need for many traditional robot cells, as robots will be able to perform a wider range of tasks in environments with real variability and complexity. This is the unlock the industry has been waiting for."*



Robotics ecosystem advances

Advances in simulation are compressing robot training cycles

Instead of learning primarily through slow, expensive, and risky physical trials, robots can now practice at scale in synthetic environments, rapidly iterating across millions of scenarios, edge cases, and failure modes before deployment. This dramatically compresses the learning cycle for robotics and reduces dependence on scarce real-world data. While real world training and validation remain essential, simulation reduces reliance on extensive physical trials, helping lower cost and shorten development cycles.

For example, NVIDIA's Isaac Sim is a robotics simulation application and synthetic data generation tool that allows developers to design, test, and train AI-driven robots in physics-based, photorealistic virtual environments.[20]

The AI-robot-data flywheel is accelerating progress

A reinforcing AI-robot-data flywheel is now emerging in which improvements in AI enhance robot performance, deployed robots generate new real-world data, and that data informs further model development. While significant gaps in real world data remain, this flywheel is starting to accelerate progress in improving performance, generalization, and scalability in physical AI.

Mind Robotics, an industrial robotics spin-out from EV manufacturer Rivian, uses data from Rivian's high volume production operations to train robots that are deployed back into Rivian's plants, generating new data for further refinement – illustrating how data flywheels are taking shape in practice.[21]

Breakthroughs in compute are enabling edge inference in real time

Physical AI systems require powerful onboard compute to handle perception, reasoning, and action in real time. Recent advancements in compute power are making this feasible. NVIDIA's Jetson AGX Thor modules, Qualcomm's Robotics RB5 platform, and Netherlands-based Axelera AI's Metis AI platform, for example, aim to bring high-performance AI processing to the edge, enabling robots to run advanced AI models locally.[22] At the same time, training large models as well as fleet level orchestration continue to rely heavily on cloud infrastructure, making hybrid edge-cloud architectures the standard approach for deploying physical AI systems.

Battery innovations are increasing robot uptime

Running compute-heavy AI models onboard places high demands on energy, making battery performance critical to autonomy. Advances in battery chemistry, packaging, and thermal and safety engineering are helping ease runtime constraints for mobile and humanoid robots. Ongoing research on solid-state batteries aims to improve energy performance and safety further. Chinese EV maker XPENG, for example, is exploring solid-state battery technology for humanoid robots to improve energy density and safety, and support compute-heavy onboard AI tasks.[23]

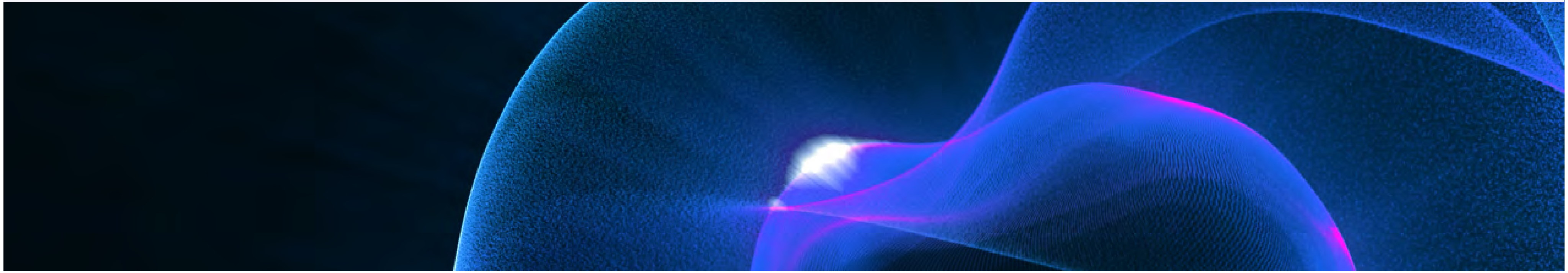
Falling hardware costs and new business models are widening access to robotics

Declining costs of key hardware components – notably sensors, actuators, and electric motors – are making advanced robotics more economically viable. Humanoid production costs, for example, have fallen roughly 30 fold over the past decade – from about $3 million to around $100,000 (with wide variation across lower-end and cutting-edge models), driven by advances in AI reasoning, actuator design, and battery systems. Actuators are the largest cost component, accounting for around 50% of production costs.[24] At the same time, new business models such as robotics-as-a-service (RaaS) and flexible leasing are making robotics accessible without heavy upfront capital.[25]

Connectivity breakthroughs are unlocking real time autonomy and spatial awareness for robots

Advancements in connectivity are unlocking the edge intelligence and spatial awareness that robots require to learn, navigate, and act effectively in real-world environments. 5G networks provide the reliable, low-latency, high-bandwidth connectivity that allows robots to perform perception and control at the edge, while precise wireless geolocation gives them an accurate, continuous understanding of where objects and assets are – something earlier positioning methods could not reliably deliver. One example of innovation in wireless positioning comes from ZaiNar, a US-based startup developing technology that turns existing 5G, Wi-Fi, and other wireless networks into sub-meter-accurate sensing layers, enabling continuous, real-time positioning without new hardware or compute.[26]

Daniel Jacker, CEO at ZaiNar, says: *"Key connectivity capabilities are maturing at the same time to support real-time, spatially aware autonomy at industrial scale. Private 5G now delivers the reliability, low latency, and reach that large sites require, while advances in wireless positioning provide centimeter-level accuracy and nanosecond-level time synchronization – giving robots a shared real-time understanding of their environment and paving the way for swarm intelligence, fleet optimization, and more autonomous operations."*



Economic drivers

Economic and demographic pressures are accelerating adoption

Labor shortages are a global challenge as aging populations shrink the workforce. In Europe, the ratio of people aged 65+ to those of working age is expected to rise from 28 to 43 per 100 by 2050. The core 25–54 age group is expected to decline by 35 million, cutting the labor force by about 10 million even as older age groups grow.[27] In the US, one in five Americans is expected to be 65 or older by 2030 as the population continues aging.[28] China's working-age population is also declining rapidly, and by 2035 more than 30% of its population will be aged 65 or older.[29] At the same time, labor costs continue to rise across major economies as employers compete for workers. These combined demographic and economic forces are strengthening the business case for automation.

Surging VC investments are fueling advances in physical AI and robotics

Venture capital (VC) investment in robotics hit an all-time high in 2025, with robotics companies raising a record $40.7 billion, accounting for 9% of total VC funding and placing the sector among the leading investment categories, alongside AI software. Investment in world models alone surged from $1.4 billion in 2024 to $6.9 billion in 2025.[30] In addition, major humanoid robotics startups secured some of the largest rounds in the industry, including Figure ($1.5 billion), 1X Technologies ($1.0 billion), Apptronik ($734 million), Agility Robotics ($400 million), and Neura Robotics ($124 million), signaling strong investor conviction in general-purpose embodied AI.[31]

Investment in world models has surged

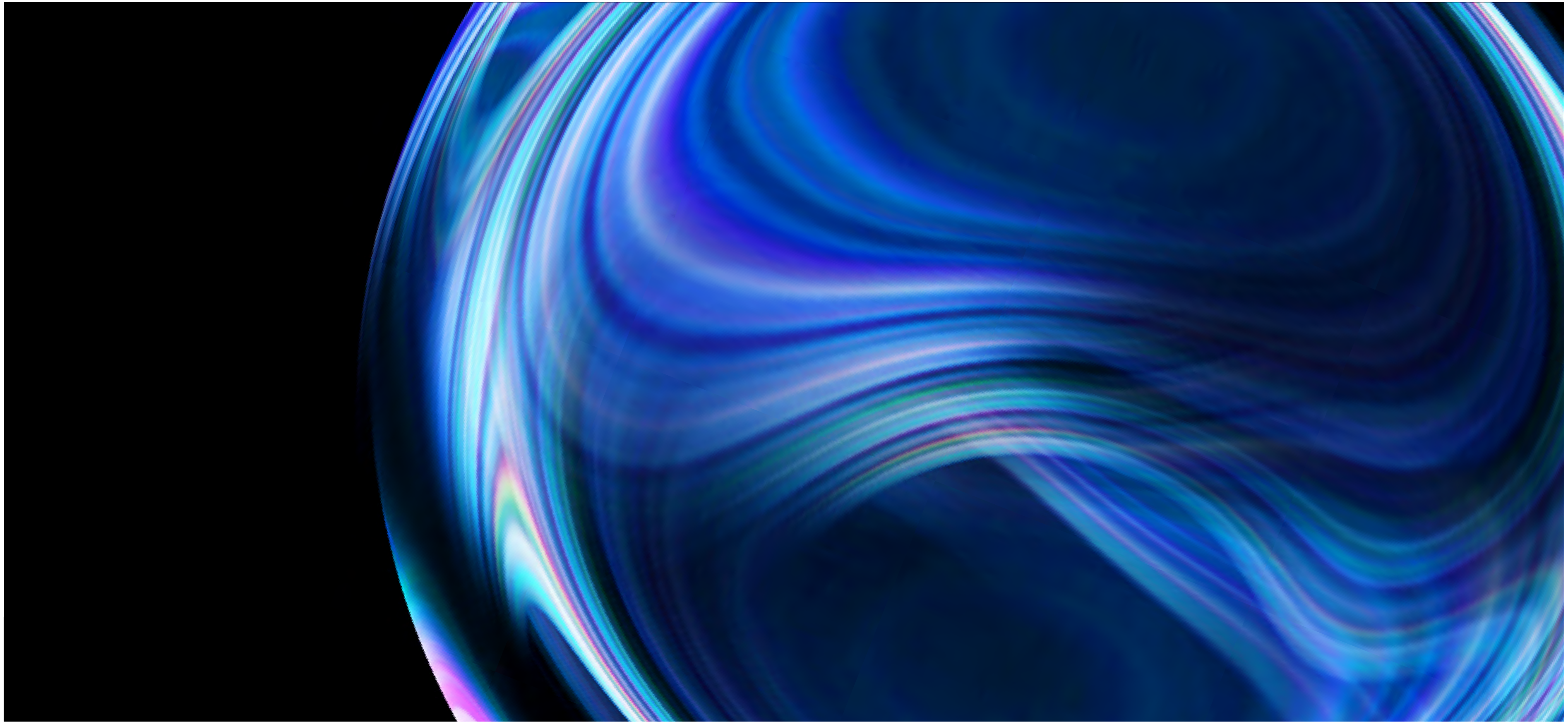
$1.4 billion
in 2024

$6.9 billion
in 2025

"Physical AI and next generation robotics are set to transform the world of manual work in the same way that generative and agentic AI is transforming digital work. We are at the tipping point and organizations who build early capability and take a long view will build sustainable advantage. This is not just about business efficiency, the winners through this disruption will build new businesses and value streams."

Tim Ensor

EVP and General Manager – Intelligent Services,
Cambridge Consultants, part of Capgemini Invent



A discussion with

Daniela Rus,

Director, Computer Science and Artificial Intelligence Laboratory (CSAIL), MIT

How is physical AI distinct from conventional AI?

Today's AI is brilliant in the digital domain but not as effective in the physical one. The techniques that underpin it are statistical and have no understanding of physics by default. Physical AI is what happens when AI's ability to understand text, images, and other online information is coupled with an understanding of the physical world and used to make physical machines intelligent. This has tremendous implications for robotics. And because many physical and safety-critical devices need to run AI on-device with low latency, physical AI requires a different kind of AI than the models built for the digital world.

On which industries will physical AI have the greatest impact?

The warehousing and logistics sector is seeing the strongest gains from physical AI today, where physical AI lets robots handle far more dynamic task allocation and make better predictions, enabling truly autonomous movement of goods. Manufacturing is the next major opportunity: traditional industrial automation was built for high-volume, low-variation tasks, so it suited industries such as automotive but much less so areas such as electronics manufacturing, where product cycles change constantly. With physical AI, we can start to imagine plug-and-play cells that learn new assemblies from just a few demonstrations, opening the door to far wider use of automation across many more segments within manufacturing.

Construction and field robotics are other strong domains for physical AI. These environments are chaotic, with clutter, dust, and challenging weather, and physical AI could make a real difference by giving robots robust 3D perception, better understanding of materials and loads, and adaptive control, allowing them to take on safety-critical tasks, support site mapping, and coordinate more effectively with human crews.

Agriculture is another powerful area: running AI on-device in an energy-efficient, weather-tolerant way could enable precision crop monitoring, disease and weed analysis, and delicate tasks like fruit picking and pruning – work that is physically demanding and ergonomically difficult.

Physical AI can also extend to service robotics, eldercare, mining, and hospital robots. The bottom line is that physical AI is a genuine game-changing technology that overcomes the brittleness of today's pre-programmed robots and enables them to adapt when conditions change, and learn skills that can be executed independent of context.

What does it take to build physical AI systems that can be trusted?

Trust comes from technologies that can be used safely. That means thinking about safety at multiple levels – through verifiable controllers, reliable perception, and reliable adaptation. But technical design is only part of it. The humans working alongside robots need time and experience to be comfortable with what the machines can do, which is why progressive deployments that gradually increase a system's capabilities help build confidence. The goal is to achieve security-by-design, and one way to augment that is by specifying clear human authority over robots: easy emergency stops, intuitive supervision interfaces, and processes that make it simple to intervene when something does not look right.

What are the technical and practical barriers holding back physical AI today?

One of the hardest challenges is ensuring reliability in the long tail – all the unexpected real-world situations that robots can encounter in physical environments. One single failure in a thousand can be catastrophic in safety-critical settings, so robustness is essential. Data is another major barrier: collecting richly labeled, safety-critical data for physical tasks is slow, expensive, and dangerous, and the near-accident situations that matter most for learning are the hardest to capture safely. This is where simulation becomes important, because it allows us to generate those rare edge cases without physical risk. Hardware also remains a constraint: even as processors and sensors are improving rapidly, complex robots face failures that can take much longer to repair than software fixes. Finally, successful deployment requires integrating robots into human workflows – which means considering regulation, training, IT integration, and day-to-day collaboration – all of which are far from trivial.

How close are we to deploying humanoids in the real world?

While locomotion has progressed, manipulation remains very challenging. The hands are still quite primitive, tactile sensing is coarse, and tasks that require dynamic stability or responding to external forces are difficult for current systems. In the long term, the appeal of the humanoid form factor is strong, because our workplaces are designed around how humans move and interact. But getting humanoids ready for complex, real-world tasks will take some time.

02 Physical AI is a game-changer for industry

Physical AI transforms robots from tools to collaborators

Physical AI represents a step change from previous waves of automation. By enabling robots to interpret context, learn, adapt, and operate in unstructured, real-world environments, physical AI gives industries a path to addressing some of their most complex and persistent operational challenges – problems that have long remained beyond the reach of traditional robotics and automation. But its implications extend far beyond overcoming today's constraints. Adaptive, context-aware robots set the stage for an entirely new industrial paradigm: one where robots evolve from tools to collaborators, enabling a shift that is no longer about optimizing existing processes but about reimagining how work is designed, coordinated, and executed, with humans, AI agents, and robots working together in fundamentally new ways.

From task specific robots to a shared intelligence platform

Further, physical AI enables a shift in robotics from task-specific machines to a shared intelligence platform by separating intelligence from robot hardware and placing it in shared models and data. Learning moves to the system level – across fleets – rather than being confined to individual robots. As this shared intelligence improves through data, simulation, and real-world feedback, capabilities developed in one context can be reused elsewhere with far lower marginal effort. This shift from isolated improvement to cumulative learning fundamentally changes how automation scales, enabling organizations to build a shared intelligence foundation that can be continuously improved and reused across the business rather than relying on one-off deployments.

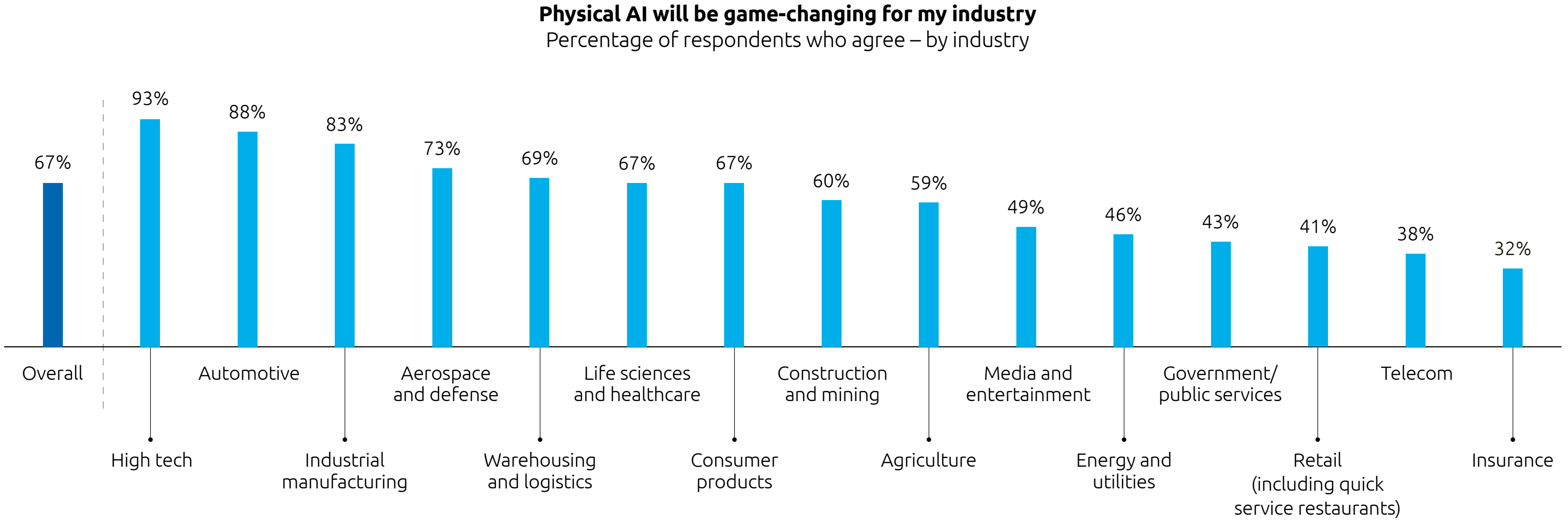
Industry sentiment underscores the transformative potential of physical AI

Two-thirds (67%) of executives viewing physical AI as game-changing. This perspective cuts across several sectors (see **Figure 3**) and is shared globally, with the majority in the US (73%), Europe (64%), and APAC (67%) in agreement (see **Figure 4**). Overall, close to two-thirds (64%) believe that physical AI will become a critical driver of competitiveness in their industry, signaling a shift that will redefine performance across sectors.

Figure 5 illustrates how physical AI drives transformation across industries. Industrial and logistics environments are emerging as the first proving ground for physical AI, as they combine strong economic pressure with relatively structured tasks, repeatable workflows, and clear performance metrics – making them well suited for early deployment and scaling. Adoption is then expected to expand into domains such as construction, mining, and agriculture, where environments are less controlled and adaptability becomes more important. As capabilities mature further, growth will increasingly extend into service oriented domains, characterized by closer human interaction and highly dynamic operating conditions.

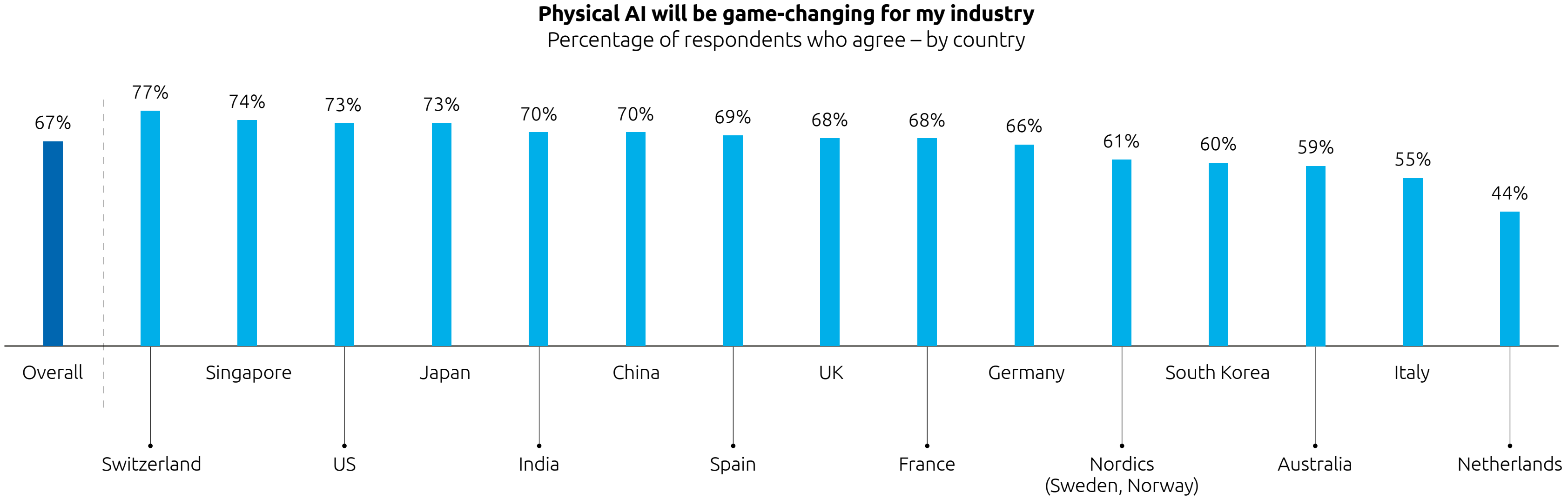
Figure 3.

Two-thirds of executives expect physical AI to be game-changing



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives. Note: The term physical AI is used here only in the context of robotics.

Figure 4.
Executives in most countries see physical AI as game-changing



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives. Note: The term physical AI is used here only in the context of robotics.

Figure 5.
Why physical AI is transformative across industries

Industry	Core industry challenges	Why physical AI is a game changer
Manufacturing	Labor shortages; demand for high-mix/low-volume manufacturing; frequent line reconfiguration; manual and semi-automated processes lead to variable quality	Enables robots to adapt to changing products, tasks, and layouts, reduces changeover time, stabilizes quality, and eases labor constraints
Logistics/warehousing	Volatile demand; labor shortages; safety risks; wide SKU diversity and irregular items that increase picking and fulfillment complexity	Allows robots to perceive cluttered environments and handle diverse SKUs
Construction	Highly dynamic and unstructured sites; hazardous tasks; persistent skilled-labor shortages; and low productivity driven by variability and rework	Automates labor-intensive construction tasks while improving worker safety, accelerating inspections, and reducing expensive rework
Agriculture	Labor shortages; harsh outdoor conditions; uneven terrain; changing weather and lighting; crop variability; exposure to hazardous chemicals and equipment	Automates agricultural tasks in unstructured, outdoor environments, reducing worker exposure to hazardous chemicals and machinery while adapting to crop and terrain variability
Mining	Dangerous environments with physical and health risks from unstable terrain, toxic exposure, and heavy machinery; remote locations; downtime costs	Allows robots to operate autonomously in hazardous and remote mining environments, reducing human exposure to risk and minimizing downtime
Energy	High-risk operations in hazardous and remote environments; heavy manual labor; pressure to rapidly scale renewable infrastructure; difficulty inspecting hard-to-reach assets	Shifts hazardous work to autonomous robots; automates strenuous construction tasks (e.g., solar panel installation) to accelerate deployment and reduce costs; enables autonomous inspection of remote assets across complex terrain
Healthcare/eldercare	Staff shortages; repetitive physical tasks; growing care demand	Enables assistive robots that can adapt to varied care tasks and environments
Insurance	Manual claims processing; slow damage assessment; safety risks in inspections	Enables autonomous inspection and assessment in hazardous or inaccessible locations, improving speed and accuracy

Sources: Capgemini Research Institute analysis.

Physical AI has multi-dimensional value

Productivity, efficiency, and quality are the strongest expected gains

Among the expected improvements from physical AI, executives most often cite productivity gains (76%), followed by improvements in cost efficiency (70%) and product quality and precision (65%) (see **Figure 6**).

While earlier generations of robots delivered these benefits in tightly controlled settings, physical AI extends them to more dynamic environments:

- Productivity increases as robots can take on a broader range of tasks, maintain higher uptime with fewer interruptions, while learning and coordination across fleets lift overall system performance.
- Costs decline across engineering, operations, training, and quality: engineering effort is reduced through less task-specific reprogramming; operating costs fall with lower manual oversight; training and upskilling costs decline; and errors and rework are reduced.
- Quality improves as robots maintain precision, even when inputs vary, performing a wider range of tasks while avoiding the fatigue-related errors and variability that affect human work.

Julien Perrin, Chief Operating Officer at Niryo, a France-based robotics startup, says: *"Physical AI is opening automation opportunities that were previously uneconomical. By shifting intelligence into software, physical AI allows us to use simpler, cost-effective hardware for tasks that once required complex and expensive machines. It also dramatically reduces integration and setup time: instead of engineers spending hours or days, people on the line can configure systems in minutes. This intelligence-driven shift lowers the total cost of automation and makes entirely new areas of the factory viable for robotics."*

Physical AI boosts operational resilience and flexibility

Over half of executives (57%) expect it to enhance operational resilience. A further 45% highlight flexibility as a key benefit, pointing to the potential to reconfigure production systems or workflows far more rapidly than with traditional robotics or fixed automation.

Physical AI unlocks new products, experiences, and business lines

While operational gains lead today, physical AI also offers significant top line potential. Organizations can begin to imagine entirely new products, services, and business lines that build on physical AI–powered robotic systems.

For example:

- Automotive manufacturers could build **dedicated robotics lines** by extending the capabilities developed for EVs and autonomous vehicles – such as batteries, sensors, real-time decision systems, and large-scale manufacturing. Tesla, for example, is pursuing humanoid robotics as part of its broader commercial strategy.[32]
- Industrial manufacturers could design **specialized robotic solutions** for sectors such as construction, logistics, and energy.
- Travel, leisure, and entertainment organizations could offer **new service experiences**, such as robotic concierge or guest-interaction systems. Disney, for example, has developed a new robotic figure for its theme parks that moves autonomously and interacts with guests.[33]

Nearly four in ten (37%) executives already see this upside, expecting physical AI to create new revenue opportunities.

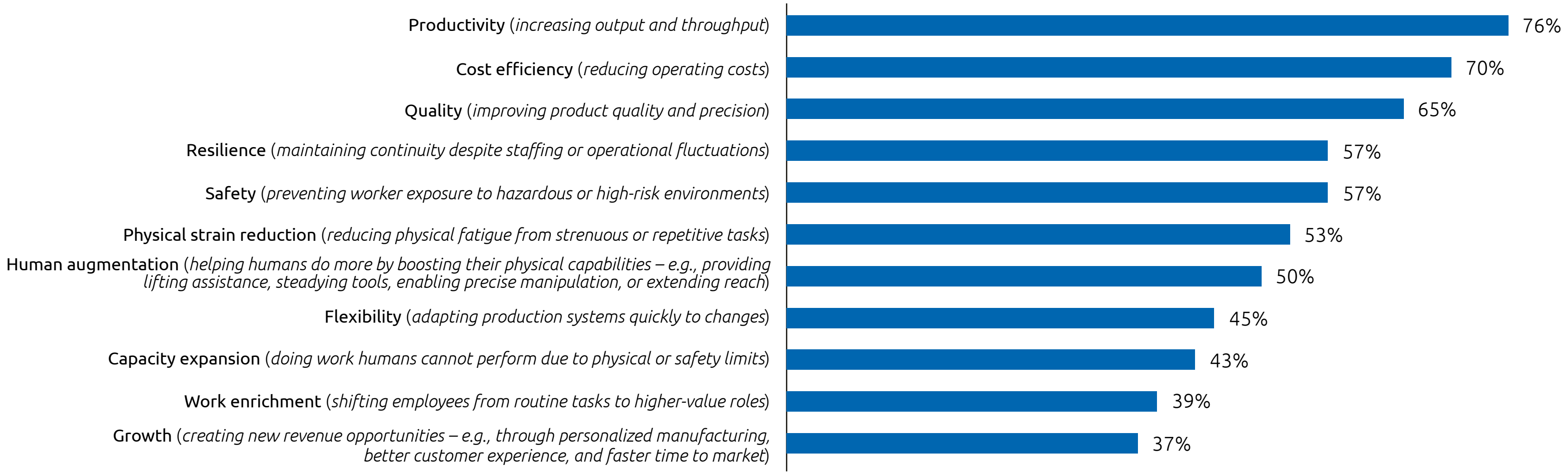
37%

of executives expect physical AI to create new revenue opportunities

Figure 6.

Physical AI's value extends beyond operational performance

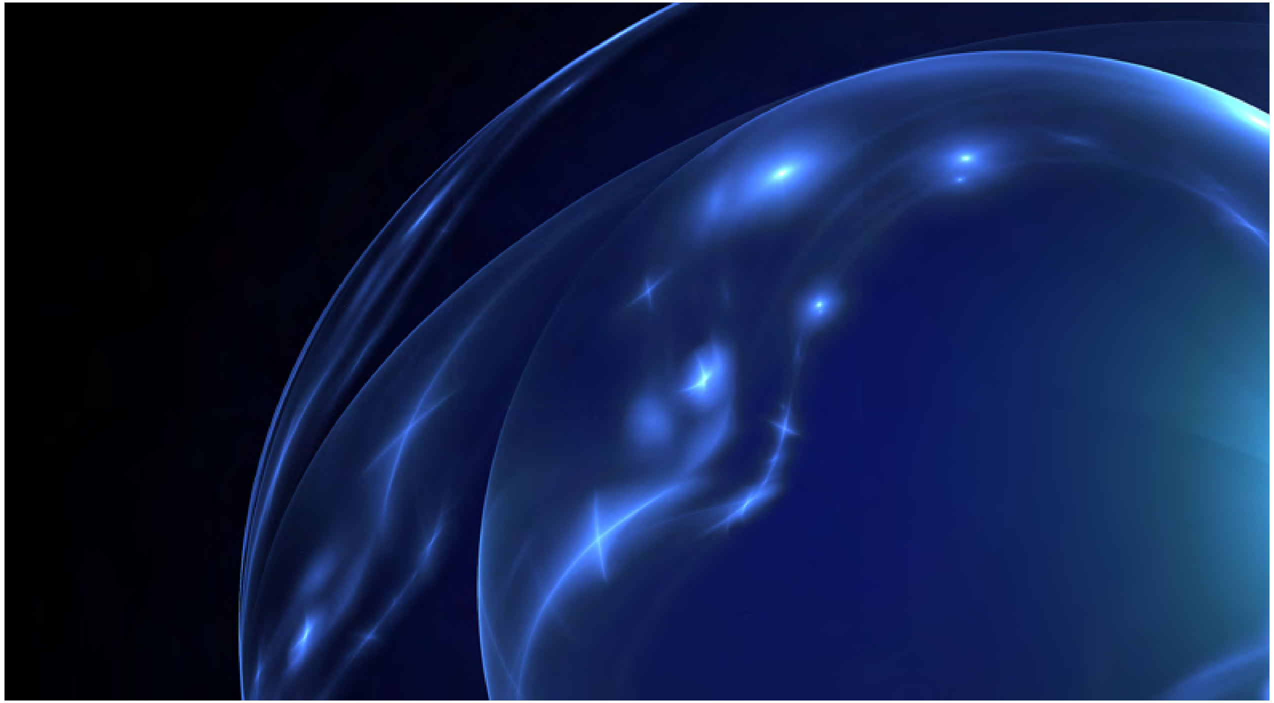
What business value could physical AI deliver for your organization if adopted?
Percentage of respondents rating each benefit as high value



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics.

Physical AI opens new frontiers in operations and value

Most executives agree that physical AI will expand the operational range of robots (62%), and 60% believe it will enable adoption in areas that were once impossible or impractical – such as unstructured settings, highly context-dependent work, and scenarios requiring autonomous adaptation (see **Figure 7**).

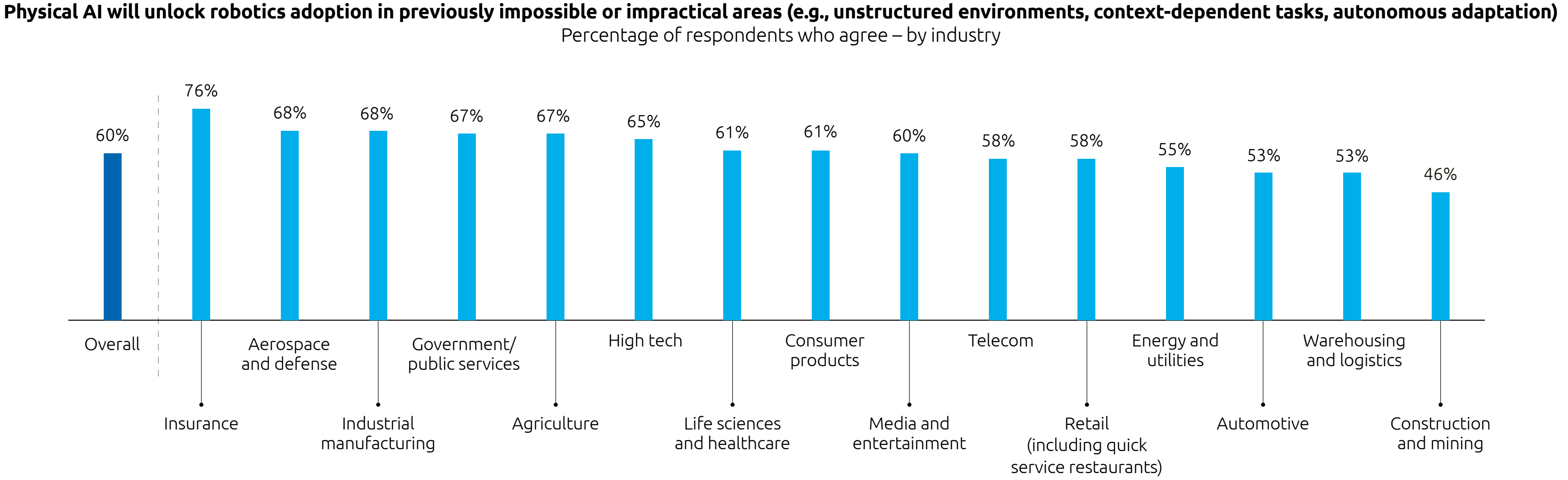


60%

of executives believe physical AI will unlock robotics adoption in areas that were once impossible or impractical

Figure 7.

Physical AI pushes robotics beyond previous possibilities



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Highest-impact use cases include hazardous ops, micro-logistics, pick-and-place, and field inspection – alongside sector-specific applications such as dynamic assembly and eldercare

Figure 8 highlights key physical AI use cases with broad cross sector relevance, as well as those with strong potential within individual industries. For the full set of use-case impact ratings, see **Figure 9**.

Figure 8.
Key physical AI use cases with high potential impact

Use cases	Description	Illustrative example
Broad-based use cases with high potential impact (*applications viewed as impactful across industries*)		
Hazardous environment operations	Robots performing tasks in conditions unsafe for humans	A robot inspecting tanks in a chemical facility
Field inspection	Robots assessing equipment or environments in dispersed locations	A mobile robot scanning wind turbines for structural issues
Micro-logistics	Small-scale, point-to-point movement of items within a site	An autonomous robot transporting medication or samples along busy hospital corridors, negotiating patients, staff, and sudden obstructions
Adaptive pick-and-place	Robots that can identify, grasp, and place varied objects	A vision-guided arm sorting mixed packages on a conveyor
Dynamic facilities management	Autonomous robots monitoring and responding to facility conditions in real time	A mobile sanitation robot operating in a busy airport terminal and negotiating unpredictable obstacles

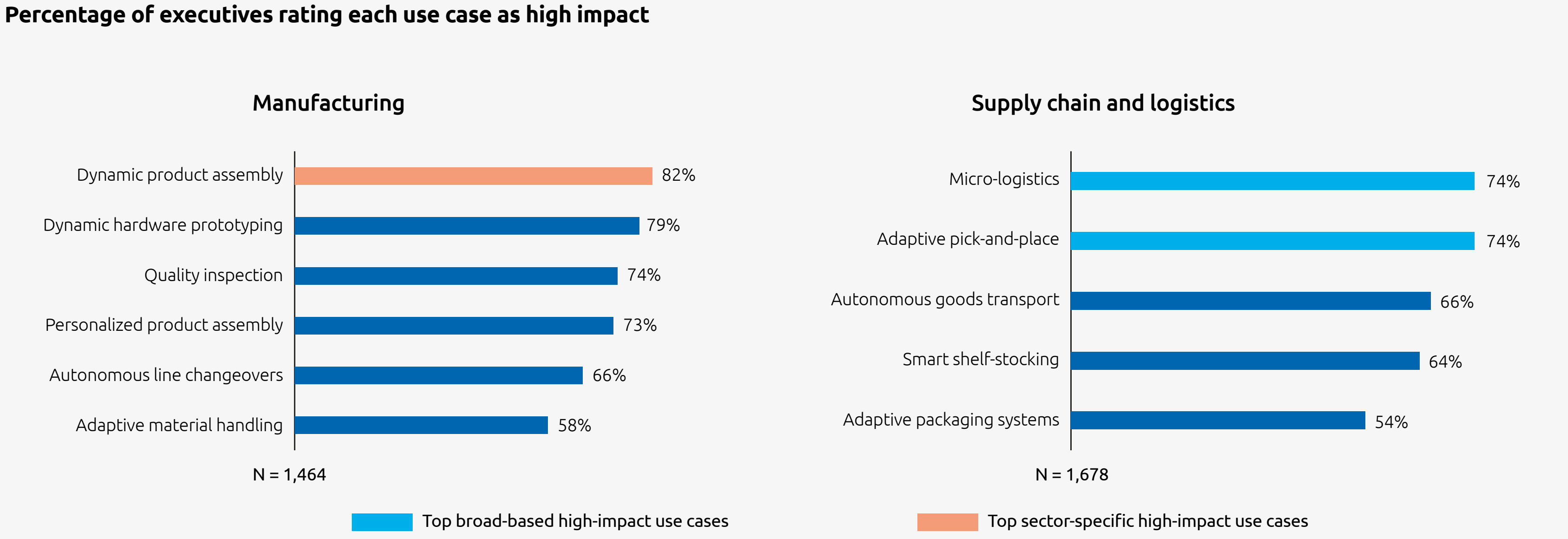
Sources: Capgemini Research Institute analysis.

Continued on next page

Use cases	Description	Illustrative example
Sector-specific use cases with high potential impact (*applications viewed as impactful within individual sectors*)		
Manufacturing: Dynamic product assembly	Robots assembling a range of product variants	An arm switching from assembling EV battery modules to powertrain parts
Government: Healthcare and eldercare	Assistive robots supporting mobility, care routines, or monitoring	An assistive robot guiding an older adult through daily routines, while adjusting to sudden movements and restricted posture
Insurance: Disaster response and disaster damage assessment	Automated on-site or aerial evaluation of damage post-event	A robot navigating debris, exposed wiring, gas leaks, and unstable foundations to document structural damage following a natural disaster
Construction and mining: Robotic surveying and mapping	Robots creating precise maps of large or complex sites	An autonomous robot navigating a construction site and capturing changes in ground conditions and partially built structures in real time
Agriculture: Precision crop care	Robots applying treatment only where needed based on real-time sensing	A robot identifying and spraying pest-affected rows
Media and entertainment: Intelligent lighting and effects	Automated systems generating dynamic visuals or movements	A robotic rig adjusting lighting cues live during a performance

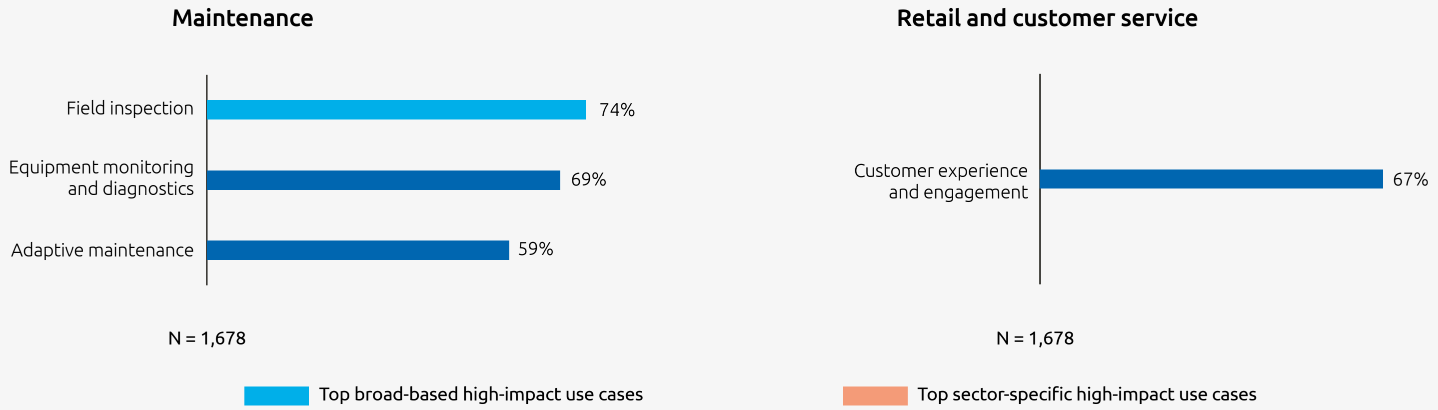
Sources: Capgemini Research Institute analysis.

Figure 9.
Physical AI use cases and their impact



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: Not all use cases were rated by all respondents. For more details on the use cases, please refer to the Appendix.

Percentage of executives rating each use case as high impact



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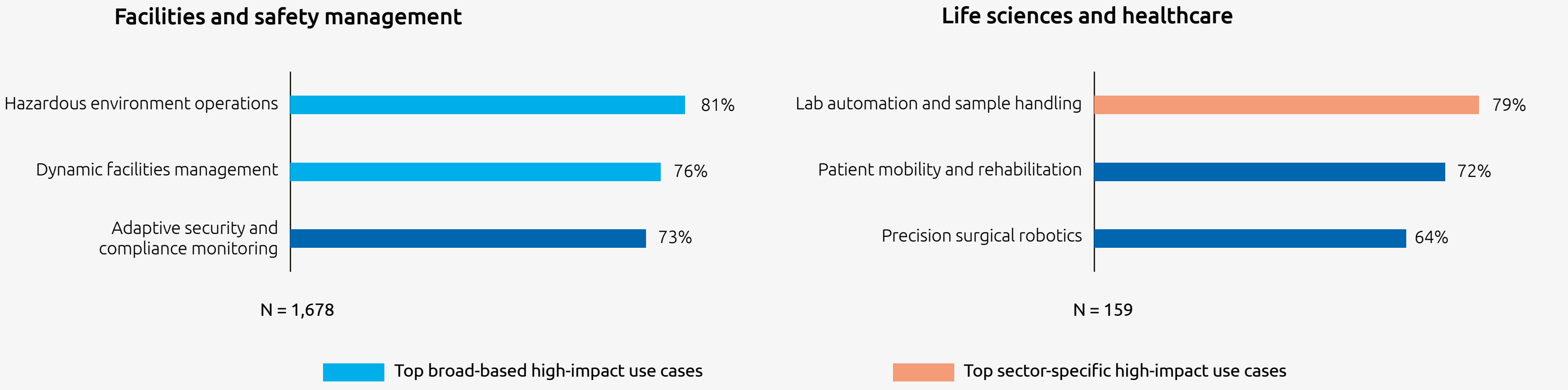

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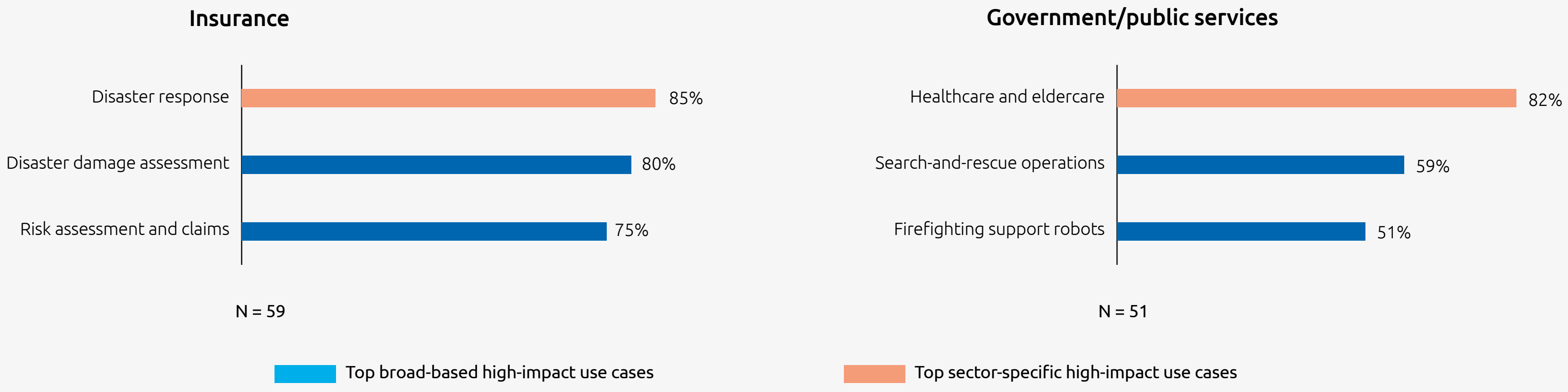

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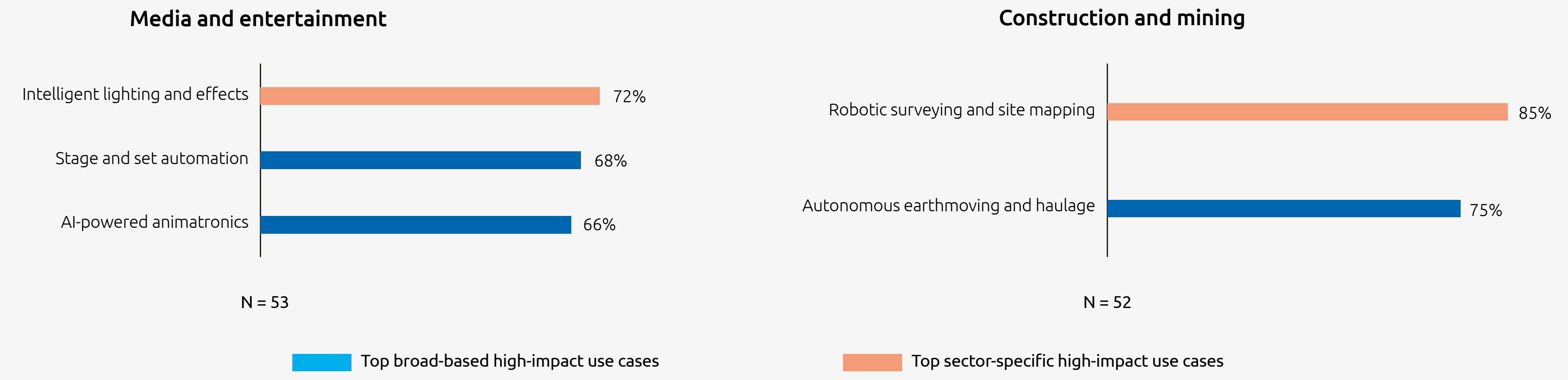

Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
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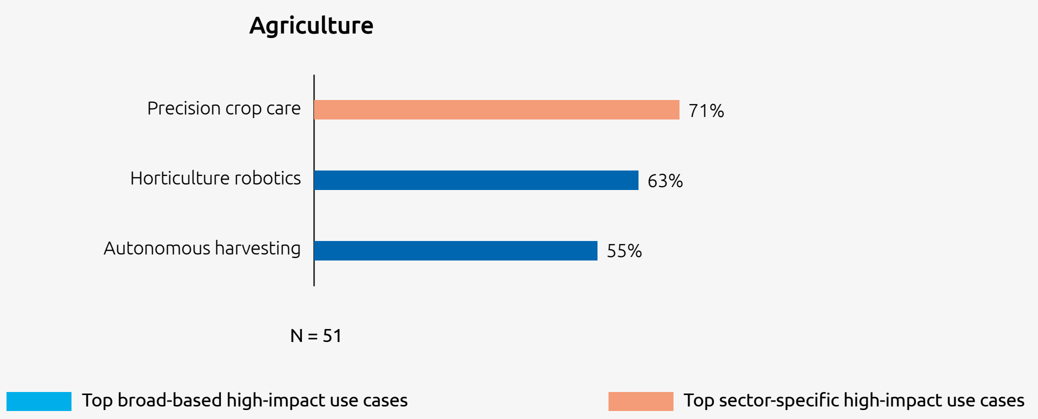

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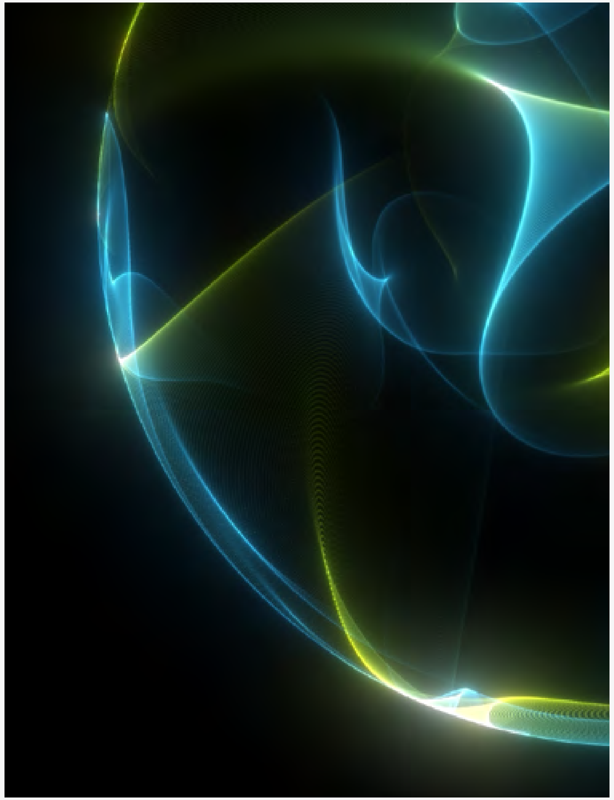
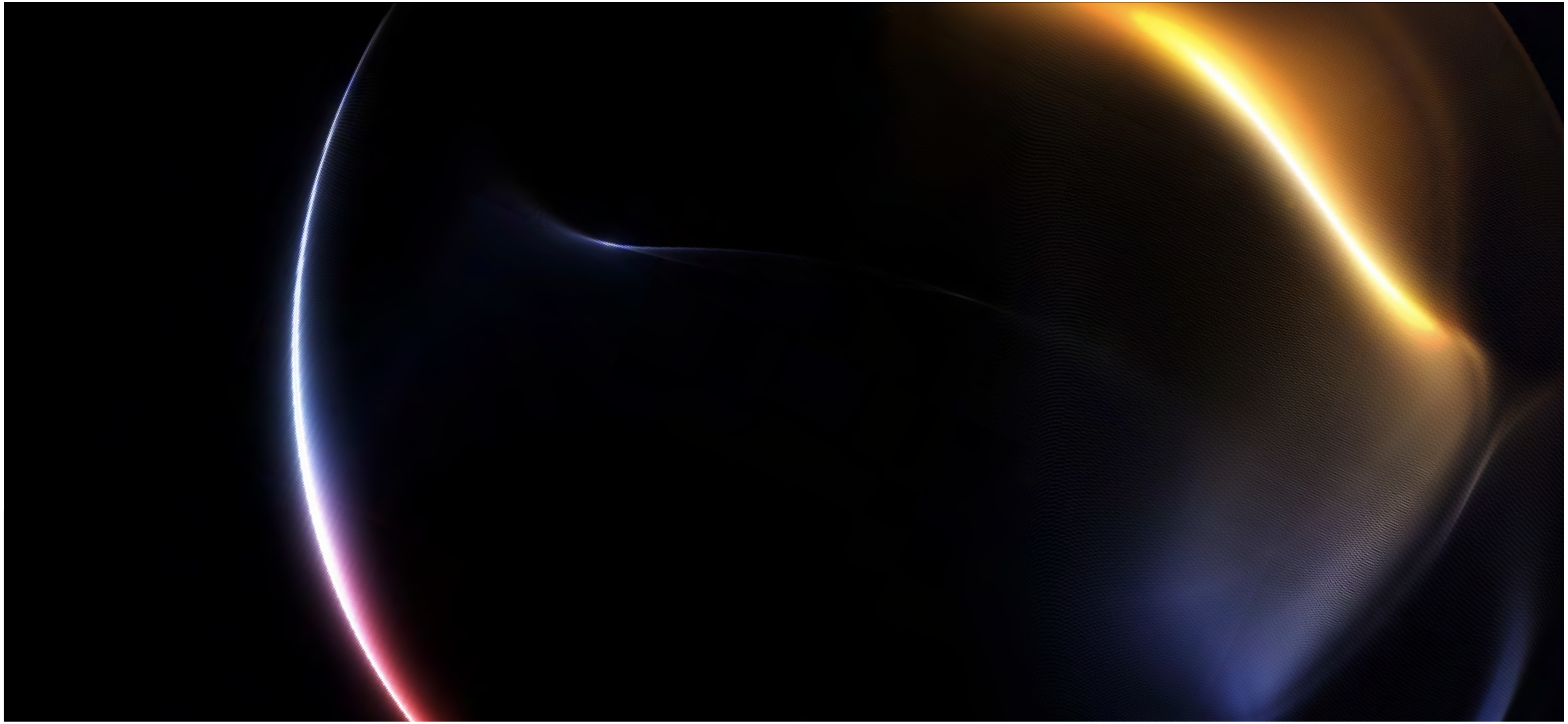


“The future of work and human experience is a seamless choreography of people, agents, and robots working in concert to amplify human potential. Physical AI takes on work that require physical presence and real-time judgment, particularly labor-intensive or unstaffed tasks. It creates space for human ingenuity, amplified by machine precision.”

John Robins

Head of Physical AI at frog,
part of Capgemini Invent



03 The growing imperative to adopt physical AI

Organizations are moving from early exploration to deployment

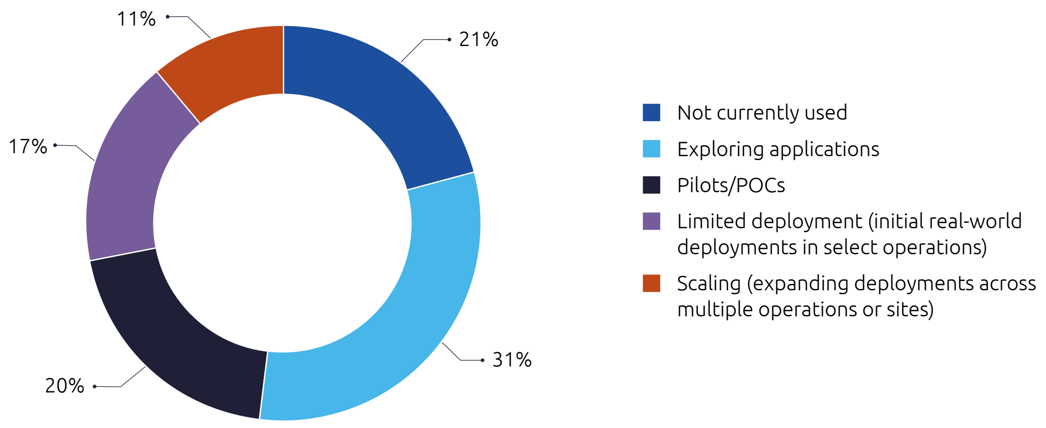
Nearly eight in ten organizations (79%) are engaging with physical AI, with 31% in the exploratory stage, 20% in pilot phases, and 27% already deploying or scaling solutions. Momentum is clearly shifting from experimentation toward real-world implementation (see **Figure 10**).

79%

of organizations are already engaging with physical AI

Figure 10.
Most organizations are already engaging with physical AI

Which of the following best describes your organization's current stage of adoption for physical AI?

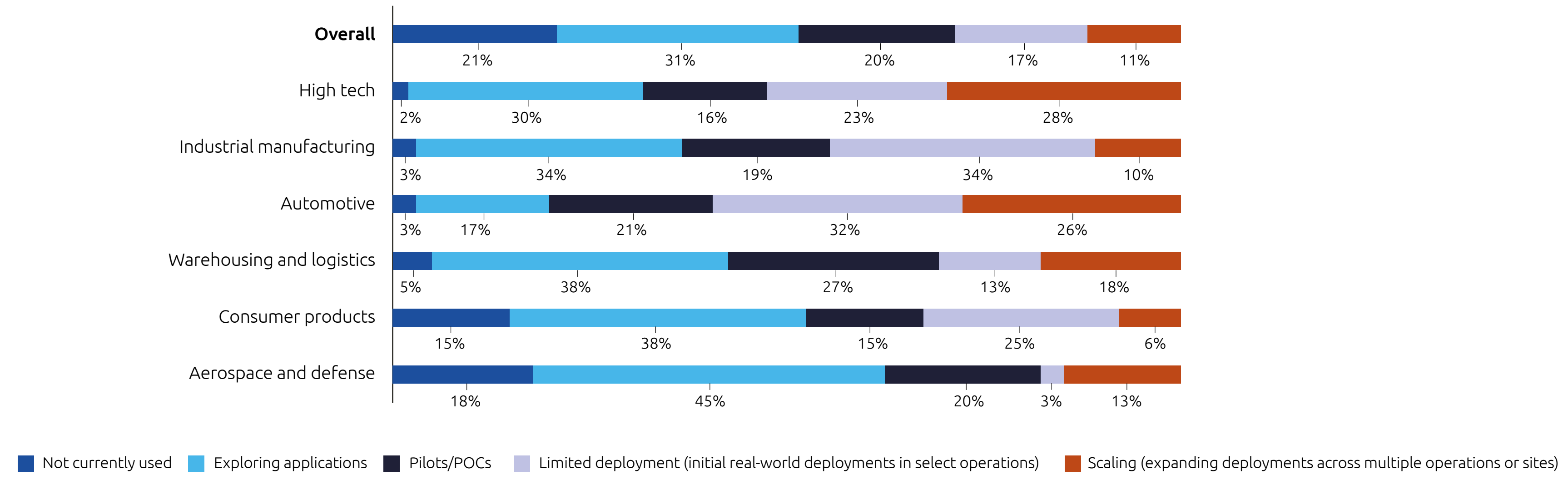


Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Figure 11.

Automation-heavy industries lead physical AI adoption, but engagement is broadening

Which of the following best describes your organization's current stage of adoption for physical AI? (by industry)



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Note: The term physical AI is used here only in the context of robotics.

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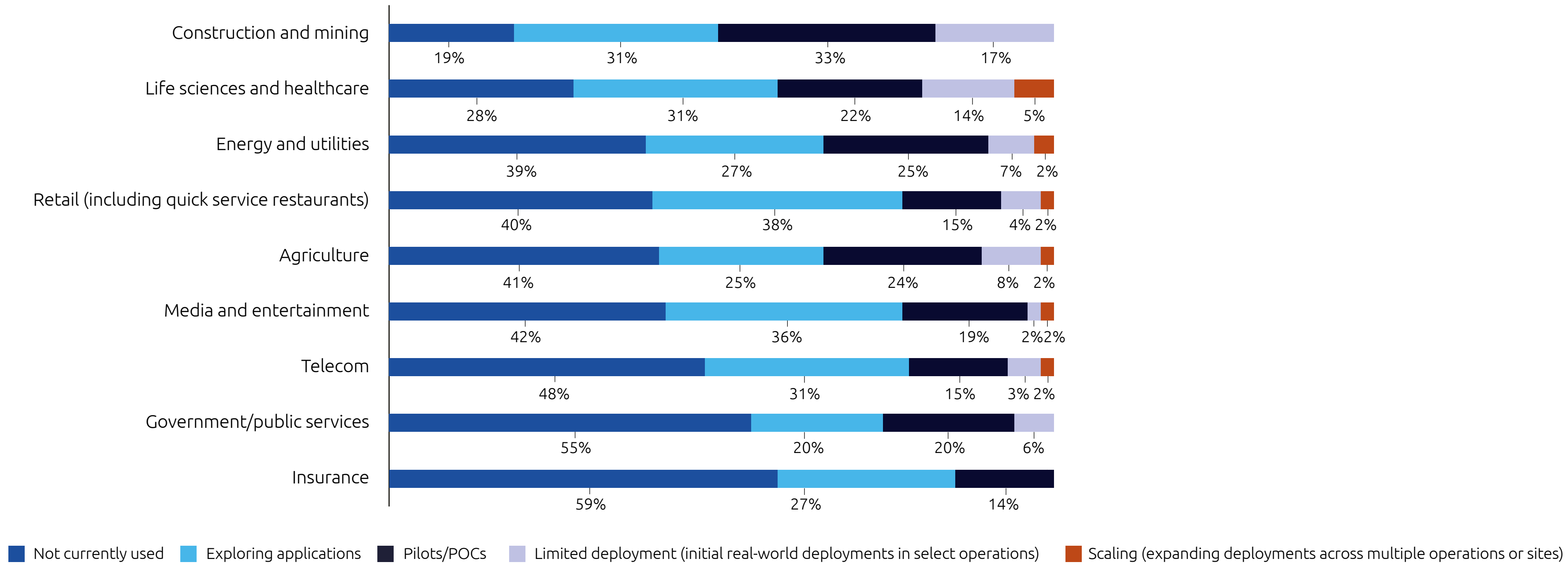


Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics.

Operational pressures are accelerating adoption

While deployment levels diverge depending on operating conditions and legacy automation footprints, there is strong interest in all major sectors:

- Industries with established robotics infrastructure, such as automotive, industrial manufacturing, and logistics, have substantially higher levels of deployment and scaling (see **Figure 11**).
- The life sciences, aerospace, and construction sectors show strong exploration and piloting activity but more measured deployment (16–19% versus 27% overall); these sectors often operate under stringent safety and regulatory requirements, which may slow progression from pilot to deployment.
- Even sectors with historically limited robotics adoption, such as public services, media and entertainment, and insurance, are exploring and piloting physical AI.

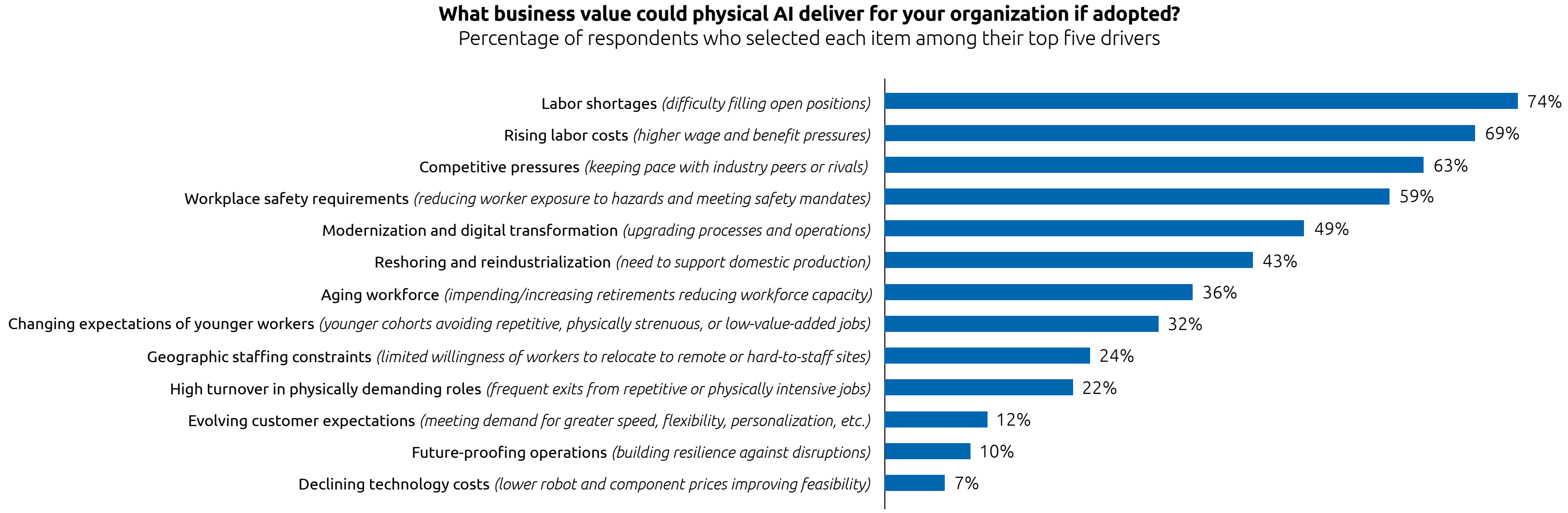
Executives most frequently cite labor shortages (74%) and rising labor costs (69%) as the top drivers of physical AI investment. Competitive pressures (63%) and safety expectations (59%) also feature prominently (see **Figure 12**).

74%

of executives cite labor shortages as the top driver of investment in physical AI

Figure 12.

Workforce pressures are the primary drivers of physical AI adoption



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics.

Reindustrialization is a catalyst for physical AI adoption

Reindustrialization is gaining momentum in the US and Europe as governments and businesses respond to supply chain vulnerabilities. But efforts to reshore manufacturing are constrained by labor scarcity. In the US, nearly half a million manufacturing roles are currently unfilled according to data from the Bureau of Labor Statistics.[34] Europe faces a similar challenge: **the European Labour Authority (ELA) reports** persistent and often severe shortages across manufacturing and industry, driven by ageing workforces and skill mismatches, particularly in welding, metalworking, machinery, and mechanical repair occupations.[35]

The role of physical AI lies in closing a structural capacity gap: taking on tasks that cannot be consistently staffed as domestic production scales. Reflecting this, 43% of surveyed executives say that reshoring and reindustrialization are contributing to their interest in physical AI as an enabler of domestic production at scale.

Physical AI is becoming a strategic priority

Two-thirds of organizations (66%) now rate physical AI as a high priority in their automation agenda for the next three to five years. Prioritization is even higher in sectors such as high tech (80%), industrial manufacturing (79%), and automotive (79%). At national level, Japan, South Korea, China and the US show the highest levels of prioritization (see **Figure 15**).

66%

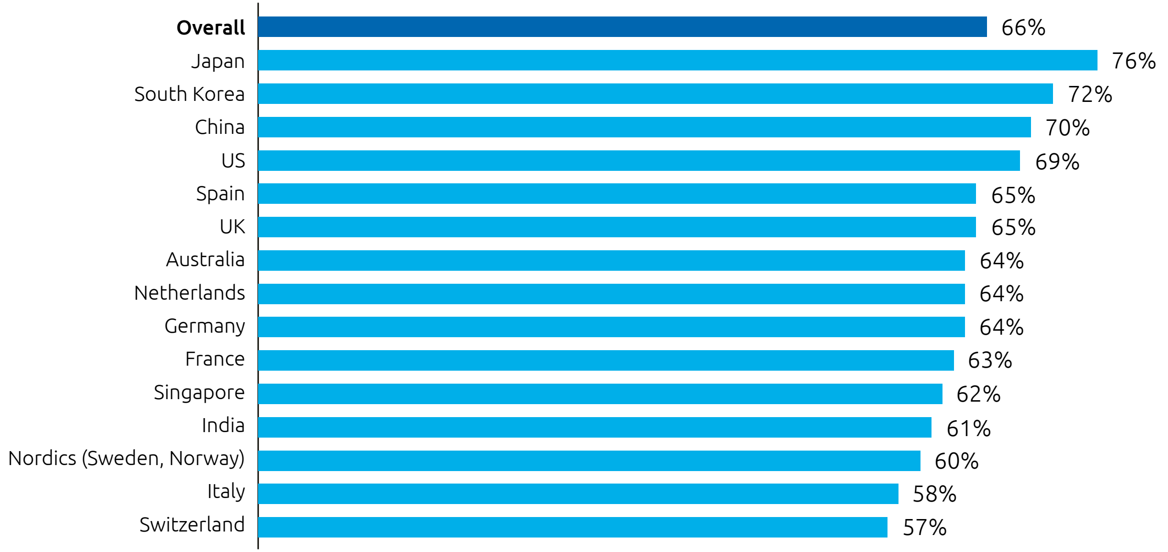
of organizations now rate physical AI as a high priority in the next three to five years

Figure 13.

Japan, South Korea, China, and the US lead in prioritizing physical AI

To what extent is physical AI a priority in your organization's overall automation strategy for the next 3–5 years (considering goals such as safety, productivity, and resilience)?

Percentage of respondents rating physical AI a high priority



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics.

Most organizations expect to scale physical AI within five years

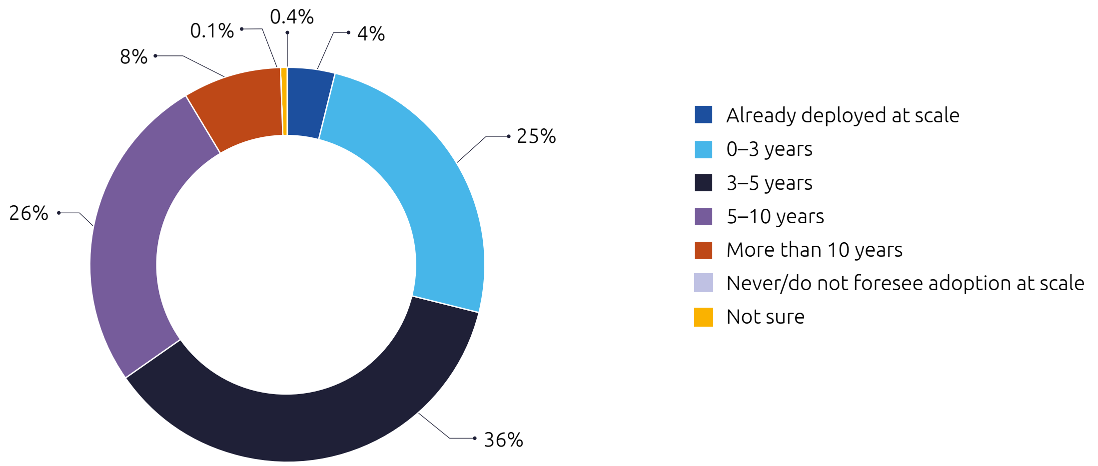
Organizations foresee rapid progress on scaling physical AI. Close to two-thirds (65%) expect to reach scale within the next five years, with a small minority already there (see **Figure 14**). The industrial manufacturing and high tech sectors and automotive industry expect to scale fastest, while sectors such as public services, media and entertainment, and telecom anticipate a longer path to scale, with timelines extending into a 5–10+-year horizon (see **Figure 15**).

65%

of organizations expect to scale physical AI within the next five years

Figure 14.
Most organizations expect to scale physical AI robotic systems within five years

When do you expect your organization to deploy physical AI at scale (beyond pilots or trials), if at all?

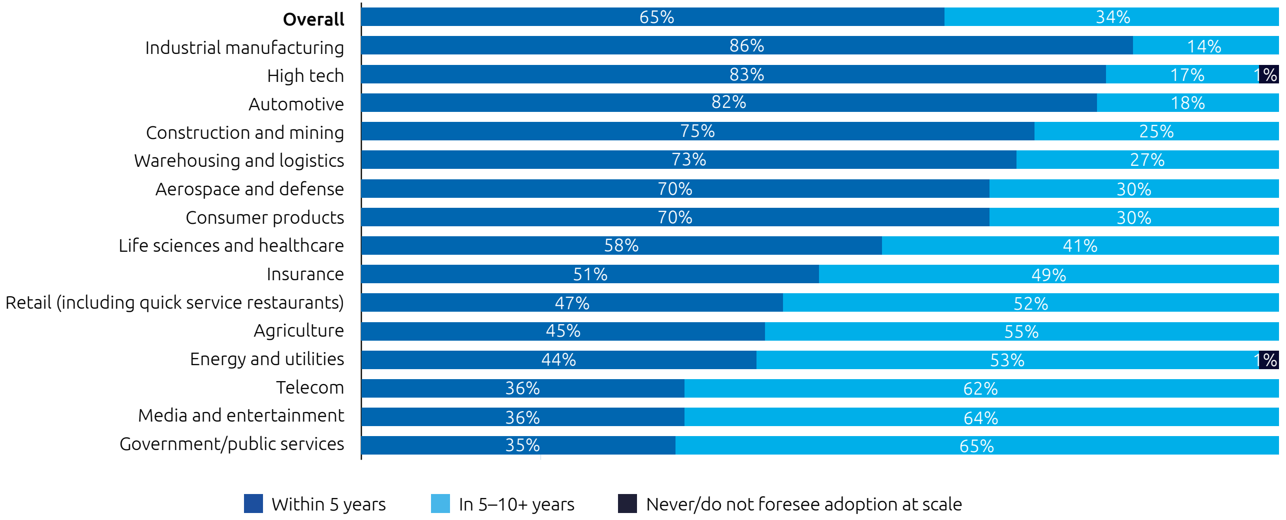


Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics.

Figure 15.

The industrial manufacturing, high tech, and automotive sectors are the fastest moving adopters of physical AI for robotic systems

When do you expect your organization to deploy physical AI at scale (beyond pilots or trials), if at all?
By industry



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.
Note: The term physical AI is used here only in the context of robotics. *The remaining respondents in the telecom, energy, retail, and life sciences sectors selected "Not sure".

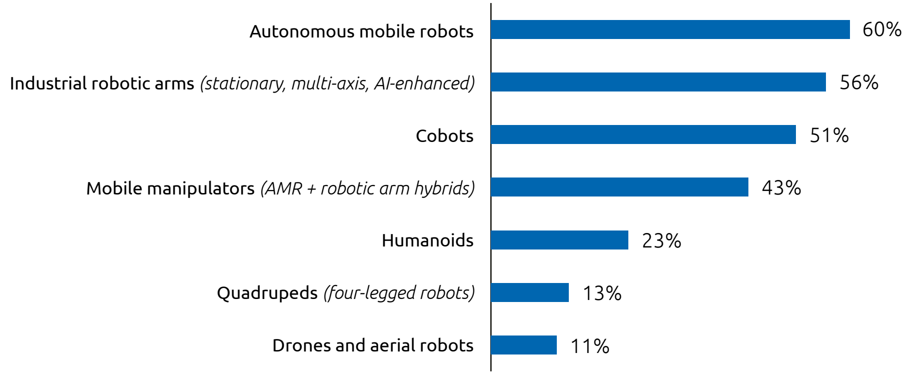
Near-term growth will come from embedding intelligence into established platforms

In the near term, growth will be driven by familiar, proven robot form factors for task-specific applications. Autonomous mobile robots (AMRs) are expected to see the strongest expansion (60%), followed by industrial arms (56%) and cobots (51%) (see Figure 16), reflecting physical AI's role in enhancing widely deployed platforms rather than replacing installed bases.

As foundation models mature and adoption deepens across industries, entirely new categories of robots are likely to emerge – purpose-built for varied environments, complex tasks, and new modes of human collaboration. Notably, 43% of executives expect mobile manipulators to grow fastest despite their current immaturity as a form factor, pointing to demand for new robot categories that depend on emerging physical AI capabilities such as dexterous manipulation, spatial reasoning, and real-time adaptation. Humanoids, despite substantial investment, remain a longer-term bet, as key challenges – including technical immaturity (reliability and dexterity), safety, and cost-to-ROI viability – must still be resolved, as examined later in this report.

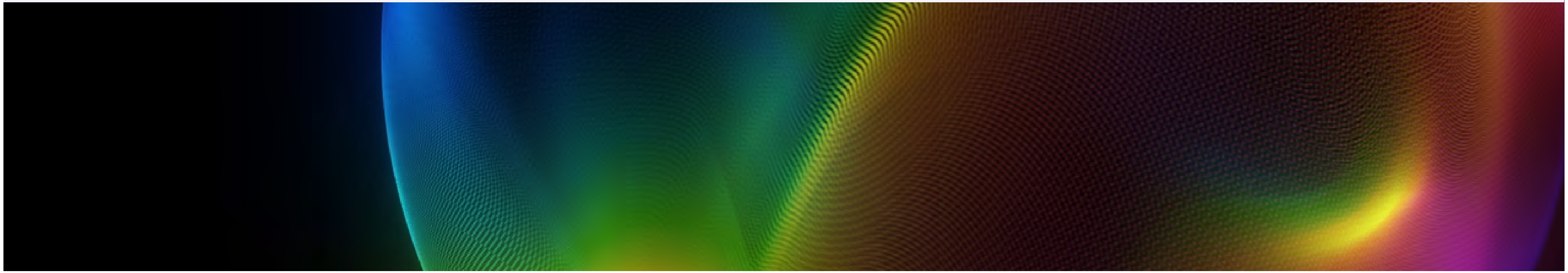
Figure 16.
Near-term growth will be led by established robot types

Which robot form factors do you expect to grow the fastest in your organization over the next 3–5 years as physical AI matures?



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Angelo Cangelosi, Professor of Machine Learning and Robotics and Co-Director of Manchester Centre for Robotics and AI, University of Manchester, says: *"Fully general-purpose humanoid intelligence will take time to mature. However, enterprises can already realize value through partial, task-specific physical AI capabilities, well before such systems become achievable."*



A discussion with

Rebecca Yeung,

Strategic Advisor at Dexterity and former Corporate Vice President for Operations Science and Advanced Technology at FedEx

Why is this a significant time for physical AI?

Several forces are converging to make this a true inflection point for physical AI. Technologically, we've moved from deterministic, task-specific programming to VLA and world models that can reason through physical tasks they have never encountered before – and simulation lets us train them at scale, compressing development cycles that once took years. Capital is pouring into robotics, giving startups the runway to mature rapidly. The cost of actuators, sensors, and compute has fallen dramatically. Robots today handle far greater variety, complexity, and reliability than any previous generation. Underlying all of this is a structural demand that is not going away: labor shortages, an aging workforce, and a global productivity slowdown mean that physical AI has moved from optional to essential for industries that depend on physical work. The last decade of AI was about information. The coming decade will be about action.

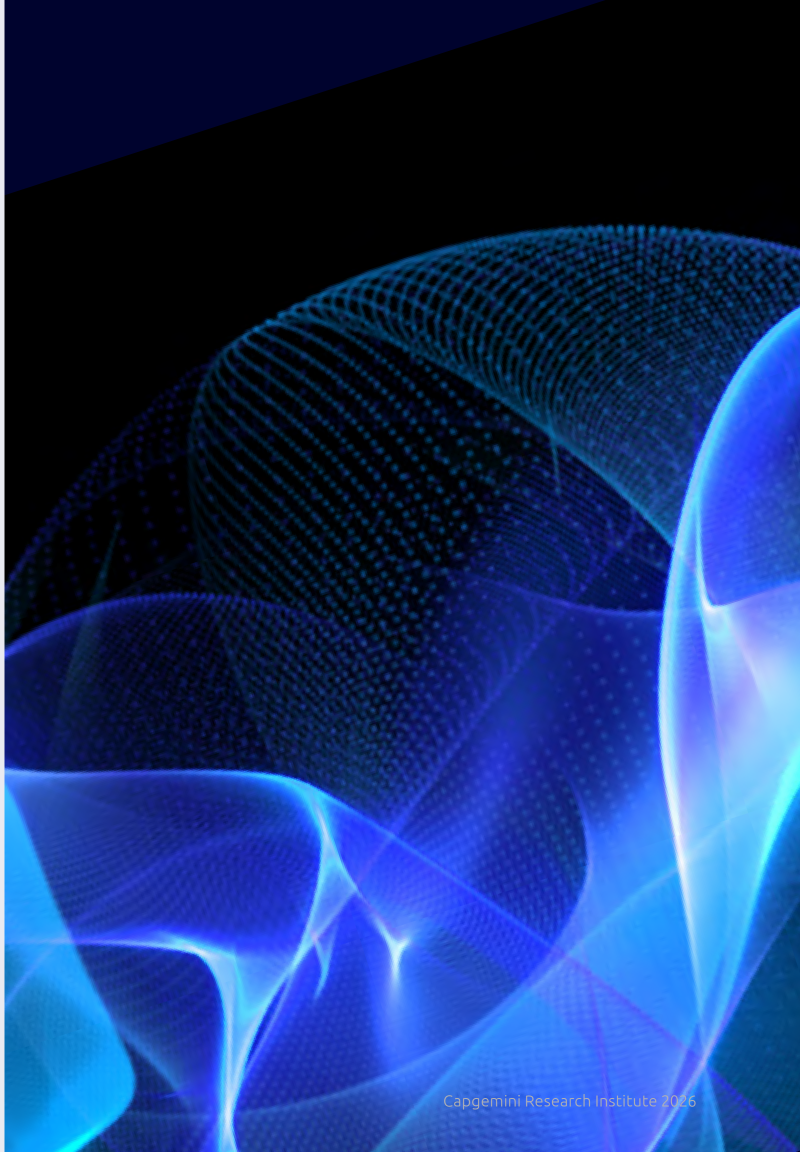
What does a compelling business case for physical AI look like?

Most organizations get the business case wrong, because they frame physical AI as a cost replacement exercise. That almost always leads to disappointing ROI. The right lens is strategic transformation. If you introduce robots into a broken workflow, all you've done is automate the inefficiency.

The real question is: where are the genuine bottlenecks – the tasks that constrain growth, strain your workforce, or create safety and quality risks? Those are the high-value entry points.

Do you see humanoids shaping the future of industrial work?

Humanoids today feel a lot like autonomous vehicles did a decade ago – there's enormous excitement and real potential, but a longer road to real operational deployment than the headlines suggest. The core capabilities are advancing fast; the real bottleneck will be the last few percent: edge cases, safety, speed, and reliability in messy environments. The critical missing piece today is haptic intelligence. Robots can move with impressive fluidity; what they cannot yet do is feel. That's why immediate value will come from purpose-built industrial systems, not humanoids. In three to five years, we'll see major breakthroughs. In five to ten, the landscape will look completely different. The companies that will be ahead are the ones building deliberately now.



04 Scaling physical AI goes beyond technology, spanning safety, cybersecurity, regulation, and operations

Industrial automation traditionally relied on deterministic logic. Physical AI brings probabilistic decisions into regulated environments, requiring strong foundations of trust, certification, and resilience. At the same time, it brings core technical challenges, from achieving reliability and dexterity to overcoming a scarcity of real-world training data.

Reliability, dexterity, and data constraints limit physical AI in practice

There are several technological challenges that constrain what physical AI systems can deliver today:

- **Reliability:** Recent advances in VLA and world models have improved AI's understanding of the real world by strengthening its semantic and contextual reasoning. However, while models can recognize objects, interpret scenes, and anticipate likely outcomes, they still struggle to reliably estimate basic physical properties such as distance, orientation, and object size. This gap in physics-grounded quantitative reasoning continues to limit autonomy and underlies the sim to real gap: robots that perform well in controlled training settings often fail to act reliably in real-world conditions. As a result, robots fail to generalize what they learn in a simulator to even small differences in real-world scenarios, making reliability a core bottleneck.

  Dr. Jeff Mahler, Co-Founder, Chief Technology Officer, Ambi Robotics, a US-based robotics startup, says: *"Despite the massive potential of AI in the physical world, reliability remains a grand challenge for the field."*[36]

  QuantiPhy, a benchmarking framework developed by researchers at Stanford, targets this limitation by evaluating whether models can produce numerically accurate estimates of physical properties from video. By making physics-aware reasoning measurable, it provides a path toward improving the reliability of real-world autonomous systems.[37]

  "To date, models appear to lean heavily on pretrained world knowledge – on memorized facts – rather than real quantitative reasoning from visual and textual inputs," says **Ehsan Adeli**, Director of the Stanford Translational Artificial Intelligence (STAI) Lab.[38]

- **Dexterity:** Robotic manipulation remains a major technical constraint: robotic hands, grippers, and fine-motor control are still limited, especially for unstructured tasks involving varied objects, soft materials, or precise coordination. Small variations during physical contact can quickly cause failure, and robots lack robust mechanisms for probing and micro-adjustment that humans rely on to recover. Further, tactile data is hard to interpret, and data on failure-and-recovery experiences that underpin dexterity are difficult to capture at scale. Progress depends on advances in hardware and physics-aware models capable of managing contact, force, and recovery.

- **Data scarcity:** Unlike language and vision models trained on internet data, physical AI depends on data that captures real-world behavior, accurately reflecting geometry, forces, friction, timing, causality, and edge cases – data that is expensive, slow, and risky to collect in real-world settings. Although advances in simulation help compress early training cycles and reduce initial reliance on physical trials, models ultimately still require high-fidelity, real-world data to cross the "sim-to-real" gap and handle unpredictable physical edge cases.

To address this gap, physical AI models are increasingly trained on a combination of real-world and synthetic data generated through simulation, helping broaden coverage and reduce reliance on costly field collection. In parallel, recent efforts reflect a push to broaden the availability of high-quality physical interaction data. AgiBot World, for example, is a large-scale, open-source dataset developed by Chinese robotics organization AgiBot to make real-world robot interaction data more widely available to the academic community and industry.[39]

In a similar vein, China-based UBTECH Robotics has chosen to open source its Thinker model, a vision-language foundation model designed for embodied intelligence. **Viki Yang**, Overseas Sales Director at UBTech Robotics, explains: *"We made our Thinker model open source because the data problem cannot be solved by any one company alone. The more researchers, institutions, and partners can build on a shared foundation, the faster the whole field moves forward."*

However, expanding datasets alone does not resolve the reliability challenge. **Dr. Ashutosh Saxena,** Founder and CEO, TorqueAGI, says: *"Robots cannot depend on endless field trials or billion-dollar data pipelines. That approach is slow, expensive, and fundamentally unscalable. Physical AI must learn efficiently – extracting structure and causality from limited experience, not brute-force scale. True progress lies not in collecting more, but in understanding better."*

Viki Yang, Overseas Sales Director at UBTech Robotics, explains: *"We made our Thinker model open source because the data problem cannot be solved by any one company alone. The more researchers, institutions, and partners can build on a shared foundation, the faster the whole field moves forward."*

Engineering safeguards for non-deterministic AI

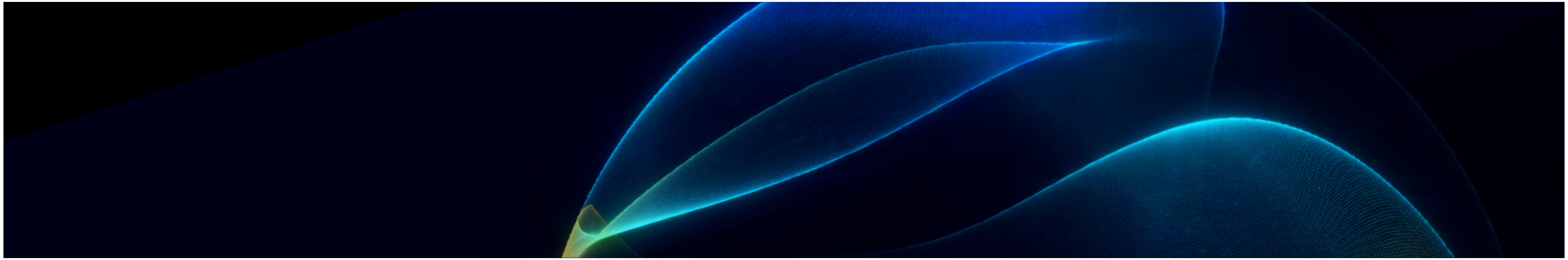
Safety is a central challenge for physical AI in environments that demand predictable, provable safety and where failures can have real-world consequences. With regulations lagging behind the pace of innovation, organizations need to act now by implementing practical functional safety measures rather than waiting for formal standards. In practice, this requires equipping robotic systems with deterministic safety mechanisms that operate independently of the AI layer, defining a safety envelope that constrains behavior and enforces safe operating limits. This ensures that even when AI behavior is uncertain or unexpected, the robot continues to operate within known, verifiable safety boundaries.

Securing autonomous systems against manipulation and misuse

As robots become more autonomous and more deeply embedded in operational environments, the risk of malicious interference and misuse increases. Protecting system integrity in this context requires strong safeguards that prevent unauthorized access, manipulation of behavior, or control over critical functions. Organizations need cybersecurity foundations that evolve in step with the expanding capabilities and operational roles of physical AI systems.

Adapting regulation to the risks and realities of physical AI

Physical AI introduces fundamentally different risk and governance requirements. Unlike traditional AI or industrial automation, physical AI involves robots making decisions and acting autonomously, often in close proximity to people. Because these decisions are probabilistic rather than deterministic, and reliability cannot yet be guaranteed, errors can translate directly into physical harm. This creates new challenges around safety and accountability. However, most existing AI and robotics regulations were not designed with these realities in mind, and few countries have updated their frameworks to explicitly



address physical AI. China stands out as an early mover, having released its first national standard system for humanoid robots and embodied (physical) AI. The framework covers the entire industrial chain and full lifecycle of humanoid robotics, with safety and ethical considerations as a core focus.[40]

In Europe, the EU AI Act extends AI regulation beyond purely digital systems by imposing requirements on AI systems used in certain high-risk physical applications – such as traffic, transport, and critical infrastructure – where failures can lead to physical harm. In parallel, the EU Machinery Regulation updates product-safety rules to address AI-enabled machinery, including autonomous and collaborative robotic systems.[41]

Anto Patrex, Founder and CEO, CosmicBrain AI, a US-based robotics startup, says: *"As robots and especially humanoids become more capable and begin working far more closely with people, we need firm ethical boundaries and strong guardrails. Robots can malfunction, be misused, or cause real physical harm, so safety rules must be built in from the start – including hard limits that automatically shut a robot down if it crosses certain boundaries. These systems will operate everywhere, not just where they're built, so governance has to be global. The world five to ten years from now will look very different, and we have to build that path responsibly."*

Establishing the operational foundations for physical AI deployment

Deploying physical AI is not an extension of traditional IT transformation but a multidimensional shift in how enterprises design, operate, maintain, secure, and scale intelligent physical systems.

01 Understanding and engineering for hardware realities

Physical AI deployments are shaped by hardware realities such as edge computing limitations, battery performance and charging cycles, thermal management, mechanical wear and tear of robots and components, robot durability, and failure rates. These factors impact not just engineering choices, but also workforce planning, service models, and lifecycle costs.

02 Managing fleet operations

As organizations scale physical AI, deployments move from individual robots to coordinated fleets that require continuous operational management. This demands predictive maintenance programs, over-the-air software updates, charging infrastructure and battery-swap workflows, large-scale sensor-data processing, and upgrades to brownfield facilities to ensure adequate connectivity, power, and safety zones. Enterprises must also determine the right balance between vendor-led and in-house maintenance. This requires specialized technicians and fleet coordinators to monitor system health and updates, structured maintenance and incident response workflows, and fleet-level KPIs that track uptime, reliability, and utilization.

03 Strengthening data governance and AI lifecycle management

Physical AI dramatically increases the volume of data generated from sensors, perception modules, and on-device decision systems. Clarity on data ownership and usage rights – particularly when AI systems are delivered "as a service" – are critical and require robust governance frameworks covering data rights, privacy, retention, and security. Equally important is managing the full AI lifecycle, including how models are trained, updated, validated, monitored, and retired.

04 Preparing the workforce

Operational readiness also depends on people. Internal operations teams require new skills – from robotics support to edge-system diagnostics and safety-system management. Building these capabilities is critical to sustaining performance, uptime, and safe operation at scale.

05 Building a physical AI platform strategy

To realize the full value of physical AI, organizations need to move beyond deploying individual robots and think in terms of a platform strategy. This includes adopting emerging APIs for physical actions, enabling enterprises to access physical skills – such as navigation, manipulation, or inspection – from a common intelligence layer. Building on this, organizations must define an orchestration layer that coordinates how AI agents and robot fleets plan, sequence, and execute tasks together – enabling coordinated behavior, shared learning, and consistent governance across sites and environments. Treated this way, physical AI becomes an extensible foundation for scaling robotics across tasks, environments, and business needs.

06 Addressing OT/IT integration

To scale physical AI beyond pilots, organizations must plan for how robots integrate with existing operational technology (OT) and enterprise IT systems. Value is realized when physical AI systems are connected to core platforms such as ERP, MES, and asset management systems. This requires addressing integration considerations including interaction with legacy SCADA systems, adoption of industrial communication standards such as OPC-UA, and the translation of ERP data into robot-executable actions. Thoughtful design of integration layers, middleware, and orchestration capabilities underpins reliable operations, coordinated fleet management, and scalable deployment across sites.

"Physical AI is not just AI in the real world. It is where failure stops being virtual. It becomes safety, security, and compliance. The real challenge is not making robots intelligent, it is making them reliable enough to act in environments we cannot control. In the next decade, the winners will not be those with the smartest models, but those who engineer trust and compliance into every layer of the system."

Marc Blanchon

Head of Physical AI,
Capgemini Engineering

05 Humanoids set the stage for general-purpose robotics

Humanoids* stand out for their general-purpose utility and ability to operate within existing human-designed environments – enabling deployment in brownfield settings with fewer physical infrastructure changes. However, the fundamentals needed for adoption are not yet in place. Progress depends on advancements in reliability, safety, cost, and societal acceptance.

**In this report, humanoids refer to robots with human-like form factors – including both full-humanoid robots (with torso, head, two arms, and two legs) and human-like robots that share some human features but may differ in structure (e.g., wheels instead of legs, fewer limbs, or simplified body plans).*

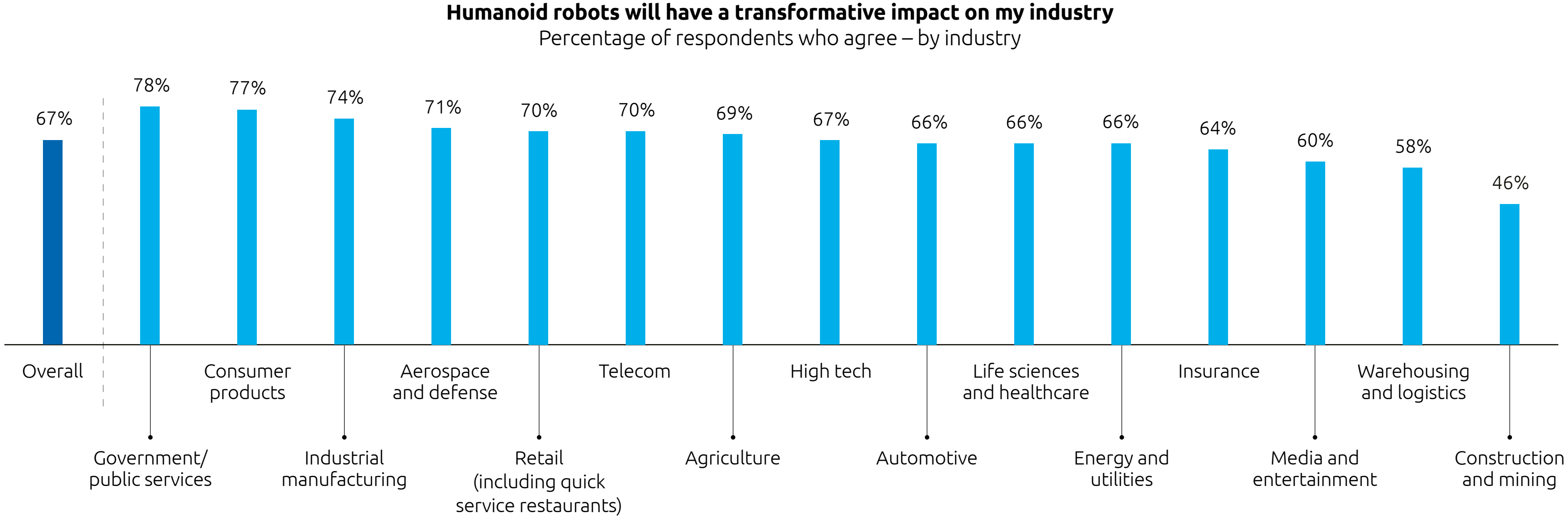
Most executives see humanoids playing a transformative role in their industry

Two in three executives believe humanoids will transform their industry. This confidence stems from their perceived ability to work in environments built for humans (75%), general-purpose utility (72%), and compatibility with existing tools and interfaces (55%).

The public sector shows the strongest belief in the transformative potential of humanoids (see **Figure 17**). Public services rely heavily on environments and workflows designed around human movement and interaction, making humanoids a natural fit for many government functions (such as eldercare, public-facing services, and emergency response).

In contrast, fewer executives see humanoids as transformative in warehousing and logistics, construction, and mining, potentially reflecting concerns that a human like form factor may not always be well suited to the physical demands of these sectors. FedEx, for instance, is exploring superhumanoids – human-inspired robots with increased strength and agility compared to traditional humanoids.[42]

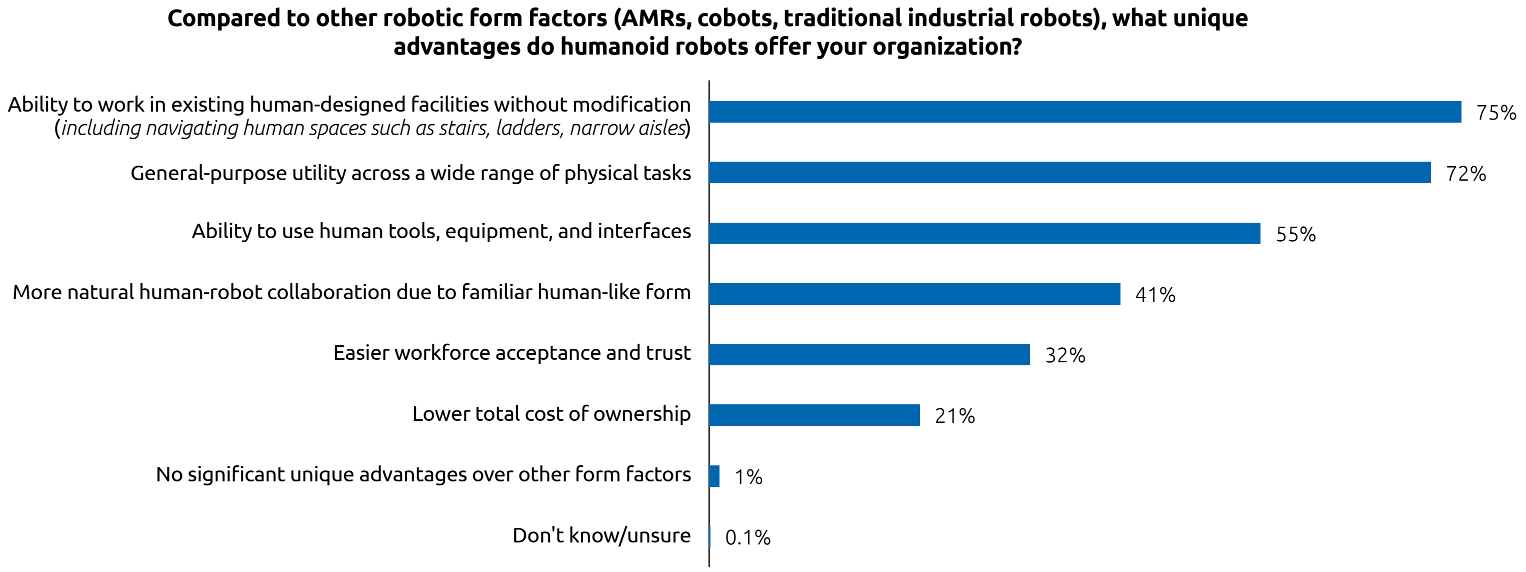
Figure 17.
Across sectors, executives agree that humanoid robots will have a transformative impact



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Figure 18.

Humanoids are valued for their potential to work in spaces designed for humans and for their general-purpose utility



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

The intention to deploy humanoids is building

More than half of organizations are already investing (16%) or planning to invest (37%) in humanoids. Early activity is taking shape: close to a quarter (25%) are exploring applications, 12% are running pilots and proofs of concept, and a similar share has moved into deployment (see **Figure 19**). Early momentum through pilots and limited deployments is visible in various sectors.

For example:

Automotive: Several automotive manufacturers are actively piloting humanoid robots in production environments for material handling, assembly, logistics, and physically demanding shop-floor tasks, including **BMW** (with Figure AI and Hexagon Robotics),[43] **Mercedes-Benz** (with Apptronik's Apollo),[44] **Toyota** (with Agility Robotics' Digit),[45] and **Xiaomi** (testing in-house humanoid robots on EV assembly lines).[46]

Logistics: Logistics providers are piloting humanoids for tote handling, line feeding, and repetitive material movement. For example, US-based logistics organization **GXO** has trialed Agility Robotics' Digit, Apptronik's Apollo, and other humanoid prototypes.[47]

Industrial manufacturing: **Siemens**, in collaboration with UK-based robotics company **Humanoid**, has piloted humanoids for production logistics tasks at its factory in Erlangen, Germany.[48]

Aerospace: **Airbus** has entered an early-stage collaboration with China's **UBTECH Robotics** to explore how UBTECH's Walker S2 humanoid robot could support aircraft manufacturing.[49]

Electronics: **Foxconn** and **NVIDIA** plan to deploy humanoid robots on production lines at a new manufacturing plant in Houston, Texas, which will produce NVIDIA AI servers.[50]

Telecom: A subsidiary of **China Mobile** has awarded a US$17.3 million contract to Chinese robot manufacturers **AgiBot** and **Unitree** to deploy humanoids across network facilities.[51]

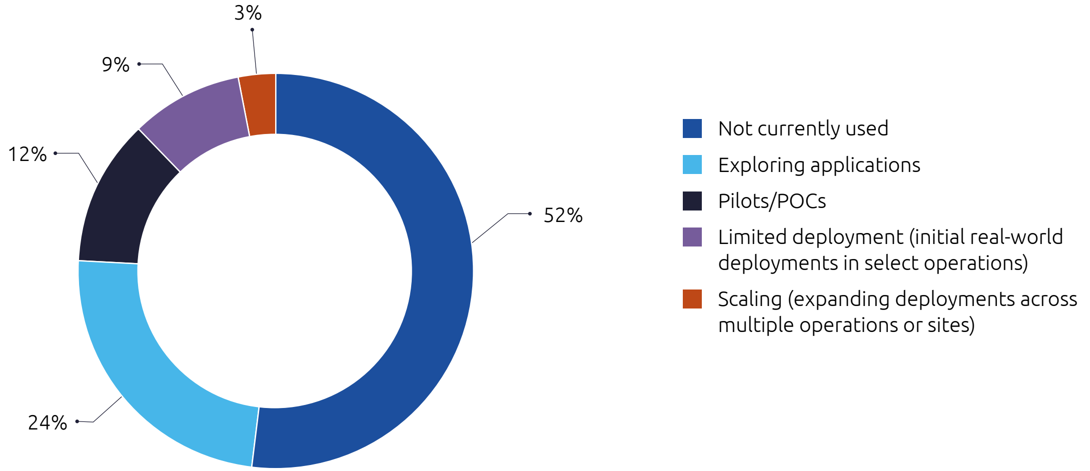
Life sciences: US-based biotech startup **Insilico Medicine** has deployed a humanoid robot in its drug-discovery lab to assist scientists with tasks such as pipetting, working with reagents, and operating laboratory equipment.[52]

Energy: **Orano**, a France-based integrated nuclear energy organization, has deployed Hoxo – the first intelligent humanoid robot in the nuclear industry – to operate alongside human teams, including in high-risk environments.[53]

"Hoxo opens new perspectives for our operations by combining an intelligent and ergonomic robotic solution with the expertise of our on-site teams. It's an innovation we aim to evolve to meet our industrial needs, contributing to both safety and competitiveness as we tackle the challenges of today and tomorrow," says **Arnaud Capdepon**, Director of Orano Melox.[54]

Figure 19.
Momentum is building toward humanoid deployment

Which of the following best describes your organization's current stage of adoption for humanoids?



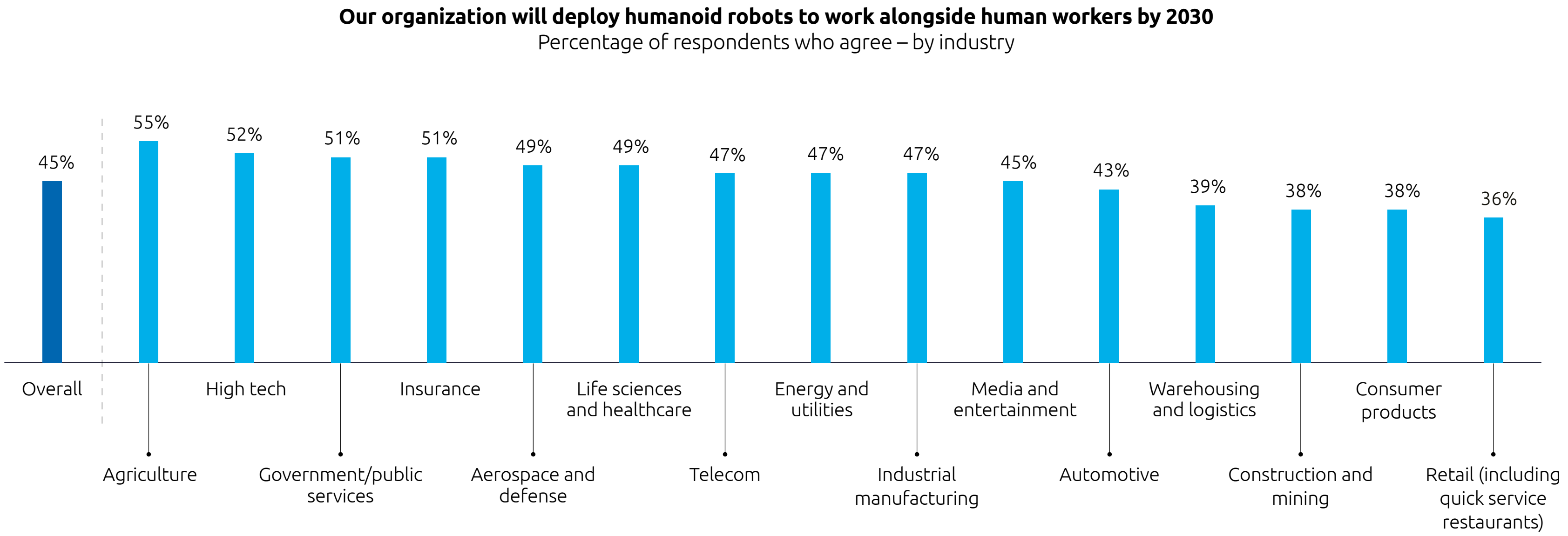
Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Looking ahead, 45% of organizations expect humanoids to work alongside employees by 2030, indicating strengthening deployment intent. Momentum varies, however: agriculture, high tech, public services, and insurance show the strongest sectoral interest (see **Figure 20**), while geographically, planned uptake is highest in South Korea, Japan, China, and Singapore (see **Figure 21**).

This intent is beginning to translate into concrete deployment plans:

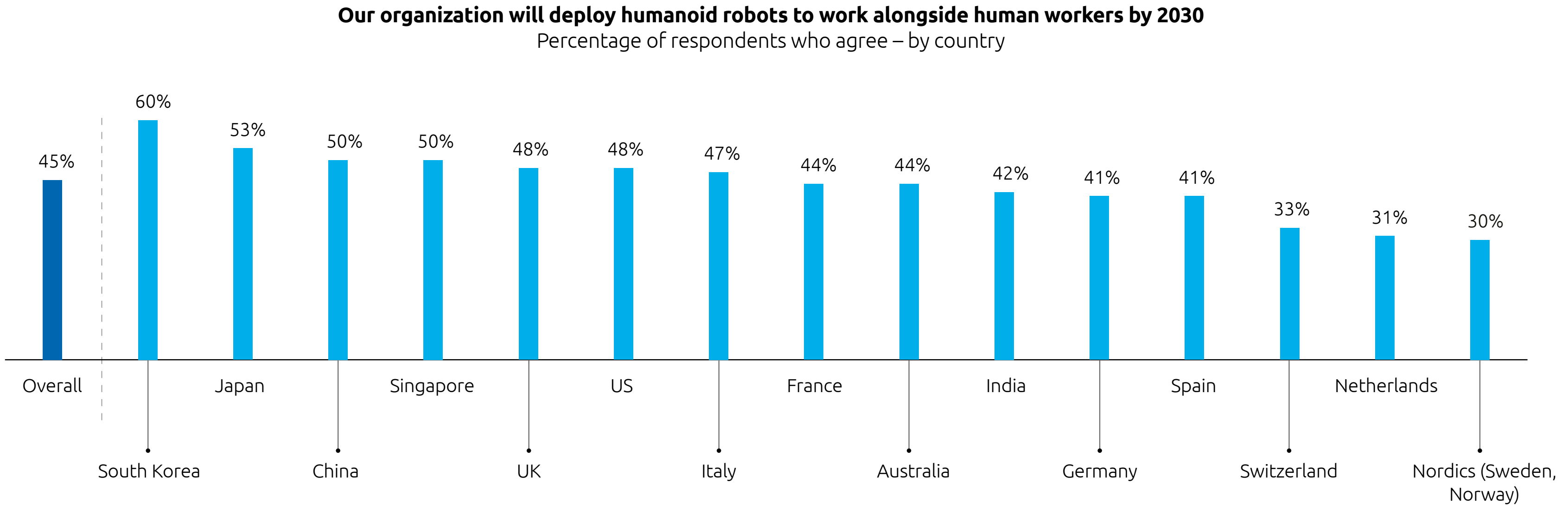
- **Renault Group** plans to deploy 350 humanoid robots across its manufacturing facilities over the next 18 months. The rollout is being carried out in partnership with French robotics firm **Wandercraft,** including co-development of its Calvin industrial humanoids.[55]
- **Hyundai,** which holds a majority stake in **Boston Dynamics,** plans to deploy Boston Dynamics' Atlas humanoid robots to work alongside human workers across its global operations. By 2030, Atlas is expected to support component assembly and, over time, take on repetitive, heavy, and complex tasks to create safer working environments. These deployments are part of Hyundai's wider push for human-robot collaboration across its global value chain, with robots taking on labor-intensive or high-risk tasks while human workers focus on training and supervision.[56]

Figure 20.
Several sectors are gearing up to deploy humanoids alongside human workers by 2030



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Figure 21.
Humanoid deployment plans are taking shape across countries, led by South Korea, Japan, China, and Singapore



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Scaling will be gradual

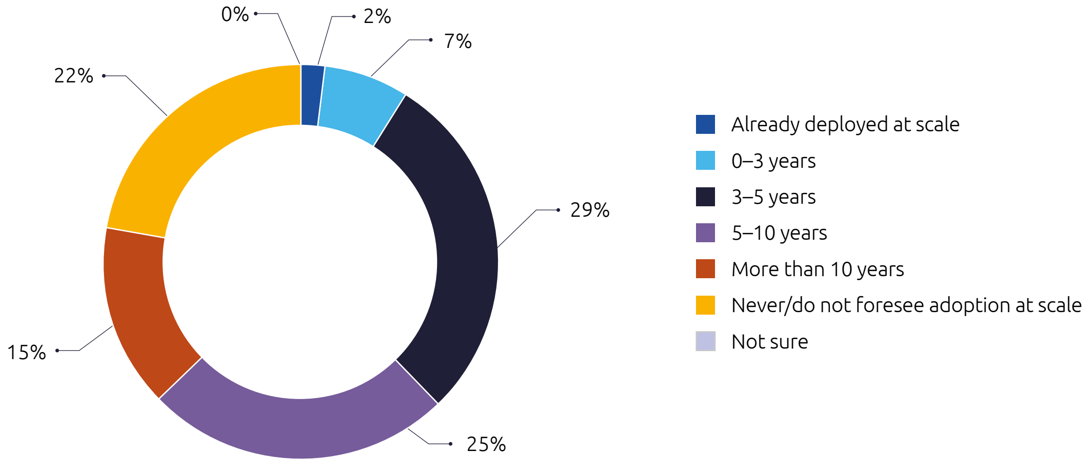
Most organizations (78%) expect to adopt humanoids at scale, but not imminently (see **Figure 22**). On average, organizations anticipate scaled deployment in around seven years, and only 30% believe humanoids will become viable general-purpose workers within the next three to five years. As outlined below, the barriers to humanoid adoption remain significant.

78%

of organizations expect to adopt humanoids at scale, but not imminently

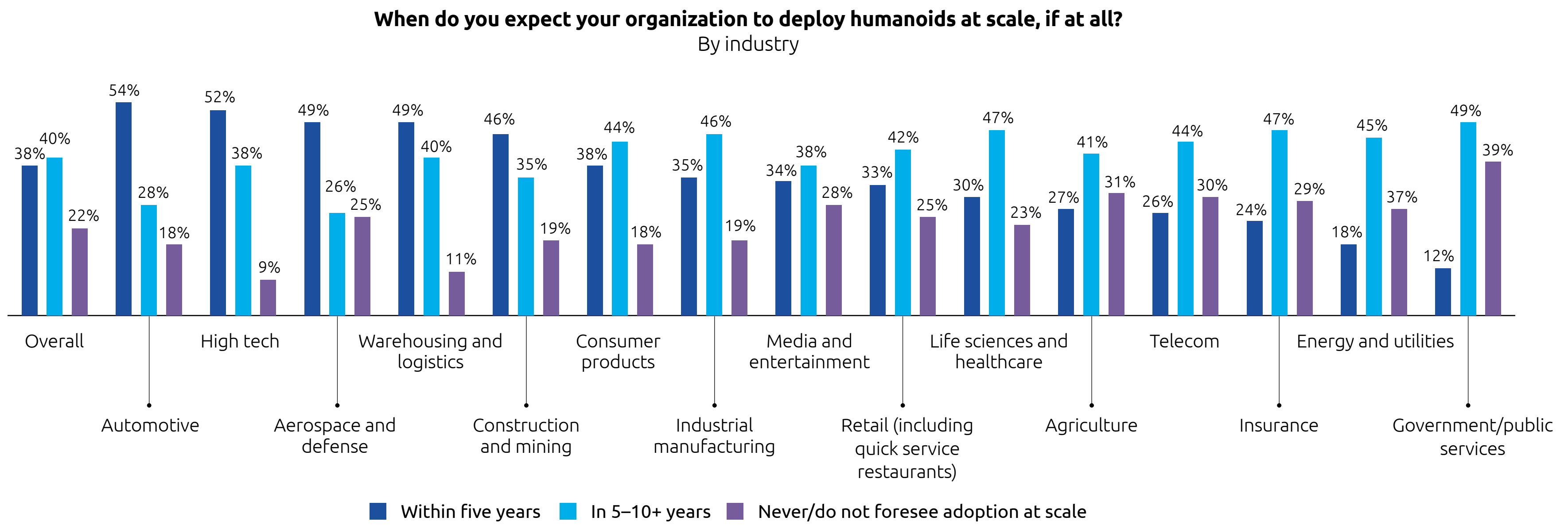
Figure 22.
Most organizations anticipate scaling humanoid deployments

When do you expect your organization to deploy humanoids at scale (beyond pilots or trials), if at all?



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Figure 23.
Automotive, high tech, aerospace, and logistics plan to lead humanoid robot deployments



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

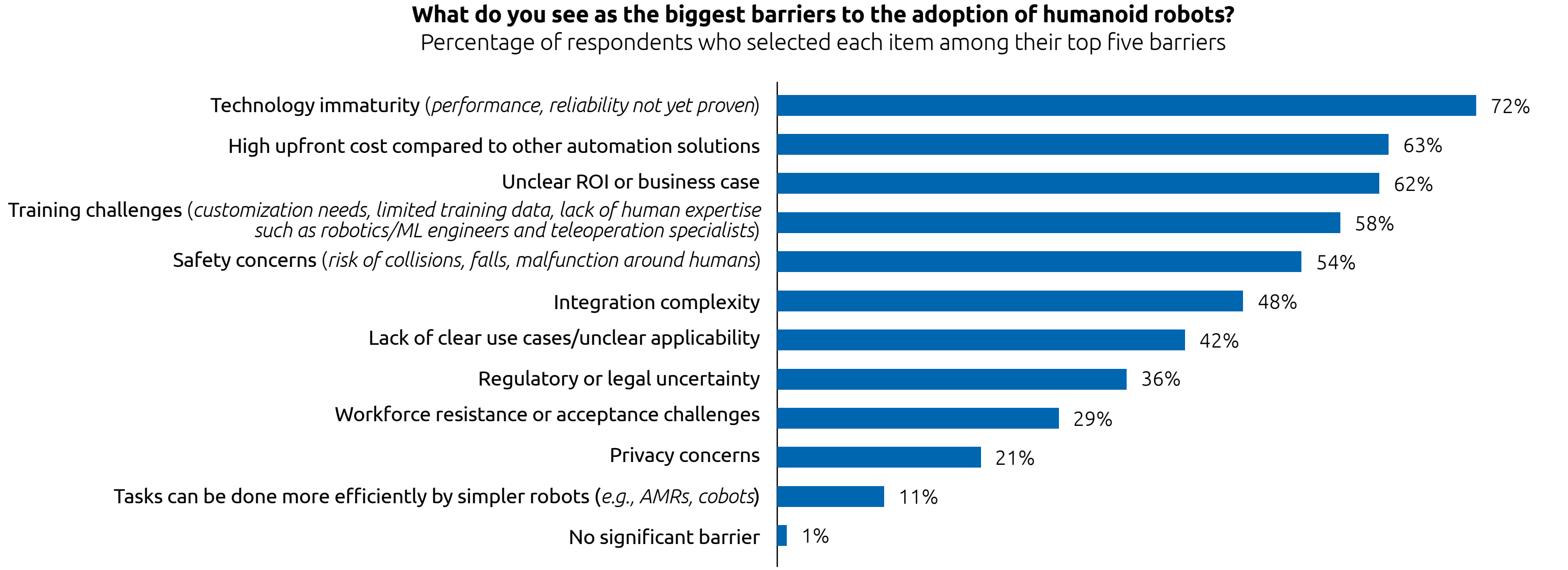
A range of factors are slowing adoption

Humanoid adoption is being held back by several significant barriers: technology immaturity (72%), high cost (63%), unclear ROI (62%), training challenges (58%), and safety concerns (54%). Notably, only 12% of organizations view simpler robots such as AMRs or cobots as a more efficient alternative – indicating that readiness, rather than a flawed value proposition, is the key (see **Figure 24**). ROI uncertainty also persists but is not unique to humanoids: 39% of executives say the business case for humanoids is clear, compared with 42% for physical AI overall, suggesting organizations are cautious about advanced AI-enabled robotics more broadly.

Dirk Geiger, Senior Director and Team Lead – Humanoid Robotics, Infineon Technologies, says: *"Safety in humanoid robots is highly situational – a robot must behave differently depending on the task it is performing and the environment it operates in. Reliably understanding the environment well enough to respond appropriately remains a major challenge. Safety also depends on system design: when issues arise, a humanoid must be able to transition reliably into a safe state."*

Figure 24.

Technological immaturity, high costs, and safety concerns are among the top barriers



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Societal acceptance is a major structural obstacle to humanoid adoption

More than six in ten (62%) executives believe that public resistance will be a critical obstacle to the adoption of humanoids. Concern is highest in France (68%) and lowest in Spain (56%).

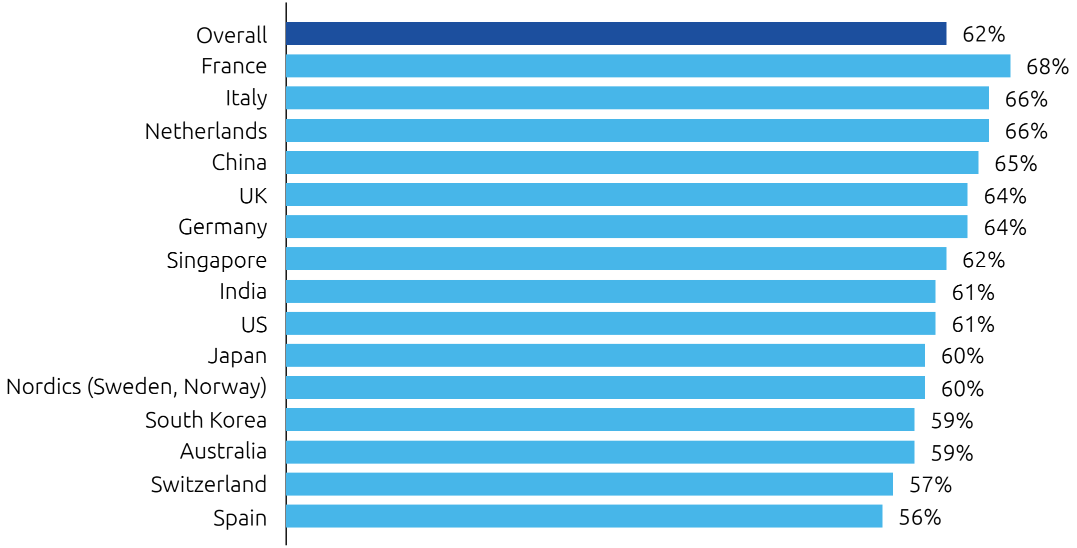
China is pursuing a range of high-visibility initiatives that may contribute to greater public familiarity with humanoid robots. In August 2025, it hosted the first World Humanoid Robot Games in Beijing, where around 500 humanoid robots competed in sports such as running, football, boxing, and martial arts, in front of live audiences.[57] At the 2026 Spring Festival Gala, humanoids from organizations including Unitree, Galbot, Noetix, and MagicLab performed on stage – dancing and demonstrating martial arts alongside human performers.[58] Beyond entertainment, humanoids have also been deployed in public service roles, for example as attendants in trains during the Spring Festival, increasing their visibility and positioning them as useful and non-threatening.[59]

Figure 25.

Concern over societal acceptance of humanoids is widespread

Lack of societal acceptance will be a critical obstacle to the adoption of humanoids

Percentage of respondents who agree – by country



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Pedro Zheng, Senior Regional Sales Manager, Unitree Robotics: *"Start where the case is clearest – harsh, high-risk environments where in the past it was dangerous for human workers. That is where humanoids can step in first. From there, companies need to build the right foundation: a digital twin platform, strong operational management systems, and an AI safety and security framework built around the humanoid. Because a humanoid is not a standalone machine – it is an operational channel, connected to enterprise systems, data, and day-to-day operations."*

Jim Ma, Regional Technical Director, Unitree Robotics: *"Reaching the next level of physical AI is not something any single company can do alone – we need to collaborate across the industry, share knowledge, and improve together. At the same time, innovation cannot happen in isolation from its broader societal implications. As AI-powered machines increasingly operate in human environments, questions around safety, certification, and trust become more important. These are challenges the industry must address collectively."*

China is setting the pace for humanoid robot commercialization

2025 is widely seen as **China's first year of humanoid robot mass production**, with over 140 domestic manufacturers releasing more than 330 humanoid models, and deployments expanding beyond labs into manufacturing, household services, healthcare, and eldercare.[60]

China also stands out as an early mover on standardization, having released its first national standard system for **humanoid robots and embodied (physical) AI**. Developed collaboratively by over 120 research institutions, enterprises, and industry users, the framework spans the entire industrial chain and full lifecycle of humanoid robotics. It seeks to remove compatibility barriers, enable modular and interoperable components, define application-specific functional and safety requirements, and embed safety and ethical considerations from the outset – helping accelerate the transition from pilots to scaled, real-world deployment.[66]

Organizations operating across international markets will need to assess how Chinese standards interact with emerging EU and US regulatory frameworks – and whether interoperability assumptions hold across geopolitical boundaries.

"The rise of physical AI marks a shift from digital cognition to a complete sensory nervous system, where machine learning fuses with tactile sensing and edge computing. Driven by labor shortages, rising costs, and the need for resilience, organizations across manufacturing, logistics, healthcare, and beyond are deploying systems that perceive, reason, and act in the real world. The opportunity is clear. But with 76% of executives citing the move from pilots to scale as a significant challenge, and 62% concerned about societal acceptance, the path forward demands as much focus on human-AI chemistry as on technology."

Charlotte Pierron-Perlès

Executive Vice-President, Managing Director of Intelligent Industry, Capgemini Invent

A discussion with

Sanjay Aggarwal,

Venture Partner at F-Prime Capital,
a US-based venture capital firm

How has the investment landscape for physical AI changed?

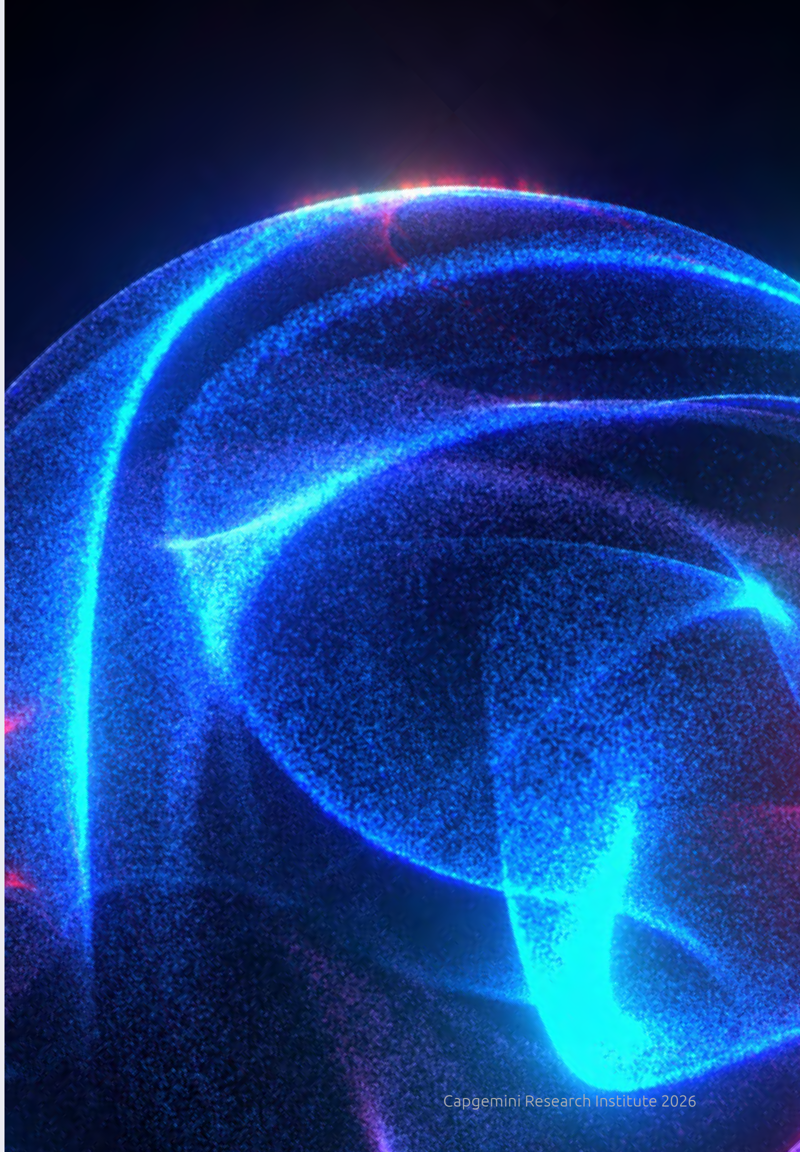
At F-Prime, we track the robotics investment landscape annually, and 2025 was the most significant year to date. Venture funding into robotics reached an all-time high. The total enterprise value of private robotics unicorns skyrocketed, while public robotics organizations outperformed the broader market. China's public market robotics organizations have seen even stronger market performance. The pace of investment in 2025 was driven by both organizations building vertical-specific robotics across sectors including logistics, medical, defense, manufacturing, agriculture, construction, and mining, and in general-purpose robotics. Overall, humanoids and foundation models have been the fastest-growing segment of robotics. Investor appetite for large funding rounds has been fueled by clear proof points of commercial scale, reinforced by success in the public markets.

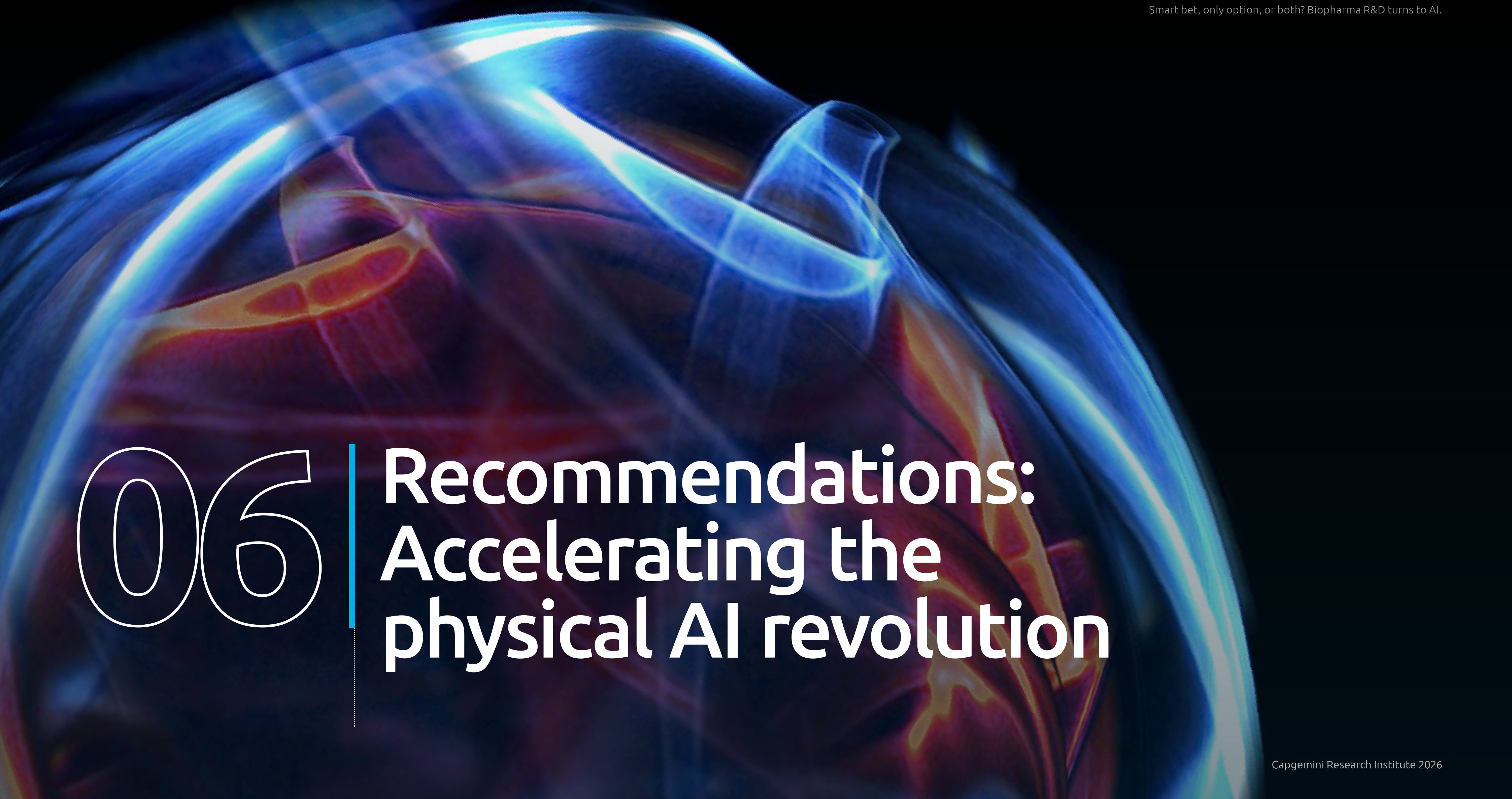
How do investors assess the business case for physical AI?

Use-case selection is where the ROI equation is won or lost. You need a system that runs all day, every day to justify it economically. The second variable is reliability. Even a high-utilization problem becomes a dead end if the system performs at 80–90% and operators lose confidence in it. Due to economies of scale, cost is the most readily solved part of the equation.

How do you see the physical AI and robotics landscape evolving?

Two things will define the next five to ten years. The first is the expansion into hard-to-automate sectors such as agriculture, construction, and mining that will see physical AI systems mature and scale. The second is what happens inside facilities that are already highly automated but still depend on manual labor for tasks that remain unstructured, such as assembly operations, wiring harnesses in manufacturing, and individual item handling in logistics. Foundation models are what make those use cases unlockable, and I expect the earliest deployments of today's general-purpose robotics technology to show up there first, in those industrial gaps, rather than in the more visible but harder-to-commercialize consumer applications.





06 Recommendations: Accelerating the physical AI revolution

Despite strong belief in physical AI's long-term impact, organizations face a range of barriers that slow adoption and limit scaling (see **Figure 27**). The most prominent challenges relate to technology readiness, driven by limitations in reliability, dexterity, and the scarcity of training data. High costs and uncertain ROI, shortages of skilled talent, and the complexity of integrating and orchestrating multiple robotic systems further constrain deployment. These obstacles are compounded by lack of mature safety standards and regulatory clarity, as well as societal concerns about job impacts – particularly in the case of humanoids. As a result, many organizations struggle to progress beyond experimentation, with 76% of executives saying that moving from pilots to scaled deployment is a significant challenge.

Against this backdrop, it is unsurprising that only 42% of executives feel the business case for investing in physical AI is clear today. Overcoming these constraints will require coordinated action across the ecosystem to reduce adoption risk and strengthen the foundations for scaling.

The actions below outline practical steps enterprises can take today to advance their physical AI journey. We also highlight broader ecosystem considerations for technology developers, policymakers, and standards bodies that will shape the pace and safety of real-world deployment.

Actions for enterprises deploying physical AI

Adopting physical AI is a multi year transformation journey, but it is one that organizations should begin now: the technology has advanced enough to support meaningful early progress, with tangible value already available. The following actions outline how enterprises can build momentum and scale adoption over time.

1. Build an understanding of physical AI

Develop a realistic understanding of what physical AI can and cannot do today – the value it can deliver and the capabilities it unlocks – alongside its current technical limits, human–robot interaction challenges, and engineering and regulatory constraints. Assess how existing data infrastructure can support physical AI deployments – or where gaps need to be addressed.

2. Start with use cases that build familiarity and confidence

Begin with clearly beneficial use cases that are feasible to deploy and offer tangible ROI – such as dull, dirty, and dangerous tasks – to build confidence, reduce uncertainty, and demonstrate value to frontline teams.

3. Design through form exploration

Iterate with multiple design concepts to understand how form shapes trust, interaction, and suitability across tasks and environments, rather than defaulting prematurely to humanoids alone.

4. Redesign workflows for human–robot collaboration

Reengineer processes to reflect new interaction patterns between people, AI agents, and robots, with clear handovers, supervision models, safety protocols, and escalation paths. Engage shop-floor teams early to ensure the needs of frontline workers who will work alongside robots are built into deployments from the outset.

5. Scale through a platform approach

Create a scalable foundation that supports expansion across tasks, sites, and robot types. This includes using architecture that lets robots access common skills, as well as orchestration layers that coordinate AI agents and robot fleets. To support scaling, core architectural and operational elements, such as data pipelines, safety and cybersecurity practices, compliance frameworks, and orchestration mechanisms should be defined and standardized early, allowing growth beyond isolated pilots to multi-site deployment.

The actions above must be anchored in a foundation of trust. This means establishing the guardrails and operating principles that make physical AI safe and predictable: defining where robots may operate, which tasks remain human-only, acceptable risk thresholds, and how human-on-the-loop oversight will function in practice. Establishing these conditions early strengthens acceptance of initial deployments and creates a stronger platform for scaling physical AI adoption over time.

Alongside this, organizations should stay closely connected to the physical AI and robotics ecosystem as the field is advancing rapidly. Ongoing engagement with robotics vendors, integrators, research labs, standards bodies, and regulators will provide early visibility into emerging advances and practical constraints, supporting more informed decision-making throughout the journey.

Figure 26.
Accelerating the physical AI adoption journey

Source: Capgemini Research Institute analysis.

"Deployment has to be a partnership with the workforce, particularly when social acceptance is identified as a critical hurdle. We have to ensure that physical AI systems are introduced transparently, using human-in-the-loop supervision, to build trust and ensure we don't outpace our ability to manage the change."

Mat Gilbert

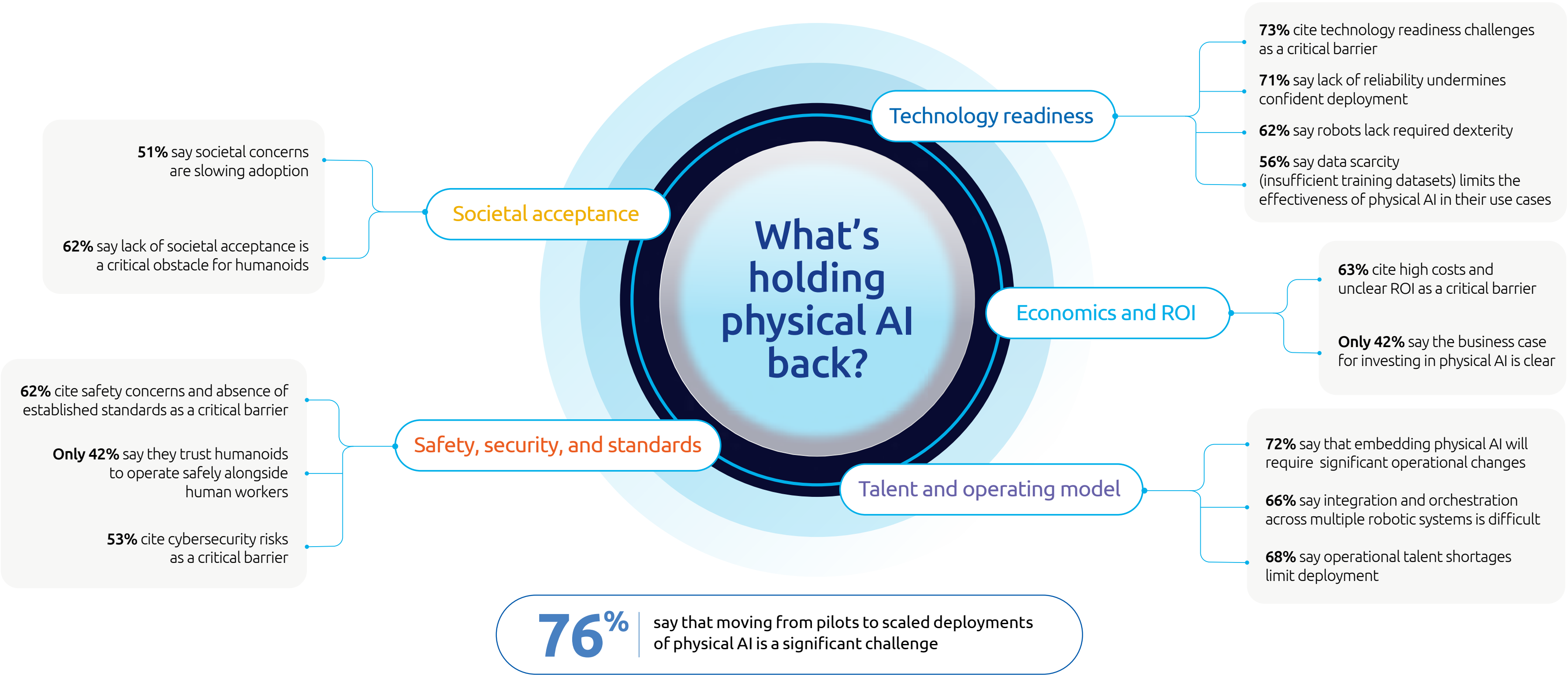
Director, Head of AI & Data, Synapse Product Development,
part of Capgemini Invent

Ecosystem considerations

Beyond enterprise actions, progress on enterprise adoption will also depend on continued advances across the wider ecosystem. Improvements in reliability and dexterity, stronger safety and cybersecurity by design, greater interoperability through open interfaces and orchestration frameworks, and commercial models that reduce upfront investment and lower adoption risk will all influence how quickly and broadly physical AI can scale. Momentum will also be shaped by the evolution of safety, cybersecurity and data protection standards, well-defined liability frameworks, interoperability standards for multi-vendor environments, and transparent public communication to build societal trust.

Nagesh Puppala, General Manager, Robotics and Physical AI, Client Computing Group, Intel Corporation, says: *"Physical AI is among the most complex domains of artificial intelligence. Advancing it at scale will require broader ecosystem collaboration – sharing lessons learned and building shared multimodal datasets for robotics across form factors, domains, and use cases."*

Figure 27.
A combination of technological, economic, operational, and societal barriers is slowing physical AI adoption



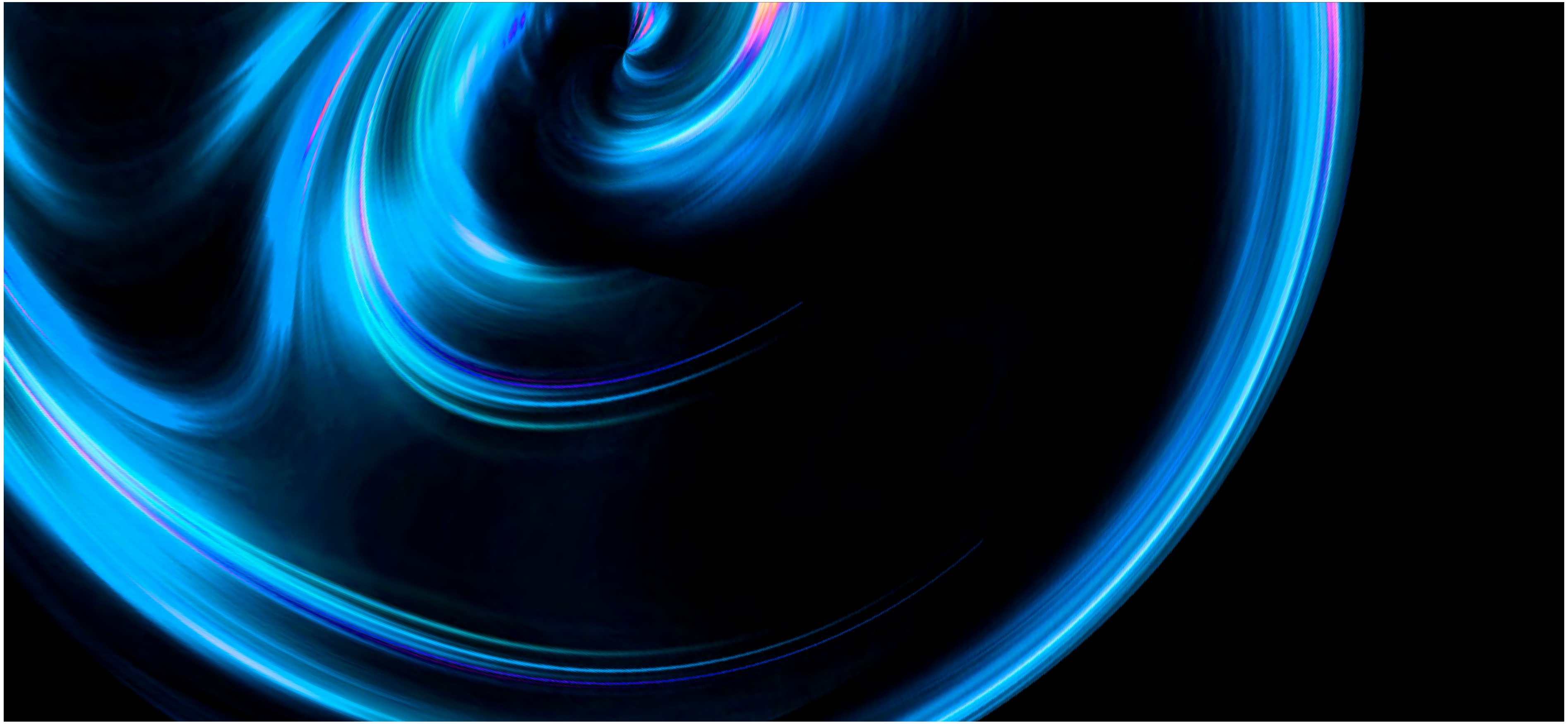
Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Designing physical AI systems for sustainability

Nearly four in ten (38%) executives express concern about the sustainability implications of deploying physical AI systems, including energy consumption, carbon emissions, and lifecycle impacts. These issues span both the physical hardware and the AI models that power these systems, underscoring the need to embed sustainability early in design decisions.

- **Hardware – avoiding material waste through better design.** A key sustainability risk on the hardware side is material waste, as robots that cannot be repaired or upgraded are likely to be discarded and landfilled. Designing robots to be modular, repairable, and recyclable will be key to preventing premature disposal and reducing the overall environmental footprint of physical AI systems.
- **AI – reducing the energy footprint of model training and inference.** AI models introduce their own environmental footprint. Training can be energy-intensive, while inference – though far less energy-demanding per operation – can accumulate across fleets as deployments scale. This makes power-efficient AI model design essential to reduce cumulative energy use over a robot's operational life.

A lifecycle-focused design and deployment approach – spanning both the physical hardware and the way AI models are trained and operated over time – helps ensure that the growth of physical AI aligns with broader environmental expectations.

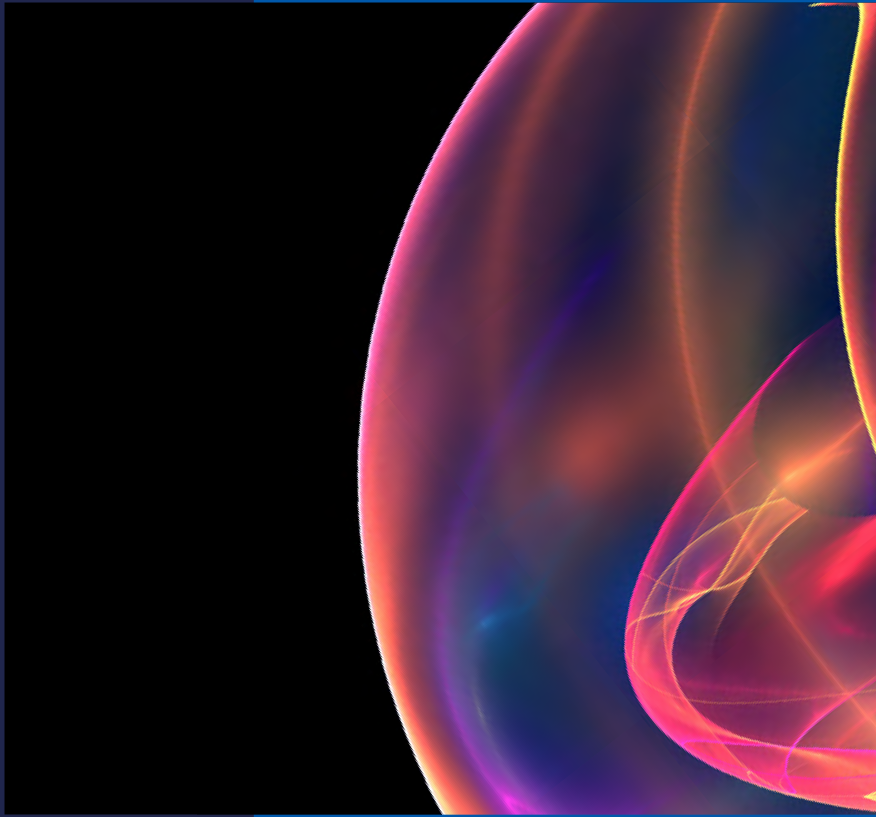


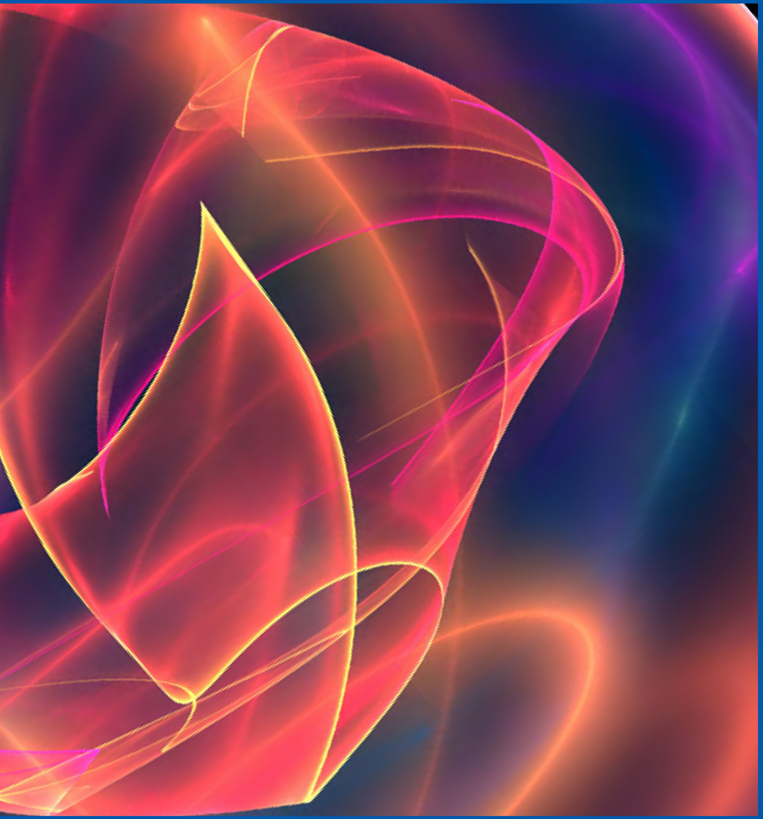
Conclusion

AI is moving beyond digital environments and into the physical world, transforming robots from rigid, pre-programmed tools to adaptive, context-aware collaborators. This shift is unlocking solutions to operational challenges in unstructured environments that traditional automation has not been able to solve. At the same time, converging forces – global labor shortages, an aging workforce, rising labor costs, and renewed momentum toward reindustrialization – are making physical AI an immediate priority rather than a distant vision. Organizations are already moving from early exploration to real-world deployment. But capturing value, especially when moving from proofs of concept to scaled adoption, requires more than better algorithms. It demands a transformation in how work is designed, how safety and reliability are managed, and how the workforce is supported and upskilled.

While humanoid form factors may play a significant role over time, immediate value can be realized today through established form factors such as autonomous mobile robots and industrial arms. Organizations can begin capturing ROI now with proven technologies, while preparing their infrastructure and workforce for the more capable, human-centered form factors that will emerge over the coming years.

Ultimately, the leaders of the next decade will be those laying the foundations of physical AI today. Organizations that begin integrating intelligent, adaptive robotic systems into their core operations now will be best positioned to shape – and benefit from – the era of physical AI.





Research methodology

In January and February 2026, we conducted a global survey of 1,678 executives from organizations with annual revenue above $1 billion*, across 16 countries in North America, Europe, and Asia-Pacific and spanning 15 industries.

Countries covered included: US, UK, France, Germany, Italy, Spain, the Netherlands, the Nordics (Sweden and Norway), Switzerland, India, China, Japan, South Korea, Australia, and Singapore.

Industries covered included: automotive, aerospace and defense, industrial manufacturing, life sciences and healthcare, energy and utilities, high tech, telecom, retail (including quick service restaurants), consumer products, warehousing and logistics, insurance, public services, media and entertainment, construction and mining, and agriculture.

Executives surveyed were director level and above. The distribution of survey respondents is provided in the following figures.

We conducted a global survey of

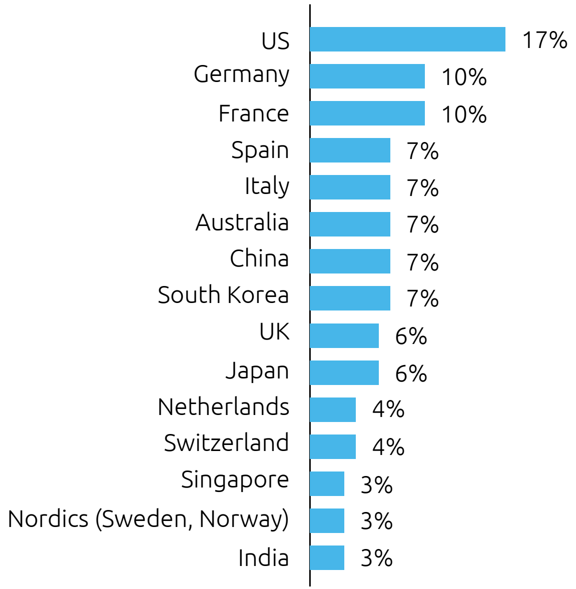
1,678 executives

across **16 countries**

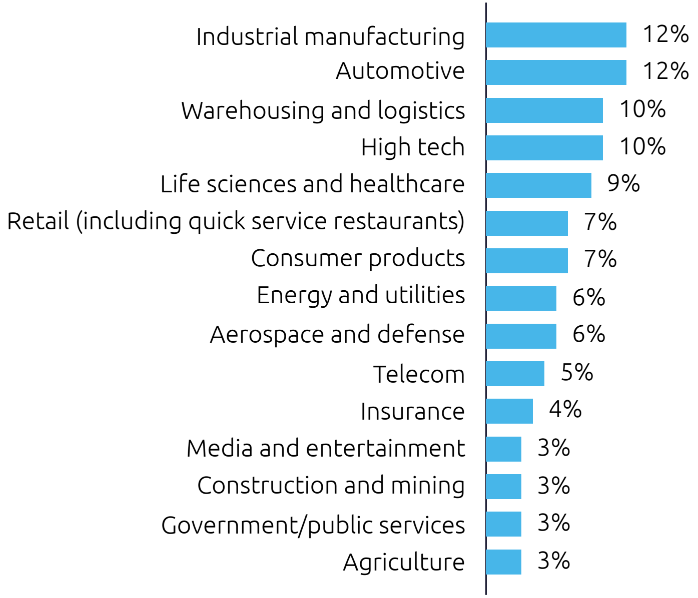
organizations with annual revenue above **$1 billion***

**For aerospace and defense and government/public services, the threshold was $500 million.*

Organizations by headquarter location

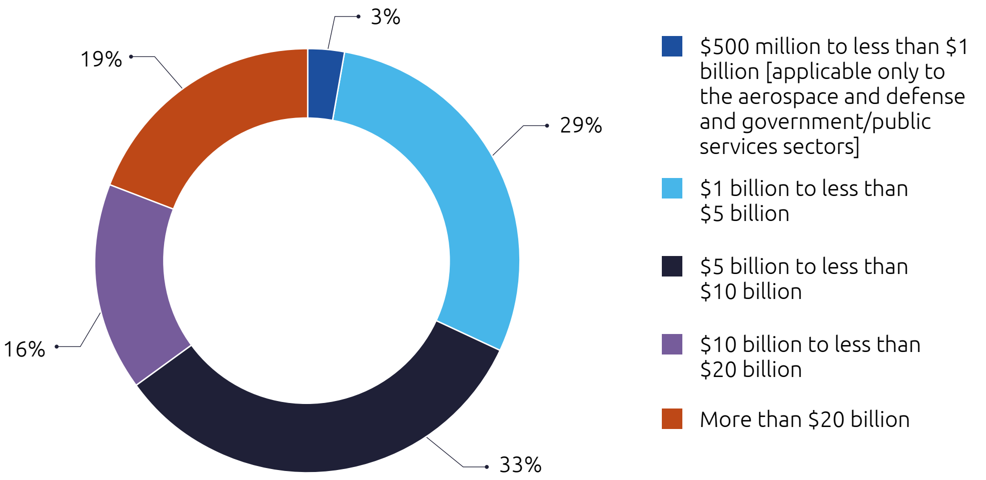


Organizations by industry

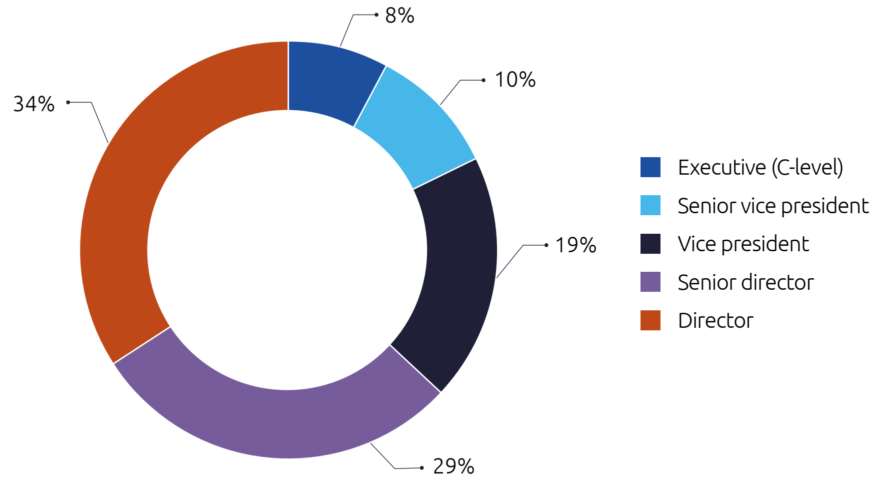


Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Organizations by annual revenue (or budget, if government/public services) in USD

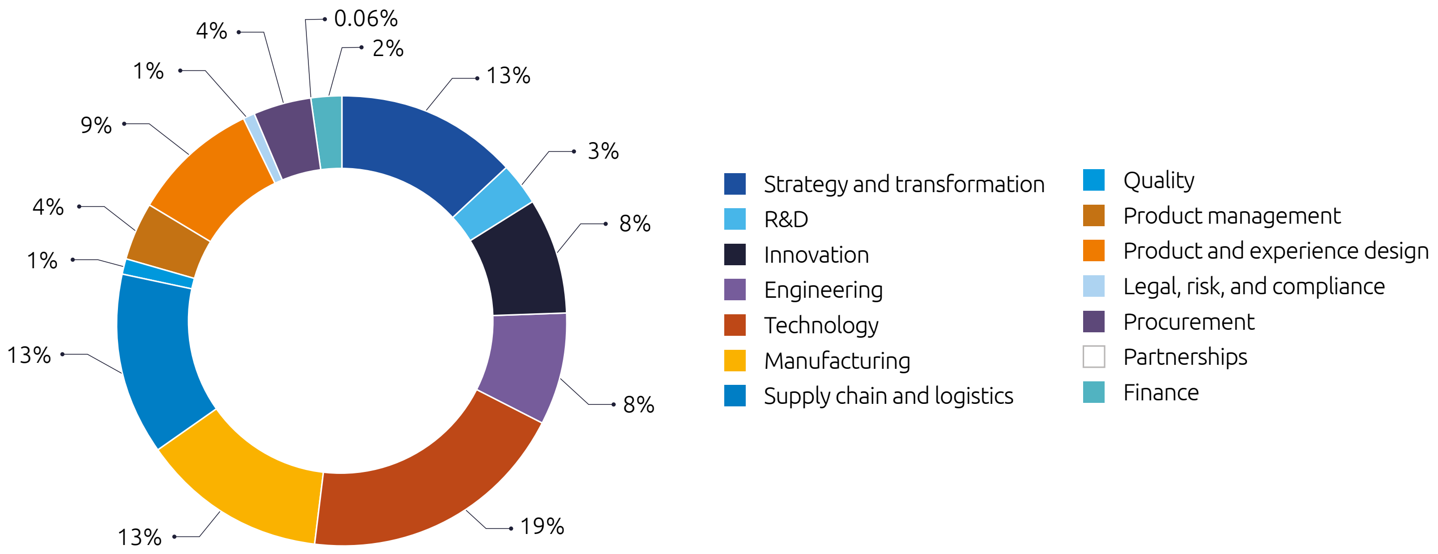


Executives by designation



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Executives by function



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

The study findings reflect the views of respondents to our online questionnaire for this research and are aimed at providing directional guidance. Please refer to the methodology for details of respondents and get in touch with a Capgemini expert to discuss specific implications.

Appendix

An introduction to physical AI and its role in robotics

Physical AI represents the next major evolutionary stage in AI: AI that acts in the physical world. While AI has so far operated largely within digital environments – analyzing data, optimizing digital workflows, and generating digital outputs – physical AI applies AI to physical systems, enabling machines to perceive, reason, and act autonomously in the real world. It achieves this by combining an AI "brain," capable of perception, reasoning, and learning, with a physical body such as a robot, autonomous vehicle, medical device, industrial machine, or connected piece of infrastructure. While physical AI applies to a broad range of physical systems (see **Figure 28**), this report focuses specifically on its application in robotics. Throughout this report, "physical AI" refers to physical AI for robotics – i.e., robots powered by AI that can perceive, reason, and act autonomously in the physical world.

What physical AI enables in robotics

Robotics is among the most significant applications of physical AI. Physical AI enables robots to perceive their surroundings, make context-aware decisions, and act autonomously. AI models are trained in the cloud and run inference on robots at the edge (see **Figure 29**). Where earlier uses of AI in robotics were largely deterministic and rule-based, physical AI uses probabilistic, learning-driven models that enable robots to adapt and make decisions in real time.

This gives robots capabilities that were previously out of reach: operating in unstructured settings, handling multiple scenarios without reprogramming, adapting to real-world variation, and learning new tasks over time. These capabilities shift robots far beyond fixed, pre-programmed behaviors and open new possibilities for deployment across manufacturing, logistics, healthcare, agriculture, construction, mining, and more.

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From task-specific robots to a shared intelligence platform

Physical AI redefines robotics by shifting the focus from task-specific machines to a shared intelligence platform. Traditionally, robot capabilities were tightly bound to individual machines, defined through fixed programming and engineered for specific environments. This delivered strong performance in controlled settings, but proved brittle, costly, and difficult to scale across real-world operations.

Physical AI changes this by decoupling intelligence from individual robots. Core intelligence resides in shared models and data rather than hard-coded machine logic, with robots acting as embodiments of a common intelligence layer that learns across fleets, environments, and use cases. As models improve through data, simulation, and real-world feedback, capabilities developed in one context can be reused in others. Learning compounds over time, enabling robotics to scale as a continuously improving platform rather than a collection of isolated systems.

From digital to embodied AI agents

By introducing a shared intelligence layer across robots, physical AI extends the agentic paradigm into the real world. Robots become embodied AI agents that can plan, orchestrate, and execute complex physical tasks.

Physical AI applies to a broad spectrum of robot form factors – and traditional robotics remains essential

Physical AI applies across many different robot form factors, each suited to different tasks and environments. Nevertheless, in highly structured settings involving repetitive, high-precision, and high-throughput operations, traditional robotics remains essential, complementing physical AI systems.

Figure 28.

How physical AI applies across machines, with robotics as a leading frontier

Physical AI: Powering the next generation of intelligent machines

Physical AI refers to the application of AI to physical systems, enabling machines to perceive, reason, and act autonomously in the real world

Physical AI applies to a diverse range of physical systems, including the following

	Examples	How physical AI applies
Robots	Industrial robot arms, AMRs, cobots, humanoids, quadrupeds, drones, special-purpose robots	Enables robots to perceive their environment, learn tasks, and act autonomously in unstructured settings
Autonomous vehicles	Self-driving cars, autonomous trucks, robo-taxis, autonomous buses/shuttles	Allows vehicles to sense, predict, and react to complex road and traffic conditions in real time
Medical devices	AI-guided surgical tools, smart drug delivery systems, wearable/implantable monitors, diagnostic imaging systems, intelligent rehabilitation or assistive mobility systems	Lets devices interpret patient signals and adjust actions or guidance dynamically during procedures or treatment
Industrial machines	CNC machines, smart conveyors, industrial compressors, pumps, turbines, generators, HVAC systems	Enables machines to self-monitor, predict failures, and optimize performance and energy use autonomously
Connected infrastructure	Smart grids, smart traffic systems, adaptive street-lighting, water/waste networks, building management systems	Allows infrastructure to sense load or demand and adjust operations automatically to maintain flow, safety, and efficiency
Satellites	Earth-observation satellites, communications satellites, navigation satellites, on-orbit servicing platforms	Enables systems to analyze data onboard, detect anomalies, and autonomously adjust operations without ground control

Focus of this report

Physical AI for robotics

Robotics is among the most significant applications of physical AI

Physical AI gives robots capabilities that were previously difficult or out of reach:

- Operating in unstructured settings
- Adapting to real-world variation
- Learning new tasks over time

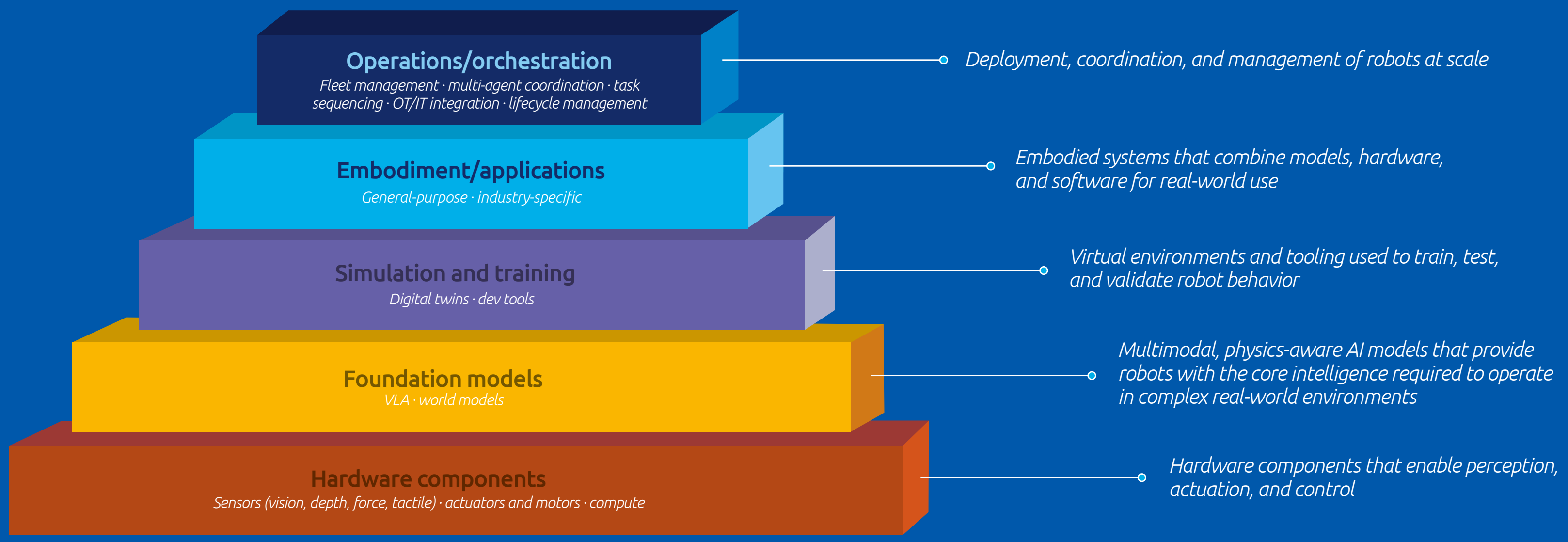
Source: Capgemini Research Institute analysis.

Figure 29. How physical AI works in robotics

Steps	Description
Model pretraining in the cloud for general physical intelligence	Large-scale foundation models (e.g., vision-language-action models) are pretrained in the cloud using images, video, and physics-based simulations to learn general representations of objects, actions, and physical interactions that transfer across tasks and environments.
Task-specific skill acquisition	Pretrained models are adapted to specific tasks through learning in simulation and, where needed, from teleoperation data. Depending on the task, systems use imitation learning,[62] reinforcement learning,[63] or a combination of both to learn task-specific policies (i.e., learned decision models that govern how a robot behaves under real-world variability).
Edge deployment of policies	Policies are deployed to the robot's onboard (edge) compute, enabling low-latency, real-time inference without reliance on continuous cloud connectivity.
Real-world operation	During operation, the robot continuously perceives its environment through sensors (vision, force, touch), performs real-time inference to interpret context and evaluate actions, and executes tasks via actuators. In industrial settings, unlocking value at scale requires integrating robot operations with enterprise and engineering systems – such as ERP, WMS, and broader manufacturing systems – to align operational execution with business workflows.
Continuous adaptation and fleet learning	Data from real-world execution is used to further refine models and policies in the cloud, with updated policies deployed across robot fleets to enable continuous, fleet wide learning.

Source: Capgemini Research Institute analysis.

Figure 30.
The emerging physical AI ecosystem for robotics



Source: Capgemini Research Institute analysis.

Physical AI use cases

Manufacturing
Adaptive material handling Managing irregular raw materials or semi-finished goods, adjusting grip and movement based on shape and weight variations
Dynamic hardware prototyping Assembling and reconfiguring prototypes, adapting to frequent design changes without manual intervention
Dynamic product assembly Autonomously adapting on production lines – recognizing different product models and adjusting grip, force, and sequence without reprogramming
Personalized product assembly Adapting to custom configurations and variable components, adjusting assembly steps dynamically for each unique product
Autonomous line changeovers Autonomously reconfiguring production lines for new product variants – recognizing form and material differences, and adjusting tooling, alignment, and operational parameters
Quality inspection Moving around complex objects, detecting defects under changing lighting and angles, and adjusting inspection paths dynamically

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Supply chain and logistics
Adaptive packaging systems Detecting irregular product shapes and adjusting packaging or wrapping techniques in real time
Adaptive pick-and-place Handling irregular or deformable items by using vision and tactile sensing to adjust grip and placement dynamically
Smart shelf-stocking Recognizing diverse product shapes, adjusting placement techniques, and navigating crowded spaces while predicting human movement
Autonomous goods transport Moving goods safely through busy facilities, predicting traffic patterns and rerouting in real time to avoid collisions
Micro-logistics Performing short-distance, localized tasks such as picking, sorting, or delivering tools and supplies within a facility

Maintenance
Equipment monitoring and diagnostics Autonomously inspecting machinery and detecting emerging faults under varying operating and environmental conditions
Field inspection Autonomously inspecting equipment, structures, and varied physical environments (including fields and crops) and adapting to terrain and environmental conditions
Adaptive maintenance Autonomous maintenance robots that detect wear and damage, interpret sensor data, and adapt tools and movements dynamically to perform repairs without manual intervention

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Retail and services

Customer experience and engagement
Robots that enhance customer journeys through interactive engagement, guidance, service, and real-time information support

Sidewalk delivery robots
Last-mile delivery robots that navigate urban environments to fulfill e-commerce and food orders

QSR automated assembly
Robotic systems that replicate precise, repeatable food preparation tasks, such as grilling, frying, or assembling orders

Shelf intelligence
Vision-enabled robots that autonomously traverse retail aisles to detect stock levels, misplacements, pricing errors, and compliance gaps to improve retail operations

Restaurant serving robots
Autonomous front-of-house robots that navigate dining rooms to deliver food and beverages from kitchen to table

Facilities and safety management

Adaptive security and compliance monitoring
Monitoring safety and compliance in dynamic, unpredictable environments
Example: A robot patrols a factory floor, detects unauthorized access, and adjusts its route to investigate

Dynamic facilities management
Cleaning and sanitization in factory floors, offices, hospitals, or public spaces
Example: A robot increases cleaning frequency in high-traffic zones after detecting spills or dirt

Hazardous environment operations
Robots deployed to perform tasks in dangerous, high-risk, or inaccessible environments – such as areas with extreme temperatures, radiation, toxic chemicals, confined spaces, or structural instability – reducing risk to human workers

Continued on next page

Life sciences and healthcare

Precision surgical robotics
Robotic systems that use imaging and sensor feedback to guide incisions and instrument movements, adjusting in real time to tissue conditions

Patient mobility and rehabilitation
Assistive and rehab robots that adapt to posture, strength, and movement patterns to support safe mobility and recovery

Lab automation and sample handling
Robots that handle specimens, pipetting, plating, and high-throughput workflows in clinical, biopharma, or diagnostics labs

Eldercare companion robots
Socially aware robots that monitor vitals, provide cognitive engagement, provide reminders, detect behavioral changes, and alert caregivers to safety concerns

Hospital logistics robots
Autonomous systems that transport medications, linens, meals and medical supplies across hospital environments

Insurance

Risk assessment and claims
Autonomous asset level inspections (e.g., homes, vehicles, or facilities) to collect evidence for underwriting and claims decisions

Disaster damage assessment
Wide-area post-disaster assessment to map severity and triage claims across neighborhoods or regions after events such as hurricanes, floods, or wildfires

Disaster response
Physically entering hazardous zones, moving debris, and assisting in rescue operations while adapting to chaotic conditions

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Media and entertainment

AI-powered animatronics
Robotic characters that deliver lifelike motion, expressions, and interactions for theme parks, attractions, and immersive entertainment experiences

Stage and set automation
Robots that move sets, props, and backdrops with precision, synchronizing with cues during rehearsals, shows, or broadcasts and adapting to last-minute changes

Intelligent lighting and effects
Robotic lighting and effects systems that reposition, refocus, and adjust illumination or effects autonomously in response to choreography, blocking, or scene transitions

Construction and mining

Autonomous earthmoving and haulage
AI-guided excavators, loaders, and haulage trucks that navigate, dig, load, and transport materials with adaptive control under changing site conditions

Robotic surveying and site mapping
Autonomous robots capturing terrain, progress, and as built data with high precision, continuously updating maps and aligning with project or mine plans

Continued on next page

Agriculture

Autonomous harvesting
Robotic harvesters that identify ripe produce and use gentle, adaptive gripping to pick fruit or vegetables without damage

Precision crop care
Robots that detect weeds, pests, or plant-level needs and deliver targeted treatments – such as micro-dosing sprays or mechanical removal, with high accuracy

Horticulture robotics
Robots that perform tasks such as pruning, trellising, pollination, canopy management, and other plant care activities in orchards, vineyards, and controlled environments

Government/public services

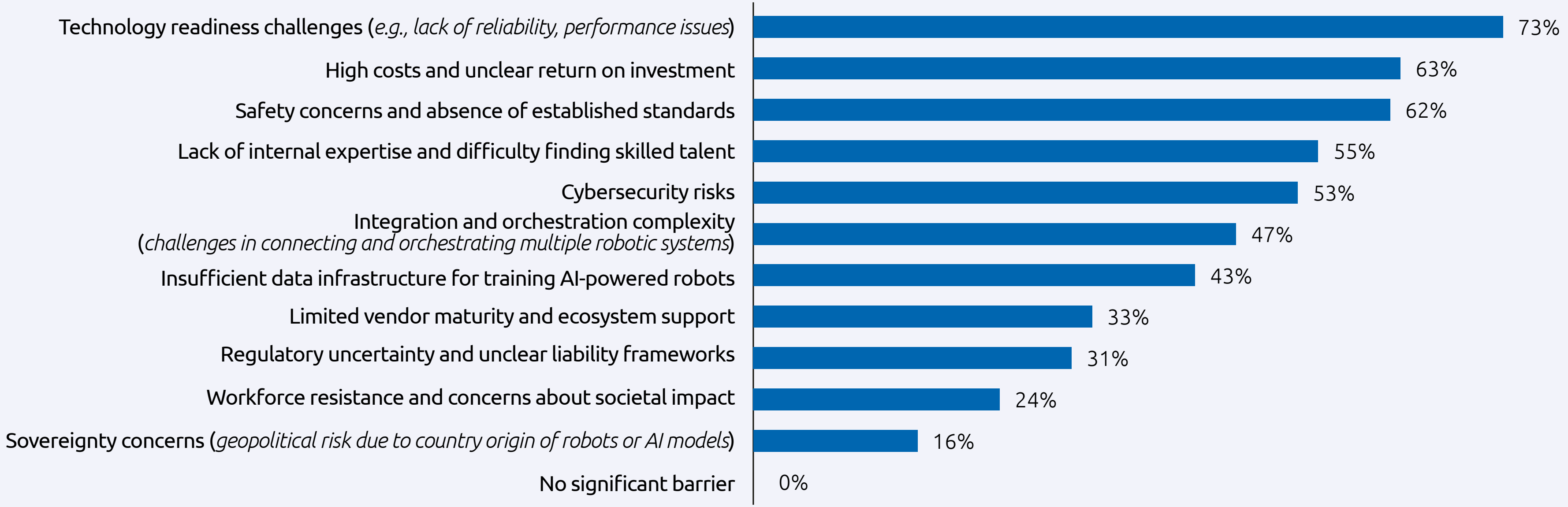
Search-and-rescue operations
Mapping chaotic disaster environments, navigating rubble, and adjusting lifting techniques to reach trapped individuals safely

Firefighting support robots
Navigating smoke-filled environments, extinguishing fires, handling hazardous materials, and reducing risk for human firefighters

Healthcare and elder care
Assisting in hospitals or care facilities, supporting staff shortages

Barriers holding back physical AI adoption and scaling

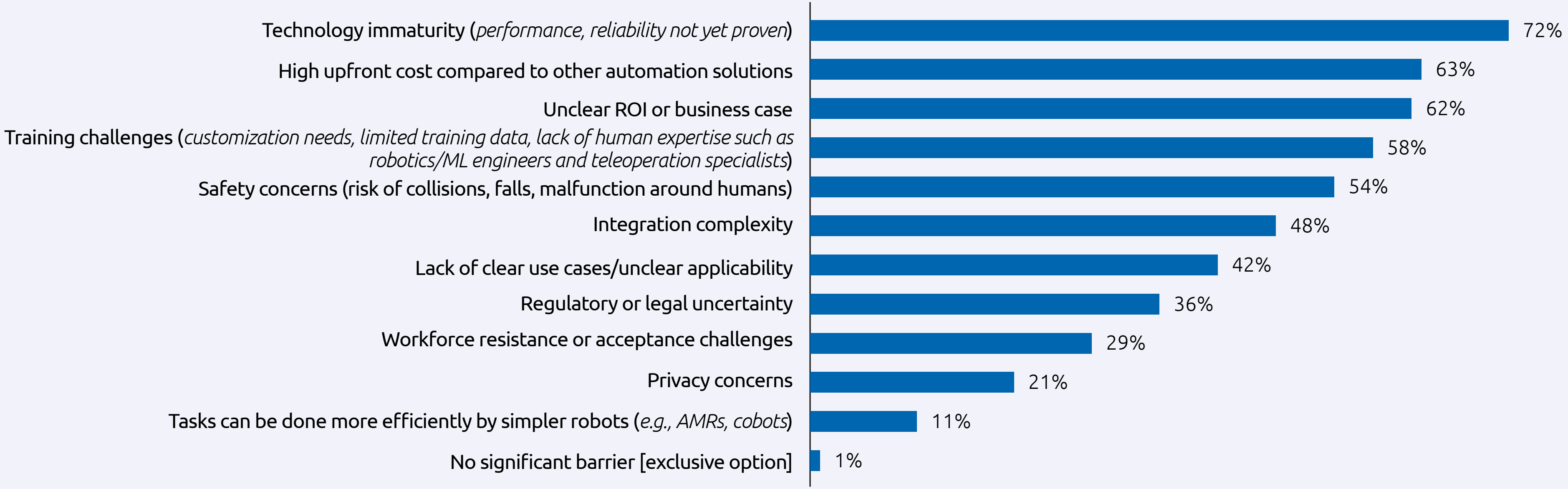
What do you see as the most critical barriers to adopting or scaling physical AI in your organization?
Percentage of respondents selecting the following among their top five barriers



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

Barriers holding back the adoption of humanoid robots

What do you see as the most critical barriers to adopting or scaling physical AI in your organization?
Percentage of respondents selecting the following among their top five barriers



Source: Capgemini Research Institute, Physical AI for robotics survey, January–February 2026, N = 1,678 executives.

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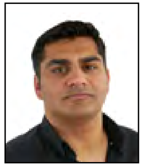

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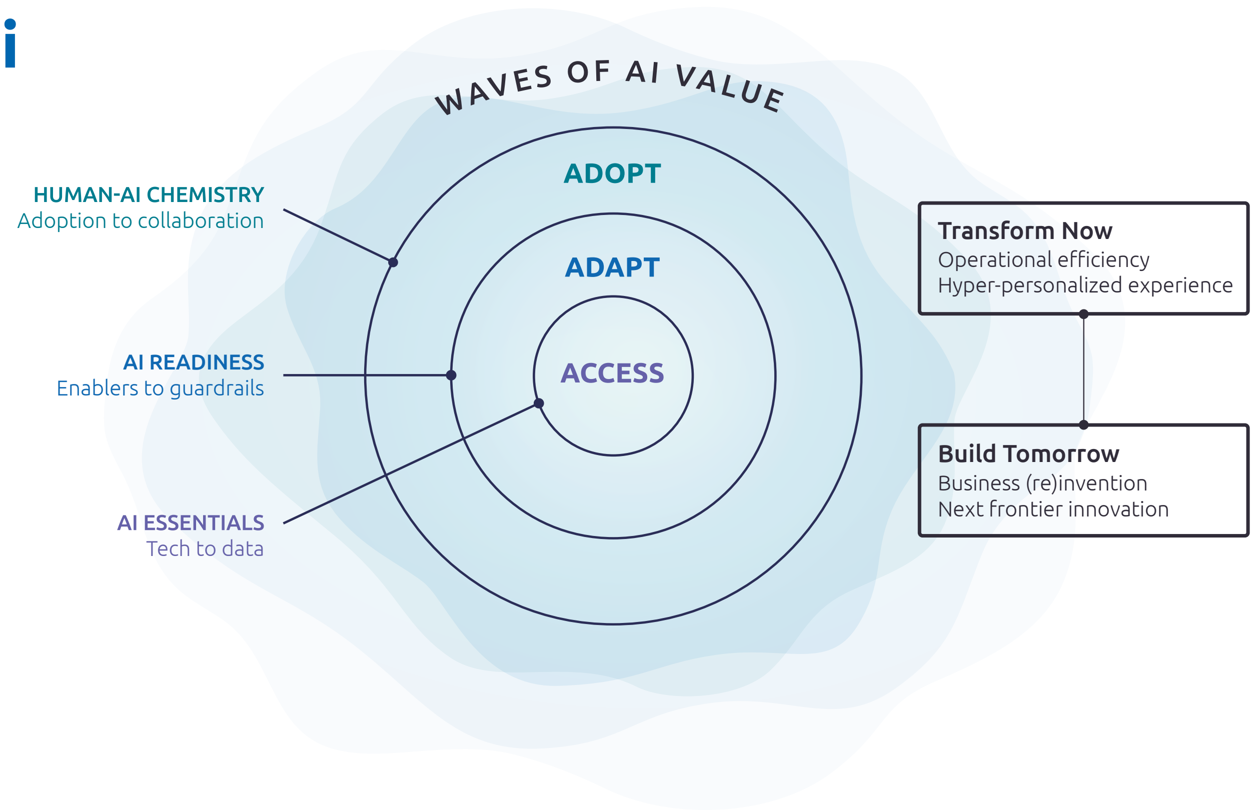
Resonance AI Framework by Capgemini

The Resonance AI Framework by Capgemini provides a sequential approach to the successful conceptualization, structuring, and implementation of AI-driven transformation. It helps business leaders realize AI's potential and achieve market leadership, regardless of the industry. Anchored in transformation strategy, the framework helps integrate operations and culture while accelerating AI value creation – to both transform today and build for tomorrow.



AI essentials

To access the transformative power of AI, organizations must establish 'Intelligence-as-a-Service.' That includes scalable and robust enterprise data foundations combined with advanced language and vision models, and applications with built-in AI capabilities. These provide the foundation to build, operate, and scale AI with real, enterprise-specific impact.

AI-readiness

Adapting AI to organizational context requires the right enablers and guardrails to secure, govern, customize, and operationalize AI. Success hinges on the ability to empower an organization to scale AI while ensuring secure, ethical, and aligned organizational AI capabilities deployed on trusted data foundations and managed as business resources.

Human-AI chemistry

Organizations adopt hybrid forms of collaboration by designing the clear roles and intuitive interactions that enable seamless collaboration between humans and AI. This mutual reliability and collaboration defines 'human–AI chemistry' – the new alchemy of innovation and the defining success factor in your AI journey.

Waves of value

With the technological, governance, and collaborative foundations in place, AI value creation is poised for acceleration across an organization, ready to deliver the operational efficiency, personalized experiences, business reinvention, and next-frontier innovation that enable an organization to transform today and build for tomorrow.

Today, Capgemini is at the forefront of industry, having initiated efforts early to drive the operational transformations of our clients

General-purpose robotics represents a **key investment area for Capgemini.** We made an **early strategic bet** on this technology, investing considerably to establish our dedicated AI Robotics and Experiences Lab long before the current market hype. This demonstrates our genuine commitment to the sector through substantial investments and deep expertise development, **positioning us as a serious long-term player** rather than an opportunistic follower.

We have the robots

Physical AI represents a key investment area for Capgemini in our innovation lab. We have developed deep expertise, positioning us as a long-term partner.

We have the partners

To stay at the forefront of innovation, Capgemini has established partnerships with key industry players such as NVIDIA, Gemini Robotics, and leading robot manufacturers.

We boost business impact

Our unique blend of business strategy, industry know-how, tech expertise and change management creates measurable impact for our clients. We track the value created.

We have the technology

Capgemini enhances and develops new assets across all stacks and components. We are platform-agnostic. Cybersecurity and safety are fundamental pillars at the heart of every polyfunctional robotics project.

We support you E2E

Capgemini possesses the complete spectrum of industry and tech expertise: from initial robot configuration to full-scale deployment and change management.

Capgemini's AI Robotics and Experiences Lab

Advances in the integration of AI, the rise of autonomous agents and rapid innovation in robotics are accelerating the convergence of the physical and digital worlds.

Capgemini's AI Robotics and Experiences Lab explores the value that can be derived from the convergence of advanced technologies such as agentic and multi-agent AI systems, humanoid robotics, reinforcement learning, spatial computing, real-time 3D environments, and humanized interfaces like conversational AI.

Through its research and application of these technologies, the lab explores the next frontier in human-machine understanding, uncovering both the opportunities and challenges that will shape our client's operational transformations.

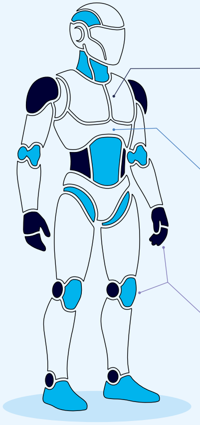
Capgemini's AI Robotics and Experiences Lab focuses on:

- Designing the future of industrial operations by exploring the convergence of technology, machines and robotics
- Simulating the human experience to study how human and machine can best interact
- Implementation of embodied AI and physical AI though scalable operational use cases

Research and thought leadership	In-house development and client exploration	Internal and external innovation ecosystem
Cutting through the hype and looking beyond the horizon with research and academia.	Continuous development of in-house expertise by combining technical and operational insights and pursuing a platform-agnostic solution.	Leveraging Capgemini's in-house experts and our world- class partner ecosystem.

Our capabilities drive distinctive value from hardware to prototyping

We don't develop out-of-the-shelf solutions but **significantly enhance and develop new assets** across all stacks and components to provide customized and best in class physical AI solutions for our clients.



COGNITION - Advanced Reasoning

On-board computer boosted by AI and NVIDIA technology, capable of analyzing the environment and making real-time decisions, supported by a modular architecture allowing the addition of intelligence and autonomy blocks, and designed as a scalable solution for wider deployment and evolution across several sites.

PERCEPTION - Contextual Understanding

Dynamic understanding of the environment through LIDAR, 3D and RGB-D cameras, combined with real-time perception of environments thanks to numerous sensors.

ROBOTIC - Precise and Fast Movements

Hand-articulated motors enable the robot to execute highly precise gestures while also performing all essential basic movements such as getting up, walking, and grasping simple objects, and the robot is capable of navigating effectively within constrained environments.

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The Capgemini Research Institute is Capgemini's in-house think tank on all things digital. The Institute publishes research on the impact of digital technologies on large traditional businesses. The team draws on the worldwide network of Capgemini experts and works closely with academic and technology partners. The Institute has dedicated research centers in India, Singapore, the United Kingdom, and the United States. The Institute was ranked #1 in the world for the quality of its research by independent analysts for six consecutive times - an industry first.

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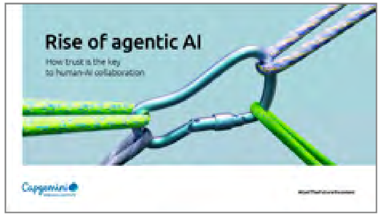
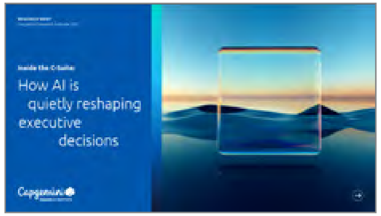


Rise of agentic AI



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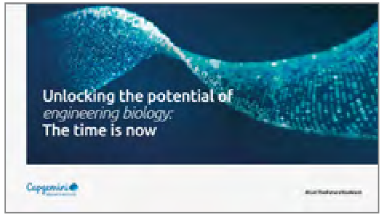

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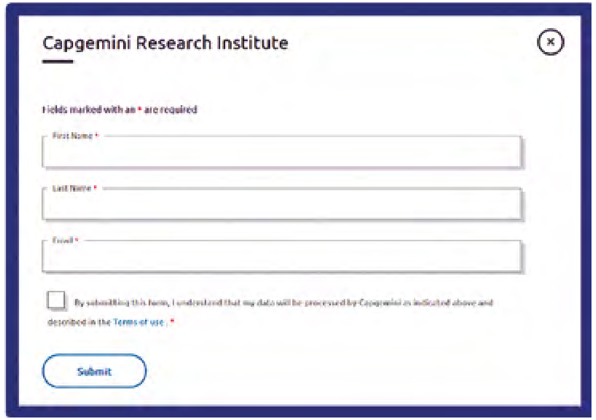
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