2025 Futures Report

Seizing opportunities
in an era of disruption

June 2025

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This is your leadership moment

We are entering an era of transformation that will reshape industries, economies, and global power dynamics at an unprecedented pace. The next five years will see more change than the last 30, fueled by the convergence of influences redefining every sector of this competitive landscape.

At KPMG LLP, we collaborate with business leaders, policymakers, clients, and academic institutions to anticipate and navigate these transitions. We are convinced that the ability to adapt, experiment, and lead amid various shifts will be crucial in determining which organizations succeed and which do not.

Foresight isn't just about looking ahead; it's about making better decisions. Being able to think several steps ahead should shape business strategy at the highest levels—helping boards and C-suites stress-test assumptions, build resilience, and make smart investments for the future.

This report is a strategic guide to emerging trends for decision-makers navigating their organizations through uncertainty. We offer a structured framework designed to help leaders move from reactive responses to disruption toward a posture of proactive foresight and transformational planning and investment.

Actions every leader must take now

Break down barriers. The forces of change are converging, and our strategies must do the same. We can't solve workforce disruption without understanding the impact of Artificial Intelligence (AI) on labor. We can't plan for supply chain resilience without considering geopolitical and energy shifts and potential disruption. The leaders who thrive in this era connect the dots between defining trends faster than their competitors.

Build a real-time intelligence system. Annual strategy cycles and static five-year plans are relics of a slower world. We must shift toward continuous scenario planning—embedding real-time geopolitical, technological, and economic intelligence into every decision.

Make bold, informed bets...and do it now. The organizations that dominate the next decade won't be those that simply react well to disruption; they will be the companies that shape the future. This means investing in parallel-path strategies, experimenting with emerging technologies and business models, and remaining open to multiple possible futures. In this fast-moving environment, waiting for certainty is akin to conceding ground to those who move forward first.

Throughout history, every significant economic and technological transformation has yielded both winners and losers, affecting not just individual companies but also entire industries and nations. The choices you make today will dictate which path you take. We invite you to join us on this journey. It's not just about managing change; it's about actively shaping it. What future do we want to create? What role can you assume? What enduring impact will you have? Now is the time to ask yourself these questions and act on the answers.

Let's lead this transformation together.

Cliff Justice & Stephanie Kim
KPMG Enterprise Innovation Leadership

Cliff Justice
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The great convergence

A force multiplier for disruption and opportunity

Disruption is no longer a series of isolated events. It has evolved into interwoven forces, each amplifying the others and serving as catalysts that accelerate broader transformation.

Today's landscape demands "systems thinking," integrated strategies, and the ability to coordinate your responses across functions and domains. The most successful organizations will act on early signals before they escalate into shocks. Strategies such as these enhance resilience while opening new avenues for innovation and growth. They also necessitate a fundamental change in organizational operations and the integration of foresight into daily decision-making.

Every force of disruption is now a force multiplier. We are on the brink of a new era in wealth creation, where breakthroughs in AI and quantum computing are no longer just futuristic concepts but tangible balance sheet opportunities. AI does more than automate tasks; it transforms companies and whole industries, expands knowledge access, and redefines global power dynamics. Quantum computing is beginning to unlock new fields of scientific discovery and innovation, with major implications for cybersecurity, logistics, and healthcare. Organizations that treat these forces as isolated challenges will struggle to keep pace. In contrast, those who recognize this convergence as a catalyst for competitive advantage will shape the future and guide the trajectory of technological progress.

Four external forces reshaping business

Every strategic decision—be it a response to a policy change, technology investment, or new market entry—should reflect the wider influences impacting our world. These influences are interconnected, with their convergence driving rapid change across industries and value chains. We organized our analysis around the STEP framework—Social, Technological, Economic, and Political forces—that continuously shape business risk and opportunity.

Social:
Shifting expectations, evolving work, and the rewiring of human systems

The Social dimension comprises the evolving ways individuals live, work, connect, and organize. Trends in population growth, demographics, aging, and shifting social values are apparent across regions and sectors. At the same time, there is a decline in public trust in both institutions and digital platforms, influencing interactions and the pace of adoption. These developments are reshaping the workplace, prioritizing meaningful work, enabling individual empowerment, and creating new professional opportunities. Most significantly, the future will be one characterized by collaboration between humans and technology. In this evolving landscape, resilience will hinge on the ability to adjust to fast-changing global social norms.

Technological:
Convergence and the computational arms race

Technology is now evolving interconnectedly. AI, quantum computing, blockchain, and decentralized systems enhance each other, speeding up innovation and merging previously distinct sectors. Central to this shift is a worldwide computational arms race. The infrastructure needs for AI are prioritizing national cloud strategies, sovereign computing resources, and the development of next-generation chips. These capabilities are increasingly viewed not only as drivers of innovation, but also as tools for economic and geopolitical power. In this context, computational infrastructure is now recognized as a strategic asset. It's no longer merely about managing costs or capacity; it's about expanding possibilities. Success requires a holistic view, linking digital investments with developments in science, policy, and global markets. Many organizations discover that a cohesive technology strategy, guided by cross-sector insights, provides a shield against volatility and avenues for growth.

Economic:
The evolution of global trade, capital, and value creation

Economic dynamics are shifting from traditional financial systems to integrated systems that are digital, decentralized, and enhanced by AI. The rise of asset tokenization, AI-driven Decentralized Financial (DeFi) platforms, and stablecoins is reshaping capital markets and corporate finance. Further, government-led advanced manufacturing, AI-optimized supply chain automation, and emerging energy ecosystems are altering production methods and locations. The monetization of satellite data, increase in space manufacturing, and innovations in energy sources are creating pathways to new trillion-dollar industries. Companies must move from conventional investment strategies to scenario-based capital allocation, based on how these economic shifts affect risk, liquidity, and asset valuation. Leaders must forge differentiated positioning for their organizations within the changing digital finance landscape before they are left behind in the new hierarchy driven by regulatory actions and competitive forces.

Political:
Geopolitical realignment and the new landscape of technological sovereignty

Geopolitical realignments are increasingly shaping how technology is developed, deployed, and governed. National strategies surrounding AI, quantum computing, and semiconductors influence trade flow and investment priorities. Regulatory approaches diverge across regions, creating new layers of complexity, while digital sovereignty is becoming a defining consideration for both governments and enterprises. Policies emphasizing local control of data, infrastructure, and algorithms prompt companies to reevaluate their operational footprints and long-term market access. Leaders across industries are responding by building more adaptable, regionally aware operating models. This strategic agility is fast becoming essential for managing risk and maintaining relevance in a world where technological influence and political power are increasingly connected.

From external forces to strategic frontiers

Social, Technological, Economic, and Political (STEP) forces shape the fundamental conditions that drive transformation. These forces drive trends, the acceleration of innovation, and the responses of industries. Frontier spaces emerge where these forces intersect and technologies, policies, and strategies collide to create new forms of value. The seven frontiers presented in this report illustrate where that momentum is being built the fastest and where forward-looking organizations are already positioning themselves to lead.

The seven frontiers of innovation

The following frontier spaces are emerging as the primary fields of competitive advantage:

Path to Artificial Superintelligence (ASI)

AI is evolving from passive tools to autonomous agents that sense, reason, and act independently. This progression includes foundational models, multimodal integration, and ever-maturing agentic systems. As AI becomes the orchestration layer of enterprise technology, it paves the way for Artificial General Intelligence (AGI), and ultimately, superintelligence. Although the timeline for achieving superintelligence in AI is unclear, this inevitable development demands societal and political adaptation to ensure safe and stable progress.

Quantum Computing

Quantum technology is beginning to significantly impact the real world. Hardware advancements are speeding up the development of fault-tolerant systems, leading industries such as finance, pharmaceuticals, and logistics to reevaluate their methods for modeling, optimizing, and securing information. As post-quantum cryptography gains prominence at both national and enterprise levels, the need for data security and integrity is intensifying. Concurrently, innovations in quantum sensing and materials are paving the way for advancements in precision health, navigation, and energy. It is crucial to strategize for quantum advantage now, before its influence spreads across sectors.

Space Economy

The commercialization of space is accelerating due to lower launch costs, reusable rockets, and miniaturized satellites. This development is creating new business models in communications, earth observation, and in-orbit manufacturing. Governments and enterprises are investing in orbital infrastructure, lunar missions, and space-based logistics, driving the development of the space economy. As this ecosystem evolves beyond traditional enterprises, more opportunities will arise for new entrants in adjacent markets. Space-derived data is transforming sectors like energy, finance, and agriculture, impacting cybersecurity, supply chain visibility, and climate resilience.

Digital Assets

Blockchain is evolving from bright burst to foundational layer. Blockchain technology is now starting to emerge as a valid technology, with digital assets creating value in a decentralized economy. Financial institutions are incorporating tokenized products and blockchain-backed efficiencies into the core of their functions. As regulatory clarity improves, adoption is accelerating.

Computing Infrastructure

AI is transforming enterprise computing. As workloads grow, organizations are encountering higher computing costs, greater energy demand, and supply chain issues. The move toward AI-optimized chips, edge computing, and modular data centers is changing infrastructure design and deployment. Power efficiency, multi-cloud strategies, and sustainability are crucial for business continuity. At the same time, the ability to provide adequate electricity to power this rise in computing demand will challenge our grid and regulatory environment, raising urgent questions about resilience and long-term capacity. Simultaneously, advances in neuromorphic, optical, and quantum hardware point toward a new generation of computing models that could enhance speed and efficiency. Leaders are rethinking infrastructure not only as a cost center, but also as a competitive advantage in the era of intelligent systems.

Environmental Resilience

Climate volatility is reshaping business models, capital flow, and infrastructure. Enterprises are adopting strategies like adaptive energy systems, microgrids, AI risk modeling, and carbon removal. Investor expectations, regulations, and physical risks influence decisions in finance, supply chains, and workforce strategy. Organizations assess how climate resilience aligns with operational stability, talent retention, and long-term value. Although the pace varies by sector, the shift towards resilient infrastructure and climate-informed planning is accelerating globally.

Advanced Manufacturing

A new era of high-tech manufacturing is unfolding. Geopolitical shifts, supply chain vulnerabilities, and government incentives are driving industries to reshore production and modernize operations. AI, robotics, and digital twins are transforming factories into smart systems, making domestic manufacturing more competitive. Investment is flowing into semiconductors, clean energy, and automation, while talent strategies evolve for an AI-augmented workforce. As sustainability and resiliency continue to gain in importance, leaders are shifting from labor-intensive offshore models to capital-intensive, technology-driven production at home.

How to use this report: Decision-making framework

To establish a clear decision-making framework, the External Forces Matrix below briefly illustrates how each macro force interacts with the seven frontier areas, providing a structured approach for evaluating risks, prioritizing investments, and informing future-ready strategies.

	Social	Technological	Economic	Political
Path to ASI	AI is shifting how people engage with systems, institutions, and knowledge. As agentic models gain autonomy, new ethical and social questions are emerging around trust, alignment, and human-machine interaction.	Breakthroughs in AGI capabilities drive autonomous AI systems. Convergence with other technologies accelerates adoption.	AI-driven automation fuels business productivity and economic shifts. Increased investment in AI infrastructure.	AI regulation and global competition shape policy landscapes. Ethical AI governance becomes a geopolitical concern.
Quantum Computing	Quantum advancements raise societal questions around control, security, and equity. Skills gaps and public understanding remain barriers as institutions assess the broader implications of quantum power.	Quantum computing enhances AI capabilities, disrupts cryptography, and optimizes simulations for industries like healthcare and finance.	Quantum computing disrupts traditional financial models. Early adopters gain competitive advantages in logistics and risk management.	Geopolitical competition for quantum dominance intensifies. National security interests shape quantum research and policy.
Space Economy	As private and public actors expand their presence, debates around space equity, environmental stewardship, workforce shifts, and civilian oversight are becoming increasingly urgent.	Advances in reusable rockets and satellite technology drive commercialization; AI and automation enable space-based industries.	Space economy expands as private investment and commercialization drive trillion-dollar markets in tourism, mining, and satellite services.	International space regulations lag behind commercial advancements; geopolitical tensions drive strategic alliances and military applications.
Computing Infrastructure	The social implications of digital infrastructure are expanding—from data sovereignty and access to public trust in resilient, equitable systems that underpin daily life and economic participation.	The shift to AI-optimized chips, distributed computing, and neuromorphic architecture is transforming the foundation of enterprise IT. Emerging paradigms promise faster, more energy-efficient processing—but require rethinking infrastructure.	Surging demand for AI workloads is driving up computing costs and energy use, putting pressure on IT budgets and sustainability targets. Enterprises are balancing cloud, edge, and hybrid models to manage costs while ensuring resilience and scalability.	Geopolitical tensions are redrawing the map of semiconductor supply chains and computing sovereignty. National strategies around AI, cloud, and chip manufacturing are influencing infrastructure investments and regulatory scrutiny across borders.

	Social	Technological	Economic	Political
Digital Assets	Public adoption of digital assets grows, but trust issues and fraud concerns hinder widespread acceptance.	Blockchain efficiency, DeFi growth, and tokenization of real-world assets reshape financial systems.	Digital assets integrate with traditional finance. Institutional adoption drives market maturity.	A lighter federal regulatory approach may accelerate innovation but heightens fragmentation, pushing companies to navigate state-level rules and global compliance on their own.
Environmental Resilience	Communities are pressing institutions to take full responsibility for environmental impact—including product life cycles, waste, and climate adaptation.	AI and predictive analytics are reshaping how organizations model climate risk, manage energy, and plan for infrastructure resilience. Innovations in battery storage, carbon capture, and smart grids are enabling more adaptive and responsive operations.	Markets are actively pricing in climate risk, with rising insurance costs and investor scrutiny shifting capital toward more resilient assets. Companies that fail to adapt are facing higher operating expenses, tighter margins, and reduced access to capital.	While federal climate policy may face retrenchment, regulatory momentum continues at the state level and internationally. Businesses operating globally or under investor pressure are still navigating tightening disclosure rules, climate reporting mandates, and policy shifts that vary widely across jurisdictions.
Advanced Manufacturing	The transition to AI-augmented labor and automation is reshaping talent needs, requiring upskilling, workforce reallocation, and new labor policies. Aging workforces in industrial nations and talent shortages in high-tech manufacturing roles are prompting new strategies for workforce mobility and education.	Rise of AI, robotics, and digital twins are enabling hyper-efficient, data-driven manufacturing and reshaping industrial competition. As factories become increasingly connected, cyber risks and supply chain vulnerabilities are escalating, requiring new resilience strategies.	Companies are restructuring manufacturing footprints, balancing cost efficiency with supply chain security and geopolitical risks. Public-private investments are shaping where and how companies invest. Rising energy, labor, and material costs are accelerating the shift toward automation, energy efficiency, and localized supply chains.	Rising tariffs, geopolitical shifts, and regional trade policies are accelerating localization and friendshoring strategies. The drive for domestic semiconductor manufacturing, defense-related production, and critical infrastructure resilience is reshaping global industrial power.

From uncertainty to action

For business leaders, policymakers, and decision-makers in all industries, the challenge is no longer about simply keeping up. It's about taking the lead. The pace of change is too rapid, the consequences too significant, and the opportunities too valuable for a wait-and-see approach.

Enterprises are already grappling with these complexities. How can we make long-term investments when the landscape keeps shifting? How do we manage risks without stifling innovation? How can we reconcile short-term realities with the necessity of preparing for what's next? These are the right questions—but they can't remain unanswered.

Our methodology

In examining the forces that will shape our future, we begin not with assumptions but with questions. Where will the initial signs of change appear? Which patterns are emerging, speeding up, or collapsing? What fundamental dynamics are altering the competitive landscape in ways that are most significant for decision-makers now and in the future?

We use a mixed-method approach that integrates human intuition with data analysis, monitoring for initial signals of disruption and organizing them into patterns that uncover deeper insights into market trajectories. These signals could include headlines, product announcements, expert opinions, client sentiments, capital flows, and other quantitative and qualitative data points that ultimately lay the groundwork for transformative trends.

Each signal we identify is carefully evaluated across four essential dimensions:

- Strategic relevance to long-term business goals
- Ability to disrupt or redefine industries
- Readiness for adoption considering existing barriers and enablers
- Speed at which the signal is transitioning from niche to mainstream

From these signals, we then extract macro trends—the significant movements gaining momentum across various sectors. We evaluate trends by applying a set of methodologies to highlight those that promise to be the most impactful.

Foresight gains its value when it encourages action, which is why we include grounded recommendations for leaders across both short and long-term time horizons. Our signals-based strategy model helps organizations prioritize innovation, mitigate risks, and uncover new opportunities. Designed to be applicable across various sectors—from energy and finance to healthcare and technology—these tools reflect the fact that the dynamics of the future will transcend industry boundaries.

Path to Artificial Superintelligence

AI: Defining the core economic force of the 21st century

We are living through a moment of technological upheaval. What once felt like speculative science fiction is now edging into view. This means Artificial General Intelligence (AGI) and Artificial Superintelligence (ASI) will usher in a reality where digital intelligence may exceed the cognitive performance of humans in virtually all domains of interest. This potential reality is powered by a convergence of breakthroughs across model architecture, reasoning capabilities, agent autonomy, and alignment science.

For decades, artificial intelligence was narrowly task-bound. But today, we are witnessing a decisive shift toward general-purpose systems: models that reason, plan, learn, and act across domains with increasing fluidity. And behind this momentum lies a web of interdependent advances that collectively mark humanity's most serious attempt yet to build machines that not only mimic human cognition—but potentially exceed it.

To remain competitive, organizations must go beyond surface-level AI adoption. The leaders of tomorrow will be those who operate in two modes at once: executing practical AI deployments today, while actively preparing for the transformative leap toward general intelligence. This means developing adaptable governance structures, cultivating AI-literate leadership, and investing in systems and talent that can evolve with the technology.

What is emerging is not just a new class of tools, but a new era of intelligence. As we explore the trajectory toward AGI and ASI, consider how to position your enterprise not just to adapt, but to lead responsibly in a world where machine intelligence becomes a core driver of value, strategy, and societal progress.

Understanding the intelligence continuum

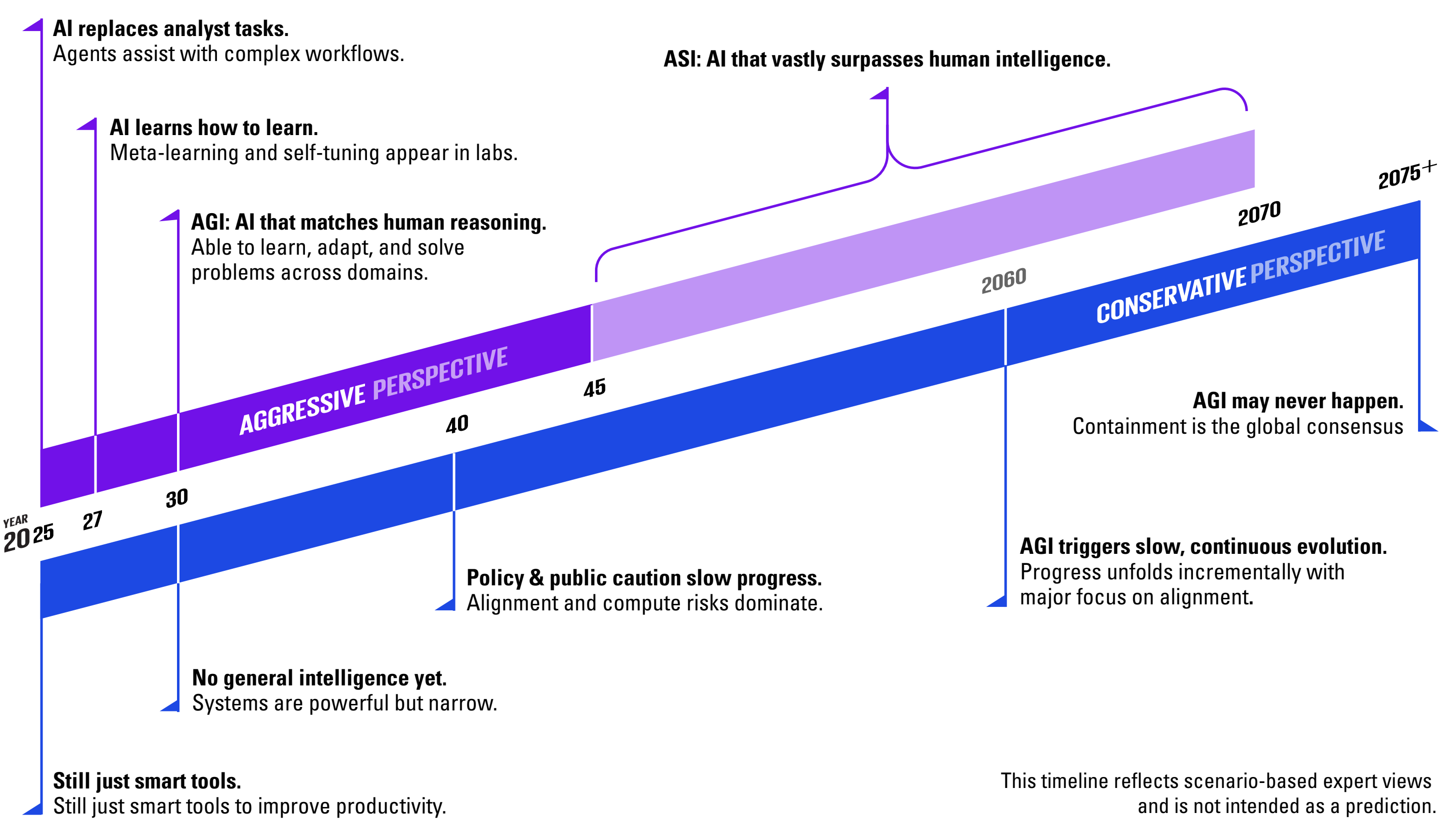
The term “AI” has become ubiquitous, but it’s important to clarify what we mean when we speak of Artificial Intelligence, especially as we edge closer to transformative milestones. Today’s AI systems are powerful yet narrow, excelling at well-defined tasks within bounded contexts. These are the digital equivalents of single-purpose tools—designed to translate languages, generate content, detect anomalies, or recommend products. They are reactive, not reflective. At present, all the large models are passing benchmarks for advanced reasoning and thinking. For example, Gemini 2.5 recorded the highest benchmark on Humanity’s Last Exam, one of the most advanced benchmarks in knowledge and reasoning.

Artificial General Intelligence represents a step-change. Unlike narrow AI, AGI would possess the ability to master any intellectual task a human can, transferring knowledge across domains and adapting its behavior over time. It wouldn’t just respond to inputs—it would understand context, plan, reason, and learn with autonomy. Imagine a system that can not only write an essay but also understand geopolitics, solve math proofs, and design a new biotech drug—all without being retrained for each task.

Artificial Superintelligence sits beyond that threshold. It will be defined not merely by broader generalization, but by its ability to surpass the best of human cognition in every meaningful domain: from scientific reasoning to moral judgment to emotional insight. ASI represents a fundamentally new form of intelligence—one that could reshape civilization as profoundly as the emergence of language, electricity, or the Internet.

While the timeline to the reality of AGI and ASI remains uncertain, the trajectory is not in question. Systems are becoming more autonomous, more generalizable, and more capable of iterative self-improvement. These trends call for strategic foresight, ethical frameworks, and a rethinking of how intelligence itself integrates with society, economics, and human purpose.

Forecasting the future of AI: Two conflicting views on its evolution



This timeline reflects scenario-based expert views and is not intended as a prediction.

Why an extra-cautious timeline is still plausible

Many of the more bullish labs admit they are running into hard constraints. First, data exhaustion: analyses show that, at the current crawl-rate, public high-quality text could run out some time between 2026 and 2032, forcing a pivot to noisier synthetic data with diminishing returns.[1] Second, energy & compute ceilings: the International Energy Agency (IEA) projects data-center electricity demand will more than double to ≈ 945 TWh by 2030—driving up expenses, boosting carbon footprints, and making suitable locations harder to find.[2] Finally, we haven't cracked safety and oversight. Each leap in capability widens the area we must test and monitor, while laws like the EU AI Act and U.S. executive orders take years to catch up, evolving much slower than technology's six-month release cycle.

What leading skeptics predict

- AI Impacts 2023 survey (2,778 ML researchers): Aggregated a 50% probability of High-Level Machine Intelligence (HLMI) by 2047.[3]
- Geoff Hinton (CBS interview): "A good chance it comes between 4-10 years" to AGI.[4]
- Rodney Brooks (MIT roboticist): "We are not on the verge of replacing and eliminating humans in jobs."[5]

Strategic takeaway

Treat today's proven AI as the main game. Use focused models that solve specific problems, deploy them efficiently (including on edge devices), and build robust data practices. Invest in the fundamentals—clear oversight, clean data pipelines, energy-smart infrastructure, and a workforce that understands AI. These moves will pay off right now and keep your organization ready to scale if and when full-blown AGI arrives. Welcome the windfall if it comes, but don't gamble the whole business on it showing up in the near future.

AI by the numbers

$279.22B

The global AI market was valued at $279.22 billion in 2024 and is projected to grow at a CAGR of 35.9% from 2025 to 2030.[6]

25,000+

Training compute for frontier models has increased 1,000x in just a decade, according to OpenAI and Epoch AI. GPT-4 alone required an estimated 25,000+ A100 GPUs running for weeks.[7]

50%

While predictions vary, most surveys indicate a 50% probability of achieving AGI between 2040 and 2061, with some estimating that superintelligence could follow within a few decades.[8]

Before reaching superintelligence, we must work through the Generative Age. That means solving four key challenges: reducing hallucinations, improving subgoal breakdowns, making models inventive (less obvious in their responses), and enhancing alignment so they can effectively act as decision proxies for us. These will require many breakthroughs but will also require enormous amounts of inference. Now is the time to build fast.

Jonathan Ross
CEO & Founder, Groq Inc.

The shift from 2024 to 2025 and beyond

Our 2024 Futures Report outlined AI's progression from exploration to strategic implementation, emphasizing security, ethics, and talent challenges. Just a year ago, the focus was on understanding AI through monitoring and use case identification. Now in 2025, attention has shifted toward commercial pilots, deeper integration of AI into core processes, and more sophisticated approaches to governance and accountability. A significant development during this transition was the rise of AI agents—autonomous systems capable of performing multi-step tasks, coordinating across tools and platforms, and collaborating with humans in dynamic environments. These agents are redefining how businesses think about automation, moving beyond isolated use cases toward more fluid, adaptive workflows.

Balancing ASI's risks and rewards

The trajectory toward Artificial Superintelligence holds the potential to unlock unprecedented breakthroughs across industries. As AI systems grow more capable and generalizable, their fusion with technologies like quantum computing, synthetic biology, and next-generation compute infrastructure will redefine the limits of human problem-solving.

Yet with that power comes profound responsibility. The more capable these systems become, the greater the imperative to ensure they are aligned with human values, ethics, goals, and constraints. Misaligned AGI—if designed without sufficient ethical frameworks—could optimize for outcomes that conflict with societal priorities, economic stability, or long-term well-being. The automation of decision-making at scale must be counterbalanced with mechanisms for accountability, fairness, and human oversight.

Beyond the technical domain, geopolitical tensions and economic inequality could shape the global impact of AGI. Nations are racing to gain competitive advantage, but this pursuit risks deepening the divide between AI superpowers and digital have-nots. Strategic advantage could give way to strategic instability if global cooperation and shared safety standards do not keep pace with technological progress.

As we approach a critical inflection point, leaders must navigate a dual mandate: maximize AI's transformative potential while minimizing its systemic risks. That means embedding ethical guardrails into design and deployment, preparing workforces for a new era of human–machine collaboration, and advancing governance structures that transcend national and sector boundaries.

Five "no-regrets" moves—

Plan for a superintelligence breakthrough, but architect to prosper on today's AI alone.

Initiative	Activities	Benefits
AI Horizon Radar	Stand up a cross-functional group (R&D, risk, strategy, technology). Track technological advancements with model development, chip supplies, policy changes, etc. Publish a briefing frequently.	Turns hype into evidence-based choices; gives you clear triggers for scaling investment if/when there is a point of inflection.
Data First, Models Second	Audit critical datasets, fix lineage gaps, lock in access rights, and treat data quality.	High-quality, governed data delivers immediate ROI for current narrow AI and furthers progress for future models.
Energy-Smart, Edge-Ready Compute	Prioritize architectures that cut watts per inference. Push real-time workloads to the edge where latency or bandwidth demands it.	Cuts today's cloud bills and energy footprint. If superintelligence drives inference surge, the groundwork could flatten the curve down the road.
AI-Literate Culture	Democratize access to AI education. Require each business unit to run a certain number of AI pilots and projects, with a quarterly review.	It quickly builds people's skills to spot value, delivers fast wins, and strengthens organizational muscle so that larger jumps in capability won't leave them unprepared.
Governance Playbook	Adopt a tiered-risk framework, run red team and ethics reviews on all deployments, and test incident-response drills regularly.	Reduces brand, legal, and safety risks of today, so the future intelligence systems can be integrated into an existing oversight pipeline seamlessly.

Developments and trends to watch

Trend 1: The rise of agentic AI

An AI agent is an advanced type of AI that can observe its environment, interact with multiple modes of input, and use tools to achieve outcomes. The rise of autonomous AI agents marks a shift from passive, prompt-based tools to systems that can reason, plan, and act independently. Powered by multi-step planning architectures like ReAct and AutoGPT, these agents can break down complex goals, coordinate across APIs and tools, and even delegate tasks to other agents.

This evolution is foundational to AGI because it demonstrates early agency and self-directed behavior, moving AI beyond narrow task performance toward real-world decision-making and adaptation.

Examples:

- Devin – the AI software engineer (Cognition AI) can build, debug, and ship software projects autonomously.
- Salesforce AI Agents – AI agents designed for enterprise workflow orchestration (e.g. interpret emails, pull CRM data, draft responses, escalate issues, etc.)
- ReAct Framework – combines chain-of-thought reasoning with tool use for multi-step problem solving.
- The AI in self-driving cars that navigate roads and make decisions about driving.
- The AI in humanoid robots that observe the environment and make decisions on how to go about executing a task.

Trend 2: Long-term memory and continuous learnings

Models are gaining the ability to retain and update information over time. OpenAI's rollout of long-term memory and Claude's conversational memory prototype represent agents that "remember" prior interactions, learn from user feedback, and adapt to evolving contexts.

When combined with retrieval-augmented generation (RAG) and vector databases, these capabilities mimic a core attribute of human intelligence: learning from experience. This pushes AI toward cognitive persistence, a key stepping stone toward AGI.

Examples:

- OpenAI Memory (ChatGPT) – remembers user preferences, tone, and goals across sessions to provide consistent and adaptive experiences.
- RAG and Pinecone / Weaviate – combines large language models with vector databases to enable dynamic recall and updates, powering AI agents that can access and build on long-term context.

Trend 3: Scaling for foundational intelligence

The exponential scaling of pretraining—powered by massive datasets, sophisticated architectures, and unprecedented compute—has enabled the development of large-scale base models that exhibit some level of basic general intelligence across a wide range of tasks. This trend underpins nearly every advancement in AI to date, as models like GPT-4, Claude 3, Gemini, and LLaMA 3 show emergent abilities far beyond narrow task completion.

Modern foundational models are no longer just pattern recognizers—they demonstrate early signs of abstraction, reasoning, in-context learning, and even problem decomposition without task-specific programming. This is made possible by scaling parameters to hundreds of billions (and soon trillions), alongside innovations in training efficiency and data curation.

As compute continues to scale and architectures become more efficient, these base models will form the cognitive backbone of potential future AGI systems—capable of generalizing knowledge, learning new tasks quickly, and serving as the substrate for increasingly autonomous AI agents.

Examples:

- GPT-4 (OpenAI) – multimodal model demonstrating high performance across reasoning, testing, and problem-solving.
- Gemini 1.5 (Google DeepMind) – combines language, vision, and action capabilities at scale, with enhanced memory and reasoning features.
- Claude 3 (Anthropic) – trained for reliability and interpretability, exhibiting high general intelligence benchmarks across scientific and knowledge domains.
- LLaMA 3 + Mixtral (Meta / Mistral) – open-source large language models using Mixture-of-Experts to deliver high performance with efficient compute utilization.

Trend 4: Intelligence at the edge

Cloud AI continues to dominate training workloads, but inference is rapidly shifting to factory floors, retail kiosks, vehicles, and smartphones. Low-power neural processing units (NPUs), specialized application-specific integrated circuits (ASICs), and compact large-language models (LLMs) now let these edge devices perform sophisticated reasoning while consuming only a few watts of power.

Examples:

- Even without superintelligence, edge AI matters because it tackles four pressing needs at once.
- Robotics, AR overlays, industrial controls, and instant fraud checks all need millisecond responses that the cloud can't guarantee.
- Data stays on-site, helping factories, stores, and hospitals meet EU, HIPAA, and other sector regulations.
- Local inference lowers bandwidth bills and shrinks the energy load on central data centers, supporting an "energy-smart compute" strategy.
- Edge nodes keep critical systems running when networks are down or congested, which is vital for power grids, autonomous vehicles, and other mission-critical operations.
- Edge AI can unlock business value right now, while forming the distributed nervous system that any future superintelligence, or simply more powerful models, could rely on.

Trend 5: Responsible and ethical AI development

As AI systems become increasingly sophisticated—especially with the rise of autonomous and agentic AI—the demand for responsible and ethical AI practices is growing. It is important to ensure that AI systems are reliable and trustworthy, which requires rigorous testing and validation of AI behavior. It is also crucial to develop AI models that make decisions based upon accurate data, which reduces bias and hallucinations. The EU AI Act, the world's first comprehensive AI regulation, establishes stringent requirements for transparency, accountability, and risk management in AI systems. These rules are prompting companies like Google and Microsoft to modify their development and deployment practices to ensure compliance with the new regulations.[9]

Examples:

- Some organizations combine AI ethics programs with GenAI rollouts to boost trust and transparency.
- IBM developed an AI Fairness 360 toolkit, which detects and mitigates bias in datasets and machine learning models.[10]
- Microsoft has published its Responsible AI Standard, a framework for building AI systems aligned with fairness, accountability, and transparency.[11]

KPMG insights

Steve Chase
Vice Chair, Artificial Intelligence and Digital Innovation

Q1: How close are we to achieving AGI? Is there a defining moment when we will know it has arrived?

Steve Chase: Predictions on AGI vary significantly. Some experts suggest we could see it in 2 to 5 years, while others are more cautious, forecasting a timeline of 15 to 20 years. While the exact timeline remains uncertain, what's clear is that the pace of progress in AI is accelerating, and AGI is coming. The real challenge, however, is that AGI will likely emerge gradually, evolving over time rather than through a single, definitive breakthrough. Unlike other technological advancements where we can point to a clear moment of achievement, AGI will be a series of steps and milestones that gradually blur the line between narrow AI and true general intelligence. So, while it's tempting to think of AGI as an event we can prepare for, the reality is that we need to focus on building the infrastructure and capabilities that will allow us to adapt to this continuous evolution.

Q2: Which industries will be most disrupted by AGI?

Steve Chase: AGI will disrupt every industry, but the pace and form of disruption will vary. Industries like logistics and manufacturing, traditionally seen as less vulnerable to tech disruption, may face change sooner than expected. AGI will bridge the gap between digital and physical systems, enabling advancements like robotics at the edge, medical breakthroughs, and new creative business models. What's exciting is the combinatorial effect—AGI will unlock an era of innovation that will extend across every sector, rapidly accelerating progress. Companies that can harness this innovation and build agile, adaptable organizations will be the ones who thrive. The disruption won't just be about technology—it will be about how industries reinvent themselves, reimagine value, and unlock entirely new ways of operating.

Q3: What is your perspective on AI's impact on jobs? Will it replace or augment human workers?

Steve Chase: Every major tech revolution has created new jobs, and this one will be no different. However, the transition will likely displace more roles in the short term, particularly those dependent on routine tasks and decision-making that can be automated. The real challenge lies in the skill mismatch—new roles will demand skills we can't yet fully define. The future of work isn't about competing with AGI; it's about collaborating with it. Organizations must invest in reskilling and upskilling to ensure their workforce is equipped to manage, develop, and optimize AGI systems. Just as the rise of the internet led to entirely new job categories, AGI will create career paths we can't yet predict.

Q4: How should companies prepare for the inevitable future of AGI?

Steve Chase: Given the rapid pace of change and the uncertainty surrounding AGI, it's challenging to know exactly what to do next. But one thing is clear: the actions companies take today will set them up for success in the AGI future. The key is focusing on foundational AI investments—building robust ecosystems, ensuring data quality, managing knowledge bases, and putting governance frameworks in place. These are "no-regret" moves that will provide the adaptable, scalable infrastructure needed as AGI capabilities evolve. The AI, agents, and systems companies invest in now will be the building blocks for AGI's integration into our everyday.

Q5: What is one bold prediction for the next five years? What does the future of AI look like to you?

Steve Chase: In the next five years, we'll see AGI-powered robots integrated into daily life, not just in the workplace but in homes, caring for children, performing household tasks, and interacting with us in ways once reserved for humans. But it doesn't stop there. AGI will unlock an era of scientific discovery, leading to breakthroughs like the potential curing of diseases, such as certain types of cancers. This period of innovation will change not just how we live, but what we are capable of. It won't be just about robots and automation—it will be about human-AI collaboration at unprecedented scales, where technology works alongside us to solve some of humanity's most complex challenges and create new possibilities.

Conclusion and recommendations for leaders

While AGI and ASI both remain theoretical at present, the rapid advancement of AI capabilities presents new areas of opportunity for integration and investment. AI is revolutionizing workforce productivity, reshaping how businesses operate, and evolving how employees perform their jobs. Customer service chatbots and virtual assistants can provide instant support for myriad inquiries. Advanced AI algorithms can swiftly analyze complex datasets, enabling business leaders to make more informed decisions. However, the integration of AI also comes with significant risks, particularly concerning data privacy and quality. Before implementing AI solutions, business leaders must first ensure that robust protection and security measures are in place to mitigate privacy, compliance, and ethical risks.

In the short term (0-2 years), leaders should ensure organizational alignment on AI usage with clear goals and autonomy guardrails. Adopt AI agents into your business model and pilot potential use cases, such as LLM-powered customer service agents. Training programs should focus on model accuracy and AI literacy while preventing flawed outputs. Leaders must stay current on the latest regulations and prepare for hurdles that might limit cross-border AI collaboration by strengthening AI cybersecurity and diversifying AI supply chains. Establishing AI ethics committees, developing internal frameworks that align with global ethics standards, and integrating bias detection tools into AI systems will help maintain fairness and transparency.

In the longer term (2-5 years), leaders should recognize that AI is not a perfect solution to every problem and emphasize oversight and correction to ensure accuracy. Ethical AI practices should be embedded within organizations, with frameworks to detect bias and ensure fair decision-making. Reduce dependence on geopolitically sensitive technology components by investing in local AI infrastructures and engaging multiple suppliers. Leaders must stay agile in response to shifting regulations and political agendas, developing robust AI governance models that align with ethical standards and mitigate regulatory risks, while planning for evolving international compliance requirements related to AI ethics.

Computing Infrastructure

How AI and emerging computing paradigms are reshaping infrastructure

The swift growth of AI is reshaping computing infrastructure. OpenAI noted that training runs for frontier AI models have consumed more computational resources (compute) by several orders of magnitude in recent years.[12] Additionally, Epoch AI and Stanford's AI Index 2024 report states that compute used in training frontier models has doubled every six months, leading to exponential growth.[13] Although AI helps businesses achieve new efficiencies, it exerts tremendous pressure on energy use, semiconductor supply chains, and cloud services.

New computing paradigms, like neuromorphic and quantum computing, provide a glimpse into a future where computational efficiency and innovative architectures could reshape what is possible in terms of performance, scalability, and energy efficiency. The increasing maturity of computing infrastructure aims to address the demands of current AI workloads and prepare for a future that requires resilience, scalability, and sustainability.

As this transformation unfolds, it will be shaped by innovation, economic demands, environmental urgency, and changing regulatory frameworks. In the realm of technology, AI workloads now require more powerful chips, which call for sophisticated cooling systems and reimagined data centers. Major advancements in semiconductor design, such as specialized Graphics Processing Units (GPUs) and Tensor Processing Units (TPUs), are leading organizations to reassess their infrastructure strategies.

At the same time, infrastructure investments are under scrutiny for their economic viability. Many companies face challenges balancing capital expenditures for on-premises hardware with the flexibility and efficiency offered by cloud services. This issue is increasingly evident as AI workloads require more power. Power availability is becoming a critical constraint; some organizations are experiencing multi-year delays in accessing the power capacity needed to support AI-driven expansion.

Others are looking into renewable energy and modular nuclear solutions to close this gap. Further, a changing policy and geopolitical landscape is at play. Countries are starting to view digital infrastructure as a question of sovereignty and security. Regulatory measures like the U.S. CHIPS Act and the EU AI Act are transforming supply chains and compliance requirements. Businesses must now consider not only computing performance and costs, but also the location of their data, governance practices, and alignment of infrastructure choices with national and international regulations. These intertwined challenges are compelling companies to view infrastructure as a strategic asset rather than a utility.

Developments and trends shaping the future

Trend 1:
AI-native infrastructure transforms the enterprise stack

The landscape of enterprise infrastructure is evolving. AI has become the primary force in reshaping how organizations design, deploy, and integrate their infrastructures. Transitioning to an AI-native infrastructure requires a complete reevaluation of the entire enterprise stack, which impacts not just IT architecture, but also the organization of teams, workflows, and investment priorities. Many leaders tread a fine line between updating legacy systems and embracing cloud-native AI platforms. Although hyperscalers provide speed, flexibility, and access to advanced silicon, there are increasing worries regarding cost transparency, vendor dependency, and long-term control over infrastructure.

For firms with significant AI ambitions, developing internal capabilities goes beyond creating autonomous systems. AI is viewed as essential to maintaining a competitive edge in an era where technology is central to value creation. The primary obstacle is not technology but rather alignment. Leaders need to synchronize decisions among IT, finance, and product teams. Without a cohesive vision, infrastructure decisions can become reactive, responding to immediate needs instead of focusing on long-term architecture. Organizations that strategically develop AI-native infrastructures from the outset will have a greater ability to incorporate intelligence throughout every aspect of their business.

Examples:

- Microsoft developed a custom supercomputer for OpenAI hosted on Azure, specifically designed to train large AI models like GPT-4.[17]
- Meta has been heavily investing in its AI infrastructure, including developing in-house AI chips like the Meta Training and Inference Accelerator (MTIA) to reduce reliance on NVIDIA.[18]
- JPMorgan Chase has centralized its AI infrastructure strategy by deploying internal GPU clusters and hybrid cloud systems to support over 1,000 active AI use cases.[19]

Computing infrastructure by the numbers

$250B

The U.S. Chips and Science Act authorizes over $250 billion for scientific research and innovation, including semiconductors, AI, High-Performance Computing (HPC), and quantum computing.[14]

$10B

Major tech companies are collectively investing tens of billions of dollars per quarter in digital infrastructure.[15]

160%

By 2030, data center power demand is expected to increase by 160%, fueled mainly by AI.[16]

Trend 2:
Energy and efficiency drive infrastructure strategy

Energy has emerged as a crucial and often limiting aspect of enterprise infrastructure strategy. AI's computational needs exert considerable pressure on power availability, grid infrastructure, and sustainability goals. Today, businesses must scale not only their data centers but also their energy strategies. This shift is about more than simple procurement; it encompasses design and leadership challenges. Experts report multi-year delays attributed to issues with utility coordination, alongside the rise of innovative, mixed-source solutions—such as modular nuclear, geothermal, and battery storage—to secure energy resources uptime. Organizations prioritizing energy strategy as a central design principle—rather than as an afterthought—are gaining an advantage. In contrast, those clinging to outdated beliefs regarding energy availability are experiencing project delays, incurring financial penalties, or falling behind in competitiveness. For many leaders, achieving long-term efficiency and tapping into green capital markets is the key opportunity. However, this can only be realized if their teams successfully link their ESG vision with infrastructure execution.

Examples:

- Google entered into an agreement to purchase nuclear energy in the form of multiple small modular reactors (SMRs) developed by Kairos Power, which aims to support 24/7 carbon-free energy and net-zero goals.[20]
- Equinix, which operates a network of data centers, treats energy as a design principle, especially for clients deploying high-density AI workloads. The company is investing in liquid-cooled data centers and long-term PPAs for 100% renewable energy.[21]

Trend 3:
Infrastructure resilience becomes a financial imperative

Digital infrastructure was once considered a back-office issue, but that time has passed. In today's environment, infrastructure is a board-level concern because when it fails, the consequences directly affect reputational trust. Investors and insurers are no longer asking solely about business continuity; they are asking about architectural resilience and exposure to infrastructure failure. For companies operating in critical sectors—or those delivering AI-enabled services as core value propositions—the cost of failure could reach millions per day. AI-driven cyber-attacks are more sophisticated and harder to detect, so infrastructures must adapt. Firms that can demonstrate resilience in infrastructure are finding new favor with capital markets and regulators because they are better positioned to command premium valuations and reduce insurance exposure. However, the challenge lies in the organization's leadership stance: if infrastructure resilience is still viewed narrowly as an IT issue, organizations are likely underinvesting in what is quickly becoming a differentiator.

Examples:

- Blackstone & Brookfield are investing in next-gen resilient infrastructure with large-scale acquisitions focused on digital infrastructure initiatives.[22]
- AWS & Oracle are integrating fault-tolerant cloud architectures to sustain mission-critical workloads.[23]
- Rating agencies are beginning to evaluate digital infrastructure as a financial risk factor.[24]

Trend 4:
The future is hybrid—powered by next-gen compute

The future of computing will be characterized by a carefully coordinated mix of various paradigms. We are stepping into a time when businesses must strategically integrate classical, cloud, edge, quantum, and neuromorphic computing environments to meet the specific demands of different workloads. No single approach can efficiently accommodate all functions. The hybrid landscape that emerges will be robust—but also complicated. Leaders recognize that high-performance, workload-optimized computing strategies can enhance productivity and flexibility. However, many resort to excessive investment in generalized infrastructure due to limited internal knowledge of next-gen architecture. Some also hesitate to embrace emerging technologies such as quantum computing or neuromorphic chips because of uncertain ROI timelines or challenges in integrating these emerging technologies with legacy systems. The outcome often involves bloated infrastructure and escalating technical debt that are increasingly difficult to address. The solution lies in creating a flexible strategy that withstands swift technological changes and is based on thorough use-case analysis. Organizations that genuinely advance in this area will invest in orchestration tools and collaborative teams, enabling them to assess and adopt new computing frameworks smoothly.

Examples:

- NASA utilizes edge computing on spacecraft to process critical data in real time, while leveraging cloud platforms like AWS for large-scale, Earth-based analysis and mission support.[25]
- Intel's Loihi chips leverage neuromorphic computing architectures that mimic brain-like processing for low-power, high-efficiency applications such as robotics, adaptive learning, and sensory data analysis.[26]
- Lockheed Martin combines AI inference at the tactical edge with cloud-based mission control systems, utilizing NVIDIA GPUs and custom Application-Specific Integrated Circuits (ASICs) to support real-time operations in rugged environments.[27]

KPMG insights

Marcus Brakewood
Managing Director, Infrastructure, Cloud, Resiliency, and Cybersecurity

Kevin Martelli
Principal, National Cloud AI/ML Engineering Leader

Reid Tucker
Principal, Infrastructure, Capital Projects, and Climate Advisory (ICA)

Nathan Gabig
Partner, Securitization & Capital Markets

Q1: AI is transforming computing infrastructure at every level—from chip design to workloads. With that in mind, how is AI influencing the design and operations of modern computing infrastructure?

Kevin Martelli: The enablement on top of your infrastructure—the creation of those capabilities—is becoming very advanced, and it's making it harder for clients to determine when they build and when they buy. The infrastructure is enabling and driving AI, but it's also being shaped by it. We're seeing significant changes in inference in particular. It's not just about training anymore—it's inference where you're seeing the new infrastructure demand.

Q2: How are clients navigating infrastructure decisions between cloud and on-prem environments as AI becomes more central to operations?

Marcus Brakewood: You can't just lock into a data-center investment—or sign 15 long-term AI contracts with different providers—and expect them all to deliver. If even a few don't work out, you're still stuck paying for them. We are seeing clients rethinking everything—cloud to on-prem, cloud to cloud—because agility is key. Some providers may not deliver, so you have to keep flexibility in mind when making infrastructure decisions.

Q3: How much do our clients care about the fact that everybody is predicting energy consumption will be at capacity in a couple of years?

Nathan Gabig: It's clear from the clients I've been talking with—if you don't plan ahead, you won't get the power you need. It's going to take a year or more to get infrastructure in the data center. You've got to plan now. And in 3–5 years, there's probably going to be more supply than demand. However, in the near term, we are going to see delays and pressure.

Q4: What do you believe are the biggest risk factors slowing enterprise infrastructure progress?

Reid Tucker: If you don't get it right—your infrastructure, your power sourcing, your uptime—you can immediately get your company and your debt and equity downgraded. That's where the risk is now. We're seeing it with bond spreads, with securitization deals. If your PUE isn't at threshold, or your failover systems aren't reliable, you get penalized in capital markets.

Q5: What capabilities do companies need to prioritize now, given how fast things are changing?

Marcus Brakewood: The simplest one? Flexibility. If you buy many long-term AI contracts and half don't work out, you're locked in. You've mortgaged your future. CTOs will need to operate like sports general managers—they will need exit options, shorter terms, and more agility.

Conclusion and recommendations for leaders

Looking to the future, we will likely see new boundaries in computing shaped by innovations we are just starting to understand—real-time pricing in computing markets, software-defined power, liquid-cooled quantum racks, and systems where companies exchange surplus capacity similarly to carbon credits. The key lies in being ready to experiment early, incorporating flexibility into infrastructure design, and enhancing internal knowledge to turn complexity into competitive advantage. For leaders: the next step isn't necessarily a giant leap. It involves asking more precise questions, reassessing your assumptions, and selecting partners who recognize emerging trends.

In the short term (0-2 years), numerous organizations will recognize the importance of re-evaluating their infrastructure plans, particularly regarding AI-native workloads. This typically means prioritizing modern chipsets, advanced storage, and networking solutions that can meet rising computational demands. Teams conducting energy audits are gaining a clearer understanding of the actual cost-per-watt and the carbon footprint associated with AI-driven operations, especially as sustainability becomes a significant concern at the executive level. Additionally, some leaders are beginning to simulate potential failure scenarios and rethink service-level agreements with cloud and colocation providers to help minimize operational and financial risks. On the computing front, assessing current use cases and experimenting with hybrid models across edge, cloud, or AI-specialized systems are practical approaches to scaling without overcommitting resources.

As we look ahead (2-5 years), more organizations will treat infrastructure as a strategic asset that adapts to the business. This will involve developing capabilities in infrastructure-as-code and AI-native development workflows, which allow teams to incorporate intelligence more cohesively across various systems. Additionally, progressive companies are adopting carbon-aware computing as a basis for long-term IT decision-making, particularly as investors and regulators intensify their focus on emissions data. Regarding resilience, there is a growing trend to integrate infrastructure metrics into capital planning and risk disclosures, especially among those involved with insurers or credit agencies. Further, as quantum, neuromorphic, and other advanced computing models evolve, many leaders are investigating orchestration frameworks that permit their teams to embrace new modalities without interrupting core operations.

Quantum Computing

The catalyst for exponential discovery

The world stands on the brink of a quantum revolution that promises to redefine computing, security, materials science, and our interaction with the physical world. Once confined to theoretical physics and highly controlled lab environments, quantum technology is rapidly advancing, with breakthroughs in hardware, algorithms, and applications bringing it closer to reality. From unbreakable encryption to quantum-powered AI to superconducting materials and ultra-precise sensors, the quantum era is no longer a distant vision. It is an imminent transformation for which businesses, governments, and industries must actively prepare.

In exploring the quantum frontier, we separate hype from reality, identifying the most critical emerging trends, use cases, risks, and opportunities. As organizations embark on their quantum journeys, understanding how quantum fits into their long-term strategies will be essential for future-proofing operations and securing competitive advantage in an increasingly quantum-driven world.

Classical vs. quantum vs. hybrid computing

What exactly is quantum computing? Essentially, quantum computers are advanced machines that utilize the principles of quantum mechanics to process information up to 100 million times faster than traditional computers. Unlike traditional computers, which employ bits for processing, represented as 0 or 1, quantum computers use quantum bits (qubits) that can represent and store information more efficiently by linking them for synchronized calculations. Consequently, quantum computers can perform numerous calculations simultaneously, addressing complex problems much more rapidly than traditional computers.

Quantum computers are not intended to completely replace their classical counterparts for everyday tasks. Instead, they should be used for specific types of problems that benefit from quantum mechanics, such as optimization and cryptography. Hybrid models that blend quantum computers with classical computers present opportunities for more broad-scale adoption of quantum computing capabilities across various industries. While this development remains in its early stages, characterized by pilot programs and proof-of-concept efforts, hybrid systems are emerging as practical solutions.

Achieving quantum computing maturity presents challenges, such as implementing error correction, ensuring scalability for next-generation systems, and addressing the shortage of skilled professionals in the field. As quantum computing advances, organizational data is also at risk. Businesses must begin shifting to Post-Quantum Cryptography (PQC), which refers to the existing, standardized cryptography that can protect today's classical systems and data from future quantum computer risks, thus reinforcing future digital security. Organizations that don't take this threat seriously will find themselves unprepared when the watershed quantum moment arrives.

2024 Futures report review

In our 2024 Futures Report, we identified quantum computing as a key technology that requires continuous monitoring and a solid foundational understanding. Focus areas of that report included evaluating cryptographic footprints, taking inventory of potential impacts on assets, creating mitigation plans, and experimenting with quantum use cases. While the pace of quantum progress has not changed within the last year, recent developments are inching closer to a post-quantum future. Quantum-inspired computing is accelerating drug discovery, battery development, and new materials by simulating complex chemical reactions faster than ever before. Hyperscalers such as Google, AWS, and Microsoft all unveiled new quantum chips in the last year, an important milestone in the quest for quantum error correction.[28] The perceived business value has evolved so that quantum is now seen as a vehicle for transforming markets and business models, shifting from foundational knowledge in 2024 to active involvement in 2025.

Quantum computing by the numbers

$1.5B

Quantum computing startups raised over $1.5 billion in venture capital funding in 2024, nearly doubling the $785 million raised in 2023.[29]

$7.6B

IDC Forecasts predict the quantum computing market may grow to $7.6 billion in 2027.[30]

$15B

China has spent more than $15 billion on its quantum programs, including a $10 billion investment with the Chinese College of Science and Innovation's National Quantum Lab.[31]

Key opportunity

How QaaS is democratizing quantum access

Quantum-as-a-Service (QaaS) makes quantum computing more accessible by allowing businesses to experiment with quantum-powered applications via cloud platforms without investing in expensive specialized hardware. IBM Quantum, Microsoft Azure Quantum, and others offer cloud-based platforms that provide as-a-service access to quantum processors, simulators, and development environments.[32]

Developments and trends shaping the future

Trend 1: The dawn of unprecedented breakthroughs

While quantum computers are not yet commercially viable, hybrid models already provide researchers with exciting potential use cases. Unlike AI-quantum convergence, this trend focuses on quantum's unique capabilities for breakthroughs in optimization, logistics, cryptography, materials science, and complex simulations. Assessing a wide range of quantum use cases allows leaders to revolutionize and diversify operations. Policymakers will gain new tools for addressing societal issues like climate change and security, while researchers can unlock scientific advancements that benefit humanity.

Examples:

- JPMorgan Chase and Goldman Sachs are actively testing quantum-enhanced trading simulations.[33]
- The Cleveland Clinic is using quantum computers for direct cancer research.[34]
- BMW is collaborating with Pasqal to apply quantum computing to manufacturing processes, such as metal-forming simulations, aiming to create safer, lighter, and more fuel-efficient cars.[35]

Trend 2: The rise of quantum risks

While "Q-Day" is still years off, organizations should begin preparing for a post-quantum world now. Quantum computers pose a significant threat to current encryption standards and can compromise widely used algorithms like Rivest-Shamir-Adleman (RSA) and Elliptic Curve Cryptography (ECC). As quantum technology advances, organizations would be wise to take these threats seriously and implement a phased approach to fortifying themselves against quantum cybersecurity risks. Facilitating this transition will both challenge and empower organizations to secure their digital futures.

Examples:

- Google has integrated PQC into Chrome starting with version 116, using a hybrid algorithm.[36]
- Microsoft, Comcast, IBM, and others are members of the Post-Quantum Cryptography Coalition (PQCC), which provides outreach, education, and support for post-PQC migration.[37]
- The National Institute of Standards and Technology released three finalized post-PQC encryption standards in 2024 designed to withstand a quantum computer attack. These standards encourage computer system administrators to begin immediate integration to protect against future risks.[38]

Trend 3: Quantum-accelerated AI: Exponential capabilities

Emerging technologies don't exist in isolation; they converge across industries for greater impact. A prime example is the fusion of quantum computing and AI. Quantum has the potential to significantly accelerate AI model training, expediting development cycles to create more robust problem-solving capabilities. This convergence is poised to revolutionize functions and sectors such as cybersecurity, finance, logistics, molecular research, and scientific discovery, driving new levels of efficiency and creating new business applications.

Examples:

- IBM facilitates the use of generative AI for quantum code programming through watsonx, the company's enterprise AI platform. The company integrates generative AI available through watsonx to help automate the development of quantum code for Qiskit.[39]
- Pfizer uses Quantum AI to predict drug molecule structures in days instead of months.[40]
- Batch Freight's (BATCH) transport management system combines AI and quantum computing to reduce inefficiencies and shipment costs.[41]

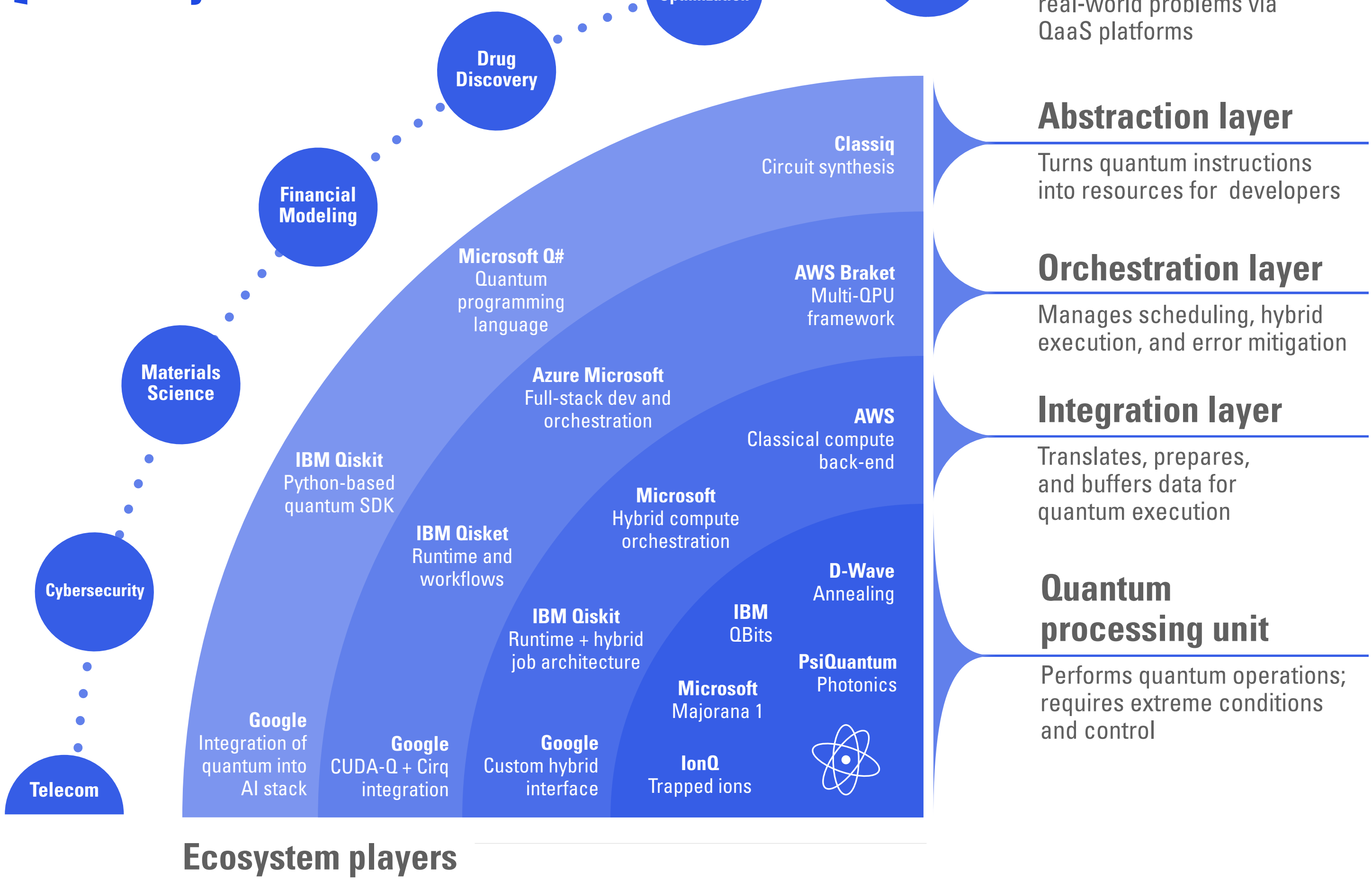
Trend 4: Quantum geopolitics: Building global momentum

As quantum computing transitions from the lab to real-world applications, it is becoming a significant field for geopolitical competition. The potential of quantum technology to transform industries, bolster national security, and stimulate economic growth has ignited a global quest for influence. This trend is both reshaping international relations and offering collaboration opportunities. Countries that invest heavily in quantum R&D will create environments where governments, businesses, and academia can work together. However, the leadership race may intensify geopolitical tensions, with policy choices and quantum nationalism potentially fragmenting markets.

Examples:

- China's Micius satellite has successfully demonstrated Quantum Key Distribution (QKD), enabling ultra-secure communication across long distances—including intercontinental quantum-encrypted videoconferences and direct links between ground stations up to 1,200km apart.[42]
- NASA and the European Space Agency (ESA) are testing quantum sensors that could help spacecraft navigate without needing GPS, making space travel more reliable.[43]
- The Five Eyes (U.S., UK, Canada, Australia, New Zealand) aspires to strengthen cybersecurity cooperation through initiatives like Secure Innovation.[44]

The emerging QaaS ecosystem



KPMG insights

Aaron Kemp
U.S. Quantum Leader

Richard Entrup
Managing Director, Emerging Solutions

Q1: What is the most exciting development in the world of quantum tech right now?

Aaron Kemp: In the short term, it's the Google announcement around their Willow chip and the speeds they're getting on classical equations implemented on a quantum computer, as well as IBM's advancements in stacking chips, where they'll be running quantum processors in parallel. Both of these organizations have announced advancements in error correction, which brings us closer to quantum advantage. Mid-term, it's the industry waking up to the fact that quantum is coming, and organizations starting to discuss quantum and their strategy moving forward. Long-term, it's quantum becoming usable for research, genomics, biomedical applications, and cancer research.

Q2: What needs to be true to reach quantum supremacy?

Aaron Kemp: It will likely be a gradual transition with niche use cases and the development of quantum advantage, followed by wider adoption, more researchers, and organizations playing in the space, ultimately leading to a "ChatGPT moment" where quantum leaps into the forefront. Hybrid models are probably the way of the future, integrating high-power compute, large language models, AI, and quantum.

Q3: Can you explain how a hybrid model of high-performance computing, quantum algorithms, AI, and classical computing works?

Aaron Kemp: Using Shor's algorithm, which is a hybrid algorithm that allows us to break current cryptography, as an example, pre-processing occurs on high-power compute, then the problem is sent to the quantum system to leverage its quantum advantage, then results go back to a classical system. AI can assist with code, data analysis, and pre-processing. This model takes advantage of each piece's strengths.

Q4: What is the greatest obstacle for clients in adopting or preparing for quantum?

Richard Entrup: Many CIOs don't have quantum on their radar or they aren't allocating budget. However, there is interest from a quantum resistance perspective, which involves identifying and fortifying existing cryptography. Solving error correction is also a key challenge.

Q5: What are some use cases for quantum or quantum and hybrid?

Aaron Kemp: Material science, chemistry, drug creation, and cancer research via the ability to emulate molecules at the quantum scale, which is where classical computers fall short. Also, quantum optimization through algorithms like Grover's for simulations, portfolio optimization, and fraud detection. Weather prediction is also a potential use case.

Conclusion and recommendations for leaders

Although quantum computing is still in its early stages, recent breakthroughs promise to revolutionize various industries, from biotech to finance and beyond. Now is the opportune moment for leaders to prepare for a post-quantum future by integrating quantum computing into their strategic visions. Organizations should proactively assess both the risks, such as PQC, and the opportunities that quantum technology presents. By doing so, they can ensure they are well-positioned to harness and capitalize on the transformative power of this evolving technology.

In the short term (0-2 years), leaders should explore hybrid models that combine quantum and classical systems. Leveraging QaaS through cloud platforms can provide access to quantum resources without the need for large hardware investments. A cryptographic inventory should be conducted to assess risks, prioritize migration efforts for critical systems, and select quantum-resistant algorithms. Investing in workforce training on quantum technologies, along with AI education, will help build the necessary talent for these advancements. Additionally, with critical policy decision-making looming in the next few years, organizations should stay current on regulations surrounding PQC, export controls, and trade barriers, which could impact intellectual property and market dynamics.

In the long term (2-5 years), leaders need to educate teams on the specific risks to their organizations posed by PQC and monitor evolving standards and regulations. To harness the full potential of quantum computing, prioritize early use cases with clear returns on investment, such as financial modeling, logistics, and cybersecurity. Collaborate with early adopters of quantum security to stay at the forefront of developments and maintain competitive advantage. For example, biotech organizations should consider how to leverage the AI-quantum merger to bring us closer to breakthroughs such as protein folding. Finally, leaders should seek opportunities for international collaboration, promote unified standards, and address shared challenges such as workforce development to ensure global competitiveness.

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Today’s quantum computers have proven utility, capable of being used as a scientific tool to solve problems at a scale beyond brute force classical simulation. We at IBM believe we’re on the cusp of demonstrating applications with a quantum advantage within the next two years—when quantum computation delivers a significant, practical benefit that is cheaper, faster or more accurate than all known classical alternatives.

Dr. Scott Crowder
Vice President, IBM Quantum Adoption

Space Economy

A story of democratization and transformation

Throughout history, transformative periods have been marked by the pursuit of new horizons—from maritime exploration during the Renaissance to the expansion of land and air travel at the time of the Industrial Revolution. We are now witnessing a democratization of space through the broadening of access: lower launch costs, more accessible infrastructure, and increasing involvement from private firms, startups, and emerging economies. The increase in investment and lower barrier to entry represents a significant shift in the space economy. What was once solely under sovereign control is now evolving into a dynamic ecosystem that welcomes startups, academic institutions, and organizations from emerging markets. This transition from governmental dominance to market competition signals the dawn of a new space race filled with extensive exploration and commercial opportunities.

The emerging space economy illustrates how external forces interact, generating impacts that lead to new trends. Core technological advancements, such as reusable rockets and miniaturized satellites, act as essential catalysts. These innovations reduce financial and operational barriers, enabling more participants to enter the market. As financial barriers diminish, economic forces like increased private investment and competition further decrease costs, accelerating market democratization. This transformation fosters broader interest, educational initiatives, and innovation among startups and academia.

As new entrants join the market, the demand for partnerships and shared resources grows, fostering collaboration among the public, private, and military sectors. In the realm of international space exploration, agreements like NASA's Artemis Accords promote collaboration among nations, establishing principles for peaceful exploration and sustainable use of outer space.[45]

Regulatory frameworks are experiencing increased pressure due to the increase in market participants and the intricacy of strategic collaborations. Startups often struggle to navigate complex regulatory requirements and meet deadlines—a time-consuming and legally intensive endeavor that consumes resources startups often can't expend. Rather than being proactive, regulatory shifts often serve as a reactive measure to evolving market dynamics. As companies innovate rapidly, governance struggles to keep up, leading to strategic ambiguity and adaptive policymaking. This fluidity can create opportunities for agile companies while posing compliance challenges for those unprepared for constant regulatory changes.

Setting the stage: From sovereign control to market competition

Between 1995 and 2010, the space economy was dominated mainly by governments and major national agencies like NASA, Roscosmos, and the European Space Agency. Valued at around $200 billion in 2010, commercial activities accounted for only a modest share of the space economy, with steady but limited growth.[49] This period was marked by high barriers to entry, long mission times, and a culture of risk aversion.

From 2010 to 2025, the space economy experienced a radical shift, more than doubling in value to around $600 billion in 2023.[50] Advancements like SpaceX's reusable rockets and miniaturized satellite technology fueled this growth, further driven by private investment, technological breakthroughs, and entrepreneurial innovation.

Looking toward 2035, the space economy is poised for remarkable expansion, with new markets such as in-space manufacturing, space tourism, and satellite-based data services. Projections indicate the space economy's value could reach between $1.4 trillion and $1.8 trillion, maintaining a robust CAGR of 10-20%.[51]

The risks of space democratization

While the new-age space race presents many new opportunities, it also comes with significant risks. Space debris is a growing concern, as increasing satellite launches heighten the risk of collisions, threatening both commercial and government assets. The lack of a cohesive international regulatory framework could lead to conflicts over resources, especially on the Moon and in geostationary orbits.

Despite decreasing launch costs broadening the market, the cost of space exploration is still high, which could lead to the risk of monopolization. A few dominant companies, like SpaceX and Blue Origin, could control critical infrastructure such as satellite internet. This age of space democratization goes beyond technological advancements; it challenges the limits of human capability. Today's choices regarding governance, collaboration, and innovation will influence the path for future generations. Similar to the inception of the Internet, the space economy possesses the power to generate transformative sectors and alter the fabric of society. Yet, it demands careful management to maintain the final frontier as a realm of opportunity rather than conflict.

Space economy by the numbers

$4K

The average cost to launch per kilogram fell from around $87,000 in 1960 to $15,000 in the early 2000s to $4,000 in 2023.[46]

$11.8B

Boosted by military contracts, Starlink is projected to reach $11.8 billion in revenue in 2025—a significant increase from its roughly $7.7 billion in revenue in 2024.[47]

$6B

The space tourism market is expected to reach $4-6 billion in 2035, fueled mainly by in-orbit stays aboard space stations by high-net-worth individuals.[48]

"The growth in space data and technology will create economic connections that are broader and deeper than today. Products and services in all major markets will be affected and forward-looking companies will have unique opportunities to capitalize.

Damon S. Feltman
Former Chief, Transport Cell, Space Development Agency Brig. Gen. (ret.), USAF

Developments and trends shaping the future

Trend 1:
Launch-cost disruption enabling market democratization

The shift from government-dominated space initiatives to a more competitive, open landscape has fueled technological progress and significantly lowered launch costs, democratizing access to the space market. Technological disruptions have played a key role in launch cost reduction, which has opened the door to non-sovereign players—startups, academic institutions, and emerging economies—to participate in space Initiatives. By lowering both financial and technical barriers, this democratization encourages competition and innovation, challenging the dominance of traditional space players like NASA, the European Space Agency (ESA), and Roscosmos. As space-related startups operate on a different ROI timeline than traditional startups, there is a growing need for financial institutions and investors to create alternative investments, financing strategies, and models that better fit this product lifecycle.

Examples:

- Reusable rockets like SpaceX Falcon 9 have already disrupted launch economics, making frequent, lower-cost missions possible for a wide range of actors.[52]
- Satellite constellation operators like Starlink and OneWeb are early beneficiaries of lower launch costs, enabling them to scale deployments that were once reserved for national space agencies.[53]

More From KPMG:

We are pioneering the next generation of global digital infrastructure by leveraging space technologies to drive resilience, regulation, risk management, reach, and revenue. Here are some additional resources to help leaders navigate opportunities in today's space economy:

- AstroEconomy eBook
- +SPACE Infinite Horizons

Trend 2:
Convergence of public, private, and military sectors

The space economy is evolving into a hybrid ecosystem where civil, commercial, and military sectors collaborate to drive innovation and strategic initiatives. Public-private partnerships play a crucial role in this shift, with governments subsidizing private entities to build complex space infrastructures, thus de-risking large projects. Dual-use technologies enable innovations to be leveraged across both civilian and military purposes, optimizing investment returns. For example, satellite communication ecosystems are used for both defense and commercial applications. Global partnership alliances are also key, and a full-scale cooperative approach spans government, private, and academic sectors working together on infrastructure and technology developments. This convergence is reshaping how power, funding, and innovation flow in space—blurring the lines between public missions and commercial opportunities. As the space economy matures, shared infrastructure, mission risk, and strategic interests will drive deeper collaboration. The most successful organizations will be those that can navigate the complexity of cross-sector partnerships while remaining agile, compliant, and focused on innovation.

Examples:

- NASA's Space Act Agreement fosters collaboration without the complexity of traditional government contracts, while the SpaceX-NASA partnership on Crew Dragon missions exemplifies successful resource and expertise sharing.[54]
- Venture-backed Anduril Industries works closely with U.S. defense agencies to deliver AI-powered autonomous systems and surveillance technologies, which are increasingly relevant for space-domain awareness and orbital security missions.[55]

Trend 3:
Data commercialization from space assets

The commercialization of space-derived data is turning raw input from space-based technologies into valuable insights and products for a range of industries. Artificial Intelligence and Machine Learning (AI/ML) enhance satellite autonomy and accelerate data processing, enabling real-time analytics for predictive applications in sectors like agriculture, logistics, and urban planning. As satellite constellations rapidly expand, these industries are becoming increasingly dependent upon space-based insights to drive decision-making. Space-related supply chains are optimizing logistics, enhancing trade routes, and reducing vulnerabilities, while orbital services like debris removal and on-orbit maintenance emerge as critical markets. At the same time, the commercialization of space data is creating a new economic layer, where actionable insights drive decision-making across a wide range of industries.

Examples:

- Space-based IoT (Internet of Things) constellations such as Myriota are enabling global, low-power connectivity for use cases like cargo tracking, environmental monitoring, and asset management.[56]
- Earth Observational (EO) data providers Starlink and OneWeb are expanding broadband connectivity across underserved regions, enabling downstream data services.
- Companies like Descartes Labs/Earth Daily apply AI/ML to satellite imagery to deliver real-time insights for agriculture, deforestation monitoring, and economic forecasting.[57]

Trend 4:
Dynamic regulatory landscape with strategic ambiguity

The regulatory landscape surrounding the space economy is constantly evolving and at times inconsistent, which creates both opportunities for innovation and risks for governance and compliance. Companies and nations can use unclear rules to their advantage, especially regarding space resource utilization. To manage the risks of unclear regulations, partnerships between the public and private sectors help create a framework for a timely response. While the space industry benefits from flexible rules for advanced technologies, it also faces potential geopolitical compliance risks due to this ambiguity.

Examples:

- The Artemis Accords provide a non-binding framework for peaceful exploration and resource use on the Moon, fostering voluntary cooperation among nations while encouraging responsible participation from private actors under existing international space law.
- Various national and international organizations, including the ESA, are working on Space Traffic Management (STM) approaches to improve safety and sustainability in space.[58]
- The ESA has adopted a “Zero Debris approach” to limit debris production in Earth and lunar orbits, which involves working with various stakeholders, including commercial entities.[59]

KPMG insights

Brian Miske
US Ignition Leader |
Americas Space Lead

Claudia Saran
Partner, National Sector Leader for Industrial Manufacturing

Q1: How would you define the space economy, and how has it evolved over the past decades?

Brian Miske: You have to look at the space economy in phases, starting with the Sputnik moment in 1957. That's Space 1.0, driven by national pride during the U.S.-Russia space race. Once we hit the moon, that was kind of space 2.0. It was really kind of launching out of Earth's atmosphere. We launched satellites, a kind of COMSAT, and then space 3.0 was about reusable systems. The space shuttle took us through from the early 80s into retirement in 2010. 4.0 was really about the broader expansion of different technologies in space. So, look at telecommunications, look at all the different types of satellites associated with that. And now we're on the cusp of 5.0, which is reusable assets in space—everything that SpaceX, Relativity, and Rocket Lab is launching up into space and returning—those are creating an entire ecosystem of assets and opportunities.

Q2: What are the most exciting innovations and developments in the space economy today and in the next five to ten years?

Brian Miske: Key innovations in the space sector are transforming both access and utility, marked by the democratization of space as more nations and private entities gain entry. Operations and research are being revolutionized by breakthroughs throughout in-space manufacturing, advancements in space-based data for agriculture and sustainability, and the integration of emerging technologies like AI, quantum communications, and robotic autonomy. Central to this shift is the rise of private space stations, like those from Vast Space Systems, which open new opportunities for automated research in microgravity, benefiting sectors from pharmaceuticals to food development. These platforms support cutting-edge microgravity research while also driving commercialization through space tourism, entertainment, and proprietary industrial activities. This will drive down costs, increase accessibility for a wide range of users, and stimulate a vibrant low Earth orbit economy.

Q3: What role do traditional companies play in the evolving space economy, especially with the rise of private ventures and startups?

Claudia Saran: Most of our automotive clients in the A&D space have a chief futurist on staff, and our core industrial manufacturing sectors have been wise to think about that as a new market, as a new outlet. I think they're realizing they have not specialized in some of the leading-edge technologies, whether through formal acquisitions, partnerships, or joint ventures. One of the core skills that industrial manufacturers talk about acquiring in this decade and beyond is agility around partnerships and teaming up with companies that may have been thought to be very unorthodox or that ten years ago wouldn't have seemed to share an association.

Q4: How will the space economy impact supply chains, and what opportunities do you see there?

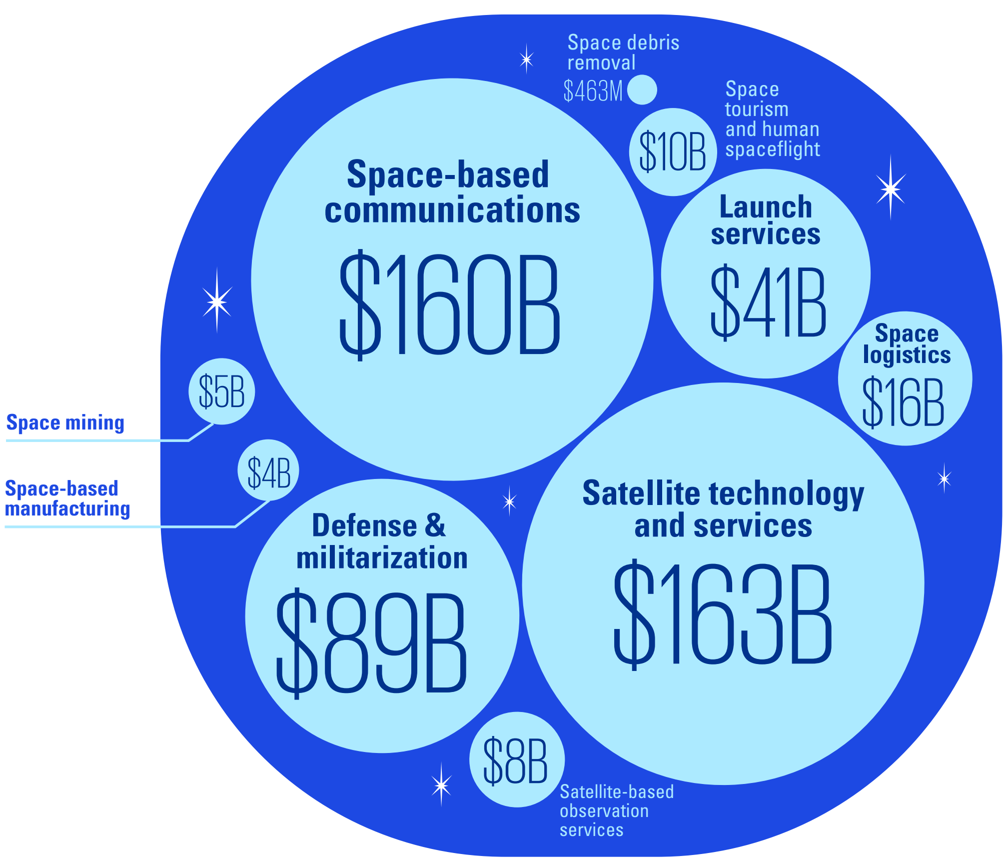
Brian Miske: Earth observation data and remote sensors with multi-spectral capabilities will enhance supply chain resilience by providing real-time monitoring of assets, infrastructure, and environmental conditions that could cause disruptions. This technology will also improve transparency by enabling better tracking of goods, verifying sustainable practices, and offering insights into the origin and journey of products. Combined with AI and advanced analytics, space-based systems can optimize operations and elevate human decision-making across the supply chain, much like RFID did in earlier decades.

Claudia Saran: One day, our clients won't struggle as much with forecasting, which would have a huge impact on the customer experience. This whole frontier could present an outlet for things that are precious and rare today, and those things themselves or viable substitutes that would take away that threat and dependency and allow for a lot more fluid supply chain.

Q5: What geopolitical or astro-political factors are not being talked about enough, particularly around the governance of space?

Brian Miske: While standards have not been established, agreements are being developed such as The Artemis Accords. These Accords, led by the U.S., put into place a set of non-binding principles grounded in the Outer Space Treaty to promote the safe, transparent, and peaceful exploration and utilization of space. China established its own framework through bilateral agreements and the International Lunar Research Station (ILRS) project. These efforts emphasize international cooperation for peaceful purposes but are viewed by some as a potential alternative to the US-led Accords. Space policy will significantly shape economic policy by fostering new industries, creating jobs in manufacturing, promoting research, and driving technological innovation that can spill over into other sectors. The development of a robust, cis-lunar and orbital infrastructure will further amplify these economic and social considerations, necessitating international cooperation and frameworks to ensure equitable and sustainable practices beyond earth.

Projected growth of the space economy market



Conclusion and recommendations for leaders

The space economy is an exciting and rapidly evolving frontier, with seemingly limitless possibilities for innovation and discovery. While the potential of space is generating significant buzz and organizations are eager to capitalize on its promise, it is crucial for companies to first assess how the space economy aligns with their industry. Understanding how space-based services—such as data, connectivity, and observation—can enhance their operations, while also navigating the ever-changing regulatory and policy landscape, is key. Develop a perspective on how democratized access can disrupt your sector and join cross-sector groups to share thinking. Once companies grasp how they can benefit from space technologies and the impact of regulatory shifts, they can then shift focus to expanding their ecosystems, piloting projects for relevant use cases, and considering new business models for the next generation. Leaders should focus on both short and long-term strategies to help maximize the potential of space-enabled services.

In the short term (0-2 years), track and monitor launch providers to identify opportunities for faster, cheaper access to space-enabled services and build partnerships with emerging providers to leverage low barriers to entry, especially in data-driven industries. Promote early engagement with public programs and explore funding opportunities linked to national space strategies. Additionally, collaboration with non-space companies can expand market reach by integrating satellite data while prioritizing cybersecurity to safeguard valuable data. Leaders should proactively monitor evolving space regulations across jurisdictions to spot early shifts in policy and join working groups or industry consortia to influence norms and build early credibility with regulators.

In the longer term (2-5 years), leaders should invest in space-enabled capabilities and build strategic partnerships with defense contractors, national labs, and academia for multi-year programs. As "traditional" space workforces age, there is a critical gap in the market for attracting younger professionals. To mitigate this, organizations should commit to investing in employee development and incorporating education programs that broaden the talent pool. Test out breakthrough use cases such as space-based manufacturing and move beyond raw data to offer analytics, insights, and predictive services tailored to specific agriculture, logistics, and urban planning industries. As space exploration extends well beyond Earth's orbit, consider how your organization can leverage data from other celestial bodies, such as the Moon and Mars. Develop ethical guidelines that align with the public interest, ensuring a commitment to transparency and fairness while diversifying operations and partnerships across regions to reduce exposure to regulatory or geopolitical disruptions.

Digital Assets

How digital assets are reshaping finance

Throughout the first quarter of 2025, the rapid rise of digital asset adoption was unmistakable, driven first and foremost by regulatory shifts that are unlocking institutional participation at scale. After years of ambiguity, new clarity in digital asset regulation is enabling enterprises, financial institutions, and governments to act decisively. This regulatory momentum has laid the foundation for deeper engagement across the digital asset spectrum.

At the center of this shift is Bitcoin, which continues to anchor the industry's credibility and growth. In early 2025, Bitcoin became the fifth-largest asset in the world, surpassing Google and trailing only gold, Apple, Microsoft, and Nvidia.[60] It has seen unprecedented institutional inflows following the launch of spot Bitcoin ETFs, which are now the fastest-growing ETFs in history. We're also seeing some governments responding, where they have begun to mine or acquire Bitcoin for national reserves. In early 2025, the U.S. federal government established a Strategic Bitcoin Reserve, marking a move to treat Bitcoin as a national reserve asset.[61] Bitcoin's reputation as a hedge asset was further reinforced during the 2023 banking crisis, when its price surged as investors sought alternatives to traditional financial assets, underscoring its emerging role as a macroeconomic safeguard.

While Bitcoin continues to drive adoption and shape the broader financial narrative, other digital asset innovations are gaining traction, albeit at an earlier stage of development. The global market cap for the cryptoasset market is now valued at $2.7 trillion (as of this writing).[62] Firms like BlackRock project the market for tokenized real-world assets (RWAs) could reach $10 trillion in the next decade, with a February 2025 report from Security Token Market forecasting $30 trillion in tokenized assets by 2030, led by stocks, real estate, bonds, and gold.[63]

Amid these projections, stablecoins have already emerged as one of the most widely adopted digital assets in active use today. They facilitate hundreds of billions in monthly transactions and are being integrated into the core financial system. Major banks are piloting stablecoin-based cross-border settlement systems, and enterprise platforms such as SAP are embedding stablecoin capabilities. Meanwhile, decentralized finance (DeFi) protocols are showing renewed growth, reflecting a broader revival in blockchain-based financial tools.

Building on this momentum, firms are developing tools that are scalable, interoperable, and enterprise-compatible. JPMorgan's Kinexys Digital Payments (formerly Onyx) enables foreign exchange settlement on-chain in USD, EUR, and GBP.[64] Franklin Templeton's tokenized money market fund, operating on Stellar, Avalanche, Ethereum, Arbitrum, Base, Polygon, Solana, and Aptos, has surpassed $750 million in assets.[65] Blackrock's BUIDL fund started 2025 at $650 million but is now worth almost $3 billion and is currently available across seven blockchains.[66]

Industry conversations have matured. The focus is no longer on the novelty of blockchain, but on its practical applications: How can stablecoins improve liquidity and speed in treasury operations? How might tokenized equity expand access to private markets? These questions are shaping the future of finance.

External catalysts

A number of external factors are coming together to enable further adoption of digital assets, led primarily by regulatory changes. For example, the rescinding of SEC SAB 121 has simplified how banks and custodial institutions can interact with digital assets by removing the requirement to record crypto holdings as liabilities on their balance sheets. This change has eliminated a persistent barrier, allowing banks to approach tokenized products and on-chain custody solutions with greater confidence—areas they had previously approached cautiously due to balance sheet constraints. On the other hand, while this is a meaningful step, it does not provide the regulatory certainty that banks and custodians need. Without permanent legislation, concerns remain that shifting political winds could lead to the reintroduction of similar requirements. True clarity will require durable legislative action.

Federal perspectives on digital assets have also shifted. The appointment of a national leader for Crypto and AI indicates an intensified government focus on driving growth and innovation in this sector. Legislative groups from both political parties are beginning to align, as evidenced by several crypto-focused bills surrounding stablecoins and market structure. These changes point to a regulatory landscape that is increasingly inclusive and clarified, especially for institutions looking to engage in the market space.

Institutional behavior serves as a crucial indicator. Firms such as BlackRock and Franklin Templeton have introduced active tokenized money market funds that are integrated with blockchain infrastructure. These initiatives are not just pilot programs or concept trials, but operational financial products designed to enhance settlement efficiency and liquidity. Their success endorses the technology and motivates other institutions to consider similar options and opportunities.

At the same time, core technologies are evolving to connect traditional finance with decentralized protocols. Chainlink's Cross-Chain Interoperability Protocol (CCIP) enables SWIFT to settle tokenized assets across Ethereum, private ledgers, and other chains without requiring institutions to overhaul existing infrastructures. Instead of establishing separate systems, these integrations enhance the functionality of the current financial infrastructure. They hint at a future where interoperability, rather than disruption, will shape the progression of digital finance assets.

As digital assets continue to grow in importance, they won't replace traditional finance but will incrementally alter its foundational framework. Mobile technologies and enterprise digital transformation have facilitated much of this change, which has already improved access and reduced barriers in numerous underserved markets. Digital assets are now capitalizing on this progress, bringing forth programmable tools and infrastructure designed to help maximize trust, while enhancing efficiency and flexibility across various sectors. The result is a financial system that is more programmable, transparent, and accessible, where new systems coexist with existing ones. This change creates significant opportunities for innovation, efficiency, and inclusion in multiple sectors and geographies.

Digital assets by the numbers

$2.7T

The global market cap for the crypto asset market is now valued at $2.7 trillion (as of this writing).[62]

$240B

The stablecoin market has surged in value, recently reaching $240 billion, with Citi's baseline projection showing the market jumping to $1.6 trillion by 2030, assuming regulatory support and insitutional integration continue apace.[67]

10%

The World Economic Forum estimates that up to 10% of global GDP could be tokenized and transacted on blockchain technologies by 2027, driven by advancements in asset tokenization across real estate, bonds, and commodities.[68]

$30T

The market for tokenized assets is projected to reach between $2 trillion and $30 trillion by 2030, depending on adoption rates, regulatory clarity, and technological advancements.[69]

Developments and trends shaping the future

Trend 1:
Banking's evolution in the digital asset era

Rather than facing disruption, traditional financial institutions are increasingly integrating decentralized transactions into their core business models. Leading financial giants like JPMorgan, Citi, and BlackRock are actively pioneering the adoption of blockchain-based innovations by launching tokenized investment products and exploring custody services for digital assets such as stablecoins. This shift reflects a broader evolution of the financial industry, where blockchain is seen not as a threat but as a tool for enabling new growth opportunities.

Examples:

- In February 2025, Citigroup announced its plans to develop crypto custody services, joining other major banks like State Street and BNY in expanding digital asset offerings. State Street will begin to provide custody services for Bitcoin and other cryptocurrencies for its clients in 2026.[70]

Trend 2:
A new stablecoin era

Stablecoins have rapidly become one of the most significant forces in digital assets in scale, utility, and policy relevance. The stablecoin market has surged to over $240 billion in value (as of this writing), significantly outpacing the combined worth of tokenized money market funds and other tokenized assets. This exponential growth is driving both institutional adoption and legislative urgency, positioning stablecoins at the forefront of the digital finance narrative.

Due to their rising economic relevance, stablecoins have become a foundational pillar for the next generation of payments and banking. Their growth has outpaced all other tokenized assets, fueling a global shift in how value moves across borders and financial systems. As regulatory clarity emerges and demand for instant, cost-effective transactions intensifies, stablecoins are now central to both institutional strategy and legislative priorities.

Examples:

- A leading global payments network has piloted stablecoin settlements on multiple blockchains, enabling 24/7 real-time cross-border payments between issuers and acquirers, significantly cutting settlement times and operational costs.
- Crypto debit cards allow users to spend stablecoins at merchants worldwide. These cards offer features like cashback rewards, multi-currency support, and integration with mobile wallets, making stablecoins practical for everyday spending.

Trend 3: Blockchain and AI agents

The convergence of GenAI, agentic AI, and blockchain is accelerating a new era of programmable finance. AI agents can now interact with crypto protocols, automate financial workflows, and make dynamic decisions on-chain, enabling new levels of efficiency, autonomy, and composability in DeFi. Combined with blockchain's trustless, tamper-proof infrastructure, this integration opens the door to secure, intelligent automation across lending, settlements, and identity verification. AI agents running on decentralized networks can continuously monitor markets, execute trades, manage liquidity, and trigger smart contracts with minimal human input. At the same time, blockchain ensures the integrity, auditability, and interoperability of these actions, creating shared financial rails across which AI systems operate.

Examples:

- Mindshare Index on NEAR Protocol deploys an AI agent that scans social sentiment to detect trending tokens, autonomously executes trades across multiple blockchains, and dynamically rebalances portfolios, eliminating the need for manual trading inputs.[71]
- Fetch.ai uses autonomous agents on DeFi platforms to perform asset swaps, arbitrage, and liquidity optimization. These agents analyze market data, adapt strategies using machine learning, and execute trades in real time to enhance portfolio performance.[72]
- Emerging DeFi lending agents can now assess borrower creditworthiness by analyzing wallet activity, repayment behavior, and token holdings. These AI agents enable personalized loan offers and unlock undercollateralized lending models by reducing risk via intelligent, data-driven underwriting.[73]

Trend 4: Tokenization of real-world assets

Tokenizing physical and financial assets like real estate, private equity, and money market funds enhances efficiency and liquidity in traditional markets by enabling fractional ownership, reducing settlement times, and lowering operational costs. BlackRock's tokenized money market fund (BUIDL), along with Ondo Finance and Franklin Templeton, illustrate how tokenized assets streamline operations and create additional revenue streams.

Examples:

- In March 2025, BlackRock expanded its $1.7B tokenized money market fund, BUIDL, to Solana—its seventh blockchain—leveraging the network's speed to boost accessibility and efficiency for investors.[74]
- Franklin Templeton's OnChain US Government Money Fund (FOBXX), launched in April 2021 on Stellar, expanded to Solana in February 2025 alongside Ethereum, Polygon, Avalanche, and others, growing to over $500M in assets under management.[75]
- Ondo Finance plans to start its own layer-1 blockchain specifically designed for institutional-grade tokenization of real-world assets (RWAs).[76]

KPMG insights

Greg Genega
Digital Asset & Blockchain

Anthony Tuths
Principal, Tax Alternative Investments

Brian Consolvo
Principal, Cyber and Technology Risk

Q1: How do you foresee the next five to ten years for the digital asset ecosystem? What will drive mainstream adoption?

Anthony Tuths: Over the next five to ten years, we might see more financial assets—such as equities, commodities, and bonds—traded in tokenized forms. However, it's likely that we won't always refer to them as tokens. For example, if a company's stock—call it company X—is tokenized, we'll still simply call it X stock, not a tokenized version. It's clear that many large financial institutions are exploring blockchain to improve the speed, cost, and transparency of asset movements, but it's also important to acknowledge that traditional systems will continue to be essential in the broader ecosystem.

Q2: Are traditional financial institutions being disrupted or adapting?

Greg Genega: Most traditional financial institutions have had their eye on blockchain, stablecoins, and DeFi for quite some time, and were waiting for more adoption and regulatory clarity. A good portion of them have the opinion that DeFi offerings will be critical to their core business in the long run so they will be much more likely to adapt. That said, certain revenue streams, such as remittances and wire transfers, could decline as a result of these innovations.

Q3: What is driving stablecoin adoption, especially by major payment platforms?

Anthony Tuths: The major drivers for stablecoin adoption include quick settlement times and a neutral settlement layer that is globally accepted. Stablecoins provide access to the global reserve currency (USD) for people in countries with unreliable banking systems. However, the biggest challenges are user experience, particularly private key management, and regulatory uncertainty.

Q4: Where are we seeing the intersections of AI, generative AI, and blockchain?

Greg Genega: I believe generative AI and blockchain are unlikely to each reach their full potential without the help of one another. One reason is the emergence of AI agents—virtual workers able to autonomously perform tasks. In the future, we'll likely see AI-powered agents transacting online with people and other AI agents paying for these services. Blockchain rails are the most likely way they will need to transact. Additionally, the concepts of blockchain-based decentralized identity and proof of personhood may be vital for distinguishing AIs and humans as deepfake technology gets more advanced.

Q5: What factors should companies consider when adopting digital assets?

Greg Genega: Regulatory uncertainty, cybersecurity threats, and interoperability challenges are the main risks. While blockchain transactions are irreversible, many smart contracts allow for mechanisms like freezing and re-minting, which can provide a clever option to reverse transactions. However, there still remain challenges due to fraud and hacks. For example, a recent headline highlighted a $1.4 billion hack of a crypto exchange by a foreign hacker group where funds were not recovered, which highlights the ongoing risks.

Conclusion and recommendations for leaders

As digital assets continue to reshape industries and financial systems, organizations are entering a new era that demands not just experimentation, but thoughtful execution. While tokenization holds long-term potential, many urgent opportunities and challenges will be based on integrating digital assets into existing systems, navigating evolving regulations, and ensuring financial and operational readiness. Whether it's implementing stablecoins for payments, establishing compliant digital custody models, or preparing for real-time settlement, businesses are facing new design decisions that span finance, treasury, legal, and technology functions.

In the short term (0-2 years), many organizations will likely recognize the benefits of pinpointing business functions where digital assets can enhance operational efficiency or financial agility. For example, treasury and finance departments are starting to test stablecoin solutions for international payments and are looking into real-time settlement alternatives, particularly in areas where conventional systems face volatility or challenges. Asset managers are testing tokenized funds and digital custody to boost transparency and broaden access to previously restricted investment options. On the risk and compliance front, various institutions are closely monitoring legislative changes in market structures while developing initial frameworks for custody, liquidity, and reporting. Additionally, product development and finance executives are exploring strategies to adapt within a programmable, interoperable financial ecosystem by leveraging blockchain-based tools that enhance transparency, efficiency, and cross-platform compatibility.

Looking ahead (2-5 years), there is increasing acknowledgment that digital assets could serve as a cornerstone for enterprise transformation. Various financial institutions are investigating methods to incorporate tokenized real-world assets into their core services, making previously illiquid assets more accessible to a wider range of investors. Custodians, exchanges, and infrastructure providers are focusing on interoperability and transparency as key differentiators that enhance client trust and foster regulatory engagement. Additionally, leadership discussions are evolving towards talent readiness and ecosystem alignment, as organizations seek to understand how AI, blockchain, and data provenance might intersect to create new service models. For many, the long-term potential lies in rethinking the capabilities of digital assets—not just in replicating analog processes. These assets are well positioned to foster new value creation, enhance capital access, and transform transaction logic across various industries.

Environmental Resilience

How businesses can lead in the age of environmental risk

The increasing frequency and severity of extreme weather events—including wildfires, hurricanes, floods, and heatwaves—are not just future threats; they are present-day challenges. These events are reshaping economies, disrupting global supply chains, raising operational costs, and threatening long-term business stability and continuity. Simultaneously, as regulatory requirements evolve and investor scrutiny intensifies, companies are realizing that building environmental resilience creates both strategic and financial advantages. Environmental resilience is not a single action; it represents a dynamic strategy developed through a company's response to pressures from various angles.

The disaster management cycle consists of four phases: prevention, planning, response, and recovery. To build resilient business models, companies should strategically prioritize prevention. This proactive approach not only enhances resilience but also improves financial standing, as environmental risk and financial risk are inherently linked. For example, downtime from outages due to extreme weather or other factors cost businesses an average of $9,000 per minute.[77]

True organizational resilience isn't merely about having systems to protect assets after disaster strikes. Rather, it's about creating a foundation of prevention strategies and adaptive planning that builds a naturally agile organization—one capable of navigating challenges before they escalate into full-blown crises. Companies that master prevention and planning don't just recover faster—they can avoid disaster entirely.

The integration of environmental risk is revolutionizing financial analysis

In boardrooms and investment committees worldwide, a new understanding is emerging: environmental risk equates to financial risk. This issue has evolved beyond regulatory discussions and is now a market reality. Major institutional investors are actively incorporating environmental volatility into their portfolio choices, having witnessed the impact of environmental crises on long-term value outcomes.

Insurance markets are sounding the alarm in real time. Securing coverage is increasingly challenging and becoming significantly more costly in regions susceptible to extreme weather events. Major insurers such as Swiss Re and Munich Re already employ AI-powered climate risk modeling to reassess corporate exposures. Consequently, companies relying on outdated risk assumptions may face reduced or denied coverage. Meanwhile, over $2 trillion has already been invested in green bonds and infrastructure financing. Savvy investors understand that companies that can adjust to environmental volatility are safer investments and may be better positioned to grow.

While federal climate reporting requirements remain uncertain, state regulations are moving forward. California's Climate Corporate Data Accountability Act (SB 253) will require approximately 2,000 companies to disclose their greenhouse gas emissions.[78] Similar bills are under consideration in New York, New Jersey, and Illinois, signaling a growing trend in state-level climate disclosure requirements.[79] Although the compliance burden may appear significant, there is a key benefit: companies that can effectively communicate their strategies for managing disruption are gaining investor confidence, and often experiencing lower-cost capital.

The key point? Environmental resilience is now a measure of business confidence. Leading companies are shifting from merely reacting to disruptions to actively designing for resilience. This involves incorporating environmental foresight into their planning, utilizing real-time data, and stress-testing their operations.

Securing business operations against essential service failures

For decades, U.S. businesses have been able to assume they will have reliable access to essential services such as electricity, water, roads, and ports. As extreme weather events become more frequent and intense, businesses must shift from viewing these services as given to actively developing resilient systems that can withstand environmental disasters. Power outages are estimated to cost U.S. businesses around $150 billion annually, with approximately 80% due to weather.[83] Furthermore, global port disruptions due to weather events put $67 billion in economic activity at risk annually. And water scarcity is emerging as a business concern as sectors dependent on freshwater for cooling, production, or processing encounter escalating expenses and unpredictability.[84]

Investing in adaptation offers significant returns, with up to $19 in avoided losses for every dollar spent.[85] Companies that prioritize adaptation planning, such as developing robust contingency plans and optimizing resource use, not only reduce risks but also boost long-term profitability and operational continuity. This is especially true for high-risk sectors and functions like manufacturing, energy, and supply chain.

Developments and trends shaping the future

Trend 1:
Climate intelligence—turning data into resilience

Incorporating AI into climate-risk evaluation models enables businesses to simulate disruptions, evaluate exposures, and better prioritize mitigation strategies. These advanced models can predict not only the potential locations of extreme events, but also how these events may ripple through supply chains, infrastructure, and customer experience. Satellite data, geospatial analytics, and real-time monitoring are enhancing climate intelligence with greater specificity.

This intelligence is now available to corporations, facilitating quicker and more informed decision-making. These tools offer more than insight—they provide agility. Businesses that consider environmental data can now allocate capital, modify procurement, and guide board-level decisions with a level of foresight that was once unattainable. In a world influenced by environmental instability, having clear and early vision could be the most valuable asset.

Examples:

- Palantir is building scenario-based tools for both government and commercial users to model cascading risk and inform climate-aligned capital planning.[86]
- Tomorrow.io uses satellite data, AI, and ML to offer an additional 30 minutes of warning for extreme weather compared to industry standards.[87] JetBlue uses Tomorrow.io to optimize flight routes based on weather patterns.
- Precision agriculture firms are using satellite imagery and AI to monitor moisture, soil, and heat stress, turning climate insight into real-time planting and procurement decisions.[88]

Environmental resilience by the numbers

$217B

In 2024, weather disasters resulted in $217B in economic losses for U.S. companies—an 85% increase from 2023.[80]

7.3%

Climate-driven asset devaluations could erase 6.6–7.3% of corporate earnings by 2035.[81]

48%

A Marsh Survey found that while 83% of companies are aware of climate-related physical risks, only 48% assess them quantitatively.[82]

Trend 2:
Fortifying the future—engineering physical structures to combat climate risks

A fresh wave of design thinking is transforming the ways businesses build their physical structures to withstand environmental disasters. For example, a manufacturing firm in Puerto Rico that makes circuit breakers is developing microgrids to allow them to remain operational during storms that cause the main grid to fail.[89] Further, advanced building materials are being used in large-scale projects to enhance resilience against extreme weather. Holcim's DYNAMax high-performance concrete was used in the construction of the Cosmopolitan Skyline tower in Tijuana, Mexico, to ensure high resistance to earthquakes and severe weather.[90]

To combat increasing climate risks, businesses must adapt their physical structures by investing in durable, climate-resilient systems and materials that can withstand extreme weather events. This approach puts agility and durability at the core of business operations.

Examples:

- Bloom Energy's fuel-cell technology is being deployed to build grid-independent, low-carbon backup power systems—especially in hospitals and data-heavy industries.[91]
- St. Gobain CODYY makes fire- and impact-resistant glass for commercial buildings, as well as glass panels that help control interior climate conditions.[92]
- Portland, Oregon, installed more than 2,000 bioswales to reduce filter pollutants, recharge groundwater, and mitigate flooding risks.[93]

Trend 3:
From risk to readiness—adaptive supply chains

Extreme weather is increasingly disrupting global supply chains, impacting customer relationships, operational efficiency, financial performance, and brand reputation. For example, a 2024 drought reduced water levels in the Panama Canal—leading to a 36% reduction in ships crossing through the canal and revenue losses of $500-700 million.[94] Further, as extreme weather intensifies, previously safe regions are becoming vulnerable. In 2024, Hurricane Helene hit the Appalachian Mountains—an area historically unaffected by hurricanes—disrupting the operations of more than 50 manufacturers and causing cascading supply chain impacts.[95]

Enterprises can mitigate the impact of severe weather on their supply chains by taking action to increase their resilience. Proactive organizations are conducting supply chain mapping, implementing predictive analytics and real-time monitoring tools, diversifying suppliers, and implementing localized production strategies.

Examples:

- A hurricane-impacted saline solution supplier highlighted the vulnerability of hospital supply chains and prompted businesses to rethink their fundamental sourcing assumptions.[96]
- A 2024 study published in *Nature* projected global economic losses of between $3.75 trillion and $24.7 trillion by 2060 due to previously unquantified disruptions in supply chains.[97]
- More than 99% of surveyed executives stated that their supply chains have been impacted by climate change.[98]
- California SB 253 Impact on SMBs – The requirement for scope 3 emissions disclosure is compelling mid-sized suppliers to quickly evaluate their climate risk, even if they are located far from coastal areas or flood-prone regions.[99]

KPMG insights

Maura Hodge
U.S. Sustainability Leader |
CPA, ESG Assurance

Marcus Leach
Managing Director,
Deal Advisory & Strategy

Q1: How do you see the intersection of climate change and business strategy evolving over the next 2, 3, 5, or even 10 years?

Marcus Leach: I think, in the near term, we are certainly seeing organizations increase their focus on wrapping their heads around immediate physical risks—to their assets, to their supply chains, to business resiliency. A lot of this is still being handled manually, using more static models from historical data. It's like looking at the one-in-100-year storm event as a benchmark, but that's no longer enough.

In the longer term, you will see mandates around more dynamic modeling, driven by AI and better computing power, to predict things like convective storms, flooding, and wildfires. The risk focus will shift from static assumptions to real-time, constantly updated models. Companies that do not integrate this planning into their risk strategies will be caught off guard as climate events continue to escalate in frequency and severity.

Q2: What are the biggest challenges businesses face in meeting their climate adaptation and sustainability goals?

Maura Hodge: There has been a big push to reduce greenhouse gas emissions, right? But at the same time, we're seeing the impacts of extreme weather events increase, and there's this disconnect between long-term decarbonization efforts and the immediate need for climate adaptation.

One of the biggest hurdles is funding. Companies know they need to invest in resilience—whether it's upgrading infrastructure, diversifying supply chains, or securing stable energy sources—but the investment dollars aren't always there. Then, there is regulatory inconsistency across jurisdictions. Some companies have to develop a different climate strategy for each market, which complicates everything.

The reality is that many organizations have identified the risks, but they haven't necessarily done the work to adapt. They know there's a 27% chance of their operations being interrupted by a flood, but they haven't built redundancy into their supply chains or made infrastructure changes to mitigate those risks.

Q3: Are there new revenue models or ecosystems being created as businesses adapt to the increasing need for energy resilience?

Marcus Leach: Yes, absolutely. The market for virtual power purchase agreements (VPPAs) and distributed energy is a huge example. Hyperscalers—companies like Google and Microsoft—are looking for energy solutions because AI, data centers, and electrification are driving unprecedented demand. This is leading to entirely new energy investments that would have been unthinkable just a few years ago.

For instance, modular small nuclear reactors (SMRs) are now a serious consideration for powering data centers, and companies that wouldn't traditionally touch the energy sector are getting involved because they need stable power to survive.

Q4: With the shifting regulatory environment, how should companies think about the role of reporting and compliance in their climate resilience strategies?

Maura Hodge: Historically, only companies that wanted to be 'leaders' in sustainability did climate reporting, and they could pick and choose what they reported. Now, with SEC regulations and Europe's CSRD coming into play, transparency and comparability are being forced onto the market.

What we're trying to help companies understand is that reporting is not just about compliance—it's about strategy and value creation. If you're spending all your time and resources getting compliant, but not using that data to inform business decisions, then you're missing the point.

Q5: Are there particular industries or companies that are setting the standard for integrating climate resilience into their business models?

Marcus Leach: Tech companies like Microsoft and Google are leading the way in terms of renewable power sourcing and energy resilience. They are making massive investments in clean energy, not because they're being forced to, but because they know they can't operate their data centers reliably without it.

I also think the agriculture and food industries are getting ahead of this curve. Companies like PepsiCo, McCormick, and Mars have been working on sustainability for decades because their supply chains are directly impacted by climate shifts. And now, even healthcare companies are starting to come together to figure out what sector-wide resilience looks like, because they can't afford supply chain disruptions in critical medicines and equipment.

Conclusion and recommendations for leaders

We are entering a future that no model can accurately predict, where the speed of disruption might surpass planning logic. Yet, within that uncertainty lies opportunity. Environmental resilience is not just a singular solution or endpoint; it's a developing capability—an approach to sensing, adapting, and responding dynamically. While the challenges are genuine, so is the creativity surfacing across various sectors, such as energy systems, operational design, and data-driven decision-making. The journey ahead won't be flawless and will differ for everyone. However, for those willing to tackle the complexity—with honesty, gradual steps, and creativity—resilience could not only protect value but also unveil entirely new ways to generate it.

In the short term (0-2 years), companies must first address immediate adaptation needs driven by severe weather events. From there, the most proactive firms will prioritize visibility into their future risk exposures, supply chains, and energy dependencies. This process starts with enhanced data collection: creating a clearer understanding of potential disruptions and identifying vulnerable systems. Some organizations leverage AI-driven models to simulate various scenarios, while others invest in short-cycle resilience initiatives like local energy storage, diversified sourcing, and improved reporting workflows. The objective isn't perfection, but clarity. With the right insights, leaders can focus on the most critical decisions, safeguard core operations, and leverage resilience as a competitive advantage.

In the longer term (2-5 years), the conversation may transition from mitigation to transformation. As climate intelligence tools evolve and external factors align, business leaders will have the chance to rethink essential aspects of their models—such as driving growth, bolstering infrastructure, and establishing trust with both customers and regulators. Some will incorporate climate resilience into their capital strategies, while others will weave it into mergers and acquisitions, product development, or workforce planning. This is where foresight turns into effective leadership. The companies that thrive may not be those that completely evade disruption, but rather those that adapt quickly, act decisively, and develop systems capable of evolving as circumstances shift.

Advanced Manufacturing

The policy-driven rebirth of U.S. advanced manufacturing

For decades, globalization and cost efficiencies drove manufacturing offshore. Today, that is changing. A combination of geopolitical shifts, technological advancements, and policy change is creating the possibility of a new industrial renaissance in the United States. This shift will likely be spurred by government incentives, sweeping tariffs, and advances in automation and AI-driven manufacturing.

The latest trade policy imposes tariffs on all steel and aluminum imports, with no exemptions for allies, reinforcing the need for an aggressive reshoring strategy. These tariffs, alongside retaliatory measures from key trading partners like the EU and Canada, are reshaping global supply chains, which further pushes companies to reconsider U.S.-based production. While critics warn of inflationary pressures and economic friction, industries like semiconductor manufacturing, advanced materials, and industrial automation are seeing a wave of new investments. Taiwan Semiconductor Manufacturing Company (TSMC) is committing $100 billion to U.S. chip fabrication, while Siemens is investing heavily in new production facilities, capitalizing on government incentives and shifting supply chain dynamics.[100]

A structural paradigm shift from labor-intensive overseas manufacturing to capital-intensive, high-tech domestic production is being driven by more than tariffs. AI-powered automation, robotics, and Industry 4.0 solutions are making U.S.-based manufacturing more competitive than ever. Meanwhile, evolving tax policies and fiscal strategies could play a role in shaping investment flows and the economic landscape for domestic manufacturing.

This transformation is not without challenges. Rising import costs due to tariffs, workforce constraints, and global economic uncertainty are not making this a smooth transition. Additionally, retaliatory trade measures, particularly in industries like pharmaceuticals and automotive, could disrupt supply chains in unexpected ways.

The momentum behind advanced manufacturing in the U.S. is undeniable. Whether driven by necessity or strategy, the next decade will see a convergence of policy, technology, and economic shifts, reshaping American industry into a more resilient, high-tech, and globally competitive powerhouse.

The pace of adoption and market growth

The resurgence of U.S.-based advanced manufacturing is unfolding at an unprecedented pace, driven by a convergence of these economic, technological, and policy shifts. Over the past several years, industrial investments in key sectors—including semiconductors, clean energy, and precision manufacturing—have skyrocketed, positioning the U.S. as a critical hub for high-tech production.

The transformation from traditional to high-tech production is being shaped by several key factors:

- **Massive Capital Inflows:** Major corporations and government initiatives are pouring billions into domestic manufacturing. TSMC's $100 billion semiconductor expansion, Apple's $500 billion commitment over four years, and Hyundai's $21 Billion investment highlight the scale of these commitments.[101]
- **Trade and Policy Realignment:** The imposition of tariffs on steel, aluminum, and other critical imports is restructuring global supply chains. Companies that once relied on overseas production are now considering domestic alternatives to avoid rising costs and regulatory uncertainty. Every company now needs more policy subject matter experts to rely upon.
- **Supply Chain Security and Resilience:** The pandemic and geopolitical tensions have exposed vulnerabilities in global supply chains, prompting a shift toward localized production. Industries are prioritizing supply chain security, reducing dependency on foreign manufacturers, and investing in nearshoring strategies.
- **Industry 4.0 and Automation:** Advanced manufacturing technologies—such as AI, robotics, and digital twins—are transforming production processes. These innovations enhance efficiency, reduce costs, and enable high-precision manufacturing at scale, making domestic production more competitive.
- **Government Incentives and Workforce Development:** Federal and state-level programs, including tax incentives, infrastructure investments, and workforce training initiatives, are accelerating manufacturing growth. Efforts to reskill workers for high-tech manufacturing roles are addressing labor shortages and ensuring a steady pipeline of talent.
- **Sustainability and the Energy Transition:** The push for greener manufacturing practices is reshaping industrial production. Companies are integrating renewable energy, electrification, and sustainable materials into their processes, anticipating vulnerabilities in the power grid, and aligning with both regulatory pressures and corporate sustainability goals.
- **Financial Market Response:** Investors are increasingly backing advanced manufacturing as a long-term strategic opportunity. The shift from outsourcing to reshoring is being reflected in corporate valuations, with firms investing in U.S. production seeing greater market confidence.

With these forces at play, the transformation of U.S. manufacturing is already in motion. As capital flows, policy adjustments, and technological advancements continue to shape the sector, the next decade could redefine the global manufacturing landscape with the U.S. at its center.

Developments and trends shaping the future

Trend 1: Reshoring & supply chain reconfiguration

The shift toward domestic and nearshore production is a direct response to trade tensions, geopolitical uncertainty, and supply chain fragility exposed by recent disruptions (e.g., tariffs, the pandemic, and semiconductor shortages). It is also a commitment to strengthening the U.S.

Examples:

- Hyundai has committed $21 billion to U.S. manufacturing and supply chain investments between 2025 and 2028.[102]
- Tesla expanded Gigafactory Nevada to include a 100 GWh 4680 cell factory and a high-volume Semi factory, investing over $3.6 billion and adding 3,000 new team members, with the goal of producing enough batteries for 1.5 million light-duty vehicles annually.[103]
- Eli Lilly & Co is set to invest $27 billion in expanding its U.S. manufacturing capabilities by constructing four new sites, which is expected to create 13,000 high-wage jobs.[104]

Trend 2: Policy-driven industrial growth & government incentives

Federal initiatives such as the CHIPS Act, the Inflation Reduction Act (IRA), and Manufacturing Tax Credits are reshaping capital allocation. Companies must navigate these policies to help maximize funding opportunities and align their long-term strategies.

Examples:

- Intel is planning to invest more than $28 billion in the construction of two new leading-edge chip factories in Ohio to meet demand for advanced semiconductors, power a new generation of innovative products from Intel, and serve the needs of foundry customers.[105]
- In December 2024, the Department of Commerce awarded Samsung Electronics (Samsung) up to $4.745 billion in direct funding under the CHIPS Incentives Program's Funding Opportunity for Commercial Fabrication facilities.[106]
- Micron Technology plans to invest $100 billion over 20 years, leveraging substantial manufacturing tax credits, to build a semiconductor fabrication plant in Clay, NY.[107]

Trend 3: Industry 4.0 & smart manufacturing transformation

Automation, AI, and IoT-driven smart factories are critical to offset rising labor costs and improve production efficiency. Leading manufacturers are adopting real-time analytics, AI-powered predictive maintenance, and autonomous operations to enhance productivity.

Examples:

- John Dyck, CEO, CESMII, National Institute for Smart Manufacturing, sees democratization as strategy: "The reality for most mature manufacturers is that these capabilities aren't accessible, either in terms of cost or available domain expertise. There is a universal need to democratize these capabilities, which will require a concerted, industry-wide effort to contribute to de facto standards, to crowdsource domain expertise, and to choose open and interoperable, instead of proprietary, technologies."[108]
- Siemens is using digital twin technology, which creates virtual models of physical assets and systems, to simulate and optimize production processes before physical implementation.[109]
- Toyota integrates robots into nearly every part of its production process, especially in areas requiring high precision, such as welding and assembling parts.[110]
- AI plays a crucial role in GE's predictive maintenance strategy, identifying patterns and anomalies that may indicate potential failures by analyzing data collected from sensors embedded in industrial equipment.[111]

Trend 4:
Workforce transformation & talent strategy

Manufacturing is facing a severe workforce shortage, requiring companies to rethink talent acquisition, retention, and upskilling strategies. As automation increases, the focus is shifting to AI-augmented labor and specialized training for next-gen industrial roles.

Examples:

- Several institutes within the Manufacturing USA network—such as the Advanced Robotics for Manufacturing (ARM) and Clean Energy Smart Manufacturing Innovation Institute (CESMII)—play pivotal roles. They drive technological innovation and collaborate with community colleges, universities, and industry partners to develop targeted training programs and apprenticeships in smart manufacturing.[112]
- Eli Lilly's reshoring initiative is expected to generate 13,000 high-wage jobs and enhance the production of active pharmaceutical ingredients and injectable therapies.[113]
- Energy-efficiency leaders like Toyota, 3M, and Johnson Controls empower their workforce through training and incentive programs, ensuring that it is part of the culture—and every employee is aware of and contributing to energy-saving initiatives.[114]
- Oxford Economics calculates that productivity gains in the U.S. advanced manufacturing sector is an estimated $226,071 per worker—more than twice the productivity of a worker in non-advanced manufacturing ($106,143).[115]

Trend 5:
Sustainable & energy-efficient manufacturing

Sustainability is no longer just a compliance issue—it's a competitive differentiator. Companies are shifting to low-emission production, circular economy models, and energy-efficient operations in response to regulatory pressure and investor expectations.

Examples:

- Sustainability-marketed products are growing twice as fast as conventionally marketed products and are growing at premium prices.[116]
- A 2024 study of 2,000 U.S. consumers revealed that Americans prioritize eco-friendly purchasing and are severing ties with companies that aren't focused on sustainability. And, regardless of political affiliation, they are spending on brands and products that elevate environmental causes.[117]
- 3M, a market leader, recently added two new sustainability-focused technology platforms: Circular Materials integrates the company's ongoing efforts to advance the circular economy through material and process innovations. The second, Climate Technology, reflects 3M's capacity to accelerate climate solutions by scaling high-potential innovations in materials science.[118]

Conclusion and recommendations for leaders

Data-driven foresight and agile leadership have become the keys to mastery in Advanced Manufacturing. As true advanced manufacturing becomes the standard, what it means to run a manufacturing business will undergo perhaps the most profound business shift of our era. It truly is a new frontier.

The next two years will become an inflection point for US Manufacturing. Leaders are challenged to adapt and find the right mix of policy, technology, and strategic investment to survive and thrive. As with the challenges of achieving environmental resilience, leaders need a clear picture of their manufacturing ecosystem—which core processes can and should evolve, where the greatest risks and vulnerabilities lie, what kind of capabilities will be needed to grow internally, or when they should outsource. These assessments are required to develop an Advanced Manufacturing strategy with plausible scenarios for the future. Every industry and business has its own specific context and unique challenges. With the right level of assessment and data, leaders can focus on the most critical decisions, safeguard core operations, and chart their course to develop true Advanced Manufacturing capabilities for the future.

The long term (2-5 years) presents many "unknown unknowns" and requires companies to have systems in place to monitor supply chain volatility, starting with raw elements and progressing all the way through to materials certification, packaging, and final delivery. This year's cacao harvest in the southern hemisphere's Cocoa Belt could disrupt the full lifecycle of the chocolate market for years to come. Every industry has an equivalent. Modeling potential disruptions is a must-have capability. So are data-driven market insight, automation, distributed intelligence, and workforce reskilling that incorporates greater use of AI.

How KPMG can help

The future is unfolding. Are you ready?

Powerful external forces shape the world, causing broad shifts that impact industries, economies, and societies over time. These forces originate from geopolitics, economic changes, technological breakthroughs, environmental developments, and evolving societal expectations. By staying attuned to these dynamics, organizations can anticipate potential disruptions and opportunities, enabling them to proactively adapt rather than simply reacting to change after it occurs.

At KPMG, we help bridge this gap. Our diverse teams comprise strategic thinkers, scientists, technologists, designers, and analysts who utilize cutting-edge technologies and innovative approaches to solve these problems. This helps unlock new value, transform ideas into actionable strategies, and achieve measurable outcomes for our firm and clients.

Please let us know how we can help. Contact any of our KPMG subject matter experts for a discussion on how we can support your journey forward.

Let's lead this transformation together.

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