Winning the AI Race:
Strengthening U.S. Capabilities in Computing and Innovation

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Chairman Cruz, Ranking Member Cantwell, and Members of the Committee,

Thank you for the opportunity to testify on the critical issue of artificial intelligence. I am Brad Smith, the Vice Chair and President of Microsoft Corporation.

AI has the potential to become the most useful tool for people ever invented. Like the general purpose technologies that preceded it, such as electricity, machine tools, and digital computing, AI will impact every part of our economy. It will shape not just how we work and live, but how we compete, prosper, and stay secure as a nation between now and the middle of this century.

The notice for this hearing aptly refers to an "AI race." I would like to talk today about what is needed to win this race.

The AI race involves both technology and economics. It requires both innovation and diffusion. It is both a sprint and a marathon. The country can win a lap but lose the race if it fails to bring together all the ingredients needed for success.

It is a race that no company or country can win by itself.

To win the AI race, the United States will need to support the private sector at every layer of the AI tech stack. The nation will need to partner with American allies and friends around the world.

In my testimony today, I will focus on three strategic priorities where this Congress and the federal government will make a difference.

First, the country must win the AI innovation race. This will require massive datacenters and AI infrastructure that need federal support to expand and modernize the electrical grid on which they depend. The country must recruit and train skilled labor like electricians and pipefitters that are in short supply. We all must summon the best of our researchers at national labs and universities, supported by federal basic research programs and partnerships that have become the envy of the world. We will need to continue to excel in moving innovative ideas from academic labs into companies and new products. And we will need to support AI developers with open and broad access to public data.

Second, the nation must win the AI diffusion race. This will require that we promote broad AI adoption that will enable productivity growth across every sector of the economy. More than anything, this requires new initiatives to promote the AI skilling of the American workforce. This will involve basic AI fluency in our schools and new AI training programs in our community colleges. It will also include advanced AI education that will represent the next generation of computer science degrees, organizational skills that will be mastered in the country's business schools, and new courses in the nation's law schools. When combined, these will enable companies, non-profits, and government agencies alike to put AI to effective use. Governments at the federal, state, and local levels can then help accelerate this diffusion by adopting AI services to improve the effectiveness and efficiency of the services they provide to the public.

Third, the United States must export AI to American allies and friends. No company or country is so powerful that it can master the future of AI without friends. The United States and China are competing not only to innovate but to spread their respective technologies to other countries. This part of the race likely will be won by the fastest first mover. The United States needs a smart export control strategy that protects our national security while assuring other countries that they will have reliable and sustained access to critical American AI components and services. Perhaps as much as anything, this requires that we collectively sustain international trust in our products, our companies, and the country itself.

AI as a General Purpose Technology

Economists sometimes put technologies into two categories, general purpose technologies and single-purpose tools. Most things in the world are single-purpose tools, like a smoke detector or a lawn mower. They do one thing very well. But over the course of history, certain so-called general purpose technologies impact and sometimes even redefine almost every sector of the economy. Electricity is the prototypical example, because when you think about it, electricity changed the way every economic sector works.

The key to mastering the future of AI starts in part by understanding the role technology has played in the past. The past three centuries have brought the world three industrial revolutions, each driven by these general purpose technologies. First, it was iron working in the United Kingdom, starting in the 1700s. And then it was electricity and machine tools in the 1800s, when the United States overtook the United Kingdom by putting these technologies to work more broadly than any other country. And then there was the third industrial revolution during the last 50 years, driven by computer chips and software.

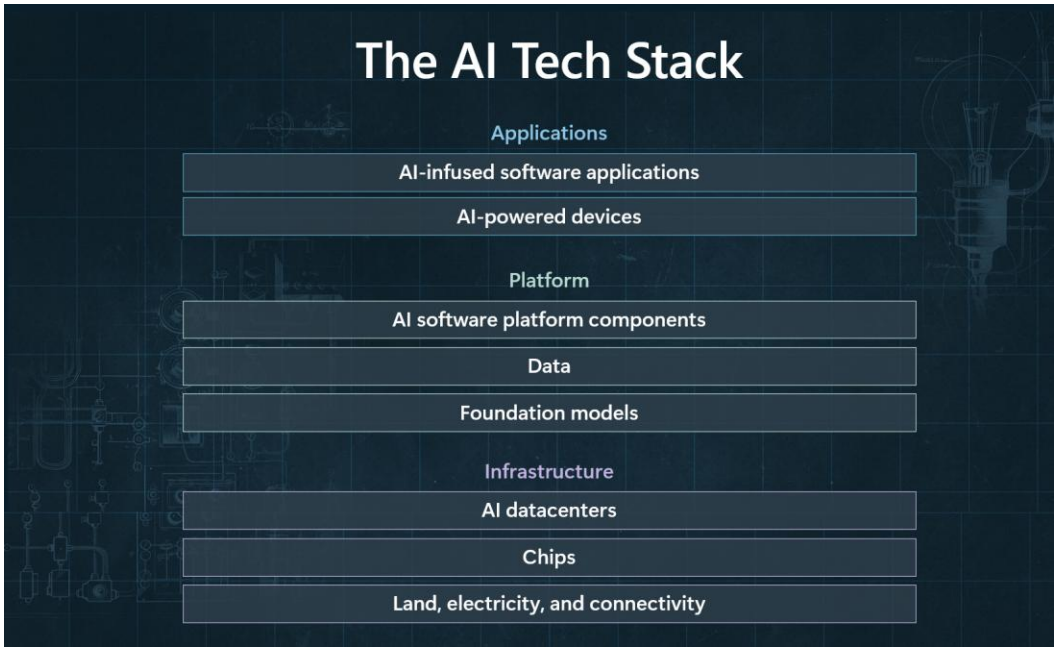
Without question, being a global leader in advancing a general purpose technology gives a country a major edge. But one lesson of history is that the countries that benefit the most and advance the fastest are not necessarily the countries where the technology is invented. Rather, it's where the technology is diffused – or adopted – the most quickly and broadly. This is for good reason. If a technology improves productivity and changes every part of an economy, then the country that uses it the most broadly and quickly will benefit the most.

This both frames and defines the AI opportunity and challenge for the United States. As a nation, we need to focus both on advancing innovation and driving diffusion, both domestically and as a leading American export.

The AI Tech Stack

The key to driving both innovation and diffusion is to recognize that AI, like all general purpose technologies, is built on what we in the industry call a tech stack – a stack of technologies that are used together. This is true for every great general purpose technology. You can see this, for example, if we go back in time and think about electricity. Thomas Edison first succeeded in 1878 in using electricity to light a lightbulb. But the illumination of lights across a city quickly required the construction of power plants, the fuel to run them, the creation of an electrical grid, the standardization of circuits, and a wide range of electrical appliances beyond the lightbulb itself. In short, a tech stack for electricity.

Artificial intelligence similarly is built on an AI tech stack. Fundamentally, it is divided into three layers, infrastructure, the platform layer, and applications. You can see this illustrated below.



The infrastructure layer is massive. Microsoft is spending more than $80 billion this fiscal year on the capital investment needed for this layer, with more than half this amount being spent in the United States. This goes to buying land, investing in electricity and broadband connectivity, procuring chipslike GPUs, and installing liquid cooling. These lead to the construction of datacenters – or often datacenter campuses with many buildings with potentially hundreds of thousands of computers. This infrastructure supports both the training of new AI models and their deployment, so they can be used for AI-based services around the world.

On top of this infrastructure, there is the platform layer. The heart of this layer consists of AI foundation models, including frontier models created by companies like OpenAI, as well as open source and other models from a wide variety of other firms – including Anthropic, Google, Mistral, DeepSeek, and Microsoft itself. The platform layer relies on data to train and ground models. And it includes a new generation of software-based AI platform services that are used to help build AI applications.

Ultimately, both the infrastructure and platform layers support the applications layer. These are devices and software applications that use AI to deliver better services to people. ChatGPT and

Microsoft's Copilot are both examples of AI applications. One of the amazing things about the applications layer is it's not just companies – large or small or established or startup – that are creating AI applications. It's everybody. It's researchers using new AI-infused applications to change drug discovery. It's non-profits changing the way they deliver services. It's teachers using AI as a tool to improve the way they prepare material for a classroom. It's governments making everything from the filing of a tax return to the renewal of a driver's license easier and more efficient.

To build a new AI economy, it's critical to get all three of these layers working and to get a flywheel turning across the ecosystem. It's essential to build the infrastructure layer so people can develop and deploy the models at the platform layer. It's essential to use the AI models so that people will build the applications on top of them. And it's essential for customers to adopt the applications, so the market can grow, and drive increased investment to expand the infrastructure further. The process repeats itself. This is how a new economy is born.

Success Requires an Entire Ecosystem

The flywheel effect makes clear that success requires not only national progress at one layer of the tech stack, but at every layer. That is what the private sector currently is pursuing in the United States better than in any other country. And it's what this Congress and the Executive Branch can help support with a strategy that promotes both AI innovation and diffusion up and down this stack.

National AI leadership requires not only success by a few companies, but by many. Today's panel, involving leading firms such as OpenAI, AMD, CoreWeave, and Microsoft, reflects important slices of the new AI economy. The AI economy requires a multifaceted and integrated ecosystem that includes "Big Tech" and "Little Tech," startups and more established firms, open source and proprietary developers, suppliers and customers, firms that create data and firms that consume it, all working together. Governments as both regulators and leading AI adopters have critical roles to play.

Commentators sometimes focus on the tensions between different participants in this tech ecosystem. These deserve attention. What's often overlooked is that the different participants also depend on each other. And this means that the different contributors to the AI ecosystem all need to be healthy.

A large technology company like Microsoft has a unique opportunity – and responsibility – to partner with and support the participants at every level of the tech stack. We strive to advance not just innovation but an economic architecture, business models, and responsible practices that will help grow the AI market on a long-term basis. Not just for the United States, but the country's friends and allies.

Winning the Innovation Race

Although the AI economy is being built mostly by the private sector, government policies and initiatives need to play a critical role. This starts with work needed to help fuel innovation. A few areas deserve particular attention in this hearing.

Power the growth of datacenters

Just as you can't have reliable electricity in your home without a powerplant, you can't have AI without datacenters and AI infrastructure. And these datacenters require a vast supply chain to construct and large amounts of electricity to operate.

America's advanced economy relies on 50-year-old infrastructure that cannot meet the increasing electricity demands driven by AI, reshoring of manufacturing, and increased electrification. The United States will need to invest in more transmission and energy resources, onshore our supply chains, and modernize our electric grid to support forecasted increases in electrical loads. Microsoft is investing in these areas itself.

We urge the federal government to streamline the federal permitting process to accelerate growth in all these areas. The current federal permitting processes often involve multiple agencies and complex, unpredictable, multi-year reviews. This hinders progress. The federal government should take immediate steps to establish reliable, reasonable, and transparent timelines for permitting decisions. This can also be done by standardizing federal permitting processes and designating a lead agency to shepherd the permits through the process. Further, the permitting agencies should utilize AI and digital tools to improve timelines and transparency for applicants and ensure the permitting agencies have quick access to information to assist them in their review and decision-making process.

We were pleased to see President Trump's recent Executive Order, "Updating Permitting Technology for the 21st Century," directing agencies to make maximum use of technology in the environmental review and permitting process. The Congress should also look to the Federal-State Modern Grid Deployment Initiative as a proven program that can be leveraged to deliver results.

This is just the start of what is needed to modernize and expand America's energy grid. We need to recognize that new investments in the grid are just as important today as they were a century ago, when the United States led the world in private and public sector support for electricity.

Grow the AI Infrastructure workforce

Perhaps the single biggest challenge for data center expansion in the United States is a national shortage of people – including skilled electricians and pipefitters. Electricians, for example, are essential to datacenter construction, installing a complex system of electrical panels, transformers and backup power systems. We have hired thousands of electricians across the country, including in Arizona, Georgia, Virginia, Washington, and Wisconsin. But the United States doesn't have enough electricians to fill the growing demand. We estimate that over the next decade, the United States will need to recruit and train half a million new electricians to meet the country's growing electricity needs. We need a national strategy to ensure we meet this opportunity for American workers.

These are good jobs that will provide great long-term careers for people across the country. We recommend making existing federal education and training funds, as well as tax incentives, available to scale up these opportunities. These could include targeting current federal apprenticeship investments in regions that have identified major AI infrastructure initiatives and supporting existing training centers to quickly increase the number of registered apprenticeships focused on electricians.

We commend President Trump's recent Executive Order, "Preparing Americans for High-Paying Skilled Trade Jobs of the Future," for highlighting the importance of skilled trades in the building of AI infrastructure and for paving the way to meet this moment. As federal agencies work to implement the order, it will be critical that industry forecasters and union training centers work together to maximize impact.

Ultimately, we need new steps at every level of government and in communities across the country. For example, we need to do more as a nation to revitalize the industrial arts and shop classes in American high schools. This should be a priority for local school boards and state governments. Similarly, the

nation's community colleges will need to do more to support a national initiative to help train a new generation of skilled labor, including electricians and pipefitters.

Invest in AI research and development

To uphold America's position as a global scientific leader, it is imperative to enhance federal investment in fundamental scientific research. The United States boasts a storied history of employing public-private partnerships. The decisions made decades ago to publicly fund research infrastructure and provide financial support to talented scientists and entrepreneurs paved a pathway to American technological leadership. Through federal, state and local government initiatives, investments were made in regional economies and programs, betting on the ingenuity of the American people. Notable incubators of the 20th century – such as Bell Labs and the network of federal national laboratories – were the result of deliberate efforts to unite industry, government, and academia to propel scientific advancement. We must deploy a similar strategy today for AI and quantum technologies. Investments in these areas are critical to advancing the development of innovative technological solutions that address complex global challenges.

To outcompete nations like China, which have significantly boosted their research and development (R&D) investments, the United States must accelerate strategic investments in scientific research for future technologies. Experts predict China will continue to invest substantial resources in next-generation technologies such as AI, advanced manufacturing, clean energy, quantum computing, and semiconductors over the next decade.

Since the Second World War, America's technological innovation has been driven by R&D based on two critical ingredients that the rest of the world has both studied and envied. The first is sustained support for basic research. While a few tech companies invest substantial sums in basic research, as we do through Microsoft Research (MSR), most world-leading basic research is pursued by academics at American universities, often based on funding from the National Science Foundation and other federal agencies. Driven by curiosity rather than a profit motive, this research often leads to unexpected but profound discoveries that are published publicly.

The second ingredient is a sustained commitment to investments in product development by companies of all sizes. The United States, more than any other country, has mastered the process of moving new ideas quickly from universities to the private sector. This success rests on healthy investments in both R and D, recognizing that basic research is often publicly funded and typically in universities, while product development is robustly and privately funded through companies. It's the combination of the two that makes American R&D so successful.

In 2019, President Trump approved an executive order designed to strengthen America's lead in artificial intelligence. It rightly focused on federal investments in AI research and making federal data and computing resources more accessible. Six years later, the President and Congress should expand on these efforts to support advancing America's AI leadership. More funding for basic research at the National Science Foundation and through our universities is one good place to start.

Ensure public data is open and accessible

Data is the fuel that powers artificial intelligence. The quality, quantity, and accessibility of data directly determines the strength and sophistication of AI models. While the internet has been a major source of training data, the federal government remains one of the largest untapped sources of high-quality and

high-volume data. Yet today, many of these datasets are either inaccessible or not usable for AI development.

By making government data readily available for AI training, the United States can significantly accelerate the advancement of AI capabilities, driving innovation and discovery. Opening access to these datasets would allow for the analysis of themes, patterns, and insights across broad datasets, propelling the country to the forefront of global AI development.

Importantly, accessible public data levels the playing field. It empowers not only large companies but startups, academic institutions, and nonprofits to train and refine AI models. This fosters a more competitive and inclusive AI ecosystem, where innovation is driven by ideas and ingenuity – not just proprietary data.

In comparison, countries like China and the United Kingdom are already investing heavily in their data resources, recognizing the economic and strategic value of national-scale data management. China's comprehensive system to manage datasets as a strategic resource and the UK's National Data Library underscore a growing global trend of treating data as a common good for economic competitiveness.

Winning the AI Diffusion Race

History teaches us that the true impact of a general purpose technology is not measured solely by the caliber of its leading inventions, but by how quickly, widely, and effectively these are adopted across society. But the reality is that technology diffusion takes time, investment, partnerships, and sound public policy.

The history of electricity offers an important insight for AI. Once Thomas Edison proved in 1878 that electricity could power a lightbulb, why would anyone choose to sit at night in a room illuminated by a candle or kerosene? Yet tonight, almost 150 years later, more than 700 million people on the planet still live without electricity in their homes. Diffusion requires not only great technology, but sound economics.

The economics of tech diffusion start with skilling. Countries need to invest in the skills needed to use new technology, both as individuals and across organizations. It is easy to underestimate both the role that skilling plays and the need for public policy to support it. But in each industrial revolution, the country that best harnessed the leading general purpose technology of its time was the nation that skilled its population the most quickly and broadly.

Skill the American workforce

In the new AI economy, Americans of all backgrounds will need critical AI skills to compete. To meet the totality of the skilling challenge, the country must pursue a new national goal to make AI skilling accessible and useful for every American. This will require a very broad range of partnerships and new policy ideas, spanning across geographic, organizational, economic, and political divides.

President Trump's recent executive orders focused on AI education and the workforce provide critical steps towards a national skilling strategy for AI. The "Advancing Artificial Intelligence Education for American Youth" EO establishes a clear policy to promote AI literacy by responsibly integrating AI into education for teachers and students. By fostering this early exposure, the nation's youth will be better positioned for AI-enabled work. Congress can also consider leveraging existing federal funding to the nation's school districts to encourage AI learning and literacy in K-12 education.

Businesses and non-profits have important roles to play. At Microsoft, we are seeking to do our part to meet this skilling challenge. In 2025 alone, we are on a path to train 2.5 million Americans in basic AI skills. We're partnering with the National Future Farmers of America (FFA) to train educators in every state to integrate AI into the agricultural classroom through our Farm Beats for Students program. We are partnering with the American Federation of Teachers (AFT), the largest organization representing the nation's educators in America, to deliver a co-developed training program to 10,000 AFT members. And we're partnering with the State of New Jersey, Princeton University, and CoreWeave on an AI Hub in New Jersey that will include support for AI education in local community colleges.

When it comes to AI skilling, the most important thing we need to do is recognize that this is a critical field that is ripe for attention, learning, partnership, and innovation. It will have a huge impact on broadening access to this technology across our economy and society. Generative AI is a new and young technology. So is our knowledge of the full extent of need in terms of AI skilling programs and support. This is a first-class priority that deserves as much attention and support as innovation in AI technology itself.

Encourage AI adoption

The federal government also will play a critical role in AI diffusion by using AI itself. There are opportunities across the government to use AI to improve the quality and efficiency of public services for citizens.

It's encouraging to see the recent OMB publication of M-Memos focused on federal government use and procurement of AI. Both memos emphasized the importance of removing barriers to innovation, maximizing the use of domestically developed AI products, and encouraging AI leaders within the federal government to facilitate responsible AI adoption.

We're seeing activity in the states as well. We partnered with the Texas Department of Transportation to launch a six-week pilot program aimed at boosting productivity and improving decision-making across various departments. The program saw strong results with 97 percent of participants using the AI digital assistant during the pilot, 68 percent have integrated it into their daily workflow, and participants reporting saving an average of 12 hours a week on routine tasks.

Exporting American AI

The ability to export our AI is essential to sustaining our global competitiveness and ensuring that our technological progress benefits not only our nation, but also our allies and partners around the world. Building on recent AI diplomacy efforts, the United States offers a compelling and trusted value proposition in the global technology landscape.

American tech companies, including Microsoft, are making unprecedented investments in AI infrastructure around the world. Microsoft alone is building AI infrastructure in more than forty countries, including regions where China has focused its investments. We urgently need a national policy that provides the right balance of export controls and trade support for these investments.

While the U.S. government rightly has focused on protecting sensitive AI components in secure datacenters through export controls, an even more important element of AI competition will involve a race between the United States and China to spread their respective technologies to other countries. Given the nature of technology markets and their potential network effects, this race between the

United States and China for international influence likely will be won by the fastest first mover. The United States needs a smart international strategy to rapidly support American AI around the world.

This fundamental lesson emerges from the past twenty years of telecommunications equipment exports. Initially, American and European companies such as Lucent, Alcatel, Ericsson, and Nokia built innovative products that defined international standards. But as Huawei invested in innovation and China's government subsidized sales of its products, especially across the developing world, adoption of these Chinese products outpaced the competition and became the backbone of numerous countries' telecommunications networks. This created the technology foundation for what later became an important issue for the Trump Administration in 2020, as it grappled with the presence of Huawei's 5G products and their implications for national and cybersecurity.

Early signs suggest the Government of China is interested in replicating its successful telecommunications strategy. China is starting to offer developing countries subsidized access to scarce chips, and it's promising to build local AI datacenters. The Chinese wisely recognize that if a country standardizes on China's AI platform, it likely will continue to rely on that platform in the future.

International partnerships will be critical. This is why Microsoft has partnered with entities like the UAE's G42 and investment funds like Blackrock and MGX, aiming to raise up to $100 billion for AI infrastructure and supply chains. American tech companies and private capital markets are forging stronger ties with key nations and sovereign investors in the Middle East, surpassing previous efforts to counter Chinese subsidies in telecommunications and reflecting our commitment to innovation and cooperation. While China's government may subsidize its technology adoption in developing regions, it will struggle to match the scale and impact of America's private sector investments.

Pragmatic American export control policies are essential, balancing security protections with the ability to expand rapidly. Protecting national security by preventing adversaries from acquiring advanced AI technology is crucial. Rules should include qualitative standards for secure datacenter deployments to prevent chip diversion to China and ensure advanced AI services are safeguarded. We support this type of approach.

However, we have expressed our concerns about the quantitative caps imposed on GPU shipments by the interim final AI Diffusion Rule issued in January. These place key American allies and partners in a Tier Two category, imposing limits on AI datacenter expansion. This includes countries like Switzerland, Poland, Greece, Singapore, India, Indonesia, Israel, the UAE, and Saudi Arabia. Customers in these countries now fear restricted access to American AI technology – potentially benefitting China's AI sector by turning to alternatives.

The Trump administration has an opportunity to revise the rule, eliminating quantitative caps and retaining qualitative standards. This approach ensures American allies and partners remain confident in accessing American AI products.

Ultimately, we need to recognize that countries around the world will use American AI only if they can trust it. This creates responsibilities for American companies to develop and deploy AI infrastructure and products in a responsible manner that meets local needs. And it requires that countries have confidence in sustained and uninterrupted access to critical AI components and services. The United States has long built a reputation for trustworthy technology that China has been unable to match. But this reputation, like everything that truly matters, requires constant attention and care.