Centre for International
Governance Innovation

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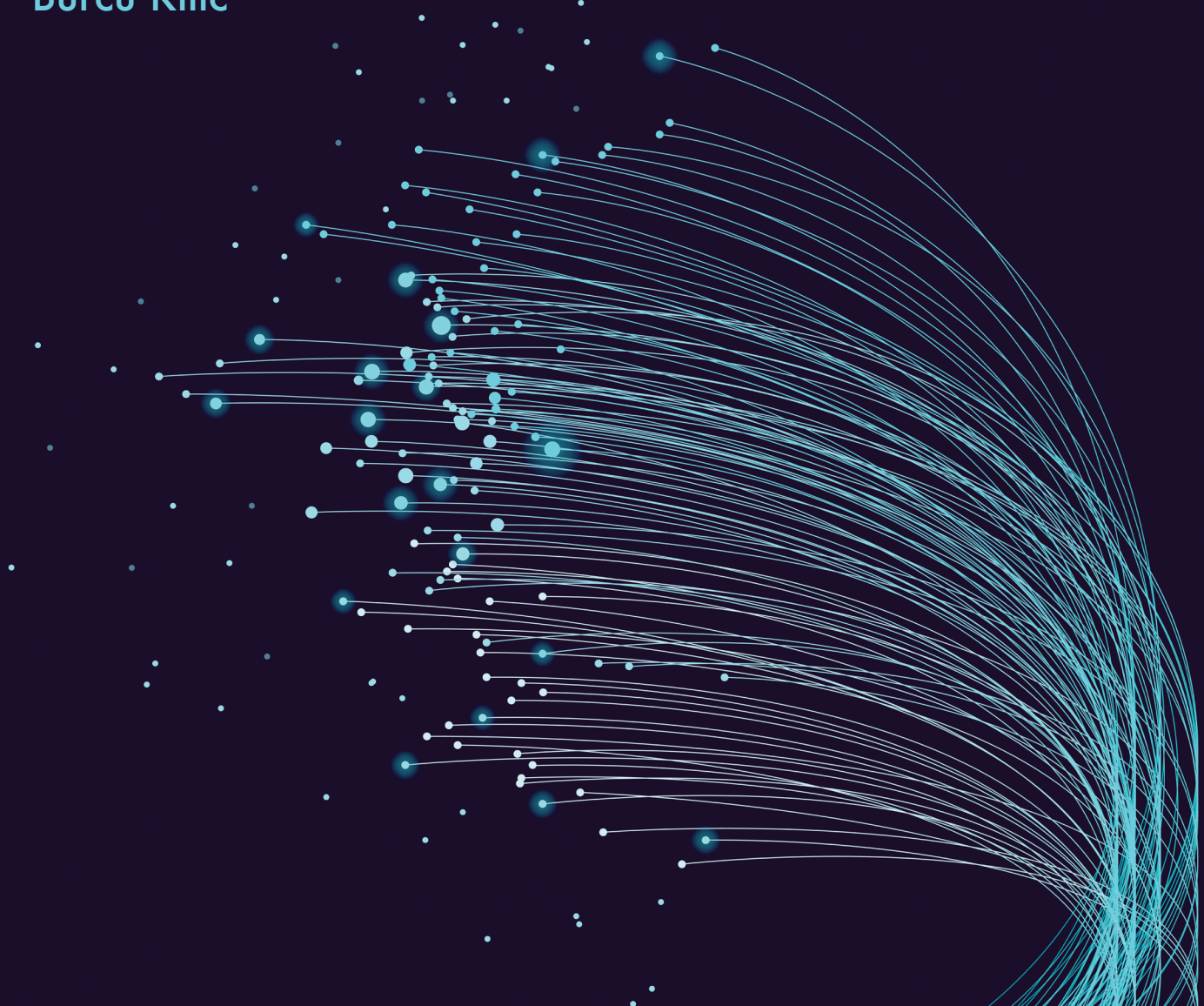
AI, Innovation and the Public Good: A New Policy Playbook

Burcu Kilic



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67 Erb Street West
Waterloo, ON, Canada N2L 6C2
www.cigionline.org

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About the Author

Burcu Kilic is a CIGI senior fellow, and tech and human rights fellow at the Carr Center, Harvard Kennedy School. She has worked with a diverse range of organizations across civil society, philanthropy and academia. Her research and writings cover digital rights, intellectual property (IP), innovation and trade, and she has provided technical advice and assistance in countries in Asia, Latin America, Europe and Africa.

As the former head of policy of Frontier Technology — a Minderoo Foundation initiative — Burcu guided the organization's approach to emerging technology, advocating for responsible, equitable and just solutions.

Before joining Minderoo, she directed the Digital Rights Program at Public Citizen, a non-profit consumer advocacy organization in Washington, DC, and also led their research on access to medicines. Her influence in tech policy, IP and trade underscores her commitment to policy entrepreneurship and rights-based advocacy. She champions collaborative civil society engagement, policy entrepreneurship and innovative policy development on a global scale. In 2015, she was recognized as one of the 300 Women Leaders in Global Health for her work on health and trade policy. From 2021 to 2022, she was a practitioner fellow with the Digital Civil Society Lab at the Stanford Center on Philanthropy and Civil Society.

She completed her Ph.D. at Queen Mary University of London and holds L.L.M. degrees in IP law from Queen Mary University of London, and information technology law from Stockholm University. She obtained her law degree from Ankara University, Turkey.

Acronyms and Abbreviations

AI	artificial intelligence
AMIs	Advanced Manufacturing Institutes
AWS	Amazon Web Services
G7	Group of Seven
GDPR	General Data Protection Regulation
ICT	information and communications technology
IP	intellectual property
LLMs	large language models
NAIRR	National Artificial Intelligence Research Resource
NIS	national innovation system
R&D	research and development
RIC	Research and Innovation Council
SMBs	small and medium-sized businesses
STEM	science, technology, engineering and math
WTO	World Trade Organization

Executive Summary

In late January 2025, a little-known Chinese start-up, DeepSeek, made headlines with a breakthrough open-source artificial intelligence (AI) model called R1. The model sent shockwaves through the tech industry and among Wall Street investors. R1 is reportedly alarmingly good, performing similarly to OpenAI's top-tier models, but it is also more cost-effective and runs on less-advanced chips. DeepSeek changed the conversation about AI and challenged the dominant AI narrative, which has long focused on bigger models, high-end chips, massive investments and expansive data centres for progress. R1 demonstrated that innovation and competition remain possible, even on an uneven playing field.

This eye-opening moment coincides with the revival of industrial policy as a strategic tool for governments aiming to build AI capacity and competitiveness. Once dismissed under neoliberal economic frameworks, industrial policy is making a strong comeback with more governments worldwide embracing it to build digital public infrastructure and foster local AI ecosystems.

This paper examines how the national innovation system (NIS) framework can guide AI industrial policy to foster innovation and reduce reliance on dominant tech companies. The concentration of AI infrastructure, compute power, training data and cloud services in the hands of a few dominant tech companies has created a bottleneck for AI innovation. It is difficult for small players to enter the market and compete on fair terms. Without targeted policy interventions, AI risks further consolidating power in a handful of tech companies.

That is why successful AI policy must go beyond passive adoption and instead focus on understanding the local context and addressing local needs. It should set clear priorities to enhance domestic innovation capabilities to ensure that AI development aligns with broader economic and societal goals. Strategic investments in AI research and development (R&D) are essential to drive independent technological progress and reduce reliance on big tech infrastructure. Additionally, restructuring public institutions and adopting a whole-of-government approach to AI governance can improve coordination and effectiveness. In this context, aligning trade policy with industrial policy and competition is critical for fostering a fair and dynamic AI ecosystem that supports local innovation and ensures long-term technological sovereignty.

The AI race is not only about technological breakthroughs or bigger and faster models. There will be no single model or country dominating the future of AI. Instead, the future of AI will be multi-model and multinational. With bold and strategic policy making, governments can shape AI's trajectory and ensure that innovation serves not only a few tech companies and nations but also global society as a whole.

Introduction

Not long ago, mentioning "industrial policy" in Western capitals such as Washington, DC, Brussels or London was considered nearly taboo. The term was so stigmatized that it risked drawing associations with European socialism or the economic strategies of developing nations.

Starting in the 1980s, the term "industrial policy" fell out of favour under the influence of the neoliberal economic order, which supported free-market ideas. There was a deep ideological divide: state intervention in markets was viewed skeptically while free-market principles dominated the political and economic discourse. The latter's influence shaped global policy, pushing for market privatization, reduced government spending and trade liberalization.

A shift began slowly after the 2008 financial crisis as governments tried to address pressing issues such as sustainable job creation, green transitions and supply chain resilience. "You never want a serious crisis to go to waste," declared an Obama official in 2008, as the president launched the American Recovery and Reinvestment Act, a historic stimulus plan that included unprecedented investments in renewable energy (quoted in Velut 2024). There was also a growing awareness among policy makers of China's increasing economic power and competitiveness, raising concerns about the impacts on the United States' own economy, jobs and welfare (Morrison 2019).

With all these factors in play, industrial policy re-emerged as a topic in academic conferences, policy forums, World Bank reports, national growth strategies, fiscal plans and even election campaigns. It is now in the spotlight, peaking as a new buzzword in policy discussions (Siripurapu and Berman 2023; Ilyina, Pazarbasioglu and Ruta 2024). Moreover, new empirical studies and different experiences with industrial policies have brought fresh insights to the debate, offering a more nuanced and contextual perspective that addresses some of the interpretational challenges. This encouraged more productive discussions among economists, shifting focus from heated disagreements to constructive analysis and understanding (Juhász, Lane and Rodrik 2023).

In short, industrial policy is back. Today, it is increasingly discussed in the context of AI. AI and industrial policy have become central themes, dominating global discussions and shaping policy agendas worldwide. Every country seems to be asking the same questions: How can we build the infrastructure needed to become competitive in AI? How do we leverage AI to drive innovation and economic growth?

AI industrial policies are now widely discussed in world capitals and policy circles. Governments worldwide are releasing strategic plans to participate in the global AI economy and leverage it for economic growth and the advancement of society. Just before leaving office in January 2025, President Joe Biden signed an executive order to advance US AI infrastructure, focusing on large-scale data centres and clean energy facilities (The White House 2025). The UK government recently introduced the AI Opportunities Action Plan, a modern industrial strategy for AI (Department for Science, Innovation & Technology 2025). Similarly, in September 2024, the European Union published a long-awaited industrial strategy aimed at enhancing EU competitiveness, particularly in digital technologies and AI (Draghi 2024). In Japan, the Ministry of Economy, Trade and Industry launched the GENIAC project,[1] aimed at leveraging generative AI to drive economic growth and societal benefits.

Industrial policy efforts are not limited to developed economies. Emerging economies such as Brazil (Ministério da Ciência, Tecnologia e Inovação 2024), India (Panday and Samdub 2024), South Africa (Makumbirofa 2024), Turkey (Ministry of Industry and Technology 2021) and many others — whether large or small — are actively exploring pathways to build AI capacity and participate in the global AI economy.

In this context, AI technologies require a fresh look at the literature and lessons from past industrial policy experiences, including the diversity of policies, structural linkages and government interventions. What is needed is a modern set of policy instruments that are flexible, responsive and grounded in experimentation, learning and continuous improvement. Given the rapid pace of technological advancements, they should be designed to respond to the evolving nature of technology.

The growing focus on AI and industrial policy highlights the need for well-crafted policies tailored to local contexts, resources and institutional capacities. These policies must ensure that efforts are sustainable and aligned with broader economic and societal goals. While the ambitions are clear to build infrastructure, foster innovation and achieve competitiveness, there is no silver bullet. A carefully designed policy road map, however, can provide the direction needed. This paper seeks to present the big picture, offering key insights and actionable ideas without getting into the granular details of each policy proposal. While each proposal deserves a detailed report of its own, the purpose here is to provide a starting point that inspires thought and action.

What Exactly Is Industrial Policy?

There is a lot of discussion about industrial policy these days. Policy makers worldwide embrace the concept, while academics, researchers and think tanks produce articles and reports, offer recommendations and host conferences (Millot and Rawdanowicz 2024; Project Syndicate 2023). Industrial policy means different things to different people, and while the term is widely used, there is no single way of describing it.

1 See www.meti.go.jp/english/policy/mono_info_service/geniac/index.html.

In simple terms, industrial policy refers to any state intervention promoting specific industries or activities. A more comprehensive definition would be "any type of intervention or government policy that attempts to improve the business environment or to alter the structure of economic activity toward sectors, technologies, or tasks that are expected to offer better prospects for economic growth or societal welfare than would occur in the absence of such intervention" (Bulfone 2023).

Industrial policy can be defined in different ways. Antonio Andreoni and Ha-Joon Chang (2019) describe it as not merely an intervention but more of an "institutionally structured process" that addresses these core issues: managing structural interdependencies, building supportive institutions, aligning policies and handling conflicts that arise from these efforts.

More recently, industrial policy has been described as a government strategy aiming to transform the structure of economic activity to achieve public goals. These goals often include stimulating innovation, boosting production and fostering economic growth, but they can also extend to promoting green transition, creating good jobs, boosting lagging regions, strengthening exports or encouraging import substitution. A defining feature of industrial policy is its focus on structural change, which requires deliberate choices and prioritization (Juhász, Lane and Rodrik 2023).

Thus, industrial policy extends beyond a single policy or institution. It is a dynamic process of "institutional engineering" (Bulfone 2023) that shapes the economy by designing, implementing and enforcing coordinated packages of interactive measures. Like completing a puzzle, each piece is strategically aligned to balance incentives and capabilities to enhance industrial competitiveness.

Industrial Policy: Past, Present and Future

Industrial policy has a long and complex history, characterized by passionate advocates and equally fierce critiques. Its role can be controversial, sparking debates about the merits and drawbacks of government intervention in the economy. For instance, East Asian countries are considered some of the most significant examples of industrial policy, demonstrating how strategic government initiatives can promote economic development and structural transformation. Different schools of thought draw different lessons from East Asia's experience. On the one hand, political science scholars typically regard industrial policies as integral to the region's success, a perspective supported by extensive comparative political science literature and echoed by some economists. On the other hand, many mainstream economists have historically been skeptical of the role of industrial policy, challenging the East Asian miracle as an isolated case and pointing to the failures of similar policies elsewhere. This skepticism has contributed to critiques of the role of government in industrial development. However, emerging research challenges this narrative. New empirical studies offer a deeper analysis of East Asia's diverse experiences, offering valuable insights into the nuances of policy design and implementation (Juhász, Lane and Rodrik 2023). These success stories hold essential lessons that can inform future industrial policy strategies, particularly in emerging sectors such as AI.

When people discuss industrial policy, Japan often comes to mind first. Japan's story is particularly significant because, in the 1950s, few believed that the country could recover from the devastation of the Second World War. Yet Japan not only recovered but also led the industrial policy debate, surpassing even Europe, which had more established and better-understood policies. Japanese industrial policy was sectoral in nature, primarily focusing on restructuring and fostering technological development, particularly in "knowledge-intensive" industries.

In the 1960s, Japan's industrial policy centred on selecting potential winners. The government promoted emerging industries through close cooperation with the private sector. Sectoral policies were instrumental in driving the growth of

several key industries. Japan recognized the need for a strong auto industry but understood that it required time to grow and become competitive (Chang 2002). So, the government stepped in to support the domestic growth of the auto sector.

Japan's industrial policy used various tools to achieve its goals, including subsidies, R&D support, lending programs and special tax incentives (Willams 1993). High tariffs and strict controls on foreign investment ensured significant profits for domestic carmakers, while foreign companies such as General Motors and Ford were asked to exit the market. During this period, Japanese industry focused on improving its technological capabilities and began investing in R&D. These strategies helped Japan become a global industrial powerhouse (Chang 2002).

Another prominent example of industrial policy following Japan is South Korea. Although South Korea's industrialization began later than Japan's, its rapid economic development has positioned it as a significant player in the global economy. This success was built on strong, formalized, government-driven policy planning. The government played a central role in orchestrating the country's catch-up process and guiding its industrialization efforts. South Korea's rapid transformation from a low-skilled economy to a high-tech nation led to remarks such as, "No nation has tried harder and come so far so quickly, from handcrafts to heavy industry, from poverty to prosperity, from inexperienced leaders to modern planners, managers, and engineers" (Vogel 1991, 65).

This transformation was driven by robust, government-led policy planning and decision making. The Korean government effectively orchestrated the initial catch-up process and later shifted its focus to technological infrastructure, R&D and local innovation to foster the development of competitive industries and promote international competitiveness. South Korea's commitment to technology-driven growth, combined with private sector investments in high-tech industries, enabled the country to emerge as a global leader in semiconductors, liquid crystal displays and telecommunications equipment (Kilic 2014).

Beyond Japan and South Korea, many other countries — including England, Germany and the European Union, and several in East Asia such as China, Singapore and Taiwan — have drawn inspiration from their success and have used industrial policies to catch up, develop industries and boost competitiveness (Andreoni and Chang 2019). Latin American countries have also embraced industrial policy with similar goals. Some of these initiatives were successful while others were not.

Among all these examples, the United States has been the most controversial. There is a common belief that the United States has never implemented an industrial policy (Taylor and Montera 2021). However, during its early stages of economic development as a middle-income country, the US government actively intervened in targeted industries. Despite lacking a formal industrial strategy, it employed various ad hoc measures to complement free-market capitalism. The US government established institutions to promote competition and used trade protection extensively to support and nurture infant industries (ibid.). Key sectors such as defence and the internet (via the Defense Advanced Research Projects Agency) clearly benefited from targeted government intervention, which laid the groundwork for long-term industrial growth and competitiveness (Yerger 2024).

Industrial policies reached their peak just before the 1980s, as skepticism about government intervention began to rise. By the 1980s, the debate over industrial policy got heated, reflecting a deeper, long-standing controversy over the role of government versus free markets. Neoliberalism called for shrinking the state, deregulating as much as possible, curtailing antitrust enforcement, and accepting higher economic inequality as a reasonable trade-off to stimulate markets as "job creators" based on the assumption that markets would deliver better outcomes than governments (DeLong 2024). It also promoted trade openness as the key to growth, suggesting that those countries that liberalize imports and focus on exports would grow faster, with quicker liberalization leading to better development prospects. This approach discouraged industrial policies, contributing to deindustrialization in many countries (Khor 2008). The World Trade Organization (WTO) and trade policy makers treated industrial policy as taboo, rejecting market-shaping policies aimed at advancing national interests and values (Kilic 2024).

Yet the consensus today is that not only did neoliberalism fail spectacularly, but the global trading system also fell short, leading to widespread disillusionment with globalization (Serra and

Stiglitz 2008). Nothing played out as neoliberalism's advocates envisioned, unless one counts the sharp increase in wealth and income inequality over the past four decades.

In a recent interview, US Treasury Secretary Janet Yellen, a key figure in the Biden administration, advocated for industrial policy, criticizing globalization without safeguards for failing to benefit most people. She argued that "unfettered adherence to neoliberal principles" had not promoted prosperity for many Americans and noted that other countries have adopted strategies for more equitable growth and stronger social safety nets (Rappeport 2024).

Industrial policy is no longer taboo — it is now the buzzword in Washington, DC, and beyond. Once linked to European socialists, Asian tigers or developing countries, it has become a key tool for governments shaping strategies around (re)industrialization and digitalization. Governments increasingly use industrial policy tools to shape their economic strategy, marking the beginning of a new and rapidly evolving era.

In recent years, governments have increasingly embraced industrial policies to tackle societal challenges such as COVID-19, financial crises, climate change, building green economies, fostering the development and diffusion of new technologies, and improving a country's overall technological competitiveness (Bulfone 2023). Industrial policy can also be more strategic and mission-oriented, as seen in examples such as the technological catch-up of East Asian economies in the 1990s (Andreoni and Chang 2019) or the drive to build vaccine manufacturing capacity in the post-COVID-19 era. These policies are designed to achieve strategic long-term goals, targeting key sectors to boost national competitiveness and resilience.

Today, terms such as "industrial policy for a green economy" or "industrial policy for AI" dominate policy discussions, reflecting its growing importance for future economic growth and competitiveness.

Building Competitiveness in AI: Is There a Path Forward?

Since the release of ChatGPT in 2022, AI has captured global attention. ChatGPT not only brought AI into our lives but also onto the agendas of policy makers. It has created anxieties around national competitiveness, the future of jobs, the economy, climate and livelihoods, and has become a top priority in global economic policies.

The AI debate remains heated. While headlines focus on breakthrough technologies and long-term risks — including social disruption, the future of jobs, geopolitical competition, and governance issues such as AI ethics, regulation and global governance — policy makers are focused on more fundamental issues. These include building digital infrastructure for local capacity, developing skills and the workforce, and leveraging AI technologies to drive economic growth.

AI companies are not making the situation better. They are playing a double-sided game, warning about AI's long-term risks while rolling out new technologies and promoting AI's potential for boosting productivity and growth. They succeeded in creating momentum for AI adoption and diffusion. However, building infrastructure and competitiveness in AI demands policies beyond mere adoption and diffusion.

As a starting point, it is crucial to develop a better and clearer understanding of AI. AI is not just a single technology; large language models (LLMs) such as ChatGPT are only a piece of the puzzle. In fact, AI has been a part of our lives for years, from algorithms recommending what to watch on Netflix to systems used in health care, finance and transportation.

Whenever someone searches on Google, AI works behind the scenes to refine the results. When Siri responds to a question through an iPhone, or someone adjusts their home's temperature via an app, that is AI at work. AI also shows ads based on data collected from a user's online and sometimes offline activity, helps manage city traffic systems and detects banking fraud.

AI is an approach to computing that relies on a combination of underlying technologies and inputs (choice of model, available data, technology, quality of prompt). These include machine learning, neural networks and other methods that allow computers to process information, learn from it and make decisions. So, when we talk about AI, we need to go beyond the buzzwords and recognize the layered system of technologies that powers it.

The core of AI is key building blocks such as raw computing power and large data sets used for training AI models. Computing power, often provided by advanced semiconductors, and data are crucial for training and running AI systems. AI models are mainly designed, trained and refined using cloud-based infrastructure and tools. These include multiple layers of technologies, each with a distinct role in facilitating AI innovation and adoption (Stryker and Kavlakoglu 2024).

Only a few big tech companies own these resources, leaving most, particularly small and medium-sized businesses (SMBs), dependent on their infrastructure. It is difficult to envision an infrastructure that operates independently of big tech. Network effects, limited access to data sets, the high cost of computing needed for inference at scale, the lack of a viable business model and current economic conditions (including high interest rates) create a significantly uneven playing field for AI (Widder, Whittaker and West 2024). With few exceptions, nearly every start-up, new entrant and AI research lab depends on Microsoft, Amazon and Google for computing power to train their AI systems and extensive networks to deploy and market AI products (Kak, West and Whittaker 2023).

While openness could, in theory, foster innovation by enabling modifications to existing models, systemic barriers often prevent such experimentation from becoming marketable solutions. For instance, systems such as Meta's Llama 3, promoted as "open," offer little more than an application programming interface, or the ability to download models subject to distinctly non-open use restrictions. The "open washing" of fundamentally closed systems misleads companies and policy makers (Widder, Whittaker and West 2024, note 42).

Some governments prioritize expanding access to large-scale advanced computing resources as part of their national AI strategies to make AI research more accessible. For instance, the US National Artificial Intelligence Research Resource (NAIRR) provides AI researchers and educators with access to high-performance computing, data and educational resources. NAIRR, backed by the National Science Foundation and the White House, seeks to establish a shared infrastructure to support AI innovation and economic growth in the United States (Bates 2024).

Similarly, the European Union has launched the AI Factories Initiative, which aims to create AI-specific infrastructures that support industry, research and academia. The goal is to bring together the necessary ingredients — computer power, data and talent — to create cutting-edge generative AI models.[2]

These programs reflect a strategic move to build sovereign AI computing capacity to reduce reliance on big tech for the infrastructure essential to AI research. The real question is how effectively they are designed to achieve that goal. The NAIRR initiative, for instance, seems more like an extension of industry-dependent resources than a genuine attempt to create infrastructure that could challenge or reduce the centralized power of big tech companies.[3]

The EU approach has also been criticized for overlooking the structure of the AI global value chain, which operates not as an open market but as a highly structured sphere. These are not simply "factories," as the EU policy makers imagined, but tightly controlled ecosystems where big tech companies call the shots. Even if European start-ups train models on EU supercomputers, they are ultimately drawn to big tech clouds to meet demand. Building advanced AI models on top of raw compute requires specialized engineering resources and programming expertise. Big tech companies offer a full suite of computing services and control every stage of the chain through concentrated data, AI talent and digital infrastructure. This enables them to shape the entire process and dictate which AI models and applications are developed and how they evolve.

Many other governments depend on tech companies for infrastructure or underestimate the costs and complexity of training advanced AI models, chasing a pipe dream of developing their own

2 See https://digital-strategy.ec.europa.eu/en/policies/ai-factories.

3 Amba Kak, Brittany Smith, Sarah Myers West and Meredith Whittaker to members of the NAIRR Task Force, October 1, 2021, https://ainowinstitute.org/wp-content/uploads/2023/06/AINow-DS-NAIRR-comment.pdf.

infrastructure. Still, many world leaders and policy makers advocate for large-scale, general-purpose AI implementations as the only way forward (Goujon 2024). In doing so, they overlook the dangerous levels of complexity and the excessive control and financial returns this approach would grant to big tech. As a result, most of these AI strategies end up reinforcing dependencies on major cloud computing platforms: Amazon Web Services (AWS), Microsoft Azure and Google Cloud.

Given these dependencies, these companies effectively steer framework development to standardize AI construction, ensuring compatibility with their own company platforms. This forces developers to create AI solutions that integrate with the proprietary ecosystems of those dominant platforms, further consolidating their power and control over the global AI market.

Most AI strategies or AI industrial policies end up being AI adoption strategies, heavily reliant on the Big Three tech companies. To further complicate the picture, there is also a stronger push for building digital public infrastructure and adopting AI in the public sector, with ambitions to transform critical areas such as education and health care. However, this approach risks driving fragmented digitization instead of prioritizing public attributes, functions and ownership of digital infrastructure (Kaltheuner et al. 2024). In their October 2024 Ministerial Meeting on Industry, Technology and Digital, Group of Seven (G7) leaders endorsed this direction, highlighting "the importance of cloud computing and other tools for providing digital public services and fostering digital public infrastructure" (G7 Italia).

Similarly, the UK government recently released an ambitious AI action plan designed to ensure that the United Kingdom remains in control of its future in AI rather than simply adopting overseas technologies beyond its influence. The plan prioritizes building more AI infrastructure, expanding access to training data, and accelerating AI adoption across public and private sectors. It proposes a 20-fold increase in AI computing power under public control by 2030, including building a new "supercomputer" and a national data library comprising state-controlled data available to researchers and companies. Apart from wide adoption for public services, the plan also introduces "sector champions" to promote AI adoption across key sectors such as banking and the creative industries (Department for Science, Innovation & Technology 2025). While these policies appear promising on paper, whether they will effectively foster a truly homegrown "sovereign" AI ecosystem in the United Kingdom remains to be seen.

When shaping policy, it is crucial to consider the underlying characteristics of the AI market. The prevailing "bigger-is-better" approach to AI development relies heavily on larger data sets, greater computing power and larger model sizes. The larger the model, the more resource-intensive it becomes to train and calibrate, making it increasingly difficult to develop it independently of dominant platforms (Widder, Whittaker and West 2024). In the United Kingdom, for instance, the government aspires to create homegrown AI champions on the scale of OpenAI. However, the country faces significant hurdles in developing an effective OpenAI alternative. The funding challenges make it difficult for UK start-ups to secure the substantial capital available to leading AI companies (Browne 2025).

Whether designing industrial policy or building digital public infrastructure, policy makers must be realistic and mindful of the AI ecosystem, existing market concentration and the power of these companies. Efforts and investments should focus on creating systems independent of these dominant platforms, prioritizing autonomy over scale. They should be supported by comprehensive policy strategies that address the challenges of relying on their infrastructure, models, data and systems, focusing on creating big tech-independent frameworks. It is important to promote industries that serve the broader interests of the public and the country, not just a few companies. Building resilient, independent systems is not just a policy choice but also a critical step for ensuring a fair, equitable and just AI-driven future.

The Data Centre Dilemma: Infrastructure for Whom?

Over the past year, discussions around AI infrastructure and investment increasingly focused on data centres. Hardly a day passes by without news of companies (mainly Microsoft, Google and AWS) or governments (whether the United

States, European Union or oil-rich economies) announcing a new data centre investment across the world. To illustrate, during the Kenyan president's 2024 visit to Washington, DC, Microsoft announced a comprehensive US$1 billion digital investment package with a state-of-the-art data centre (Microsoft Source 2024). Promoted as the largest single private-sector digital investment in Kenya's history, it was presented as a driver for economic development across East Africa. It is interesting how data centres have quietly transformed from obscure server warehouses in industrial parks to critical infrastructure for digital society. This transformation calls for a closer look into their role, if any, in developing AI infrastructure and fostering AI competitiveness.

Back in 2019, *The New York Times* described modern data centres as sprawling, secretive facilities, often the size of a football field or larger, housing countless racks of hundreds of thousands of computers. These highly secure buildings, with bulletproof doors and fireproof walls, were rarely accessible to outsiders. Over time, these data centres have evolved to become the engines of AI technologies (Lohr 2019).

According to McKinsey & Company, global demand for data centre capacity is projected to rise annually by 19 to 22 percent between 2023 and 2030, primarily driven by the growing computational needs of AI and cloud-based applications (Srivathsan et al. 2024). These facilities are now indispensable to the infrastructure powering the digital and AI-driven economy.

By way of illustration, most of Microsoft's AI revenue in 2024 has been generated through its cloud services, especially with significant demand for its Azure platform. To support this growth, Microsoft increased its capital expenditures substantially, investing US$14 billion in Q3 alone — a 50 percent increase from the previous year — primarily for data centre expansions to support the infrastructure needed for AI workloads and cloud growth (ibid.). This investment reflects Microsoft's strategy of building extensive AI infrastructure, driven by strong enterprise adoption of its AI-powered tools and services, including models such as Azure AI and GitHub Copilot (ibid.).

In today's surveillance-capitalist economy, dominated by a handful of powerful tech companies and China as a major tech exporter, industrial policy discussions increasingly focus on bilateral interactions between governments and these corporate giants. These interactions are typically vertical, characterized by a significant power imbalance that favours tech companies. Two major factors give these firms the upper hand: their vast computational power and ability to choose from multiple destinations eager to host tech investments. This leverage enables tech companies to exploit competitive tensions among governments, driving them to outbid one another with more generous subsidies, tax breaks and political concessions to secure tech investments. This dynamic also shapes ongoing discussions on digital public infrastructure, especially with the rapid expansion of data centres worldwide. Governments compete to host these data centres, creating dependency on tech infrastructure while undermining their climate goals, increasing energy and water usage, and weakening their regulatory power. Tech companies exercise control at the architectural level of the digital ecosystems, particularly in developing countries. Ultimately, this cements the surveillance-capitalist business model, consolidating tech companies' power and elevating them to state-like or quasi-state entities, marking a structural shift in the locus of global power (Khanal, Zhang and Taeihagh 2024).

Data centres are often presented as essential infrastructure for building AI capacity, but their contribution to local economies and innovation systems is minimal. In reality, data centres are private infrastructures primarily serving the operational needs of large tech companies. While they may create some short-term construction jobs, they contribute little to long-term economic development, NIS or the transfer of technical skills to local industries.

Moreover, data centres come with significant environmental costs. They consume vast amounts of energy to power and cool the hardware required to train and operate AI models, contributing disproportionately to carbon emissions and worsening climate change. As AI models grow more complex, energy demands are expected to increase, raising further concerns about sustainability and resource use.

Data centre investments are often promoted as an AI innovation strategy and sometimes described as "sovereign" simply because they are located within a country. Yet they are owned and controlled by tech companies that hold the "kill switch" (Berjon et al. 2025). It is not enough to simply build more data

centres — they must be constructed with specific uses to contribute to national innovation strategies.

When governments invest in data centres, they should consider introducing conditionalities, standards and guardrails, including measures mitigating environmental harms and stimulating local industrial capabilities, such as developing the workforce or enhancing skills.

In some cases, hosting a data centre is viewed as the only industrial policy strategy for countries, particularly smaller ones that lack the scale for the data and compute resources required to develop large AI models. This view is shortsighted. As noted earlier, the AI landscape is highly uneven and dominated by a few companies. However, this does not mean that smaller countries must rely solely on those companies or build their AI infrastructure dependent on them. Whether it is a large or small economy, there are pathways to establish some degree of digital sovereignty and develop national AI models, even on a modest scale. The current fixation on large models leads back to big tech, reinforcing the existing power imbalances. With the right policies and a clear vision for building strategic independence, countries can break this vicious cycle and foster sustainable and self-reliant AI ecosystems.

NIS

The revival of industrial policy has inspired extensive policy discussions among economists, digital policy specialists and public policy experts on how much countries can use "old but new" industrial policies to build infrastructure, capacity and competitiveness in AI. Each industrial policy discussion, whether focused on manufacturing, green transition or AI, comes with its own unique set of stakeholders, internal tensions, power dynamics and underlying technological conditions (Estevez 2023), much like the AI landscape itself. Earlier sections addressed some of those issues, including the "old but new" concept of industrial policy, power dynamics at play and underlying technological conditions of AI. This section shifts the focus to the question of "how" and outlines key policy proposals.

In this context, recent years have seen a growing understanding of industrial policy and an expanding literature that provides rigorous evidence on how it works rather than debating whether it works. Modern industrial policy is inherently complex and often consists of many distinct outward-oriented policy levers. Innovation policy, a mature field that overlaps with industrial policy (Juhász, Lane and Rodrik 2023), offers valuable frameworks and lessons for developing better insights into what works and under what conditions.

A system of innovation typically outlines the key economic, social, political, organizational and institutional factors that impact its development and dissemination. Collectively, these elements shape how innovations are generated and embraced within an economy.

Bengt-Åke Lundvall introduced the term "innovation system" in 1985 to describe the interaction between firms and institutions involved in knowledge production. He emphasized that innovation emerges not from isolated actors but from the relationships between various organizations, including basic research institutions, applied research centres, universities (as knowledge producers) and industries (as knowledge users). This perspective underscored the importance of the interplay between supply and demand in driving innovation (Kilic 2014).

Modern innovation theory builds on this concept by focusing on the interactions between different actors and institutions involved in the innovation process. Instead of treating these fields separately, it combines them into a single policy framework. This approach also focuses on the broader cultural landscape of institutions engaged in scientific research, knowledge dissemination, employee education and technology development. This includes policy frameworks (regulations, laws, standards) and government investments in infrastructure (Caracostas 2007).

A country's innovation success largely depends on an effective NIS, which includes various sectors that extend their influence through research, entrepreneurial activities or policy making. A crucial aspect of this system is the strong connection between learning and innovation, shaped by institutional frameworks, established practices, standards and rules that guide interactions among these groups (Kuhlmann 2003).

It is widely recognized that no two innovation systems are identical, just as no two societies are the same (Edquist 2005, 182). The process of building infrastructure and distributing technological innovation varies from country to country, as does the role of policy in supporting it. This is where the NIS framework becomes relevant: the overall design of national innovation policy should address technological innovation comprehensively, considering each country's unique needs and capabilities.

The essence of the NIS lies in its dynamic nature, which is shaped by different institutional factors, such as laws, social and cultural norms, routines and habits, which guide the interactions among innovation actors (Nelson and Rosenberg 1993).

Modern innovation policies combine science, technology and industrial policy and are driven by five essential processes: knowledge, supply of skills, demand for innovation, financing of innovation and shaping of institutions (for example, laws and regulations). Rather than functioning as substitutes, these elements work together to create and sustain technological progress (Fagerberg and Hutschenreiter 2020).

The NIS approach leverages existing knowledge to build on skills, technology and connections while tailoring strategies to a country's unique needs and circumstances. It is grounded in realistic, achievable goals rather than policies that look good on paper. A robust NIS in AI depends on how effectively countries can build a strong AI technology ecosystem, covering everything from basic research to end-user applications.

It is not an easy task to build support for an innovation system. There is no doubt that there would be resistance from established economic interests, neoliberal scholars and others skeptical of government-led initiatives. They may question the need or benefits of industrial policy on grounds such as a lack of infrastructure, a small economy or a lack of skills. The critical first step is achieving consensus among policy makers and stakeholders on the importance of this mission and the necessity of technological independence. Equally important is understanding and effectively engaging with the existing structures and institutions central to local innovation. Developing a whole-of-government approach to AI within the NIS framework is crucial for crafting an industrial policy that is both forward-looking and welfare-oriented. This approach can support the domestic industry while addressing social and environmental challenges specific to each country, ensuring that innovation aligns with broader national priorities and societal needs.

To integrate AI within a broader NIS framework, several complementary policy measures can be adopted, including but not limited to:

- → understanding local context and addressing local needs;
- → setting priorities to enhance domestic innovation capabilities;
- → investing in AI R&D;
- → organizational innovation and restructuring of public institutions; and
- → shaping of policies (aligning trade policy with industrial policy and competition).

The following policy measures draw on past success stories and insights from current research. They are intentionally broad and adaptable, encouraging innovative thinking that reduces reliance on big tech. These recommendations can be tailored to align with each country's unique conditions, priorities and goals. They serve as a call to action, urging policy makers to rethink conventional innovation strategies, explore new paradigms and develop frameworks that empower local ecosystems.

Understanding Local Context and Addressing Local Needs

Understanding the local context and addressing specific needs is crucial when designing an innovation strategy. Unfortunately, many policies developed, recommended and promoted globally often lack an understanding of local needs and conditions.

Many tech policies, for instance, are crafted in Europe and then adopted in other countries under a one-size-fits-all model. The General Data Protection Regulation (GDPR) exemplifies this trend. As a pioneering privacy regulation, the GDPR quickly became a global template. However, many countries replicated it in their legislation without tailoring it to their specific contexts. This led to limited enforcement as many countries lacked the institutions, legal tools and stakeholders needed for effective enforcement.

The much-celebrated "Brussels effect" has, in many cases, turned out to be hype, undermining the significance of the GDPR as a groundbreaking framework for privacy rights and protections. While GDPR-style laws are widespread, there is no/limited enforcement against big tech companies. Data free-flow provisions in trade agreements and practices often shield these companies from local privacy regulations, leaving domestic companies to bear the compliance burden. This creates an uneven playing field, stifling local innovation while enabling big tech to dominate and shape the digital ecosystem in these countries.

The same trend is emerging with AI-related regulations and strategies. As more countries pursue AI regulation or develop national AI frameworks, they risk adopting strategies or legislation that may not fully align with their AI ecosystems and future prospects and may create an uneven field for local innovators.

Industrial policy is described as a search process that requires embeddedness — a close collaboration between government and local industries without allowing vested interests to dominate or exert undue influence. This process is filled with uncertainties, especially when pursuing highly ambitious goals, as governments often lack detailed knowledge of the industry and capabilities and the techniques available to solve them. To address this, it is recommended that governments and businesses engage in meaningful dialogue to gather information, assess capabilities and create synergies with other policies (Aiginger and Rodrik 2020).

Each country has different capabilities and infrastructure regarding AI. Policies should be based on these realities while addressing the specific challenges that a country faces. Industrial policy seeks to provide institutional solutions to those challenges.

Rather than simply adopting AI technologies or digitalizing public services relying heavily on the infrastructure of dominant companies, countries should consider developing policy solutions that reduce their near-total dependence on big tech infrastructures, R&D resources, skills and labour, and value chains underpinning all digital experiences, whether AI or broader digital services. By doing so, they can work toward a more independent and resilient digital ecosystem.

It is essential to consider each country's unique contextual and institutional factors. Even if two countries import the same technologies, they are unlikely to achieve similar progress due to differences in local institutions, capacity, skills and social structures. The NIS involves not only acquiring technology but also organizing, coordinating and managing related activities within a tailored institutional framework. A country can build its social capacity by working within its legal, economic and scientific institutions, adapting these structures to meet its needs and realities (Odagiri et al. 2010).

While industrial policy will naturally differ across countries at different stages of development, there are opportunities for mutual learning and shared insights. In the context of AI, this involves understanding the AI ecosystem, addressing technological dependencies, and setting priorities and goals that align with local realities to minimize and ultimately reduce deepening reliance on big tech companies.

Setting Priorities to Enhance Domestic Innovation Capabilities

Industrial policy is a flexible but complex tool. The goals of industrial policy differ widely and require different strategies. If the objective is innovation, then R&D incentives are essential. If the goal is building an AI-skilled workforce, strategies for skill building are needed — focused on services, STEM (science, technology, engineering and math) education, linking university research to industry, and support for SMBs. If it is about building public infrastructure for AI, the focus shifts to addressing infrastructural dependencies, reducing market concentration and promoting public good. There is no magic formula; each priority demands a unique approach.

Creating future jobs is often highlighted as a critical goal for industrial policies for AI. For example, in the United States, efforts focus on workforce development to prepare both current and future workers for AI adoption across all sectors, with a strong emphasis on upskilling in literacy, numeracy, problem-solving and promoting lifelong careers in AI.[4]

European policy makers also prioritize AI expertise to address skills and labour shortages. Their

4 See National Artificial Intelligence Advisory Committee (2023).

plans include building infrastructure, fostering public-private partnerships, strengthening academia-industry collaboration and enhancing STEM education (focusing on increasing female participation in tech fields) (Pal 2024).

Contemporary industrial policies often prioritize AI skill development and STEM education to build an AI workforce for the future. While the creation of an AI workforce is an important goal for industrial policy, it must be aligned with local needs and priorities rather than narrowly focusing on high-tech jobs at the expense of other essential occupations. Countries still need doctors, teachers, nurses, plumbers, truck drivers and carpenters, which support the overall functioning of the national economy.

Another critical point to consider is that misaligned market incentives with societal objectives often distort the innovation process. For instance, the imperfections of the labour market can create a divergence between the social cost of labour and market wages, which may skew technological development toward automation rather than worker-complementary technologies (Acemoglu 2023).

To ensure sustainable growth, the AI labour market and skills development should be integrated into the NIS framework to develop domestic innovation capabilities. A nuanced approach is necessary to balance market dynamics with strategic public interventions that guide innovation toward broader societal benefits. This approach will help build on existing strengths while addressing gaps in the labour market. Doing so can create a balanced ecosystem of skills and industries, ensuring both economic growth and technological resilience over the long term.

In this context, universities play a crucial role, and building linkages between local industry and universities becomes equally important. Modern innovation theory emphasizes the interactive nature of the innovation process, with universities playing a key role as collaborators. Knowledge-based innovation systems increasingly adopt the triple-helix model, which captures multiple reciprocal relationships between universities, industry and government at various levels. Silicon Valley is one of the most cited examples of the triple-helix model of innovation, with each helix building upon and reinforcing the other. Stanford University played a crucial role in the region's development, supported by government initiatives that enabled Silicon Valley to become a global innovation hub. This synergy attracted and circulated talent and technology internationally, making it a leader in innovation (Etzkowitz and Zhou 2017).

Coordination failures between university research and industry can distort the direction of innovation and hinder the effective translation of research into technological innovations. Bringing innovation from the research lab to the market often involves collaboration among diverse stakeholders, including researchers, companies, universities, government agencies, angel investors, venture capitalists and other firms along the supply chain. However, companies often struggle to find the right partners — whether a university, a research institute or an investor — with the necessary expertise, resources and trustworthiness. These network failures prevent promising innovations from reaching the market, stalling progress and limiting innovation opportunities in the country (Acemoglu 2023).

The US government's strategy of investing in research centres that bring together publicly and privately funded technologists is widely regarded as a best practice in innovation policy. A good example of this approach is the Advanced Manufacturing Institutes (AMIs), a direct initiative to foster collaborative innovation and production. Building on a tradition of state-sponsored collaborative innovation and production dating back to the 1970s, the AMIs comprise 45 institutes nationwide. They are designed to address network failures, connecting a network of businesses, universities and laboratories. Each institute specializes in specific technology and serves as a hub for a local cluster of companies and expertise. The institutes provide a platform for government leadership and intervention. They play a critical role in bringing partners together, coordinating innovation efforts, certifying competence and trustworthiness, and mitigating concerns about intellectual property (IP) theft. The AMIs have achieved significant success in enhancing network connectivity, lowering the costs of searching for the right partners, addressing collective action problems, developing technology road maps and investing in workforce development. AMIs contributed to the development of resilient, innovative and collaborative industrial ecosystems (Block, Keller and Negoita 2020).

The United States is not the only example of a country with government-driven successful

innovation programs that foster cooperative relationships by bringing together universities, innovators, companies, investors and policy makers. Successful innovation policies that effectively address network failures have been implemented in countries such as Denmark, Finland, Ireland, Israel and Taiwan (ibid.). These programs facilitate shared resources, knowledge exchange and collaborative problem-solving. They also help reduce transaction costs and minimize the risk of technological stagnation, strengthening domestic local capabilities.

The productive innovation policies traditionally applied to manufacturing can also be adopted for AI. They provide a framework for fostering technological advancement, enhancing domestic capabilities, improving workforce skills, creating good jobs and promoting collaboration among key stakeholders. In the context of AI, such programs can be designed to bring together local researchers, universities, technologists, companies and investors to build an equitable infrastructure that provides access to compute power and clean data sets. This framework would promote a collaborative model, empowering civil society, local communities, researchers and local innovators to participate in designing and developing AI systems. In the long run, this would reduce reliance on big tech companies for infrastructure, public services and technological needs.

A strategic policy approach should prioritize educational and institutional capacity building to empower local companies and start-ups to scale responsibly. Government demand can be a powerful driver of local innovation, whether by procuring new AI systems or investing in infrastructure. This requires designing government procurement processes to support local innovation where feasible and prioritizing domestic players while taking into account trade commitments under various agreements. Such procurement policies can create opportunities to level the uneven playing field and promote a more equitable and dynamic innovation ecosystem.

Investing in AI R&D

Economists have long recognized that market forces alone may not distribute sufficient resources to research and innovation, justifying government support for innovation through investment in research infrastructure or R&D tax credits (Acemoglu 2023).

In the early twentieth century, the United States and Germany advanced rapidly in science-based industries, largely because their university systems were highly responsive to the demands of emerging technologies. Similarly, Japanese universities played a crucial role in Japan's early industrialization by helping local industries upgrade their technological capacities. This university-industry collaboration gave Japanese industries a significant competitive edge, setting the stage for long-term success (Kilic 2014).

Basic academic research lays the groundwork for innovation. Historically, there has been a significant divide between academia and industry regarding basic research. Large corporations traditionally prioritized short-term deliverables and patents over fundamental research or academic publishing. However, tech companies have increasingly shifted this dynamic by heavily investing in basic research and academic publishing, breaking from the industry pattern of relying on universities for basic research (Ahmed and Wahed 2021).

This shift highlights a broader issue: it is not only markets, infrastructure and compute power that are dominated by tech companies, but research itself is also increasingly monopolized by big tech, consolidating control over innovation and knowledge production.

The linear innovation model, structured around three stages — basic research, applied R&D and diffusion — operates on the principle that "science invents, industry adapts and society conforms." Universities are considered central to this model, justifying the use of public funds for basic research and R&D activities. While the model has been instrumental in funding basic research, it faced criticism for oversimplifying the innovation process and limiting universities to basic research. It failed to account for the systematic and interactive nature of innovation, ignoring the dynamic relationships between various actors in the ecosystem (de Oliveira 2014).

In the context of AI technologies, basic research is essential, but it cannot be the only focus of R&D efforts. With tech companies increasingly dominating the basic research space, public R&D initiatives should go beyond basic research to support applied research, foster collaboration with the local industry, and address broader societal and economic dimensions of AI development.

The public has a strong interest in ensuring AI models are trustworthy and supported.

There is a clear distinction between private and public interests in AI research. Big tech research increasingly focuses on advancing frontier LLMs, while critical areas such as robustness, interpretability, fairness and security receive far less attention. To address these gaps, public funding should prioritize areas that align with broader societal needs, including interpretability, defensive cybersecurity, benchmarking and evaluations, and privacy-preserving machine learning. These domains are essential for ensuring AI systems are reliable, equitable and secure in their applications (Watney 2023).

AI research demands costly computational resources, including specialized hardware designed to meet the immense demands of large machine-learning models. This creates a compute divide, where tech companies (with their extensive infrastructure and resources) and elite universities (often backed by similar resources or partnerships with tech firms) hold significant advantages over non-elite universities, which lack both (Ahmed and Wahed 2021).

Tech companies and, to a certain extent, elite universities benefit from their ability to recruit top talent and access the large, high-quality data sets essential for training advanced AI models. Without such resources, non-elite universities struggle to contribute to modern AI research. This resource imbalance threatens to undermine the long-term research and training functions traditionally performed by universities, hobbling their ability to sustain innovation and educate the next generation of AI talent.

It has been suggested that governments invest in a "national research cloud" to address the computing divide between tech companies and universities.[5] It is crucial that such infrastructure remains independent of tech companies and promotes public-interest research free from corporate influence. It is also essential to ensure that this investment does not inadvertently become a research subsidy for tech companies (Ingram 2021).

The United Kingdom, for instance, has announced plans to establish a "National Data Library," a comprehensive data set of government-controlled public records. The initiative aims to attract leading AI companies to collaborate with the United Kingdom. It offers access to in-depth, real-world data to drive the development of homegrown AI models. However, beyond the privacy and security concerns already raised (Milmo and Stacey 2025), critical questions remain about who will be the primary beneficiary of this public data. While the United Kingdom appears determined to establish a homegrown sovereign AI ecosystem, the success of this initiative will depend on the adoption and execution of effective complementary policies. With the right strategies in place, the United Kingdom could become an AI success story discussed in the years to come.

Fostering Participatory and Coordinated Governance

Historically, industrial policies have been designed top-down, targeting pre-selected sectors and relying on a standard list of subsidies and incentives. This model was prevalent in countries such as Japan, South Korea, Taiwan and some European countries (Aiginger and Rodrik 2020).

Both Japan's and South Korea's success stories were built on strong, formalized, government-driven policy planning and strong political leadership. In both cases, the governments reorganized themselves under their NIS goals, actively engaged with key stakeholders and recalibrated policies to match their respective stages of development. While there were differences in approaches and specific policies, both efforts were highly structured and well organized.

Nevertheless, modern industrial policies have shifted away from top-down approaches. They are designed to foster sustained collaboration between the public and private sectors to advance productivity and achieve social goals. The design of NIS requires not only well-developed analytical capabilities in policy making but also effective coordination among various actors. Such coordination can help policy makers connect innovation policy with broader strategic goals (for example, addressing societal challenges such as climate change, social inequality or technological resilience). A shared vision or mission can help achieve the necessary coordination in innovation policy (Fagerberg and Hutschenreiter 2020). Consequently, a successful NIS strategy requires

5 Stanford Institute for Human-Centered AI to President Donald Trump and Members of Congress, n.d., https://hai.stanford.edu/national-research-cloud-joint-letter.

the public sector to articulate a clear vision and purpose and prioritize creating collaborative and participatory institutional structures. These structures are subject to continuous monitoring and revision based on outcomes, ensuring that policies remain responsive to changing circumstances and effectively serve their intended purposes.

A good example of this coordinated approach is Finland, an industrial latecomer that achieved significant progress in the twentieth century, particularly in the information and communications technology (ICT) sector. The Research and Innovation Council (RIC), chaired by the prime minister, brought together public and private innovation actors. The council played a crucial role in evaluating policy effectiveness and shaping innovation policy in the country. Finland faced significant challenges with its ICT industry in the early 2000s, particularly with the decline of its national champion, Nokia. The RIC became less prominent than it once was. However, Finland's recent shift toward more cross-sectoral and transformative R&D and innovation programs reinforces the importance of high-level policy coordination. These programs require adaptations in the institutional and regulatory framework to succeed (Fagerberg and Hutschenreiter 2020).

For modern industrial policies to succeed, they must be deliberately sustainable, public-oriented and led by local innovation. These policies should be coordinated as part of a holistic package and implemented in cooperation with government agencies and local industries. Chinese NIS is another powerful example of how strategic government intervention can drive rapid economic diversification and structural change. China has invested billions in sectors such as telecommunications, information technology, car manufacturing and steel. By strategically directing resources and fostering coordination between government, industry and research institutions, China's NIS supported its technological catch-up and built global competitiveness, especially in AI (Lundvall and Rikap 2022). While many countries have tried to copy aspects of China's strategy, they often fall short due to insufficient capital, lack of institutional connections, weak political will or misaligned priorities (for example, focusing on overly ambitious goals such as developing large AI models).

Similar to Finland, Sweden and the Netherlands have institutionalized high-level policy coordination, with the prime minister taking the lead to set the direction and facilitate policy coordination. This kind of high-level coordination extending beyond the remit of innovation agencies has led to the emergence of "whole-of-government" approaches. These frameworks emphasize the importance of policy coordination across various policy areas and organizational boundaries of sector ministries. Such coordinated efforts are especially relevant for contemporary innovation policies, which span multiple policy domains and involve diverse stakeholders. In fact, as innovation policies evolve to address complex challenges and grow more ambitious, effective coordination — extending beyond conventional stakeholders to include academia, researchers and civil society — becomes even more critical (Fagerberg and Hutschenreiter 2020).

Maximizing AI's economic potential relies heavily on access to compute, data, energy and human capital. However, with an unprecedented concentration of capital, data, talent and resources in the hands of a few big tech companies, the narrative surrounding AI and industrial policy has become heavily dependent on these companies. Many policy proposals fall short of offering an alternative vision because doing so requires not only effective policies but also bold and innovative thinking that challenges long-held economic theories and assumptions, along with substantial financial investment and political will.

Governments should not give up in the face of challenges and uncertainty. Instead, they should embrace these complexities as opportunities to shape policies that rebuild the AI ecosystem from the ground up. This calls for bold and decisive political leadership, a "whole-of-government" approach and participatory policy making, where civil society, local communities, workers and researchers can help design AI policies. Starting small, focusing on smaller AI models can provide a more practical and achievable foundation for AI development. Rejecting the blind replication of the US tech model characterized by data extraction, commodification and market concentration creates a space for responsible, equitable and democratic innovation that prioritizes productivity and social goals. Complementary policies, such as IP reform, competition policy, algorithmic transparency and accountability, are critical for shaping industry outcomes and fostering a robust innovation ecosystem. Ultimately, it all comes

down to balancing the need to foster innovation with serving the public interest. Poorly crafted policies can have significant and far-reaching consequences for public interest and digital public infrastructure. They risk concentrating power within existing dominant players, limiting opportunities for local innovators, and further deepening the knowledge and technology gap between big tech companies and small local players.

Formulating and implementing effective innovation policies requires a broad understanding of local contexts. There is no universal, one-size-fits-all strategy that every country can adopt. The application of NIS differs across countries, but the key elements remain consistent. Organizational innovation and a "whole-of-government" approach can be transformative for the public sector, not necessarily through digitalization alone but through governance and regulation of innovation. It requires rethinking organizational structures, improving processes and developing policies based on new narratives tailored to each country's unique challenges and opportunities.

Shaping of Policies: Aligning Trade Policy with Industrial Policy and Competition

Another critical component of NIS is its institutions, which include policies, rules and regulations designed to support the country's innovation goals and priorities. Modern industrial policies employ a dynamic mix of policies and regulations. Ensuring policy alignment is crucial for success. In recent years, the "whole-of-government" approach has become increasingly important in addressing complex policy challenges, such as innovation, competition and development. Applying this approach to AI innovation could prove instrumental in addressing some of the pressing challenges governments face.

One of these challenges is the market concentration in AI and the growing influence of AI companies in shaping technological, political and policy landscapes across borders. For big tech, innovation often serves as a tool for maximizing profits or extending influence. With only a few companies controlling essential digital infrastructure, data flows and computing power, meaningful progress requires addressing this concentration of power.

The success of industrial policies depends heavily on their ability to build a digital ecosystem that is independent of US or Chinese tech giants. This is why it is crucial to ensure AI remains open and competitive. Countries can leverage their existing antitrust powers to investigate and prohibit unfair and anti-competitive practices such as self-preferencing, tying, exploiting customers and restricting access to key inputs. Existing laws already cover many of these monopolistic behaviours, and cracking down on them would protect the ability of new entrants to challenge tech giants, driving innovation and expanding choices for businesses and consumers.

Structural interventions (for example, blocking anti-competitive mergers or imposing binding conditions such as divestment of assets) are more effective than behavioural remedies, which focus on regulating a company's behaviour rather than changing its structure. They are often complex to monitor, easy to bypass and quickly become outdated. Competition authorities worldwide, including those in Africa, Asia, Australia, Canada and Latin America, have the power to block mergers or impose conditions to prevent dominant tech companies from solidifying their control over AI markets through mergers and acquisitions of small players (von Thun and Hanley 2024).

Competition policy should not function in isolation but rather align with a country's industrial and trade policies, ensuring it is not treated as an afterthought. Effective competition policy requires striking a balance between short- and long-term priorities, price effects versus investment incentives and consumer interests versus local industries. Yet conventional competition policy often fails to fully address these tradeoffs, as it remains grounded in a neoliberal framework that prioritizes productive efficiency and relies on outdated tools to maximize the "narrow concept" of consumer welfare, often prioritizing consumer interests over broader national economic goals. It presumes that competition naturally delivers low prices, innovation and optimal levels of competitive investment, with limited scrutiny of whether this holds across sectors, types of investment or innovation landscapes (Caffarra 2024).

Integrating competition policy into national innovation strategies can establish new parameters beyond the outdated consumer welfare standard. A competition policy that primarily targets consumer welfare may conflict with the industrial policy that fosters productive and dynamic industries (Aiginger and Rodrik 2020). Aligning competition policy

with a country's innovation agenda allows it to evolve into a tool that fosters both innovation and economic development, making it a more integral part of national economic policy. When carefully designed, industrial and competition policies can work together to foster innovation, market fairness and sustainable development. Without such efforts, countries risk remaining participants rather than creators in the digital economy.

In addition to competition policy, trade policy plays a critical role in shaping economic strategies, particularly in industrial development and technological progress. Historically, trade policy has been a key component of industrial policies throughout the twentieth century. However, in the context of AI industrial policy discussions, its significance has been largely overlooked. This can be attributed to several factors, including the complexity of trade policy, the lack of depth in discussions on digital technologies, and the tendency to sideline trade issues because they are seen as too technical or not popular. Trade policy and its connection to industrial policy received more attention after the release of the Draghi (2024) report on the future of European competitiveness.

The Draghi report outlines ambitious measures to address Europe's economic challenges, including a large-scale proactive industrial policy, an innovation-driven competition policy and the strategic use of state aid. It also emphasizes aligning competition and trade policy with the European industrial strategy through careful, case-by-case analysis rather than adopting broad, generic positions (ibid.).

While the report offers valuable insights, a solid critique of the EU regulatory framework and bold policy proposals, it falls short regarding trade policy. Although it acknowledges the importance of trade policy — a positive step — it remains rooted in an outdated neoliberal perspective on global trade. For instance, it recommends maintaining low trade barriers for digital goods, services and infrastructure with the United States to ensure access to the latest AI models and processors. While such low barriers may favour big tech companies — especially those wary of European regulations on privacy, workers' rights, competition and democracy, often dismissed as non-tariff barriers — it is unclear how this approach aligns with Europe's industrial strategy or helps the European Union reduce its reliance on big tech's dominance in the AI market.

In fact, industrial policy and the neoliberal trade agenda are fundamentally incompatible. Trade policy has traditionally been designed to restrict the very tools on which industrial policy depends. Measures often dismissed as "trade barriers" by companies are, in fact, essential for industrial policy (Kilic 2024). The neoliberal global trade system operates with a winner-takes-all mindset, limiting the policy space countries need to develop industrial strategies that protect workers, citizens, the environment and democracy (Fraser 2017).

Since the 1980s, the neoliberal consensus has not only marginalized industrial policy but also shaped global trade policy. Trade agreements dismantled barriers to trade and financial flows, reduced regulation and minimized government involvement in the economy. Institutions such as the WTO and trade policy makers rejected industrial policy, viewing market shaping for national interests and values as incompatible with their framework.

Milton Friedman, often regarded as the most prominent father of neoliberalism, framed the dynamic clearly: the market must dominate and democratic institutions must recede. Instead of democracy regulating the market, the market was tasked with regulating democracy. Politicians and policy makers internalized this mindset, learning to operate within a system where the absence of rules became the only rule (Zuboff 2022). For decades, this corporate-centric approach has resulted in a trickle-down mindset shaping trade policy making, turning it into a tool to liberalize and deregulate markets to benefit big players and their interests. Policies were crafted from a consumer welfare perspective, emphasizing the utilitarian benefits of market liberalization, and were executed in ways that favoured large corporations.

Structural adjustment loans, foreign aid and WTO regulations require countries to reduce and — in some circumstances — eliminate many of the very industrial policy instruments that have proven effective (Schwarzenberg 2024).

As industrial policy makes its comeback, long-held assumptions about trade policy also need revisiting and rethinking. Effective trade policy today must address the realities of the competitive landscape, including the disadvantages workers face due to digital technologies, market concentration and unfair competition. It requires policy space and flexibility to support the digital transformation of economies.

Under the Biden administration, the United States has shifted from neoliberalism toward a more integrated trade and competition policy approach, focusing on improving resilience and curbing excess market concentration. The administration had adopted a "whole-of-government" strategy to ensure that trade and competition policies were proactively aligned and complemented US industrial policy, especially in the context of the digital economy (The White House 2021). As antitrust policy moved away from solely focusing on consumer welfare to broader considerations of keeping markets open, free and competitive, enhancing market access and recognizing workers' rights, US trade policy had similarly shifted its focus from the interests of US corporations and consumer welfare to workers, farmers, small business owners and communities, guided by an explicit antitrust agenda.

In this context, the US shift in digital trade policy was notable. In October 2023, the United States Trade Representative revised its approach to several key digital trade proposals, granting policy makers greater flexibility and policy space to curb tech power and introduce industrial policy measures. These proposals addressed data free flows, server location requirements, and trade secret protections for source code and algorithms, which all have significant societal and economic implications.

Rather than solely promoting big tech's innovation and competitiveness, this revised approach challenged the unchecked power of tech companies. It emphasized accountability and responsibility in the digital economy while giving SMBs a fair chance to compete. This approach complemented, not overrode, industrial policies.

Considering the need for countries to retain policy space to address their digital development and AI infrastructure needs, the US shift in digital trade should encourage more countries to revisit their trade policies and step back from the neoliberal surveillance-capitalist digital trade framework embedded in the WTO talks and bilateral trade agreements. Trade rules should align with — not constrain — competition policies and support measures that promote economic and digital resilience. They should not dominate or dictate what countries can or cannot do. The current global digital trade framework fails to support AI industrial policy; instead, it reinforces structural dependencies and increases reliance on big tech companies. Shaping trade rules to align with industrial policy objectives is essential for creating a fairer and more inclusive digital economy.

Conclusion: The Path Forward

Industrial policy is similar to other policy domains, such as education or health care, where there are strong justifications for government intervention but not necessarily definitive evidence to support such measures. In these fields, research and policy debates typically focus on understanding what works, under what conditions the government should intervene and how policy should be implemented (Juhász, Lane and Rodrik 2023). A similar approach should apply to industrial policy. It is essential to look at the success stories to identify the most effective strategies and evaluate different forms of implementation to guide policy design and execution.

Since the release of ChatGPT, the dominant narrative around AI has focused on adoption and deployment. This narrative suggests that to achieve competitiveness in AI, countries should prioritize adopting AI and digitalizing public services, health care, education and other sectors (Berglind, Fadia and Isherwood 2022; Delmolino 2024).[6] According to this view, a lack of adoption and deployment constrains AI innovation, and innovation will follow once there is a wider adoption of AI.

But real innovation does not work that way — especially outside the big tech domain. While a lack of broad adoption may hinder "innovation" in a country, the more critical issue is often the lack of strategic direction. Rather than simply pouring resources into blind AI adoption and creating AI capacity dependent on a few companies, it is crucial to think strategically about how current infrastructure and capabilities can be leveraged to support growth and the appropriate policies for building an independent, publicly driven AI ecosystem.

At the core of industrial policy is the principle of directionality. The way forward requires a greater

6 See https://wwps.microsoft.com/blog/ai-public-sector.

integration of economic, legal and technological considerations into each country's NIS. A robust NIS is essential to building sustainable AI infrastructure and capabilities, providing a comprehensive framework for innovation to thrive. NIS must be driven by clear missions and specific transformative goals that align with national priorities and leverage domestic capabilities.

An effective NIS involves a well-coordinated network of institutions, policies and linkages that influence the adoption, creation and development of technology within a national economy. To succeed, policies and instruments must be aligned with local needs and priorities and build on local capabilities and resources.

The flow of information and collaboration among key actors — government, industry, academia and civil society — creates the momentum necessary to drive innovation. However, focusing on a single component, such as regulations, is unlikely to yield significant results. Instead, a whole-of-government approach is required to determine the right structures, institutions and policies to support innovation. Without this comprehensive strategy, efforts to build sustainable AI systems and capabilities will remain fragmented and fall short of their potential.

As emphasized in the beginning, there is no silver bullet. However, there are real-world examples, case studies, extensive academic research, thought leaders and advocates pushing for AI policies that serve the public interest — innovation for people and the planet. It is not an easy task, but it is achievable.

With bold vision, strategic action and determination, we can turn possibility into reality and build AI systems that truly serve society. As the saying goes, where there is a will, there is always a way.

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