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AI Nationalism(s): Global Industrial Policy Approaches to AI

In this essay collection we survey the nationalist narratives and emergent industrial policies being proposed by governments with differing economic and geopolitical motivations. The national policies surveyed in this collection have largely functioned to reinforce the notion that AI is both a socially and geopolitically important sector, and therefore worthy of government strategies (and spending) to promote it. With such far-reaching consequences for the public at stake – from the allocation of public funds to the rapid promotion of AI tools in sensitive social domains through procurement mandates – any claims to advancing public good must be scrutinized.

Why AI? Critiquing AI Industrial Policy

In the past year and a half, with the release of sophisticated AI tools to the public, interest in the speculative promise of AI technologies has exploded across the globe. AI is now firmly positioned as a critical strategic technology for the geopolitical and economic ambitions of nation-states. As governments, and the public, solidify their orientation toward the AI industry, we are forced to wrestle with the relative advantages and disadvantages of AI industrial policy — a term referring to government spending, investment, and regulatory strategies focused on the AI industry. Many governments are increasingly focused on promoting, nurturing, and growing national AI economies–and the industries that underpin them.

This uptick in government support opens up space to question: why AI? Current industrial policy frequently assumes a world in which government spending — whether on the procurement of AI products or development of the industry — is a goal that should take precedence over others in the name of 'innovation'.

But before investing deeper in the development of an AI industry we need concrete and material answers to questions like: Do efficiencies gained through AI-based climate modeling justify the energy cost of training these models? Should we invest in the advancement of edtech at the cost of providing more students school lunch, or AI medical software over funding home healthcare?

In this essay collection we survey the nationalist narratives and emergent industrial policies being proposed by governments with differing economic and geopolitical motivations. The national policies surveyed in this collection have largely functioned to reinforce the notion that AI is both a socially and geopolitically important sector, and therefore worthy of government strategies (and spending) to promote it. We find that true to historical tradition, governments are using industrial policy as a tool to increase their own geopolitical leverage and economic competitiveness – even as they cloak those objectives underneath thinly defined "AI for social good" aims.

Perspectives in this collection also warn that industrial policy as it is currently structured functions only to further expand and concentrate private (largely US-based) power, under the banner of democratization. Simply diversifying the range of actors involved in AI development while commercial entities continue to define the horizon for development does little to contest their dominance. With such far-reaching consequences for the public at stake – from the allocation of public funds to the rapid promotion of AI tools in sensitive

social domains through procurement mandates – any claims to advancing public good must be put under the scanner.

Here we build on scholarship calling for a more democratic practice of industrial policy[1] to reject the notion that the current trajectory of AI-centered development is inevitable.

Instead of naturalizing the idea that larger and larger scale AI is a self-evident public good, we must start by seeking a clear-eyed understanding of the ways that AI acts on our core social and economic institutions, and to whom AI's benefits and harms accrue.

We need to look at which business models make social benefit more–or less–likely, and what the impact is on workers, the environment, and democracy. The evidence suggests that while benefits accrue to a handful of corporate actors, current AI industrial policy perpetuates a long cycle of racialized disenfranchisement of groups that reap few of the benefits and bear most of the harms.[2] Instead, we must recognize that benefits to corporate actors often manifest as harms to the people subject to corporate AI systems.

This is why we need to look beyond our current echo chambers. **For a conversation about AI and the public good to meaningfully take place, industrial policy will need to answer to the imperatives of a public beyond the tech and defense industries, and particularly to those structurally disadvantaged groups that have already borne the brunt of the costs of this industry.** While this collection grapples with the limitations of the current approach to AI industrial policy, and the narratives that support it, the work ahead is a much more difficult task: articulating the kind of economy we want in the first place, and where–if at all–AI could play a part. We intend for this to serve as a provocation for taking this conversation forward, beyond the geographic boundaries of the United States and EU, and beyond the silos of tech policy debates.

[1] Amy Kapczynski and Joel Michaels. "Administering a Democratic Industrial Policy," *Harvard Law & Policy Review, Forthcoming, Yale Law School, Public Law Research Paper*, January 30, 2024, https://papers.ssrn.com/abstract=4711216; Isabel Estevez, "Multi-Solving, Trade-Offs, and Conditionalities in Industrial Policy," October 2023, Roosevelt Institute, https://rooseveltinstitute.org/publications/multi-solving-trade-offs-and-conditionalities-in-industrial-policy/.
[2] Todd Tucker, "Industrial Policy and Planning: What It Is and How To Do It Better," July 2019, Roosevelt Institute, https://rooseveltinstitute.org/wp-content/uploads/2020/07/RI_Industrial-Policy-and-Planning-201707.pdf; Emily Bender, Timnit Gebru, Angelina McMillan-Major, Shmargaret Shmitchell, "On the Dangers of Stochastic Parrots: Can Large Language Models Be Too Big?" *FAccT '21: Proceedings of the 2021 ACM Conference on Fairness, Accountability and Transparency,* https://dl.acm.org/doi/10.1145/3442188.3445922.

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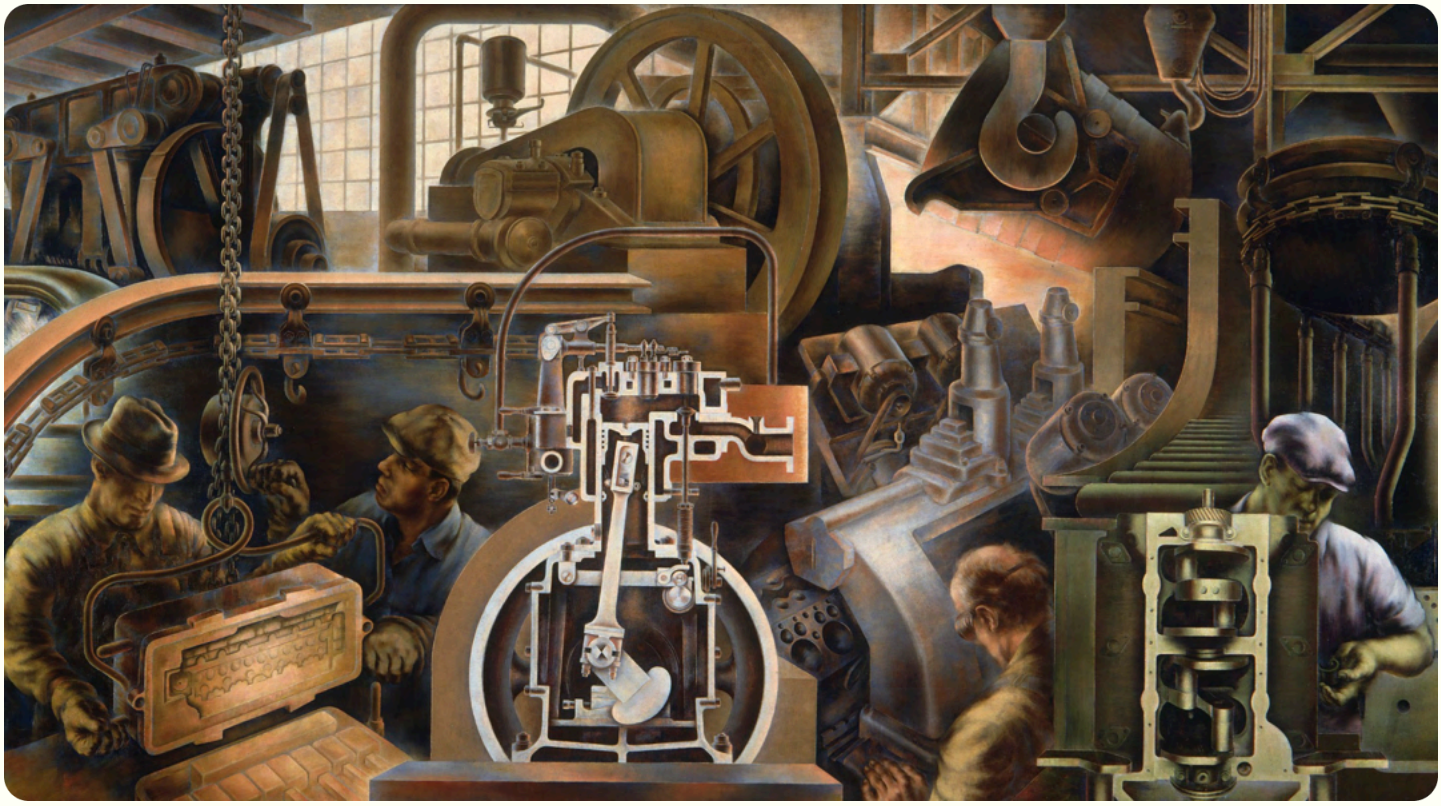

Executive Summary

by Amba Kak

What Are You Reading?

In this collection of essays, we bring together for the first time various emergent global perspectives on AI industrial policy. “AI industrial policy” refers to a set of investment, regulatory, and government-spending strategies that aim to shape—and, at present, largely promote—national prowess on artificial intelligence. The essays in this collection, and this broader project, begin to challenge this narrow focus on national competitiveness in favor of one that is grounded in a (democratically contested) understanding of public benefit. Each of the regions analyzed here has created its own narrative of AI development; together, these stories illuminate emergent trends in the way governments are choosing to respond to this uniquely charged moment.

What Counts as Industrial Policy?

The essays in this collection reflect a clear uptick in AI policies being trialed by governments globally, while also drawing attention to the lack of a coherent and clearly defined vision behind these moves. The industrial policy tools in play are wide ranging: from direct investments and tax credits to hybrid public-private AI initiatives to the platformization of government assets towards AI development; alongside regulatory strategies like competition and antimonopoly policy.[3]

In the US and the EU, the term "industrial policy" is being used to describe major flagship public investment initiatives in clean-energy generation, and in the technology sector, especially vis-à-vis semiconductors.[4] In other regions, "industrial policy" is a less familiar term in public discourse, and AI-related government investments are typically narrated as part of national AI strategies or innovation policy initiatives aimed at bolstering the growth and competitiveness of the domestic AI market.

In this collection, we survey the expanse of what currently counts as "industrial policy." This includes traditional levers like direct investments, subsidies, and tax credits of the kind we see in the US CHIPS Act; but also, working backward from the multiple forms of market-shaping we see in practice, reveals varied and often subtle institutional and policy engineering.

For one, there's an uptick in hybrid public-private arrangements that evade any strict state-versus-market binary through the "merging or fusion of public and private resources."[5] This is in part explained by the concentration of AI-related resources and expertise within the private sector that makes it almost inevitable

[3] For similarly expansive orientations towards industrial policy see Todd Tucker, "Industrial Policy and Planning: What It Is and How To Do It Better," July 2019, Roosevelt Institute, https://rooseveltinstitute.org/wp-content/uploads/2020/07/RI_Industrial-Policy-and-Planning-201707.pdf; Amy Kapczynski and Joel Michaels. "Administering a Democratic Industrial Policy," *Harvard Law & Policy Review, Forthcoming, Yale Law School, Public Law Research Paper*, January 30, 2024, https://papers.ssrn.com/abstract=4711216.

[4] Greg Ip, *'Industrial Policy' Is Back: The West Dusts Off Old Idea to Counter China*, WALL ST. J., July 29, 2021; https://americanaffairsjournal.org/2021/08/the-emerging-american-industrial-policy/; Brian Deese, National Economic Council Director, Remarks on Executing a Modern American Industrial Strategy (Oct. 13, 2022), https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/10/13/remarks-on-executing-a-modern-american-industrial-strategy-by-nec-director-brian-deese/; *see also* Jake Sullivan, National Security Advisor, Remarks on Renewing American Economic Leadership at the Brookings Institution (Apr. 27, 2023), https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/. In Europe, see, European Council, "EU Industrial Policy," Accessed March 1st, 2024, https://www.consilium.europa.eu/en/policies/eu-industrial-policy/; Terzi, Alessio, Monika Sherwood, and Aneil Singh. "European Industrial Policy for the Green and Digital Revolution." *Science and Public Policy* 50, no. 5 (October 16, 2023): 842–57. https://doi.org/10.1093/scipol/scad018.

[5] Weiss, Linda. *America Inc.? Innovation and Enterprise in the National Security State*. Cornell Studies in Political Economy. Ithaca ; London: Cornell University Press, 2014.

that all roads (and explicitly, profits and revenue) will lead back to industry, even in the implementation of public AI infrastructure. The pilot for the US National AI Research Resource, which Amba Kak and Sarah Myers West analyze in detail in Chapter 2, for example, invites AI companies to offer up donated resources on a public-private marketplace hosted by the National Science Foundation, alongside access to existing government supercomputers, datasets, and research resources. Other public-private moves happen in tandem, complementing each other. For example, with the UK government investing close to $1.5 billion in compute investments, Microsoft pledged close to double that amount toward building out AI cloud infrastructure in the country.[6]

There's also the emergence of practices best understood within what is termed the **"de-risking state,"**[7] a mainstream government tool of "crowding in" private capital, where the **government spearheads the creation of a new ecosystem that is lucrative for private actors, but where the state bears most of the real risk.** This is by no means a recent phenomenon. As Susannah Glickman describes in Chapter 1, programs like the Small Business Innovation Research Program (SBIR) were designed to ensure that venture capitalists (VCs) bore less risk, creating what she terms "a permanent role for the VC in industrial policy", while simultaneously integrating VCs into decisions regarding which entities received state funding.

We find a striking contemporary example of this trend in India. Jyoti Panday and Mila T Samdub describe in Chapter 4 that the Indian state has created **foundational software data platforms** (for example, a set of platforms known as "IndiaStack") enabling private and public access that have facilitated the emergence of a lucrative domestic market subsidized by government spending. These hybrid infrastructures, promoted globally under the broader umbrella of "digital public infrastructure" or DPI, are all set to provide the foundation for AI-enabled use cases. While these initiatives have already reaped dividends for the private sector, Panday and Samdub also draw attention to their "significant costs when it comes to citizens' rights and state power."

In a similar vein, Matt Davies, in Chapter 5, spotlights the **"platformization" of UK government assets**, including valuable and highly sensitive NHS data, to service

[6] Department of Science, Innovation & Technology, "Science and Technology Framework: Update on Progress," GOV.UK, February 2024, https://assets.publishing.service.gov.uk/media/65c9f67714b83c000ea7169c/uk-science-technology-framework-update-on-progress.pdf; UK Government. "Boost for UK AI as Microsoft Unveils £2.5 Billion Investment," November 30, 2023, https://www.gov.uk/government/news/boost-for-uk-ai-as-microsoft-unveils-25-billion-investment.
[7] Daniela Gabor, "The (european) Derisking State." Preprint, SocArXiv, May 17, 2023, https://doi.org/10.31235/osf.io/hpbj2.

the private sector. He warns: "Even the AI Safety Institute—heralded as a 'startup within government'[8] and an attempt to do something different by building state capacity on AI—risks essentially becoming the provider of voluntary services to large incumbent companies."

Another consistent theme is that the uptick in AI industrial policies often walks hand in hand with a non-interventionist or weak regulatory posture that serves the same ends. Or, as in the case of trade deals, the creation of legal regimes that entrench this deregulatory posture. **Antitrust or competition regulation should be viewed, then, as a kind of industrial policy.** As Glickman argues in Chapter 1: "A coup of bipartisan American propaganda promoting the myth of the lone American entrepreneurial tech genius has been to veil the equally bipartisan support for tech industrial policy." After decades of inaction, however, now that the US has taken a renewed aggressive stance on competition under the Biden Administration, efforts to reinvigorate public alternatives in AI find it difficult, if not impossible, to evade entrenching power back into this concentrated market (more on this below). In the UK, the failure to block Google's acquisition of DeepMind has been questioned by influential tech figures who fault it for giving away what would have been a real national champion in AI. (Ian Hogarth, the British venture capitalist who was also Chair of the UK AI Safety Taskforce, asks, "Is there a case to be made for the UK to reverse this acquisition and buy DeepMind out of Google and reinstate it as some kind of independent entity?") The AI hype cycle fueled by the release of ChatGPT landed at a time when considerable progress had already been made on advancing regulation for the AI sector, most notably in the EU. In Chapter 3, Max von Thun argues that the focus on promoting European champions and competitiveness in AI has "in some instances led policymakers to actively undermine efforts to impose regulatory guardrails, most notably in relation to the EU's AI Act."

"AI" Interventions up and down the stack

The term "AI" is a fuzzy umbrella term for a suite of technologies, few of which are actually new, often distracting from the reality that AI is both a product of, and amplifying, concentrated power in the tech industry. For a decade, AI has been

[8] Notably by Ian Hogarth in AI Safety Institute and Department for Science, Innovation and Technology, *Frontier AI Taskforce: Second Progress Report*, GOV.UK, October 30, 2023, https://www.gov.uk/government/publications/frontier-ai-taskforce-second-progress-report/frontier-ai-taskforce-second-progress-report.

routinely invoked in policy documents as one of many technologies of the future, in the same breath as blockchain or quantum computing, in service of broad pro-innovation policies or specific infrastructural upgrades. But in the more recent past, and with a growing drumbeat of attention and investment in AI, it has been established as worthy of its own dedicated industrial strategies. **Today AI provides an attractive banner for industrial policies aimed at inputs necessary for AI development, and a more central feature of broad-based government technology initiatives.** Semiconductors are a perfect example; Glickman explains in Chapter 1 that "the history of AI is inseparable from the history of semiconductors," and that "the technofuturist promises of AI have functioned to provide cover for the funding of more banal improvements in chips and chip infrastructure." A closer look at the public relations and policy narrative around the CHIPS Act, too, as Kak and West undertake in Chapter 2, reveals that AI was only one among a list of industries that the Act would benefit—but the ChatGPT-triggered upswing of demand for state-of-the-art chips in spring 2023 gave renewed momentum and attention to homegrown investment in semiconductors for AI. This led to a decision by TSMC to expand its investments in the US, though ultimately the company's supply chain for chip production will remain globally distributed.

Focusing only on industrial policies specifically earmarked for AI can therefore be an underinclusive lens that overindexes on recent developments that are branded around AI, and can lead to missing the forest for the trees. Instead, many essays in this collection track interventions at different points of layers in the AI stack—or, various "inputs" necessary for AI development. Those include: compute, data, models, and labor.

Given that the infrastructure needed to develop AI is monopolized up and down the stack, most notoriously within cloud computing, data centers, and the chips needed to process AI, the shoring up of compute resources is a key focal point for many national AI industrial policies. The UAE is a particularly interesting case study in this regard. Islam Al Khatib notes that the capital-intensive nature of compute resources for AI has made the region an unavoidable partner for those who, like Sam Altman, need to raise staggering amounts of capital to set up alternatives to Nvidia's chokehold on the chip market.

Compute initiatives foreground that there are no straightforward paths to "democratizing" what is already a concentrated and vertically integrated industry. We wonder, then, whether this is even an appropriate goal; whether through

arrangements made with cloud providers or procurement of GPUs, public investments in AI will accrue to one or another concentrated sector. Europe in particular has seen a great deal of activity around public investment in chips and government supercomputers, and the most recent 2024 European Commission Innovation package proposes a new initiative to develop state-of-the-art chips for AI development. The French government has allocated over a billion euros toward funding public supercomputers even as it seeks €7 billion worth of private institutional investment into AI. As Samdub and Panday detail in Chapter 4, the Indian and Japanese governments, too, have launched AI-specific cloud computing infrastructure built in a centralized facility, rather than in a way that relied on using commercial cloud solutions. This is an attempt to avoid depending on providers like Amazon's AWS or Microsoft's Azure. They note that despite the relatively tiny capacity of India's public compute initiative ("AIRAWAT") compared to the capacity enjoyed by large tech companies, offered at a discount to Indian startups, it still offers an attractive option in a market where demand far outstrips supply.

After compute, the next area of heat across jurisdictions appears to be data. Across various regions we see similar efforts to increase access to properly cleaned, labeled, and structured (or "AI-ready") data for AI development. The primary focus of these efforts has been on making government datasets available for direct access by companies and researchers, as well as standardization and benchmarking to improve the usability of these datasets with comparatively less focus on ensuring the privacy and security of this data. Even as data is readily acknowledged as a key input (and therefore a bottleneck) in AI development, the US government rarely calls attention to the fact that a large amount of such high-quality datasets are controlled by private industry, and specifically by big tech companies. By contrast, in Europe and India, as part of a broader movement to call attention to US Big Tech data monopolies, there have been one-off proposals for mandating data-sharing and private-sector contributions to data commons.

Market Concentration and National Champions

Instead of enforcing regulations on industries prone to natural monopolies—those with high start-up costs and other barriers to entry—governments have typically tried to wield them as extensions of state power. In the US, this has certainly been the case with the semiconductor industry.

As Glickman explores in Chapter 2, the dependencies on scale in this sector have led some in government to believe they had to rely on industry consolidation to continue making advances in the field. With AI, the "bigger is better" paradigm for large general-purpose models means that market concentration at every layer of the stack is only intensifying. Industrial policy formulations, then, all lead to partnerships with large tech companies. In addition, a fast-evolving and increasingly institutionalized discourse around AI not only promotes these technologies as necessary to economic and national security interests, but also positions Big Tech firms as themselves security assets that need to be bolstered rather than held back by regulation. Under this narrative, all that is required is to ensure that these commercial actors are sufficiently responsive to the strategic needs of the state.

In the US, the home of most frontrunner AI companies, the current government's orientation however marks a historically significant rupture with Big Tech. The Biden administration has deliberately created distance between Big Tech interests and US state interests across policy domains from trade[9] to technology.[10] They have boldly confronted the concentration of power in the tech sector with a muscular orientation of US enforcement agencies against Big Tech, an integration of competition concerns in procurement guidance, and a clear assertion that "the answer to the rising power of foreign monopolies and cartels is not the tolerance of domestic monopolization."[11] However, Kak and West argue in their chapter that despite these efforts, industrial policy initiatives under the banner of democratizing AI still fail to challenge the deep structural dependencies on private technology companies at every layer of the AI stack, and especially compute. Kak and West question whether "democratization" of AI alone is an appropriate litmus test for public AI. They write, "simply diversifying the range of actors involved in AI development while commercial entities continue to define the horizon for research does little to contest their dominance."

Outside the US, however, there are different approaches and degrees of comfort with a "national champions"-focused AI industrial strategy. In Europe, we see official narratives that take aim at the concentration of power in foreign tech industries. This is true for the Commission's flagship efforts but is also heightened

[9] Farah Stockman, "Opinion | How the Biden Administration Took the Pen Away From Meta, Google and Amazon." The New York Times, November 27, 2023, https://www.nytimes.com/2023/11/27/opinion/google-facebook-ai-trade.html.
[10] Makena Kelly, "Biden Rallies against Big Tech in State of the Union Address." The Verge, February 8, 2023. https://www.theverge.com/2023/2/7/23590396/state-of-the-union-sotu-biden-tech-tiktok-privacy-antitrust.
[11] White House, "Executive Order on Promoting Competition in the American Economy," July 9, 2021. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/07/09/executive-order-on-promoting-competition-in-the-american-economy/.

in member states like France, Germany, and Italy, as von Thun explores in Chapter 3. In these countries, the desire for national AI champions has motivated a range of public investments and regulatory postures in the past few years. **But the intention for autonomy alone cannot wish away the reality. It will continue to be a formidable challenge to develop industrial strategies that meaningfully steer clear of dependency on US Big Tech.** In February 2024, Microsoft acquired a minority stake in France's main AI champion, Mistral, with an agenda explicitly focused on building applications for government use in Europe. Davies points to a similar tension in the UK, arguing that the current blitz of activity to build the UK's public supercomputer "offers a fantasy of independence that masks deeper structural dependence on a paradigm of AI development led by, and wholly dependent on, funding and infrastructures provided by Silicon Valley."

Pitting "Innovation" Against Regulation

On the surface, pro-regulatory stances are more mainstream than ever, with high-level support from powerful industry actors. Today innumerable and largely voluntary governance initiatives exist around mitigating AI risks and creating responsible AI use. **However, we are simultaneously seeing a well-funded "innovation versus regulation" narrative gather steam. This depicts industrial strategy efforts that promote the AI industry as pro-innovation, while regulatory efforts are characterized as hampering national competitiveness.** In this context, "regulatory sandboxes" have become increasingly popular. These are flexible regulatory arrangements aimed at encouraging time-bound experimentation unhampered by onerous regulation.

To be clear, AI regulation, much like any other domain of technology and data policy, has rarely been immune to economic logics. In Chapter 3, von Thun tracks the consistent effort to foreground the economic and strategic benefits of the EU's flagship AI Act, including positioning the EU as setting the rules of the global market and underscoring exceptions for small businesses. But in the post-ChatGPT AI race, European industry players and big-tech lobby groups have worked to whip up fears about Europe's lack of competitiveness in AI, and push for a weaker regulatory regime. Reportedly fueled by domestic companies like Mistral and Aleph Alpha, France, Germany, and Italy argued that imposing strict regulatory

requirements on foundation models would hamper the continent's ability to compete—arguments soon belied by Mistral's partnership with Microsoft.[12] In the UK too, Davies tracks the "contradictory impulses" of deregulatory strategies carried out through legislative proposals that deliberately avoid interventionist approaches and a broader unwillingness to endow regulators with new statutory powers to address current harms with AI.

In other regions, like India and South Africa, we explore how AI regulation has been reduced to an empty signifier, often bandied about as a national priority despite lack of meaningful legal progress to meet mounting challenges with AI systems concerning privacy, security, competition, and discrimination. The UAE's Minister of State for Artificial Intelligence, Omar Al Olama, meanwhile, positions the UAE as "a testing ground for AI advancements and the construction of experimental regulatory frameworks."

But there are also other regulatory currents, outside those explicitly focused on AI, that are already shaping the market. This was also a concern in the heated public discourse of the past year; where discussion has been narrowly preoccupied with future risk scenarios and novel policies, rather than how to leverage existing regulatory frameworks. In the EU, for example, the Digital Markets Act and the Data Act both have the explicit aim of boosting Europe's economic competitiveness and establishing technological sovereignty and von Thun argues that there is tremendous scope to harness the DMA proactively so that it "could be used to promote a fairer and more diverse AI European ecosystem." In South Africa, too, despite almost no progress on AI-specific regulation, the Competition Commission concluded its market inquiry on big-tech platforms with bold recommendations and enforceable remedies around competition concerns like self-preferencing and algorithmic pricing.

Beyond the US-China AI Arms Race

The "US-China AI arms race" has lurked in the background of policy discussions on AI for close to a decade now. Initially a sporadic talking point for tech executives, it has evolved to become an increasingly institutionalized position, represented by collaborative initiatives between government, military, and tech-industry actors

[12] Madhumita Murgia, "Microsoft Strikes Deal with Mistral in Push beyond OpenAI," *Financial Times*, February 26, 2024, https://www.ft.com/content/cd6eb51a-3276-450f-87fd-97e8410db9eb.

and reinforced by legislation and regulatory debates.[13] In the US, this race has been invoked to both kindle an appetite across party lines for increased public investment for AI, and also push back against calls for slower, more intentional AI development and stronger regulatory protections.

The bipolarity of the US-China framing has always been myopic, leaving out the complex ways in which other regions participate in the dynamic. This is even truer today as an increasing number of governments make strong nationalistic plays around their role in the AI future. Yet this narrative persists. For one, the idea that we are in a geopolitically sensitive AI race has only gained traction in the scramble to market post-ChatGPT. As AI is heralded today as the digital infrastructure of the future, security implications mean that striving for hegemony in this domain is non-optional. As Khatib notes in her essay, the UAE sees becoming "the best" in AI as crucial to securing the country's stability in any "post-oil" future: "the association of AI with fantasies of 'absolute sovereignty,' 'progress,' and the persisting belief that 'future wars' will be centered around data and information (language of information war and cyberwars) rather than land and resources."

The US-China Arms Race, has largely been tracked using inconstant quantitative metrics like most-cited papers or patents. So too are AI-related national readiness rankings and metrics proliferating, guiding the allocation of public resources. As Sandra Makumbirofa argues, South Africa's AI strategy has been guided by the need to be perceived as leading AI on the continent, despite a complete lack of defined metrics or broader public discourse on why, and how, the nation intends to achieve these objectives.

We observe opportunistic behavior amidst the escalating tensions between the US and China, with countries like the UAE attempting to play "both sides." More recently, India has positioned itself as a stable "democratic" semiconductor hub that could function as an alternative to Taiwan.[14]

Strands of AI nationalism do exist outside of the US-China geopolitical framing: AI developmentalism, for example. Panday and Samdub note that India's national AI strategy headlines the goal of becoming an "'AI garage for 40% of the world'" alongside calls for using AI for economic development, "particularly in Global South

[13] For an updated timeline of the proliferation of the US-China AI arms race, see https://ainowinstitute.org/publication/tracking-the-us-and-china-ai-arms-race
[14] Sankalp Phartiyal, "India Chip Strategy Makes Progress With $21 Billion in Proposals," Bloomberg, February 26, 2024, https://www.bloomberg.com/news/articles/2024-02-26/india-chip-strategy-makes-progress-with-21-billion-in-proposals.

countries, which may provide markets for solutions developed in India." A closely related theme is localization: the idea that countries with large addressable markets will find their niche catering to the specific needs of their population. Promoting linguistic diversity in AI is a prominent example of this; as Khatib notes, Jais, UAE's LLM, was not a PR exercise oriented solely at the Global North—"it also offers 400 million Arabic speakers access to generative AI technologies."

What Does "AI for the Public Good" Really Mean?

The AI industrial policies we've surveyed here have largely functioned to reinforce the notion that AI is a socially as well as geopolitically important sector, and therefore worthy of government strategies to promote it. This needn't necessarily be the case, as Amy Kapczynski and Joel Michaels argue in a forthcoming paper.[15] Industrial policy, they state, must be held to strict standards of ensuring AI meets public aims. This might not necessitate growth; it may include demoting certain sectors that cause public harm—cryptocurrency, for example.

Does the premise that AI advances public aims hold up? We recently argued, "with an overwhelming focus on AI-driven harms, we've missed a key piece of the puzzle: demanding that firms articulate, clearly and with evidence to back it, what the benefits of AI are to the public." We still see no persuasive or cohesive articulation of a vision for social good that justifies public endorsement—and taxpayer dollars—outside of shallow assertions that AI will lead to productivity gains and leapfrogging advancements in fields like medicine and climatology. Partly, this stems from the fact that "AI" is often used as an empty signifier for technological innovation. Since the ChatGPT-inspired AI hype wave, it is easier than ever for governments and industry advocates to coast by on high-level assertions about AI without pointing to real-world use cases. As Davies puts it, the UK "central government has rarely, if ever, advanced a coherent vision for the role that a domestic AI sector should play within the UK economy." We find a similar conundrum across US AI policy documents, where outside of generic policy narratives about pushing the frontiers of science and the public good, there's no meaningful scrutiny of either the current or speculative advancements. Nor is there

[15] Amy Kapczynski and Joel Michaels. "Administering a Democratic Industrial Policy," *Harvard Law & Policy Review, Forthcoming, Yale Law School, Public Law Research Paper*, January 30, 2024, https://papers.ssrn.com/abstract=4711216.

acknowledgement of the enormous and well-evidenced energy and water costs to this industry. In South Africa, Makumbirofa explores this disjunction: the government is apparently convinced that AI prowess is crucial for economic development but has no answer for how this will help high unemployment, racial inequality, and unreliable electricity supply.

Makumbirofa explores, too, how the current Ramaphosa government routinely advocates for AI in government procurement amid calls to cut public-sector employment costs. **In fact, data-driven tools like AI have routinely and historically been used across the world to justify austerity measures that disenfranchise the public.**[16] Glickman takes us back to the Clinton years, where technology was likened to a lifeboat that would save the public from living in inadequate material conditions. Instead, it "provided cover for the Clinton administration to significantly cut welfare."

With such far-reaching consequences for the public at stake – from the allocation of public funds (that would otherwise go elsewhere) to the rapid promotion of AI tools in sensitive social domains through procurement mandates – any claims to advancing public good must be put under the scanner. This is especially challenging given that the current paradigm for large-scale AI is a product of concentrated power in the AI industry, making it difficult to develop a clear-eyed account of the public benefits of AI outside of the terms set by the market. The adoption of large scale general purpose AI as a priority in US federal R&D strategies, for example, never acknowledges the market, financial, and environmental impacts that the compute and data dependencies that this trajectory entails. Moreover, with ever-larger-scale general-purpose AI models like LLMs often positioned by industry stakeholders as stepping stones to forms of so-called "artificial general intelligence" (AGI), there is a wholesale acceptance that scale is a proxy for progress and performance. The promise of AGI is also inextricably linked to national security dominance—whoever builds AGI first will win the AI race—making the commercial and national security goalposts all but meld into one another.

The inability of current AI industrial policy to meaningfully make a public interest case is as much a failure of process as it is of substance. As Kapzynski and Michaels argue, industrial policy mechanisms must be designed to be responsive and accountable to the public beyond powerful elite interest groups, and the need for

[16] See for example, Philip Alston, "Report of the Special Rapporteur on Extreme Poverty and Human Rights," October 11, 2019, https://srpovertyorg.files.wordpress.com/2019/10/a_74_48037_advanceuneditedversion-1.pdf; and "AI Now Report 2018," December 2018, https://ainowinstitute.org/AI_Now_2018_Report.pdf.

"organized capacity of structurally disadvantaged groups" to influence policy. Without a procedural focus on democratic deliberation, the 'public interest' aims of industrial policy will inevitably fall back into a framing that looks at AI primarily as part of the arsenal for the US-China race. For example, one critique of current industrial policy argues for a pivot to "AI manufacturing".[17] It takes aim at Silicon Valley's "consumer-focused" approach to innovation for its failure to create middle-class job growth and align appropriately with defense interests.[18] But this manufacturing-focused vision, likely to be propelled forward under the political banner of rivaling China, will inevitably function to galvanize big tech to 'innovate' on manufacturing, potentially further entrenching concentrated power (Amazon, for example would have a clear edge given their investment in supply chain optimization[19] and generative AI use cases for manufacturing[20]). It's perhaps obvious that industrial policy visions will reflect the constituencies they are designed to appeal to (the manufacturing-focused AI project, for example, is clearly designed for political appeal to the white, male, working class). But AI's potentially most harmful impacts — from discrimination to informational harms to workplace surveillance — disproportionately burden people of color, making it imperative for structurally disadvantaged groups to influence the shaping of this policy vision.

Before investing deeper in the development of an AI industry, in any form, we need to understand who AI serves, consider the opportunity costs and question the assertion that this technology will inevitably lead to social progress. We need to be asking grounded and critical questions like: do efficiencies gained through AI-based climate modeling justify the energy cost of training these models? Should we invest in the advancement of edtech at the cost of providing more students school lunch? These answers need to be concrete and material, and won't be found in echo chambers. For a conversation about AI and the public good to happen meaningfully, industrial policy will need to be responsive and accountable to perspectives outside of the tech industry.

[17] David Adler, William B. Bonvillian, "America's Advanced Manufacturing Problem—and How to Fix It," *American Affairs Journal*, Volume VII, Number 3 (Fall 2023): 3–30, https://americanaffairsjournal.org/2023/08/americas-advanced-manufacturing-problem-and-how-to-fix-it/.
[18] David Adler, "The American Way of Innovation and Its Deficiencies." *American Affairs Journal,* Volume II, Number 2 (Summer 2018): 80–95, https://americanaffairsjournal.org/2018/05/the-american-way-of-innovation-and-its-deficiencies/.
[19] Mala Jenkins, "Amazon Taps AI to Expand Sellers' Ecosystem and Supply Chain Capabilities," Retail Info Systems News, September 13, 2023, https://risnews.com/amazon-taps-ai-expand-sellers-ecosystem-and-supply-chain-capabilities.
[20] Scot Wlodarczak,"How Generative AI Will Transform Manufacturing," June 20, 2023, AWS for Industries (blog), https://aws.amazon.com/blogs/industries/generative-ai-in-manufacturing/.

1. AI and Tech Industrial Policy: From Post-Cold War Post-Industrialism to Post-Neoliberal Re-Industrialization

by Susannah Glickman

As a category, “tech” emerged in its current form in the mid-1980s, relying on the conflation of economic and national security made tangible in the form of high-tech products like semiconductors. As an industry, tech has since its inception been marked by governmental intervention, which has sustained the industry and upheld particular players, priorities, and uses. The ways in which academia, industry, and government have enmeshed have changed over time; the fact of their imbrication and interdependency has not.

Tech and the industries associated with it have rearranged governance and political economy around redeeming the promises of speculative futures. At various moments, tech has come to represent the health of the US state—its prestige, its ability to project global power, and its economic and national security. Tech's symbolic and material importance has meant that the US government and information industries have remained intertwined.

Hailed by many as the return of industrial policy and government intervention, the 2022 CHIPS Act and Biden's chip-focused executive orders are continuous with older forms of US industrial policy. The model of this policy changed significantly during the eighties under Reagan, creating a closer synthesis of the tech industry and the US national security state.[21] The Clinton administration entrenched and extended Reagan-era institutional experiments, which became norms after 9/11 took defense-industrial cuts off the table. As industries that relied on cheap chips ascended and US leadership in microelectronics was taken for granted in the Obama era, government focus and support waned. Until events in 2016 convinced the defense world and 2020 COVID-era shortages convinced politicians to reengage with the industry, semiconductors were not a central focus for policymakers. However, the political economy inaugurated through this history persisted.

Artificial intelligence has significantly benefited from, and been shaped by, government intervention not just in AI itself but crucially in semiconductors. From the early Cold War to the present, "AI" has referred to many disparate sets of practices. In particular the meaning of intelligence in "artificial intelligence" has numerous and shifting connotations that complement the assumptions adopted by its practitioners and conditioned by their context. Broadly speaking, "intelligence" encompasses any attempt to make machines display human capabilities such as understanding language (e.g. speech recognition and translation), learning, and problem-solving. Federal funding was, and continues to be, essential for the development of AI. Until recently, in fact, the US federal government provided the bulk of funding for research into AI and AI-related fields. When industry at various points abandoned AI for fear that commercial implementation was distant, federal funding filled the gap in areas like expert systems, speech recognition, natural-language processing, and image processing. Moreover, significant portions of what is recognized today as AI originated in other fields. Speech recognition,

[21] It is hard to tell the story of one set of institutions without the other.

graphical models, and natural-language processing all use techniques borrowed from mathematics, statistics, and physics rather than what has traditionally been labeled as AI.

The history of AI is inseparable from the history of semiconductors. Advances in what now gets called AI (formerly termed "machine learning" or "statistical prediction") are entirely dependent on computing power that in turn derives from exponential improvements in semiconductors.[22] Advances in chips have also undergirded advances and profits in personal computing, graphics, communications, networked computing (e.g., the internet, the cloud), and most other information technologies. According to the National Academies, for example, "[o]nly after continued increases in processing power and memory capacity did hidden Markov models become feasible for use in recognizing continuous speech on PCs" in the 1990s.[23]

These massive quantities of resources, complex coordination, and global negotiations needed to make ever-improving semiconductors inevitably require considerable state involvement, partnership, and active intervention. Despite this fact, government intervention is rarely given its due. A coup of bipartisan American propaganda promoting the myth of the lone American entrepreneurial tech genius has been to veil the equally bipartisan support for tech industrial policy. The American state has created the conditions that make Bill Gates's massive profits possible—including, for example, an extremely permissive antitrust policy.

Government support for these infrastructures has largely emerged from the national security state. Defense's needs have always shaped these industries in one way or another. The Pentagon's oft-renewed strategic focus on high tech has led to consistent defense funding and defense interest in information industries. The relative emphasis on a given information technology and the means through which defense needs have shaped technology have changed over time, but the overbearing impact of national security agencies has not. During the Cold War,

[22] Guido Appenzeller, Matt Bornstein, and Martin Casado, "Navigating the High Cost of AI Compute," Andreessen Horowitz, April 27, 2023, https://a16z.com/navigating-the-high-cost-of-ai-compute. See also Jai Vipra and Sarah Myers West, "Computational Power and AI," AI Now Institute, September 27, 2023, https://ainowinstitute.org/publication/policy/compute-and-ai.
[23] National Research Council, *Funding a Revolution: Government Support for Computing Research* (Washington, DC: National Academy Press, 1999), 151, https://doi.org/10.17226/6323.

these were tools of the state's imagined electronic battlefield.[24] That vision, as many have noted, still shapes the DoD's approach to information technologies.[25]

Cold War Status Quo (Pre-1970)

The Cold War US state institutionalized state support for technology development in agencies derived from WWII institutions and projects. The National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), and other elements of the national security state emerged from the early Cold War, for example. Physicists dominated these new institutions, and the state prioritized the production of such physicists.[26] Dangerous and increasingly taboo tests of nuclear weapons and their components drove physicists toward computer simulations. As Peter Galison shows in his article "Computer Simulations and the Trading Zone," prominent physicists began to view computers less as tools and more as reflections of nature itself.[27] Through new questions about the limits of computation (and with that, the limits of physical reality), physicists became increasingly concerned with and involved in computing (especially theories of computation). Carver Mead, for example, a major Moore's law promoter, developed Very Large Scale Integration (VLSI) with Lynne Conway and worked closely with Gordon Moore. A physicist by training, he engaged directly with the limits of computing and physics of computing fields. Likewise, by the 1970s, famous physicists like Richard Feynman and John Wheeler, who had close relationships to the Cold War national security state, began to pursue the physics of computation. Perhaps because of this theoretical orientation, these physicists tended to have an exaggerated view of the capabilities of computer systems.[28] The relative power and esteem in which physicists held computing led to its imbrication in more areas of government—especially defense.

At the same time, the less-practically-realized technofuturist fields of cybernetics and AI emerged from an interdisciplinary attempt to create master sciences across minds and machines. AI was one of many fields in the soup of economics, physics,

[24] Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1996), 300.
[25] Ibid. See also Rebecca Slayton, *Arguments That Count: Physics, Computing, and Missile Defense, 1949–2012* (Cambridge, MA: MIT Press, 2013); Gian Gentile, Michael Shurkin, Alexandra T. Evans, Michelle Grisé, Mark Hvizda, and Rebecca Jensen, "A History of the Third Offset, 2014–2018," RAND Corporation, March 31, 2021, https://www.rand.org/pubs/research_reports/RRA454-1.html.
[26] David Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33, no. 1 (September 1, 2002): 131–59.
[27] Peter Galison, "Computer Simulations and the Trading Zone," in *The Disunity of Science: Boundaries, Contexts, and Power*, eds. Peter Galison and David J. Stump (Stanford: Stanford University Press, 1996), 118–57.
[28] In her book *Arguments that Count,* Rebecca Slayton compares their approach to the much more circumspect views of those who worked on implementation and software, who would become known by the 1980s as *software engineers*.

neuroscience, information theory, systems theory, operations research, and game theory in Cold War defense institutions like RAND, the DoD, and other elements of the military-industrial complex.[29] The advent of nuclear weapons during WWII required secrecy, motivated the creation of the national security state, and necessarily consolidated power within the executive-controlled national security apparatus.[30] Nukes, with their demonstrated capability for massive destruction, arrived with multiple rapid technological changes. These swift-moving technological shifts produced a unique "Cold War rationality" in state institutions—a desire for subjectivity-free knowledge and mechanized decision-making.[31] Such "trading zones" made AI and other technological dreams of the present thinkable and desirable. The same circumstances convinced pioneers of AI like Herbert Simon to identify options pricing theory as closely resembling the kind of random walk-style optimization he imagined for AI when it emerged in the early 1970s.[32] Meanwhile, what would lay the foundations for the modern machine learning version of AI was developed during the same period as a branch of physics called statistical mechanics.

Significant components of the tech sector emerged from the Cold War state and both shaped and were shaped by the contours of its history. From the dawn of the space race in the 1950s, semiconductors have been at the heart of US defense strategy. In the 1970s, this found a formal articulation in the Offset Strategy: Pentagon leaders believed they could offset the Soviet advantage in sheer numbers of soldiers with superior technological capability.[33] US technology leadership in microelectronics at the time served as the basis for this strategy, which was an explicit declaration and extension of the relationship between defense and computing.[34]

AI similarly owes a significant debt to the Cold War national security state. "The establishment in 1962 of DARPA's Information Processing Techniques Office (IPTO)," for example, "radically changed the scale of research in AI, propelling it from a

[29] Warren McColloch and Walter Pitts's neural networks, for example, emerged from this context.
[30] Garry Wills, *Bomb Power: The Modern Presidency and the National Security State* (New York: Penguin Press, 2010).
[31] Paul Erickson et al., *How Reason Almost Lost Its Mind : The Strange Career of Cold War Rationality* (Chicago: University of Chicago Press, 2013), 1–26.
[32] Orit Halpern, *Beautiful Data: A History of Vision and Reason since 1945* (Durham: Duke University Press, 2014), 176–7.
[33] Specifically, this technological capability would be used for things like surveillance, reconnaissance, intelligence, precision-guided munitions, sensors, and targeting.
[34] As Paul Edwards writes in *The Closed World*, Cold War politics and computing cocreated each other; Cold War computers served as a support for Cold War culture, politics, and worldview. Command and control as a paradigm shaped both computers and military strategy: "[T]he key theme of closed world discourse was global surveillance and control through high technology military power. Computers made the closed world work simultaneously as technology, as political system, and as ideological mirage." This culture and its institutional effects created the conditions for the perpetuation of the Offset Strategy, and therefore for the centrality of information technology to conceptions of national security. See Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1996), 1–2.

collection of small projects into a large-scale, high-profile domain."[35] DARPA "supported work in problem-solving, natural-language processing, pattern recognition, heuristic programming, automatic theorem proving, graphics, and intelligent automata. Various problems relating to human-machine communication—tablets, graphic systems, hand-eye coordination—were all pursued with IPTO support."[36] This support "rapidly advanced the emergence of a formal discipline" and legitimized the field.[37] Because AI objectives often took a very long time to accomplish, federal support was necessary; private companies had little patience or financial incentive to fund long-term research.

Nixon–Carter: Economic Conversion from Vietnam and the Remaking of Tech Policy Infrastructure (1970s–1980s)

The Cold War triple helix[38] of national security state, academia, and industry began to unravel in the late 1960s and early 1970s as the Vietnam War wound down. Unlike after WWII, the US did not demilitarize significantly after the end of the Korean war, due to the exigencies of the Cold War. Therefore, the demilitarization that occurred in the wake of the Vietnam War created significant economic and social problems—for example, the massive unemployment of engineers, computer scientists, and technicians.

This and the earlier end of cost-plus contracting in Robert McNamara's Pentagon led to a sudden drop in defense spending without any substitute (despite several prospective plans). Mathematics, computer science, and AI were hit especially hard. DoD funding for mathematics and computer science reached a two-decade low in 1975.[39] The Nixon administration pushed for an emphasis on discrete applications in federal research. Together with the short-lived 1969 Mansfield Amendment (which forbade military funding for research without military applications), this decimated funding for long-term or speculative projects. This trajectory was reinforced by

[35] National Research Council, *Funding a Revolution*, 204.
[36] Ibid., 205.
[37] Ibid.
[38] Henry Etzkowitz and Loet Leydesdorff, "The Triple Helix – University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development," *EASST Review* 14, no. 1 (1995): 14–19, https://ssrn.com/abstract=2480085.
[39] National Research Council, *Funding a Revolution*, 112.

Ford's DARPA director George Heilmeier (1975–77), who created "tremendous pressure to produce stuff that looked like it had a short applications horizon."[40]

The decrease mobilized two related groups in defense of their fields: venture capitalists and their allies; and scientists, engineers, and technicians working in defense. The effects were not evenly spread. Massachusetts, California (Silicon Valley and SoCal), and the Sunbelt especially suffered because of the concentration of the defense industry in those areas.[41] In Massachusetts, this meant that influential Massachusetts democrats like Edward Kennedy, Paul Tsongas, John Kerry, Robert Drinan, Barney Frank, Michael Dukakis, and others elected to state and federal office were closely tied to this new coalition. Underemployed defense workers were also important to the McGovern campaign, which promised this group McGovern would not eliminate any aerospace and defense jobs until there were comparable civilian jobs.[42] The reconversion promised by McGovern and sought by these scientists and technicians stressed public-private partnerships, as well as public support for small innovative new businesses (what would later be termed "startups") through R&D spending.

The mobilizations of venture capitalists and scientists were not immediately linked. In response to both genuine opposition to the Vietnam War and the social stigma experienced by those working in defense, scientists, engineers, and technicians organized around a conversion of the defense industry to civilian uses. These hopes seem to have been dashed with the McGovern campaign and his loss.

Venture capitalists (VCs) like William J. Casey[43] mobilized instead to secure subsidies and benefits for "small businesses" and eventually "small innovative businesses" from state and federal governments.[44] He and others in the conservative finance world saw the nexus of security state and industry in high tech as a vehicle for their ends, tying VCs to "tech" and securing numerous regulatory and tax benefits and state backing, as well as promoting "tech" narratives. This coalition also created political support and infrastructure for a broader high-tech-focused deregulatory project as well as state-industry transformation.[45] Casey's agitation led to the Small Business Administration Task

[40] Ibid., 113.
[41] For example, the Massachusetts company Raytheon went from thirty thousand jobs to 3,500 jobs. See Lily Geismer, *Don't Blame Us: Suburban Liberals and the Transformation of the Democratic Party* (Princeton: Princeton University Press, 2014), 150–2).
[42] Ibid., 169.
[43] Casey was a famous theorist of tax havens and the CIA director during the Iran–Contra affair.
[44] Molly Sauter, "A Businessman's Risk: The Construction of Venture Capital at the Center of U.S. High Technology" (PhD diss., McGill University, 2020), https://escholarship.mcgill.ca/concern/theses/j6731853z.
[45] Ibid., 51. Casey's own firm Vanguard Ventures, formed in 1968, also operated as a tax shelter for investors—not surprising for a theorist of tax havens.

Force on Venture and Equity Capital in 1976, later known as the Casey Task Force. According to historian Mols Sauter, this report "largely invented and certainly normalized the view that the venture capital funding structure, particularly as manifest in the limited partnership organizational model, is a basic and inextricable part of what would come to be identified as the 'innovation economy.'"[46]

The two groups, however, came together for the January 1980 White House conference on small business. The fundamental thesis of this meeting was that small business was not getting its fair share of institutional support.[47] Though the authors intended to evoke mom-and-pop enterprises and offered small business as a vehicle for women and minorities to get ahead, the top legislative priority coming out of the conference was the Small Business Innovation Research Program (SBIR). This program benefited both VCs and the small innovative businesses (proto-startups) that former defense workers thought would be a long-term solution to their funding and employment problems. The report offered small business as a solution to all the era's issues: flagging productivity, inflation, innovation and competitiveness, postindustrialism, high unemployment, general American decline, and the difficulty of maintaining the US's position in high tech and automobiles. Stressing the need for a supply-side approach, the report called for, among other things, tax cuts,[48] slashing regulations, shrinking government, reversing antimonopoly legislation, and lowering or eliminating the minimum wage.[49]

Following the conference, members of the small business coalition expected President Carter to implement their recommendations. Instead, he cut funding for SBIR and other high-tech small-business priorities. Irate, members shifted their allegiances to the right for the 1980 election.

In the late 1970s, with the rise of civilian computing, tech industries experienced major structural shifts. Civilians began consuming vastly larger numbers of chips than the military, which caused big companies such as Bell Labs—which consisted of major research arms and subsisted on large government contracts—to give way to smaller startups that targeted the civilian market. The immense growth of civilian

[46] Ibid., 86–7.
[47] But what did they mean by "small business"? The term was intended to produce a patriotic update on the Jeffersonian yeoman farmer ideal—the report that came from the meeting claims that small business creates truly free citizens with "*with a direct stake in fortifying democratic government.*" See *Hearing before the Committee on Small Business*, Ninety-Sixth Cong., Second Session (1980).
[48] For example, removing or lowering the capital gains tax and estate tax, as well as corporate taxes for "small businesses."
[49] Ralph L. Stanley et al., *The White House Conference on Small Business: A Report to the President of the United States* (Washington, DC: US Government Printing Office, 1980).

computing meant that companies had more incentive to focus on that market at the expense of defense—especially in the wake of Vietnam and public pressure to stay away from military projects.[50] Arati Prabhkar, who served as the director of DARPA, where she headed coordination with SEMATECH and NIST, and who now currently heads the White House Office of Science and Technology Policy, stated that DARPA made concerted efforts to reduce its dependence on scale in semiconductor manufacturing, but that these endeavors ultimately proved unsuccessful. Consequently, she claimed, DARPA had to rely on civilian firms, dual-use technology, and industry consolidation to continue making advances in this field.[51]

Carter and Reagan: The 1980s and the Japan Crisis

Upon entering office, Reagan, unlike Carter, delivered for the small business-VC coalition by supporting SBIR, a variety of tax breaks, subsidies, antitrust benefits, new public and private initiatives to assist small business, export controls, and other measures. In supporting the SBIR and similar government benefits for high-tech innovative small businesses, Reagan defied members of his coalition like paleocon Dennis Prager and more libertarian organizations like the Heritage Foundation, as well as universities and big electronics companies represented by the American Electronics Association (AEA). His defense buildup, together with his aggressive trade policy, benefited high-tech companies, especially chipmakers who faced a vigorous challenge from Japan. According to organizers, a majority of the sixty recommendations from the 1980 White House Conference on Small Business were acted upon.

These policies delivered for defense hubs—for example, Massachusetts received one-third of the total SBIR funding. Such programs kept startups afloat.[52] They also worked for Silicon Valley. As Victor Reis, Deputy DARPA director from 1989 to 1990, and then DARPA director from 1990 to 1991, claimed: "DARPA [was] very integral in getting a lot of that Silicon Valley stuff [...] going at Stanford. And all the spin-offs that went with that were, in large measure, from DARPA."[53]

[50] Linda Weiss, *America Inc.? Innovation and Enterprise in the National Security State* (Ithaca : Cornell University Press, 2014), 38.
[51] Arati Prabhakar interview with author, May 19, 2021.
[52] Chris Miller, *Chip War: The Fight for the World's Most Critical Technology* (New York: Scribner, 2022), 139.
[53] Victor Reis, interview by DARPA, January 17, 2007, https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/DARPA/15-F-0751_DARPA_Director_Victor_Reis.pdf.

The SBIR, similar programs, and other Reagan-era changes institutionalized the role of VCs in the federal research apparatus. Programs like SBIR meant that VCs bore much less risk. SBIR not only provided billions in funding but moreover provided multiple non-monetary benefits.[54] The government did the early technology development and evaluation, significantly cutting the time from investment to payout. These programs and their extensions have created an environment where, contrary to the public narrative, "federal programs, not private VC, provide the majority of the high-risk startup and early-stage capital for U.S. innovation."[55] The SBIR created a motor for the VC industry; the program was structured such that government would fund and oversee the first two phases of startup development and VCs would invest in the third phase. This created a permanent role for VC in industrial policy. Small businesses, startups, and VCs were also much more integrated into federal governance—in policymaking, grant evaluation, and the selection process for contracting. This in turn led to a greater emphasis on commercialization and economic criteria in awarding funding. Similarly, pressure from this coalition convinced Reagan to lean on other sources of funding like Federal Focus to support applied research. This was an effective subsidy for tech businesses.

The institutionalization of VCs in the same framework as startup and small-business funding solidified the coalition of right-leaning financial interests and liberal tech and defense interests. It also led to the expansion of the SBIR model: the Defense Small Business Advanced Technology Program was structured in the same way as the SBIR. This later became the Advanced Technology Program (ATP) under Bush and influenced other industrial policy programs like the Technology Reinvestment Project (TRP).[56] The democratic side of this coalition, moreover, reined in the ambitions of Atari Democrats[57] like Paul Tsongas, who wanted to pursue policies modeled after Japan's Ministry of International Trade and Industry (MITI).

[54] Tom Nicholas, *VC: An American History* (Cambridge, MA: Harvard University Press, 2019), 246–7.
[55] Weiss, *America Inc.?*, 74.
[56] According to Tony Tether, DARPA director under Bush II, the idea behind TRP was: "Hey, we got a bunch of smart guys that have really done great in the '80s. Let's have them do venture capital types of things—commercially." See Tony Tether, interview by DARPA, May 1, 2007, https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/DARPA/15-F-0751_DARPA_Director_Tony_Tether.pdf.
[57] The term "Atari Democrats" came into use in the 1980s to refer to young Democratic legislators who championed tech and believed that it and efficiency through market mechanisms would stimulate the economy and create jobs. I follow Lily Geismer's definition in *Left Behind: The Democrats' Failed Attempt to Solve Inequality* (New York: Public Affairs, 2022), 18–19, 29, 40. Atari Democrats as a group predated the "Reagan Revolution" and aimed to reformulate liberalism and the traditional precepts of the party with the belief that "the market and private sector [can] do social good." This meant "fusing government reform and economic growth with opportunity and equality." They likewise believed that "the future for the economy and the Democrats lay in a new model of growth that focused on bolstering trade and the postindustrial sector, especially high-tech entrepreneurship."

The transition from the Cold War into the "unipolar moment" (i.e., US hegemony) was also the beginning of a period where science and technology played a more central role in politics; the coalition forged in the wake of the Vietnam War by Midwest and Eastern financial interests and tech liberals ensured that. As historians like Lily Geismer have documented, ex-Defense scientists, engineers, and technicians bound the Democratic Party to the interests of the emerging tech sector—then made up of small, often spin-off science-and-engineering-focused government contractors—in a political alliance that has only recently begun to fray.[58]

This bipartisan coalition emerged at the same time that intellectual justifications for favoring high tech blossomed in economics policy circles. Prominent MIT economist Lester Thurlow, for example, posited that 1970s economic crises could be resolved by accelerating productivity through boosting "sunrise industries" (e.g., computing and biotechnology) and offshoring "sunset industries" (automobiles, steel, textiles, consumer electronics). Sunset industries could offshore to cheaper countries, which would then supposedly be elevated to the next stage of development through these industries.[59]

Proponents of New Growth theory on the center-left and supply-side economists on the right could all find common cause in championing a transition to a new postindustrial economic order where control of sunrise industries would determine global power. This belief guided the design of US industrial policy through the Clinton administration. Moreover, this theory broadened the coalition around industrial policy for high-tech industries to include not just high-tech industry and VCs, but also foreign-policy hawks interested in the maintenance of American power projection.

The coalition of Atari Democrats, defense scientists, foreign-policy realists, and VC-related financial interests proved powerful enough to successfully withstand the pressures of more radical groups like the Heritage Foundation and the Gingrich Congress elected in 1994. The policies pursued by this coalition maintained and even intensified the military reliance on high tech despite its frequent failures in practice.[60] Tech not only offered appealing fantasies of control, but moreover

[58] John Ganz, "The Emerging Tech-Lash: The Politics of Tech Oligarchy," *Unpopular Front* (blog), April 26, 2022, https://www.unpopularfront.news/p/the-emerging-tech-lash.
[59] These political choices were, by the end of the 1990s, portrayed as inevitabilities. A large literature premised on the belief that the US "lost" the auto industry flourished. See National Research Council, *Funding a Revolution*; and Alex Roland and Philip Shiman, *Strategic Computing: DARPA and the Quest for Machine Intelligence, 1983–1993* (Cambridge, MA: MIT Press, 2002), 91.
[60] Consider, for example, US interventions in Vietnam and Iraq, and US use of imprecise or poorly targeted drone strikes and precision-guided munitions both in war and in other, more ambiguous contexts.

functioned as a central engine of the US economy that could survive right-wing attacks on the state.

The symbolically laden economic conflict with Japan peaked from the mid-1980s to the early 1990s. For many observers, it confirmed the importance of high tech as the centerpiece of the next stage of economic development and therefore government support for this sector. Japan's 1976 VLSI Program aimed to improve the manufacturability of devices through a collaborative research effort involving the country's five largest industrial chipmakers.[61] The program was widely acknowledged as one of the most successful national cooperative research efforts in the history of the industry, and its success inspired similar collaborative research efforts.[62]

In response to Japanese success in the semiconductor market, bookings (orders received) for the US semiconductor industry dropped suddenly in December 1984.[63] The industry had been blindsided by the challenge to American dominance in semiconductor markets and was "in full crisis mode."[64] Industry lobbyists swarmed Washington, urging legislators to help resolve the issue. The lobbyists and industry leaders framed the problem of their dwindling market share as a national security one necessitating urgent state action. The government's formal responses to this program were extensive.[65] They aimed to help the US regain technological parity with Japanese commercial industry and advance integrated circuit (IC) technology for the benefit of the US semiconductor industry, all while making sure the DoD's needs were met in a context where the semiconductor industry no longer relied on government contracts.[66]

[61] The program was apparently sparked by rumors in 1975 that IBM was working on a new line of computers that would use VLSI. The Japanese VLSI program was such a success that IBM modeled later initiatives after it. See Kiyonori Sakakibara, "R&D Cooperation Among Competitors: Lessons from the VLSI Semiconductor Research Project in Japan" (working Paper #650, University of Michigan School of Business Administration, January 1991), https://deepblue.lib.umich.edu/bitstream/handle/2027.42/36069/b1425067.0001.001.pdf.
[62] Robert Schaller, "Technological Innovation in the Semiconductor Industry: A Case Study of the International Technology Roadmap for Semiconductors (ITRS)" (PhD diss., George Mason University, 2004), 437.
[63] Arati Prabhakar interview with author, May 19, 2021. See also "CEO Sees End to 'Cowboy' Chip Purchasing," *Electronic Business Buyer* 21, no. 7–8, July 1995.
[64] Harry Sello and Daryl Hatano, "Oral History of Paolo Gargini," transcript, Computer History Museum, 20, July 27, 2011, https://archive.computerhistory.org/resources/access/text/2012/08/102714338-05-01-acc.pdf.
[65] Responses included the DoD's Very High-Speed Integrated Circuit (VHSIC) Program and DARPA's VLSI program, though US firms also pursued VLSI.
[66] The VHSIC Program had technology targets based on device feature sizes, and despite being focused on defense, it made important contributions to industrial integrated circuit technology. The VLSI program, on the other hand, was very open and less focused on specific military applications. Larry Sumney, the director of the VHSIC Program, became director of the industry group Semiconductor Research Corporation (SRC) in 1982. Sumney remained as the director and later president for the entire life of the SRC. See Robert M. Burger, "Cooperative Research: The New Paradigm," Semiconductor Research Corporation, March 1, 2001, 26; and Schaller, "Technological Innovation in the Semiconductor Industry," 438.

By the time the Japanese government announced its Fifth Generation Computer System (focused on AI and logic programming) and SuperSpeed (focused on supercomputing) programs in the early 1980s, many in Congress found this threat more urgent than anything related to Communist states.[67] In response, funding for a wide variety of computing projects dramatically increased with the 1983 Strategic Computing Initiative (SCI). On the other hand, the technical community had a more varied assessment of this announcement's potential. Many saw this moment instead as a means to increase federal funding for computing research.[68] In some cases it was.[69] In others, computing and microelectronics figures genuinely saw foreign competition as their biggest threat.[70] The DoD was deeply concerned about "plac[ing] technology critical to American security interests in the hands of foreigners."[71]

AI was a key early focus of the Reagan administration, along with other technofuturist endeavors like the president's efforts to construct space lasers. In 1981, "the Defense Science Board, a panel of civilian experts advising the Department of Defense, ranked AI second from the top of its list of which technologies had the most potential to make an order-of-magnitude impact on defense in the 1990s."[72] This group recognized that the "key limiting factor on progress towards AI was clearly computing power, and this spurred calls for research into the development of faster and more powerful interactive computer systems."[73]

The SCI aimed to create an "industrial base for artificial intelligence."[74] In AI, the SCI focused research around concrete military applications "intended to spark the military services' interest in developing AI technology based on fundamental research."[75] This applied vision "altered [the] character [of AI research]."[76] The SCI "attracted a tremendous amount of industry investment and venture capital to AI

[67] Roland and Shiman, *Strategic Computing*, 320.
[68] Ibid.
[69] "Cooper, Kahn, and others, who had gone to Japan to see for themselves what kind of threat the Fifth Generation posed, came back with a very different view than the one that Feigenbaum had sold to Congress. They thought the Japanese were far behind the US in computer development and AI. What is more, they were sure that the Japanese were headed down the wrong path. But if playing the Japan card would help sell SC, then they would play it. 'We trundled out the Japanese as the arch-enemies,' Cooper later confessed, noting that in private conversations with congresspeople and senators he 'used it . . . unabashedly.' In fact, Cooper went so far as to assert that he went to Japan specifically to gather material for this argument. The tactic worked. Congress formally approved the SCI in the Defense Appropriations Act of 1984. President Reagan signed it on the day it was passed, 8 December 1983. Roland and Shiman, *Strategic Computing*, 91.
[70] Roland and Shiman, *Strategic Computing*, 300.
[71] Ibid., 287.
[72] Emma Salisbury, "A Cautionary Tale on Ambitious Feats of AI: The Strategic Computing Program," *War on the Rocks*, May 22, 2020, http://warontherocks.com/2020/05/cautionary-tale-on-ambitious-feats-of-ai-the-strategic-computing-program.
[73] Ibid.
[74] National Research Council, *Funding a Revolution*, 123.
[75] *Ibid.*, 214.
[76] Ibid.

research and development,"[77] and sent close to half of its research funds to industry hoping for spin-offs.[78] These planners wanted to produce a true AI industry that could be embedded into "'central roles in military equipment and command.'"[79]Advances in chips during this period allowed ideas like John Hopfield's neural nets to be tested in practice; once again, increases in AI capabilities relied on government intervention in semiconductors.

The Japan conflict convinced pundits and national-security intellectuals that economies were the battlefields of the future. They expressed belief in the term "economic security," an expansion of national security to include "disposable capital in lieu of firepower, civilian innovation in lieu of military-technical advancement, and market penetration in lieu of garrisons and bases [...] the logic of war in the grammar of commerce."[80] What mattered most was "control of markets, investment, and technology."[81]

US policymakers and various companies arranged for frequent visits to Japanese industry to learn about their methods and technologies; this was formalized by the Clinton administration's commerce department as the Japan Technology Project. These trips and facilitated information exchanges led to the professionalization of US chip manufacturing. Where manufacturing facilities had previously resembled research labs, they became more like profit-maximizing factories as a result of Japan competition.[82]

The chip industry, in particular, closely copied Japanese organizations and methods. The US government-industry collaboration, SEMATECH, for example, was explicitly modeled on Japan's MITI. The National Cooperative Research Act of 1984 "exempted research consortia from some antitrust laws and facilitated [...] mergers."[83] This made initiatives like SEMATECH possible. Defense needs were also represented. "DARPA's objectives" for example, "were mentioned in SEMATECH's strategic plan, including efforts to rapidly convert manufacturing technology into practice and to develop technology for more flexible semiconductor production."[84]

[77] Ibid.
[78] Ibid.
[79] Edwards, *The Closed World*, 295; National Research Council, *Funding a Revolution*, 123.
[80] Mario Daniels and John Krige, *Knowledge Regulation and National Security in Postwar America* (Chicago: University of Chicago Press, 2022), 200.
[81] Ibid., 199. See also Reis, interview by DARPA: "So, how do we deal with that? He [DARPA director Craig Fields] felt that the thrust was going to be in things like, high-definition television, advanced electronics, and advanced computing. And it was important for DARPA to stay ahead in those sorts of things. In other words, the interaction between the commercial world and the military world was going to get more and more blurred as time goes on. So, it was important for the nation to stay ahead in the commercial world, as well as in the national security world."
[82] Miller, *Chip War*, 126.
[83] National Research Council, *Funding a Revolution,* 113.
[84] Ibid., 130.

SEMATECH coordination "allowed equipment manufacturers to meet one set of industry specifications rather than a variety of company specifications."[85]

The Japan conflict justified coercive trade agreements for the Realist school. This is particularly interesting because it runs counter to the common understanding of the Reagan era as a period that centered the hegemony of neoclassical economics. Instead, the reactions to this conflict demonstrate the power of the national security state in alliance with semiconductor firms (contra the near-term interests of the computing industry).

The extent to which the US conflict with Japan reshaped understandings of war and peace in an imagined postindustrial age is clearly apparent in ex-DARPA director Craig Field's remarks at a 1995 White House forum:

> [W]e are in a new age [of national security]. We cannot quite tell the difference between peace and war. It is not now black and white, it is shades of gray. It is not so clear who are friends and who are foes. [...] There are lots of different kinds of aggression other than direct military aggression[:] indirect, trade, and so on. It is not so clear what a country is anymore, and companies are more and more global.[86]

This blurring moreover meant that realists increasingly viewed globalizing industries and multinational firms as extensions of US state power: "even if markets were populated by private actors, the 'security issues do not disappear'; they only 'become submerged and hidden by market relations.'"[87]

As industry and VCs moved away from early-stage, high-risk ventures in the 1980s, the federal government increasingly filled the gap. Moves like this one intensified what Daniella Gabor terms the "de-risking state." The 1988 Omnibus Competitiveness bill, for example, transformed NIST and the federal labs around the needs of industry in the name of US "competitiveness."[88] While some accounts depict this as corporate capture, the reality is somewhat more complex.

[85] Ibid., 129–30.
[86] Clinton White House (archive), "National Security Science and Technology Strategy," Strengthening Economic Security, 1995, https://clintonwhitehouse3.archives.gov/WH/EOP/OSTP/forum/html/fields.html
[87] Daniels and Krige, *Knowledge Regulation and National Security in Postwar America*, 201.
[88] "New Directions: Overview," NIST, July 23, 2001, https://www.nist.gov/pao/nist-100-foundations-progress/new-directions-overview.

The Japan panic of the 1980s, and the belief that future post–Cold War conflicts would resemble it, convinced many that US corporations were extensions of the US state and state power.[89] The federal government helped create a new ecosystem around high tech that shifted risk from private to public institutions and simultaneously shifted profits from public to private ones. Other benefits were more subtle: where defense and federal money used to focus on the production of physicists during the Cold War,[90] it now began to focus on the production of chip designers—aiming to keep Moore's law going and to produce related technicians. In return for shouldering the burden of high-risk investments, federal agencies got seats on the boards of new tech companies, access to and a role in shaping new technologies, and influence over the system as a whole.

Bush I: Semi Chips & Potato Chips

Reagan-era tech policy marked a shift in focus toward civilian industry. This shift became a site of conflict under the Bush and Clinton administrations as Heritage-style conservatives became more organized and gained political power on the right. The New Right stalwarts were critical of Reagan's aggressive trade policy on behalf of semiconductor firms. They were also furious at the government intervention involved in programs like SBIR and the practices of agencies like NIST. The semiconductor industry was at the heart of this dispute. In the words of one analyst writing about SEMATECH, "the half-billion-dollar federal commitment marks a major shift in U.S. technology policy: a turn toward explicit support for commercially oriented R&D carried out in the private sector."[91] As the Cold War wound down in the late 1980s, some imagined "a civilian DARPA that could do for U.S. economic competitiveness what the old DARPA had done for military competitiveness."[92] This view significantly shaped programs like the SCI.

Reagan's defiance of institutions like Heritage on aggressive state intervention for high-tech industries led to significant pressure on his successor, George H.W. Bush. New Right Republicans trusted Bush much less than Reagan and could vent their frustration more easily because Bush was not an emblem of their movement's success. The end of the Cold War added fuel to the orthodox New Right case as

[89] Daniels and Krige, *Knowledge Regulation and National Security in Postwar America,* 85.
[90] Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists after World War II."
[91] National Research Council, *Funding a Revolution,* 129.
[92] Roland and Shiman, *Strategic Computing*, 7.

well. Was defense spending on the scale of the Cold War necessary? The National Academy, writing in 1999, outlined the novelty of this debate. According to this body, the conflicts of the 1990s constituted "the first time in which fundamental questions are being raised about the infrastructural commitments and organizational principles that have guided federal support for research."[93]

The dismissal of DARPA's director Craig Fields by the George H.W. Bush administration was a pivotal moment in this struggle over the role of the state. Fields's firing was significant because DARPA had a long history of promoting the kind of innovation Field promoted. The pressure on H.W. Bush to make this move came from libertarian-leaning groups. Bush dismissed Fields for pursuing ventures "deemed to be more concerned with improving US commercial competitiveness than enhancing military preparedness."[94] Specifically, Fields was fired for providing too much obvious aid to the semiconductor industry—through dual-use ventures and investments in semiconductor firms. He was "appearing to stray too far into the commercial arena, after having taken DARPA into a series of new dual-use ventures. But the final straw came when he authorized a $4 million equity investment in a company making semiconductor devices with advanced materials," which was an "obvious breach of the state-market divide."[95] Fields subsequently became the president of the Microelectronics and Computer Technology Corporation (MCC) and played a major role in Clinton administration tech and defense policy.[96]

Even after Fields's dismissal, key figures in the Bush administration were deeply concerned about industrial policy and its effect on the budget deficit.[97] According to Alex Roland and Phillip Shiman's book on the SCI, "[s]everal of the president's close advisers, particularly Richard Darman, the budget director, and Michael Boskin, the chairman of the Council of Economic Advisors, were particularly opposed to any interference in the functioning of the free market."[98] Boskin is famous for his (possibly apocryphal) comment on chips: "Potato chips, semiconductor chips, what is the difference? They are all chips."[99] Darman, a Reagan holdover, similarly demonstrated his commitment to "the free market" when he showed little concern

[93] National Research Council, *Funding a Revolution,* 34
[94] Weiss, *America Inc.?,* 164.
[95] Ibid.
[96] Roland and Shiman, *Strategic Computing*, 310.
[97] Ibid., 315.
[98] Ibid.
[99] Carl Cannon, "Letter From Washington: The Bill Comes Due," *Forbes*, September 10, 2001, https://www.forbes.com/asap/2001/0910/032.html.

over Japan dumping DRAM chips, claiming: "What's wrong with dumping? It is a gift to chip users because they get cheap chips. If our guys can't hack it, let them go."[100]

Nonetheless, the Bush administration continued Reagan's significant and enthusiastic support for computing, especially the microelectronics industry. For example, the High-Performance Computing and Communications Initiative (HPCCI) began in 1989 as an Office of Science and Technology Policy (OSTP) initiative and was formally legislated in 1991.[101] This program coordinated DOE, NASA, NSF, NSA, EPA, NIH, NIST, NOAA, DOE, and the VA around supercomputing. Due to the pace of microelectronics improvements, infrastructure developed for high-end computers was rapidly diffused to everyday civilian applications, so the program had considerable impact.

The semiconductor industry served as a model for government involvement in other industries as well. As a result of the greater emphasis on industrial needs initiated because of small-business and VC organizing, the federal role in research and development continued to transform under Bush. NSF, for example, "established a number of Engineering Research Centers (ERCs) to better link academic research to industrial needs, and the National Institute of Standards and Technology began its Advanced Technology Program, which funded consortia working on precompetitive research projects of mutual interest," in the model of SEMATECH.[102] Likewise, interdisciplinary science and technology centers (STCs) focusing on areas in computer science[103] began appearing in 1989, funded by multiple agencies, universities, and industries.[104]

The Gulf War created the impression that the technological dreams of Vietnam had been realized, and convinced many in the realist foreign policy camp that their support for tech industrial policy had been worth it. In particular, for AI, a "report by the American Association for Artificial Intelligence (1994) paraphrased a former director of ARPA in saying that DART (the intelligent system used for troop and materiel deployment for Operation Desert Shield and Operation Desert Storm in 1990 and 1991) 'justified ARPA's entire investment in artificial-intelligence technology.'"[105] This use of AI mirrors modern uses. Israel in its present war on Gaza

[100] Ibid.
[101] National Research Council, *Funding a Revolution,* 130–1.
[102] Ibid., 154.
[103] These areas included computer graphics and scientific visualization, discrete mathematics and theoretical computer science, parallel computing, and research in cognitive science.
[104] National Research Council, *Funding a Revolution*, 124–6.
[105] Ibid., 225.

uses AI in similar ways[106] to generate targets that are legitimated by the public's trust in numbers[107] and in tech's infallibility.[108] These military ambitions and uses have shaped the form, funding, and development of information technologies.

The Clinton Administration: Gingrich versus Atari Democrats and the Information Industry Coalition

The Clinton administration was the purest articulation of Atari Democrat orthodoxy, further binding the party ideologically and materially to the tech sector. In their 1992 run, Clinton and Gore focused on seducing tech executives, who typically skewed Republican.[109] They aimed to replicate Reagan's industrial policy focused on civilian industry rather than defense—with a few additional tweaks. As information industries occupied a larger and growing position in the nation's economy because industrial policy favoring this industry matured and other unsupported industries collapsed and consolidated, this favoritism became a matter of common sense and political survival. Exponential growth, underlain by exponential improvements in chip technology, made this strategy even more imbricated and easily justified. By the end of the 1990s, the National Academies of Sciences could write narratives like the following:

> The computer revolution is not simply a technical change; it is a sociotechnical revolution comparable to an industrial revolution. The British Industrial Revolution of the late 18th century not only brought with it steam and factories, but also ushered in a modern era characterized by the rise of industrial cities, a politically powerful urban middle class, and a new working class. So, too, the sociotechnical aspects of the computer revolution are now becoming clear. Millions of workers are flocking to computing-related industries. Firms producing microprocessors and software are challenging the economic power of firms manufacturing automobiles and producing oil. Detroit is no longer the symbolic center of the U.S. industrial empire; Silicon Valley now conjures up visions of enormous entrepreneurial vigor. Men in

[106] Ben Reiff, "'A Mass Assassination Factory': Inside Israel's Calculated Bombing of Gaza," *+972 Magazine*, November 30, 2023, https://www.972mag.com/mass-assassination-factory-israel-calculated-bombing-gaza.
[107] Theodore M. Porter, *Trust in Numbers : The Pursuit of Objectivity in Science and Public Life* (Princeton: Princeton University Press, 2001).
[108] It looks as though the US is adapting the same approach. Manson, Katrina. "AI Warfare Is Already Here." *Bloomberg.Com*, February 28, 2024. https://www.bloomberg.com/features/2024-ai-warfare-project-maven/
[109] Lily Geismer, *Left Behind: The Democrats' Failed Attempt to Solve Inequality* (New York: Public Affairs, 2022), 236.

> boardrooms and gray flannel suits are giving way to the casually dressed young founders of start-up computer and Internet companies. Many of these entrepreneurs had their early hands-on computer experience as graduate students conducting federally funded university research.[110]

Not only did the Clinton administration desire a closer relationship with tech industries like the semiconductor industry, but the semiconductor industry also wanted a closer relationship with the government.[111] Clinton administration figures correctly identified the extent to which Republicans were constrained by their right flank in support for the tech industry and made explicit promises to deliver where Bush could not. For example, in 1993 talking points for an upcoming meeting with Semiconductor Industry Association (SIA) figures, Clinton's OSTP writes that "despite industry's concerns, this administration will provide a more favorable environment than the Bush administration did for NACs."[112] Both industry and the Clinton administration wanted to extend the SEMATECH model within and beyond the semiconductor industry.[113] Clinton administration figures attributed chip industry resurgence to Reagan-era policies such as SEMATECH and US government efforts to "open the Japanese market."[114]

The SIA road map created a vehicle for more closely coordinating government and industry, as well as for major changes in industry itself. SIA, SEMATECH, and Semiconductor Research Corporation (SRC) adapted their structures to roadmap needs and began collaborating more closely. Likewise, the document and attendant planning and implementation processes gave industry the occasion to coordinate with numerous agencies (e.g., DoD, DoE, DoC, NSF, NIST, OSTP, and NEC) around roadmap goals. The administration formalized this collaboration by creating the Semiconductor Technology Council, which replaced the SEMATECH oversight committee. The Clinton administration also made industry partnership with agencies and labs easier.[115] Industry actively and urgently sought this collaboration.[116]

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[110] National Research Council, *Funding a Revolution,* 1–2.
[111] Craig Barrett to John Gibbons and John Deutsch, July 1, 1993. William J. Clinton Presidential Library and Museum, National Archives. Craig Barrett here is acting in his position as chair of SIA strategy.
[112] Mark Hartney to John Gibbons and Kitty Gillman July 16, 1993. William J. Clinton Presidential Library and Museum, National Archives.
[113] Bill Spencer to D.A. Henderson March 22, 1993. William J. Clinton Presidential Library and Museum, National Archives.
[114] John Gibbons to Ron Brown, Hazel O'Leary, William Perry, and Neal Lane, January 13, 1993. William J. Clinton Presidential Library and Museum, National Archives.
[115] Via Cooperative Research and Development Agreement (CRADA) agreements.
[116] Bill Spencer, for example, wrote to Gore: "To be effective, it [the road map] will require an interagency perspective from the government as well as a capability to act on cross-cutting initiatives that go beyond the mission of individual agencies or departments. [...] A partnership is now needed to mobilize our nation-wide talent and to address the entire range of semiconductor technology complexities that will confront us as we face the challenges of leadership in the information age." Bill Spencer to Al Gore, March 10, 1993, William J. Clinton Presidential Library and Museum, National Archives.

Government partnerships with information industries were even more extensive and formalized in the first half of the Clinton administration. Government adoption of business practices is often commented upon, but not the inverse; yet this was the product of the revolving door and other forms of public-private blurring in addition to ideology.[117] As Clinton figures articulate, the "magnitude [of government-industry cooperation in microelectronics] masked its dispersal across various agencies and firms."[118] The Clinton administration, for example, formalized access to Japanese techniques and technologies along with other foreign tech assessments—which industry repeatedly asked for.

The Clinton administration, moreover, presided over and shaped the construction of a new global order in the wake of the collapse of the Soviet Union. The administration built that order around the needs of high-tech industries. As Chris Miller argues, the US had replaced the early-Cold War order in Asia, which centered around the Korean and Vietnam Wars, with a post-Vietnam US-centered order around chip production.[119] While the ascendency of Japanese high-tech companies endangered this order in the 1980s, by 1993, the Japanese threat to American technological supremacy had faded. The Clinton administration formalized, extended, and expanded this strategy as computing and information industries gained greater shares of the US economy—a natural outcome of policies pursued under Reagan and the elder Bush.

The Clinton administration and tech industry worked closely on trade deals, rules, and institutions to shape the post–Cold War international order, as well as domestic policies. The administration also gave industry other benefits like lax antitrust regulation. AI, despite declines in federal funding, got an effective subsidy from US government funding, planning, and foreign policy for semiconductors and other information technologies.

The SIA roadmap delivered benefits not just for the semiconductor industry but for all industries that relied on cheap, predictable improvements in chips. It coordinated vast swaths of the industry, including suppliers and peripheral entities; and institutionalized Moore's law, which delivered relatively predictable advances in chip technologies. Other industries could plan around and reap the benefits of this

[117] This collaboration further blurred the public-private divide, and institutionalized this blurring in personnel decisions and in many industry-government initiatives. At the same time, government and industry practices began to resemble each other more and more. Industry adopted more governmental features and practices, while government did the same with industry practices.
[118] Mark Hartney to Skip Johns, April 1, 1993, William J. Clinton Presidential Library and Museum, National Archives.
[119] Miller, *Chip War,* 78, 112–4, 132, 149, 163–7.

predictable advance in capability. In the late 1990s, when engineering challenges and fears of international competition pushed the road map to internationalize, these benefits to related industries like AI increased.

In tandem with this industrial-state coordination, narratives about "the New Economy" were developed and disseminated through networks of politicians, pundits, and executives:

> [T]he rapid integration of computing and telecommunications technologies into international economic life, coupled with dramatic rounds of corporate layoffs and restructuring,[120] had given rise to a new economic era. Individuals could now no longer count on the support of their employers; they would instead have to become entrepreneurs, moving flexibly from place to place, sliding in and out of collaborative teams, building their knowledge bases and skill sets in a process of constant self-education. The proper role of government in this environment, many argued, was to pull back, to deregulate the technology industries that were ostensibly leading the transformation, and, while they were at it, business in general.[121]

Accounts like these, distilled by Fred Turner, were undergirded by myths of the self-made tech entrepreneur, who supposedly started lucrative multinational corporations from his[122] garage. Such myths have been punctured time and time again. Is it any wonder that these elite-flattering narratives were originally produced to sell tech-anxious elites consulting services and access to elite networks?[123]

At the same time, these narratives and others that painted tech as a tide that would lift all boats provided cover for the Clinton administration to significantly cut welfare. As a result, people who were not in any way freed from the banalities and rootedness of their jobs (unless they were ex-factory workers unlucky enough to be freed from employment entirely as a result of new tech-friendly trade deals) suffered. Nonsense techno-optimist narratives, self-flattery, and visions of liberation from material conditions and "nonhierarchical meritocracy" for the new elite; cheap credit, "access" to banking and trimmed-down welfare (which had

[120] The defense industry, most notably, imploded.
[121] Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006), 7.
[122] And it was almost always "his."
[123] Stuart Brand's Global Business Network, for example. See Turner, *From Counterculture to Cyberculture*,, Chapter 6; and Geismer, *Left Behind*, 237.

actually provided some protection from the vicissitudes of the market) for everyone else.[124]

Clinton's reelection campaign deepened the administration's ties to Silicon Valley; software and new Silicon Valley businesses began flexing their political muscles. Seventy-six prominent tech executives, including Steve Jobs, backed Clinton; Marc Andreesen gushed about Gore.[125] Once Republicans regained control of the legislative branches in the same 1994 election, they attacked the mainstays of Reagan-era industrial policy. These Republicans rejected the idea that the "federal science establishment" had much to do with US technological competitiveness.[126] They even objected to the public-private partnerships that became a staple of Clintonite industrial policy: "promoting government industry partnerships to advance technology for which the government is not the primary customer."[127] They claimed all foreign industrial policy efforts had failed.[128]

Upon his election as House majority leader in 1995, New Right Republican congressman Newt Gingrich took up the mantle of Reagan with a greater allegiance to the libertarian New Right elements of the party. He and his allies espoused an even more techno-utopian ideology than the Atari Democrats. They imagined the internet as the mechanism through which to present the aims of the party—"welfare reform", tough-on-crime policies, tax cuts, and deregulation—as policies of the future.[129] Gingrich believed technology would obviate the need for the state economically and politically.[130] It is notable, then, that high-technology industries for the most part aligned with the Atari Democrats—on the side of industrial policy. In particular, the Gingrich house-led scorched-earth campaign against the ATP and Technology Reinvestment (TRP) programs, which were designed in large part to help the semiconductor and electronics industry, forced industrial planners to hide their work. The Gingrich House likewise tried to dismantle the Department of Commerce (home of NIST) and the federal laboratory system.

[124] Geismer, *Left Behind,* Chapter 5.
[125] Ibid. 238–9.
[126] Weiss, *America Inc.?*, 44. United States, Department of Commerce Dismantling Act of 1995: *Joint Hearing before the Subcommittee on Commerce, Trade, and Hazardous Materials and the Subcommittee on Telecommunications and Finance of the Committee on Commerce*, House of Representatives, One Hundred Fourth Congress, First Session, on H.R. 1756, July 24, 1995 (Washington, DC: US Government Publishing Office., 1995), 7.
[127] Ibid..
[128] That was demonstrably not the case; cf. Japan's VLSI program.
[129] Turner, *From Counterculture to Cyberculture*, 231.
[130] "The elections of 1994 usher in the first Republican majority in both houses of Congress for forty years. Led by Newt Gingrich, the House of Representatives in the mid 1990s pushed for the downsizing of government and widespread deregulation—especially in the telecommunications sector. Together with Alvin Toffler, George Gilder, and technology journalist and entrepreneur Esther Dyson, Gingrich argues that America was about to enter a new era, one in which technology would do away with the need for bureaucratic oversight of both markets and politics. As Gingrich and others saw it, deregulation would free markets to become the engines of political and social change that they were meant to be." Turner, *From Counterculture to Cyberculture*, 215.

Industry and government agencies banded together and successfully blocked most of the proposed changes.

In coordination with industrial partners, Clinton implemented a shadow policy for the information sector (like the semiconductor industry) and extended methods pioneered there to other service industries like banking.[131] The boundaries between public and private blurred significantly as a result of the political necessity to conceal industrial policy and close coordination with information industries. AI benefited from the information revolution and industrial policies put in place by the Clinton administration. Several AI initiatives funded by DARPA in the 1960s and 1970s found applications in the "emerging national information infrastructure and electronic commerce" of the 1990s.[132] Although funding for AI was significant, it was hidden by its dispersal throughout a number of programs and agencies like the Intelligent Systems and Software program, Intelligent Integration of Information program, and basic research in the information sciences budget.[133]

The Second Bush Administration: Privatization, VCs, Neglect, and Military-Industrial Consolidation

Following Gingrich and the libertarian right, the second Bush administration originally sought to dismantle Clinton-era government support for industrial policy. 9/11, however, made any cuts to the national security state industrial complex politically impossible. The collapse of the defense industry through massive mergers and cuts during the 1990s created an opportunity for massive tech profits in the 2000s. New tech companies and startups filled the void when the US invaded Iraq in 2003. Following the apparent success of Desert Storm and Rumsfeld's aspiration to put the DoD in charge of tech policy, Iraq War military funding emphasized information technologies. The second Bush administration similarly advanced the privatization of more military functions through outsourcing and contracting.[134] New tech-focused defense conglomerates like Booz Allen Hamilton gained prominence; surviving older defense contractors developed tech

[131] Banking as an industry transformed dramatically as a result of information industries and relaxed antitrust rules. In the 1990s, the industry consolidated dramatically and practices transformed as computers and the internet were integrated into everyday life. See David P. Leech, Albert N. Link, John T. Scott, and Leon S. Reed, *NIST Report: 98-2 Planning Report The Economics of a Technology-Based Service Sector* (Arlington, VA: TASC, Inc.: January 1998).
[132] National Research Council, *Funding a Revolution,* 216.
[133] Ibid., 219.
[134] Jennifer Mittelstadt and Mark Wilson, eds., *The Military and the Market* (Philadelphia: University of Pennsylvania Press, 2022), 30.

capabilities.[135] Another outcome of the Bush II-era defense policies was the proliferation of agency venture capital initiatives modeled on the VC appendages developed by companies like Intel in the 1990s. These VCs allowed US agencies like the CIA to shape technology development, much in the same way as Intel's VC did in the 1990s. This occurred as most VCs retreated from semiconductors and biotech and moved into software, internet services, and (as many alleged in the wake of the collapses of Pets.com and WeWork) vaporware.[136]

The second Bush administration was characterized by a permissive attitude toward tech firms, devolving control to the security state in the wake of 9/11. At the behest of Intel, they further relaxed export controls, and transferred extreme ultraviolet (EUV) lithography technology to Dutch firm ASML.[137] Similarly, the administration did nothing to prevent technology transfers to Korean, Taiwanese, Singaporean, Japanese, and eventually Chinese chip producers. As companies like Intel felt assured in their continued hegemony via the international road map, they became less entwined in government lobbying.

Firms like Windows and Intel significantly benefited from the government's relaxation and consistent lax enforcement of antitrust rules. Chips for Microsoft's PCs helped give Intel its technological lead in the 1990s and early 2000s. The collaboration, known as Win-Tel, meant that most computers were sold with Intel chips and Windows software, producing massive profits and near-monopoly status for both companies.[138]

The Obama Era: Neglect and the Fabless Model

The Obama administration followed in the footsteps of the Clinton-era Atari Democrats. They were politically cozy with tech elites and ignored chip-producing firms in favor of design firms and (at least in the short term) cheap consumer electronics. Another marker of this era was the proliferation of agency "ARPAs" to fund technology like the Intelligence Advanced Research Projects Activity (IARPA) for the intelligence community.[139]

[135] Ibid., 54–5.
[136] Nicholas, *VC*, 268–9.
[137] Miller, *Chip War*, 187–9.
[138] Ibid., 127.
[139] This may be for both ideological and practical political reasons—preferring to echo DARPA rather than VCs, which had been increasingly associated with vaporware and valuation collapse.

The expense of new lithography techniques separated design and fabrication firms, an innovation pioneered by Apple and Taiwan Semiconductor Manufacturing Company Limited (TSMC). This separation was accelerated by a shift in who headed tech firms. The proliferation of MBAs rather than engineers accelerated the fabless model, which cut operating costs in the short term by outsourcing fabrication. A focus on short-term profits over long-term research and sustainability spread under Obama's term like wildfire via firms like McKinsey, which had no special expertise[140] in the complicated field of chip production.[141] TSMC, incidentally, went in the opposite direction during this period and significantly reinvested in production, unlike Intel.[142]

Following Clinton-era thinkers like Craig Fields, the Obama administration believed that tech diffusion and globalization were inevitable and could only be slowed. This belief caused them to misdiagnose problems in the chip industry as related to globalization instead of correctly attributing those issues to monopolization.[143] This configuration seemed to work as new, improved chips continued to provide the basis for other monopolistic firms like Google and to produce new AI-esque products—such as improving natural language processing and virtual assistants like Siri.

Conclusion

The end of the Obama administration brought about a number of major interrelated changes: the shift to costly EUV lithography; the end of the semiconductor road map and the inauguration of the less influential device road map (IDRS); Intel's inability to keep up with competition; the closure of IBM's fortress-model fab for defense; and Intel's panic about Chinese subsidies and interference (not unlike the 1980s Japan panic), which had dashed dreams of a US solar panel industry. All of these events together created a renewed chip panic among the defense-industrial complex by 2016. COVID-era supply chain issues in 2020 and 2021 caused politicians and lawmakers to pay attention; they conflated defense concerns with

[140] Laleh Khalili, "In Clover," *London Review of Books* 44, no. 24 (December 15, 2022),, https://www.lrb.co.uk/the-paper/v44/n24/laleh-khalili/in-clover.
[141] Miller, *Chip War*, 215.
[142] Ibid., 220.
[143] Ibid., 297.

these short-term visible shocks. This conflation led to the passage of the CHIPS bill in 2022.

The rise of cloud computing and the more recent increase in AI use of cloud computing facilities is leading to new vertical integration. Because specialized chips save energy (and thus money) for data center firms like Amazon, such firms are buying Nvidia-style chips for now, but are beginning to design their own chips for machine learning applications.[144] This innovation has cut into the profits of general-purpose chip-producers like Intel.[145] Yearly conferences on how to continue or move beyond Moore's law likewise frequently float special-purpose chips as a means to maintain Moore's law-like improvements.

Defense needs have shaped chips and information technologies like AI for their entire existence. Most major tech companies do at least some significant work with defense. The fact that they do not exclusively function as defense contractors shields them from the typical stigma of working in the defense-industrial complex. Many technologies are developed to be dual-use and therefore have imagined civilian and military uses. The US military is presently imagining a new offset strategy based not in microchips, but instead in AI (though this would, like Reagan's Strategic Defense Initiative, require advances and investments in chips).[146] The collaboration with tech executives cuts both ways. The consequences of Democrat—and increasingly Republican—affiliations with tech companies have meant that the executives of those companies have an outsize influence on seemingly unrelated policy. For example, tech executives provided the major impetus for charter schools and "education reform" under Clinton and Obama.[147]

As I've detailed throughout this chapter, the histories of AI and compute power (especially semiconductors) are closely intertwined. Often, the technofuturist promises of AI have functioned to provide cover for the funding of more banal improvements in chips and chip infrastructure. This was true of SCI funding and continues to be true of present AI funding—for example, with Governor Hochul's recent promotion of New York as an AI hub.[148] With the rise of special-purpose chips and cloud computing facilities, the fates of AI and the chip industry are entwined

[144] Ibid., 238.
[145] Ibid., 237.
[146] Ibid., 287.
[147] Geismer, *Left Behind*., 239.
[148] Governor Kathy Hochul, "Governor Hochul Unveils Fifth Proposal of 2024 State of the State: Empire AI Consortium to Make New York the National Leader in AI Research and Innovation," press release, January 8, 2024, https://www.governor.ny.gov/news/governor-hochul-unveils-fifth-proposal-2024-state-state-empire-ai-consortium-make-new-york.

even more closely than before. Several semiconductor firms contest this and insist AI is a short-term bubble not requiring sustained investment in new kinds of chips. Whether or not AI produces anything like the promised revolution, the current volume of money directed at AI chip production by the industry (bubble or not) will impact the trajectory and production of ever-improving semiconductors. In turn, those chips, their cost, and their capabilities will shape the political economy of tech and will determine how sustainable the political order built around access to cheap and regularly improving semiconductors proves.

2. A Modern Industrial Strategy for AI?: Interrogating the US Approach

by Amba Kak and Sarah West

A Modern Industrial Strategy

> A modern industrial strategy identifies specific sectors that are foundational to economic growth, strategic from a national security perspective, and where private industry on its own isn't poised to make the investments needed to secure our national ambitions. [...] This is about crowding in private investment—not replacing it. It's about making long term investments in sectors vital to our national wellbeing—not picking winners and losers.[149]

[149] White House, "Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution," April 27, 2023, https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution.

US National Security Advisor Jake Sullivan's speech on April 27, 2023 at the Brookings Institute sketched out key pillars of the Biden Administration's industrial strategy: the Administration's intention to make sound public investments, promote competition, and empower workers to grow the middle class.[150] This signals a notable departure from prior framings of industrial policy in recent decades, which have tended to foreground free market and neoliberal principles at the cost of the wellbeing of the public at large, with effects that are particularly stark along racial divides.[151]

Read in its entirety, the speech is most notable for its delicate disentangling of US national interests from those of the largest American companies. It deliberately distances this administration's industrial policy from promoting so-called national champions, favoring a policy that instead prioritizes workers, small businesses, and the public. It also signals departure from the neoliberal orthodoxy by advocating for the abandonment of traditional approaches like free trade and the notion that all growth is good growth, instead using the apparatus of trade law to advocate for high-quality jobs and the working class, tackling economic inequality and shoring up the nation's industrial capacity. It also matters that this statement came from within the national security establishment, where the strategic benefits of concentrated power are often deployed to perpetuate and maintain monopoly power.[152]

In this essay, we argue that the Biden administration's general posture towards a more democratized and worker-led industrial strategy has not translated into its initiatives on AI. We question if such a vision can even be translated within an industry that is constituted by the unprecedented concentration of capital, talent, and resources in a handful of companies, and a technological trajectory that is trending toward larger- and larger-scale development? While Sullivan's speech makes clear that the Biden administration does not want to be seen to promote national monopolies as national interest (a stance also made explicit in Biden's earlier Executive Order on Competition[153]), this should not be confused with a more

[150] White House, "Bidenomics Is Working: The President's Plan Grows the Economy from the Middle Out and Bottom Up—Not the Top Down," June 28, 2023, https://www.whitehouse.gov/briefing-room/statements-releases/2023/06/28/bidenomics-is-working-the-presidents-plan-grows-the-economy-from-the-middle-out-and-bottom-up-not-the-top-down.
[151] Todd Tucker, "Industrial Policy and Planning: What It Is and How To Do It Better," July 2019, Roosevelt Institute, https://rooseveltinstitute.org/wp-content/uploads/2020/07/RI_Industrial-Policy-and-Planning-201707.pdf.
[152] Dakota Foster and Zachary Arnold, "Antitrust and Artificial Intelligence: How Breaking Up Big Tech Could Affect the Pentagon's Access to AI," Center for Security and Emerging Technology (CSET), May 2020, https://www.geopolitic.ro/wp-content/uploads/2020/05/CSET-Antitrust-and-Artificial-Intelligence.pdf.
[153] White House, "Executive Order on Promoting Competition in the American Economy," July 9, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/07/09/executive-order-on-promoting-competition-in-the-american-economy.

general move away from the promotion of US commercial interests as central to industrial policy: if anything, recent moves indicate a tension between these expressed priorities and the measures used to enact them.

Across emergent industrial policy initiatives on AI, we find a glaring lack of any coherent substantive vision for the public good that would animate and justify this focus on public investment in AI research and development. In this sense AI is unlike green technology, another pillar of the Administration's industrial policy ambitions, where the climate crisis has galvanized a broad, global coalition united by clear objectives. Here, the AI investment imperative threaded through the administration's strategy rests on the assumption that advancements in AI equate to progress (progress toward what?), and that AI, in its current form, is imperative to ensuring national security, sovereignty, and economic well being.

This chapter engages with these key questions, starting with a wide-ranging account of industrial policy in AI over the past five years (2019–2023). But the contours of this reinvigorated industrial policy as applied to artificial intelligence must be located within a longer history: as Susannah Glickman outlines in Chapter 1, for decades, US industrial policy focused on semiconductors and the promotion of a US-led semiconductor manufacturing industry as the foundation for advanced computing technologies, including artificial intelligence. Beginning in the 1990s, Glickman notes a decline in direct government investment in the sector. But this decline did not mean an end to US promotion of its tech industry broadly. Rather, it meant a change in approach. Instead of direct public investment, the Clinton administration and its allies favored promoting US corporate interests, particularly in the tech industry. Nurturing the US tech industry became a key pillar of their trade and domestic policy. During this Clinton-era period of global expansion for tech firms, "permissionless innovation" formed a core element of US policy rhetoric, and the promotion of "free and open" tech development was narrated as broadly aligned with the US national interest. This translated to policies that left US tech companies comparatively unencumbered by regulatory constraints over the past two decades, as policymaking sought primarily to remove obstacles to expansion.

This is important context for the return under the Biden administration (and to a lesser extent the Trump administration) to a familiar playbook of direct research and development investment—an approach that characterized US industrial policy for tech from the 1950s through the 1980s, albeit under markedly different geopolitical conditions. During the 1990s and 2000s, consumer tech companies

grew their economic and political power exponentially, with "Big Tech" emerging on the global stage as powerful geopolitical players. In tandem, the role of the US itself evolved with the end of the Cold War and emergence of a multipolar world order. The power of US companies, and particularly the large corporations that now dominate AI, became ascendant at the same moment that the US state itself began a comparative decline, even as US economic and trade policy promoted the interests of US companies and the US national interest as aligned.

AI has been increasingly central to US industrial policy since the Trump administration (and there, primarily a product of the Trump administration's geopolitical interests), with an especially sharp uptick in the last year. Before we delve into specific interventions, these are key narratives that are routinely invoked to justify the need for public investment or public-private hybrid arrangements for AI:

- **AI as critical strategic technology:** The promotion of AI development as necessary to advance US economic and national security interests is prominent in discourses coming from the NSCAI/SCSP, which seamlessly bridge the pro-Big Tech and national security imperatives for fueling public investment into an AI arms race.[154]

- **Democratizing AI:** Under the Biden administration there has been a more recently emergent fault line, and potential historical rupture, in the expressed promise to confront concentrated power centralized in large tech companies. The need to "democratize AI" is a common refrain, notable in both the National Security Commission on Artificial Intelligence (NSCAI) final report[155] and the National Artificial Intelligence Research Resource (NAIRR) midterm.[156] Outside of government, too, there are varying dimensions of what it means to democratize AI, with a diverse range of interests embracing democratization as a key banner.[157]

[154] See also White House, "White House Office of Science and Technology Policy Releases Updated Critical and Emerging Technologies List," February 12, 2024, https://www.whitehouse.gov/ostp/news-updates/2024/02/12/white-house-office-of-science-and-technology-policy-releases-updated-critical-and-emerging-technologies-list.
[155] National Security Commission on Artificial Intelligence (NSCAI), National Security Commission on Artificial Intelligence Final Report, March 2021 https://reports.nscai.gov/final-report/.
[156] White House, "National Artificial Intelligence Research Resource Task Force Releases Final Report," https://www.whitehouse.gov/ostp/news-updates/2023/01/24/national-artificial-intelligence-research-resource-task-force-releases-final-report.
[157] Elizabeth Seger et al, "Democratising AI: Multiple Meanings, Goals, and Methods", Arxiv, March 2023 https://doi.org/10.48550/arXiv.2303.12642.

- **Procurement as industrial policy:** As one of the largest purchasers of AI systems, US government procurement policy forms a key lever in US industrial policy. In fact, procurement has been a central form of shaping technology development for the US government since World War II. In 2022, the US federal government spent an estimated $3.3 billion on AI-related contracts.[158] While the Biden administration's Executive Order on AI and the related OMB guidance promise new oversight structures for federal agencies contracting with private companies to provide "AI" services, however, some in civil society raise the most existential critique that using AI to substitute key public functions also "risks conceding critical ground—that corporate needs, and not the public's, will drive agencies' governing strategies."[159]

- **AI and the production/preservation of "good jobs":** In reaction to narratives about AI driving job replacement, the production and preservation of high-paying, middle-class jobs is another key fault line in AI industrial policy. Public investments in AI, particularly in manufacturing, are frequently justified through promises of job production—although, as we detail below, these figures are often inflated and include lower-paid and contingent work in addition to a smaller pool of unionized jobs. In tandem with these job creation measures are "reskilling" and other initiatives that foreground the need for workers to adapt to the pace of development, rather than mandate that industry meaningfully attend to the effects on workers or position workers in a place of decisionmaking authority on whether and under what conditions AI is used.

AI Industrial Policy: Intervening across the AI stack

Since AI itself is a notoriously underspecified and shape-shifting term,[160] we categorize government efforts based on where they focus their interventions in the AI stack: data, compute, labor, and R&D. We track policy statements, legislation, and

[158] National Artificial Intelligence Advisory Committee (NAIAC),"Recommendations: AI's Procurement Challenge," October 2023, https://ai.gov/wp-content/uploads/2023/11/Recommendations_AIs-Procurement-Challenge.pdf.
[159] Surveillance Resistance Lab, "Re: Request for Comments on Advancing Governance, Innovation, and Risk Management for Agency Use of Artificial Intelligence Draft Memorandum, OMB 2023-0020-0001", December 2023 https://www.regulations.gov/comment/OMB-2023-0020-0077.
[160] AI Now Institute, "What Is AI? Part 1, with Meredith Whittaker | AI Now Salons," July 19, 2023, https://ainowinstitute.org/general/what-is-ai-part-1-with-meredith-whittaker-ai-now-salons.

the broader cross-cutting government narratives that have sustained these developments.

Compute

The infrastructure needed to develop AI is monopolized up and down the stack, most notoriously within cloud computing, data centers, and the chips needed to process AI. In acknowledgment of the effects of these infrastructural dependencies, the shoring up of compute resources forms the core of US AI industrial policy. This focus on compute for AI is premised fundamentally on the idea that more AI development is necessarily good for the public, whether that good comes in the form of innovation, resilience or competition. These premises are woefully underspecified - both whether the shoring up of computational resources will necessarily lead to these end objectives, and whether these objectives necessarily serve the needs of the public (or sufficiently justify the use of taxpayer dollars). Given the detrimental environmental effects of both semiconductor manufacturing and running energy-intensive data centers, investment in supply in this sector may run counter to the Administration's policy goals elsewhere to address climate change.

Two tentpole policy initiatives form the core of compute industrial policy: the CHIPS Act, federal legislation that subsidizes US-based semiconductor manufacturing; and the NAIRR, a proposal for the creation of cloud-based resources for research and development into artificial intelligence. These exist in several forms:

- The CHIPS and Science Act of 2022, signed in to law on Aug. 9, 2022[161]
- NAIRR Pilot, enacted by the National Science Foundation under the Executive Order on AI[162]
- The CREATE AI ACT,[163] proposed legislation that would implement the fuller vision for the NAIRR outlined in the final report of the National AI Research Resource Task Force.[164]

[161] H.R.4346 - Chips and Science Act, https://www.congress.gov/bill/117th-congress/house-bill/4346.
[162] White House, "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence," October 30, 2023, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence.
[163] Anna G. Eshoo, "AI Caucus Leaders Introduce Bipartisan Bill to Expand Access to AI Research," press release, July 28, 2023, https://eshoo.house.gov/media/press-releases/ai-caucus-leaders-introduce-bipartisan-bill-expand-access-ai-research.
[164] White House, "National Artificial Intelligence Research Resource Task Force Releases Final Report," https://www.whitehouse.gov/ostp/news-updates/2023/01/24/national-artificial-intelligence-research-resource-task-force-releases-final-report.

These initiatives share the same broad contours: they involve the use of public resources and appropriations to incentivize US-based technological development in markets that are currently highly concentrated. Where they differ is in the problems they aim to address: the CHIPS Act is tied up in assuring US dominance in technological innovation and the resilience of its supply chains, in the face of geopolitical threats from an increasingly assertive China. By contrast, the NAIRR initiative identifies "democratization," barriers to access, and a lack of diversity in AI as the primary challenges it aims to solve - though it, too, is trending toward adopting 'arms race' framing as a key justification. While it acknowledges the problems of concentrated power as a key issue in AI, it does not offer a structural remedy to the underlying problems with the structure of the compute market. This essentially incremental approach contrasts with the Biden Administration's efforts to signal its willingness to engage in bold policy moves to protect fair competition.

Across the administration's stances on computational industrial policy, there thus remain considerable shortcomings in the fit between the diagnosis and the cure—and in the case of the NAIRR, the risk that the solution may in fact exacerbate the problem it aims to solve.[165]

The CHIPS Act: A Legacy of Past Industrial Policy Regimes

As a hallmark of contemporary US industrial policy, the CHIPS Act built on the legacy of past eras of semiconductor investment, positioning AI as one among several "industries of the future" that the US would need to invest in to ensure its continued technological dominance and competitiveness with China. In the wake of the COVID-19 pandemic and a series of supply chain failures, the Biden Administration issued an executive order (EO) that, among other things, identified the need for upgrades to the country's semiconductor manufacturing capacity as a central economic and national security concern,[166] tying supply chain disruption to growing rates of inflation and demands to bring American manufacturing back

[165] AI Now Institute and Data & Society Research Institute, "Democratize AI? How the Proposed National AI Research Resource Falls Short." AI Now Institute, October 5, 2021, https://ainowinstitute.org/publication/democratize-ai-how-the-proposed-national-ai-research-resource-falls-short; Amba Kak and Sarah Myers West, "The Problem With Public-Private Partnerships In AI." Foreign Policy, February 2, 2024, https://foreignpolicy.com/2024/02/12/ai-public-private-partnerships-task-force-nairr/#:~:text=We%20can%20learn%20from%20past,the%20contributions%20of%20workers%20in.

[166] White House, "Executive Order on America's Supply Chains," February 24, 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains.

within the country's borders.[167] The initiative—and an ensuing legislative push led by senators Charles Schumer and Todd Young[168]—aimed to boost US funding in R&D generally from 0.7 percent to 1 percent of GDP,[169] and to increase the US share in the memory chip market by 500 percent.

Both the EO and legislative proposals reflected an underlying concern about a growing technological Cold War with China: "It's not an overstatement to say [that semiconductors] are the ground zero of our tech competition with China," remarked President Biden in one speech following the passage of the Act,[170] which was followed in short order by a set of sweeping restrictions from the US Commerce Department limiting the sale of semiconductors, chip-making equipment, and other materials needed to maintain chip production facilities,[171] leading several US-based chip manufacturing firms to recall their staff from China-based chip plants.[172]

Press coverage also raised concerns that the US was ominously dependent on chips sourced from Taiwan amid these growing tensions;[173] though the White House foregrounded US-based firms in its drumbeat of public engagement around the act,[174] and US firms have been the first to receive CHIPS funding, Taiwan Semiconductor Manufacturing Company received much of the press attention.

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[167] White House, "Remarks by President Biden on the CHIPS and Science Act at IBM Poughkeepsie," October 6, 2022, https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/10/06/remarks-by-president-biden-on-the-chips-and-science-act-at-ibm-poughkeepsie.

[168] The CHIPS Act went through several forms prior to its passage; it was initially brought to the floor as the Endless Frontier Act in 2020, and then as the Innovation and Competition Act in 2021. See Endless Frontier Act, S.3832, 116th Congress (2019–2020), https://www.congress.gov/bill/116th-congress/senate-bill/3832/text; and David E. Sanger, Catie Edmondson, David McCabe, and Thomas Kaplan, "Senate Poised to Pass Huge Industrial Policy Bill to Counter China," *New York Times*, June 7, 2021, https://www.nytimes.com/2021/06/07/us/politics/senate-china-semiconductors.html.

[169] White House, "Remarks by President Biden on the CHIPS and Science Act at IBM Poughkeepsie."

[170] White House, "Remarks by President Biden in Meeting with CEOs and Labor Leaders on the Importance of Passing the CHIPS Act," July 26, 2022, https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/07/26/remarks-by-president-biden-in-meeting-with-ceos-and-labor-leaders-on-the-importance-of-passing-the-chips-act.

[171] Ana Swanson, "Biden Administration Clamps Down on China's Access to Chip Technology," *New York Times*, October 7, 2022, https://www.nytimes.com/2022/10/07/business/economy/biden-chip-technology.html.

[172] Bloomberg News, "US Chip Suppliers Pull Back from China's Yangtze Memory After Biden Ban," Bloomberg, October 12, 2022, https://www.bloomberg.com/news/articles/2022-10-12/us-chip-suppliers-pull-back-from-china-s-yangtze-after-biden-ban. Around this time, Intel announced plans to take over an abandoned factory in China for its chip production; it later canceled those plans following the announcement of federal subsidies for homegrown manufacturing. See Ana Swanson, "Congress Is Giving Billions to the Chip Industry. Strings Are Attached," *New York Times*, August 3, 2022, https://www.nytimes.com/2022/08/03/business/economy/chip-industry-congress.html.

[173] See Alan Crawford, Jarrell Dillard, Helene Fouquet, and Isabel Reynolds, "The World Is Dangerously Dependent on Taiwan for Semiconductors," Bloomberg, January 25, 2021, https://www.bloomberg.com/news/features/2021-01-25/the-world-is-dangerously-dependent-on-taiwan-for-semiconductors; Kyle Amonson and Dane Egli, "The Ambitious Dragon
Beijing's Calculus for Invading Taiwan by 2030," *Journal of Indo-Pacific Affairs* 6, no. 3 (March–April 2023): 38–54, https://media.defense.gov/2023/Apr/24/2003205865/-1/-1/1/07-AMONSON%20&%20EGLI_FEATURE%20IWD.PDF; and Mary Bruce, Luke Barr, and Justin Fishel, "Xi Told Biden at Summit That China Plans to Reunify with Taiwan," ABC News, December 20, 2023, https://abcnews.go.com/International/xi-warns-biden-china-plans-back-taiwan/story?id=105815520.

[174] See for example White House, "Remarks by President Biden on the CHIPS and Science Act," November 4, 2022, https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/11/04/remarks-by-president-biden-on-the-chips-and-science-act; White House, "Remarks by President Biden on the CHIPS and Science Act at IBM Poughkeepsie"; and White House, "Remarks by President Biden on Micron's Plan to Invest in Chips Manufacturing," October 27, 2022, https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/10/27/remarks-by-president-biden-on-microns-plan-to-invest-in-chips-manufacturing.

TSMC is central to the supply chain choke point in global chip fabrication, as the sole manufacturer able to make the state-of-the-art chips used in much of advanced AI development and model training, and the company became a particular flash point for the concerns about China that motivated the bill. TSMC announced a $40 billion plan to manufacture two chip fabrication plants in Phoenix, Arizona, which was touted as having particular focus on building the chips needed for Apple to manufacture iPhones and MacBooks.[175]

But the TSMC plants found new relevance on the public agenda in 2023, following a sudden burst of interest in artificial intelligence when OpenAI released ChatGPT. Prior to this moment, the PR and policy narrative around CHIPS included AI on a laundry list of industries that the Act would benefit, including the development of energy-efficient and environmentally sustainable computing, quantum computing infrastructures, and material design and rapid printing techniques, among others. The bill included a handful of AI-specific provisions, including a mandate for the National Institute for Standards and Technology (NIST) to "support the development of AI and data science" and to conduct research and testing to improve AI-enabled cybersecurity, and for the National Science Foundation (NSF) to expand its scholarship programs to include greater funding for AI scholarships.

The investments in CHIPS proved salient, though, when demand for state-of-the-art chips soared in spring 2023. Demand for computational power began to influence the behavior of AI firms large and small, motivating OpenAI to strike an exclusive agreement with Microsoft as its cloud provider and to convert from a nonprofit to a limited partnership in 2019, leading countless startups to make contractual arrangements with cloud infrastructure firms, and those firms themselves to restructure internally to maximize efficient use of data center resources.[176] Picking up on these movements, TSMC decided to inject an additional $3.5 billion into its Phoenix plants,[177] and announced the plants will produce 3nm chips, the current state of the art for AI model training, and an upgrade from the 5nm chips originally slated for production at the plants.[178]

[175] Debby Wu and Jenny Leonard, "Biden Joins Tim Cook to Hail TSMC's $40 Billion US Chip Venture," Bloomberg, December 6, 2022, https://www.bloomberg.com/news/articles/2022-12-06/tim-cook-biden-to-help-tsmc-unveil-40-billion-us-chip-buildout.
[176] See Sundar Pichai, "Google DeepMind: Bringing Together Two World-Class AI Teams," Google (blog), April 20, 2023, https://blog.google/technology/ai/april-ai-update; and Aaron Holmes and Kevin McLaughlin, "Microsoft Rations Access to AI Hardware for Internal Teams," *Information*, March 15, 2023, https://www.theinformation.com/articles/microsoft-rations-access-to-ai-hardware-for-internal-teams.
[177] Tobias Mann, "TSMC Injects a Bonus $3.5B into Arizona Chip Fabs," *Register*, February 14, 2023, https://www.theregister.com/2023/02/14/tsmc_chip_fab_arizona.
[178] TSMC, "TSMC Announces Updates for TSMC Arizona," press release, December 6, 2022, https://pr.tsmc.com/english/news/2977.

Ultimately, however, reports indicate that it may not, in fact, address resilience concerns across the entire semiconductor supply chain: all chips produced at Fab 21 will still be shipped back to Taiwan for assembly and packaging, the final step before they can be used in devices—potentially undermining the underlying goal of the investment in the first place.[179] While CHIPS investments may lead to the reinvigoration of US semiconductor manufacturing, they will not ultimately address the bottlenecks and geopolitical tensions that currently shape the provision of chips for cutting-edge AI development.

NAIRR: "Democratizing" AI Through Compute Subsidies

Against this backdrop, the National AI Research Resource emerged as a much more explicitly AI-focused industrial paradigm, conceptualized through the American Artificial Intelligence Initiative, the Trump Administration's national strategy for coordinating AI development efforts across the federal government.[180] At its outset the NAIRR was designed as a set of public-private partnerships between government, academia, and industry players,[181] meant to prioritize the provision of compute resources and data for AI research in order to "democratize" AI innovation.[182] The problem diagnosis outlined in the final report produced by the Committee is much more critical than this initial frame on the question of how high levels of industry concentration shape the landscape for AI development: it identifies an "access divide" that limits the ability for researchers beyond those at "well-resourced technology companies" to "leverage AI to tackle the big challenges in our society,"[183] treating resource concentration as an inhibitor to technological development. The report notes that barriers to accessing advanced computational power constrain "the diversity of researchers in the field and the breadth of ideas

[179] Wayne Ma, "The Flaw in Apple's Plan to Make Chips in Arizona," Information, September 11, 2023, https://www.theinformation.com/articles/apples-plan-to-make-chips-in-arizona-tsmc-nvidia-amd-tesla.
[180] Trump White House (archive), *Artificial Intelligence for the American People*, n.d., accessed February 13, 2024, https://trumpwhitehouse.archives.gov/ai. NAIRR was first proposed in a letter by Stanford researchers, then outlined in the 2019 Executive Order Maintaining American Leadership in Artificial Intelligence, and finally implemented in the National Artificial Intelligence Initiative Act of 2020, signed into law as part of the National Defense Authorization Act of 2021. See "National Research Cloud Call to Action," Human-Centered Artificial Intelligence, Stanford University, n.d., accessed February 13, 2024, https://hai.stanford.edu/national-research-cloud-joint-letter; National Archives, "Maintaining American Leadership in Artificial Intelligence," *Federal Register*, February 11, 2019, https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence; and William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, H.R 6395, 116th Congress (2019–2020), https://www.congress.gov/bill/116th-congress/house-bill/6395.
[181] Michael Kratsios, "Why the US Needs a Strategy for AI," *Wired*, February 11, 2019, https://www.wired.com/story/a-national-strategy-for-ai.
[182] Trump White House (archive), "The White House Launches the National Artificial Intelligence Initiative Office," press release, January 12, 2021, https://trumpwhitehouse.archives.gov/briefings-statements/white-house-launches-national-artificial-intelligence-initiative-office.
[183] National Artificial Intelligence Research Resource Task Force, *Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem: An Implementation Plan for a National Artificial Intelligence Research Resource*, AI.gov, January 2023, https://www.ai.gov/wp-content/uploads/2023/01/NAIRR-TF-Final-Report-2023.pdf.

incorporated into AI innovations, contributing to embedded biases and inequalities found in AI systems today."[184]

But the solution, as outlined in the final NAIRR report, entails a series of awards that would essentially serve as subsidies to an already concentrated cloud market: $2.25 billion earmarked for contracts, capped at $200 million per provider—made in cohorts of at least six providers on six-year contracts for cloud service provision. What this means is that NAIRR—in this version—would be structured as a licensing regime under which term contracts are allocated to commercial cloud infrastructure providers. Though this approach offers a pragmatic path to implementation in the short term, given the paucity of alternatives, it will ultimately entrench incumbent firms, despite the inclusion of some guardrails.[185]

"At present, only a handful of companies can afford the substantial computational resources required to develop and train the machine learning models underlying today's AI," Stanford University's Institute for Human-Centered Artificial Intelligence codirector John Etchemendy told Science in 2021, making clear that the proposal—which he helped draft—was designed to expand rather than contest commercial cloud infrastructure. "The commercial cloud providers are doing the innovation, and they invest massive amounts of money to keep it up to date. It would be a huge mistake to build a facility like a supercomputer center because it would be obsolete within a few years."[186]

The current NSF project CloudBank[187] was designed to offer a template for what this would look like: NSF runs a portal for researchers to access cloud services for NSF-approved research projects.[188] The four commercial cloud providers offered through CloudBank are Amazon Web Services, Google Cloud, Microsoft Azure, and IBM Cloud—a very limited vision for diversity. The CREATE AI Act, the legislation that would ultimately implement the full version for the NAIRR, leaves the exact structure unspecified beyond a mandate for "public cloud providers providing access to popular computational and storage services for NAIRR users", which could take the form of licensing per the Task Force proposal, credits to access computational resources, or some other model. To move forward, this would require congressional approval and appropriations to be brought into being.

[184] Ibid.
[185] AI Now Institute and Data & Society Research Institute, "Democratize AI? How the Proposed National AI Research Resource Falls Short," https://ainowinstitute.org/publication/democratize-ai-how-the-proposed-national-ai-research-resource-falls-short.
[186] Jeffrey Mervis, "U.S. Law Sets Stage for Boost to Artificial Intelligence Research," *Science*, January 6, 2021, https://www.science.org/content/article/us-law-sets-stage-boost-artificial-intelligence-research.
[187] CloudBank (website), accessed February 13, 2024, https://www.cloudbank.org.
[188] Mervis, "U.S. Law Sets Stage for Boost to Artificial Intelligence Research." .

The NAIRR pilot, created under the Biden administration EO on artificial intelligence,[189] offered an interim step toward implementation absent such funding measures. In place, the pilot adopts a new set of distinct structures: first, it creates a platform through which applicants can seek to access existing government supercomputers and government datasets operated by several agencies. Second, it introduces a marketplace of offerings by a range of organizations - including a number of AI companies - for NAIRR users to apply for developer resources. Several of the offerings on this marketplace give the companies providing access the ability to direct how they're used - for example, mandating that compute credits, API access or allocated funds be given only to researchers from specific types of institutions or for specific types of work.

Across these varying structures for the NAIRR, there are a shared set of tensions that call into question whether 'democratization' is an appropriate litmus test for public AI; simply diversifying the range of actors involved in AI development while commercial entities continue to define the horizon for AI research does little to contest their dominance.[190] In practice, the vision for the NAIRR only extends as far as providing on-ramps for researchers to access resources for AI development in a highly captured market. It will not meaningfully perturb the development process itself, exemplifying the deficiencies of public investment-style industrial policy proposals for cloud computing absent other measures for structural accountability in the sector, or that address monopolization up and down the tech stack.

Moreover, proposals like the NAIRR do little to address the question of why artificial intelligence is deserving of additional resourcing and support: it operates from a presumption that more AI development, from a more diverse range of actors, will create beneficial effects that accrue to the nation. But it does little to justify or engage with what these beneficial effects might be.

The messaging surrounding the CREATE AI Act suggests that these are articulated predominantly through a geopolitical 'AI arms race' frame rather than a public benefit frame that might be more easily intuited from the 'democratization' language that accompanied much of the NAIRR Task Force's work. In a fact sheet describing the legislation, this is described as follows: "Without full congressional authorization and approval, American leadership in academic AI research could be

[189] White House, "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence.".
[190] Amba Kak and Sarah Myers West, "The Problem With Public-Private Partnerships In AI."

forfeited. Other countries are not waiting around: the UK government recently approved a plan to spend $1.1 billion on a public sector AI supercomputer, and China is moving ahead with similar plans."[191] Even here, it's unclear how an investment even at the scale recommended by the NAIRR Task Force ($2.6 billion) effectively competes with that of the deep pockets of the AI industry - not when Amazon has pledged $35 billion toward upgrading its data centers in the state of Virginia alone.[192] As such, there are reasons to question whether the NAIRR is designed to live up to its intended effects, in addition to challenging the underlying presumption that any benefits it offers justify taxpayer investment.

State-Level Initiatives: Public Compute, Without Scale

In the swell of attention to artificial intelligence over the past year, several states have adopted their own industrial policy measures. These similarly focus on the provision of computational resources to encourage AI research and development, seeking to bring AI investments to specific localities and develop localized innovation hubs. New York has been one of the most active on this front, given Senator Schumer's vocal interest in rallying to ensure that federal funding would flow to his home state of New York.[193] Building on initial CHIPS Act investments in upstate New York, in early 2024 Governor Kathy Hochul announced an "Empire AI" initiative designed to commit state funding toward establishing a university-led consortium focused on "responsible AI research and the public good." The flagship project for the consortium includes the construction of a computing center to be built in upstate New York, a proposal designed to ensure the state has its own cloud infrastructure (as opposed to a licensing contract with an existing cloud firm).[194]

According to a statement announcing the project:

> Access to the computing resources that power AI systems is prohibitively expensive and difficult to obtain. These resources are increasingly concentrated in the hands of large technology companies, who maintain outsized control of the AI development ecosystem. As a result, researchers,

[191] Eshoo, "AI Caucus Leaders Introduce Bipartisan Bill to Expand Access to AI Research."
[192] Matthew Barakat, "Virginia, Amazon Announce $35b data center plan," Associated Press, https://apnews.com/article/technology-data-management-and-storage-amazoncom-inc-virginia-business-c75df1f34069b09549fe15c99335b8fb.
[193] Ana Swanson, "Schumer Wields Political Heft in Bid for New York Chips Funds," *New York Times*, August 6, 2023, https://www.nytimes.com/2023/08/06/business/economy/schumer-new-york-chips-funds.html.
[194] Liz Wolfe, "Empire AI," Yahoo News, January 9, 2024, https://news.yahoo.com/empire-ai-143008080.html.

> public interest organizations, and small companies are being left behind, which has enormous implications for AI safety and society at large.[195]

The new initiative commits $275 million in state resources, matched by $125 million in private funding from the Simons Foundation and Tom Secunda, a cofounder of Bloomberg.[196]

California has also explored similar investments through legislation that would create a "CalCompute" resource within the public University of California system. According to the initial proposal, CalCompute would be "a collaboration between academics, policymakers, and industry experts from large institutions to guide the development of AI in responsible and secure directions and ensure the benefits of this technology are spread widely."[197] Specifics on how this would be structured have yet to be announced, though a bill, SB 1047, seeks to initiate the process by mandating a deliberation on the appropriate structure for CalCompute.[198]

Across these examples, public investment in compute is taking an increasingly prominent role in AI industrial policymaking in the United States, with approaches coalescing around two strategic choices: procurement of cloud resources on one hand, and direct investments in chip manufacturing on the other. Absent other policy measures, neither of these approaches addresses the scope and scale of monopolization of compute in AI, which stretches across the tech stack. In some instances, as in the case of NAIRR and EmpireAI, there's acknowledgment of the harmful effects this concentration can have in narrowing the scope for innovation. But this only goes so far in shaping the diagnosis of evidence marshaled behind the investment, stopping short of rallying political capital behind bolder interventions that would more meaningfully address market concentration.[199]

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[195] Governor Kathy Hochul, "Governor Hochul Unveils Fifth Proposal of 2024 State of the State: Empire AI Consortium to Make New York the National Leader in AI Research and Innovation," press release, January 8, 2024, https://www.governor.ny.gov/news/governor-hochul-unveils-fifth-proposal-2024-state-state-empire-ai-consortium-make-new-york.

[196] These numbers pale in comparison to earlier rounds of investments made into semiconductor manufacturing in the state: New York committed $5.5 billion to secure $100 billion in investments from Micron into the construction of a new chip manufacturing facility in Syracuse, New York; and IBM announced a $20 billion investment under the CHIPS Act in a new chip manufacturing plant in the Hudson Valley. See White House, "Remarks by President Biden on the CHIPS and Science Act at IBM Poughkeepsie." .

[197] Health Care Coverage: Independent Medical Review, S.B 294 (2023–2024), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202320240SB294.

[198] Scott Wiener, "Senator Wiener Introduces Legislation To Ensure Safe Development Of Large-Scale Artificial Intelligence Systems And Support Ai Innovation In California", February 8 2024, https://sd11.senate.ca.gov/news/20240208-senator-wiener-introduces-legislation-ensure-safe-development-large-scale-artificial.

[199] For more on concentration in compute and policy interventions across the AI tech stack, see Jai Vipra and Sarah Myers West, "Computational Power and AI," AI Now Institute, September 27, 2023, https://ainowinstitute.org/publication/policy/compute-and-ai.

Data: Creating "AI-Ready" Data

Access to a large volume of high-quality, "AI-ready" datasets has been a consistent theme in government strategy around AI. From the 2018 Trump Management Agenda, which created a cross-agency goal to "leverage data as a strategic asset" and initiated the "Federal Data Strategy"[200] and the 2019 Executive Order,[201] to the Biden Administration's recent AI R&D strategies[202] and the NAIRR,[203] there has been a range of government activity around data as a core strategic input for AI. Often captured in the term *AI-ready data*, there's also a clear emphasis on *quality* of data, acknowledging that only properly cleaned, labeled, and structured data will be of value for AI uses. There have also been efforts toward standardization and benchmarking in this domain. The Trump White House Office of Science and Technology Policy (OSTP) Subcommittee on Open Science released a four-tier, pilot AI-readiness matrix that agencies could use to benchmark data quality.[204] The Biden Administration's NAIRR Task Force implementation plan similarly calls for "analysis-ready" datasets to be defined using community-driven standards.[205]

Even as data is readily acknowledged as a key input (and therefore a bottleneck) in AI development, the US government rarely calls attention to the fact that a large amount of such high-quality datasets are controlled by private industry, and specifically by Big Tech companies. Unlike in Europe[206] or India,[207] where, as part of a broader movement to call attention to data monopolies, there have been one-off proposals for mandating data-sharing and private-sector contributions to data commons, American AI policy has been notably restrained around pushing for data access or even acknowledging the data advantages enjoyed by large tech

[200] "Federal Data Strategy: Leveraging Data as a Strategic Asset," Office of Management and Budget, the CDO Council, and the General Services Administration, accessed February 13, 2024, https://strategy.data.gov.
[201] See National Archives,"Maintaining American Leadership in Artificial Intelligence," *Federal Register*, February 11, 2019, https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence. Executive Order 13859 requested that agencies "improve data and model inventory documentation" and "prioritize improvements to *access* and *quality*" based on the "AI research community's user feedback" (emphasis added).
[202] Select Committee on Artificial Intelligence of the National Science and Technology Council, *National Artificial Intelligence Research and Development Strategic Plan 2023 Update*, May 2023, Executive Office of the President of the United States, https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf.
[203] White House, "National Artificial Intelligence Research Resource Task Force Releases Final Report," https://www.whitehouse.gov/ostp/news-updates/2023/01/24/national-artificial-intelligence-research-resource-task-force-releases-final-report.
[204] "ESIP Data Readiness Cluster," Earth Science Information Partners (ESIP), accessed February 13, 2024, https://esip.figshare.com/articles/online_resource/Checklist_to_Examine_AI-readiness_for_Open_Environmental_Datasets/19983722/1.
[205] White House, "The Biden Administration Launches the National Artificial Intelligence Research Resource Task Force," June 10, 2021, https://www.whitehouse.gov/ostp/news-updates/2021/06/10/the-biden-administration-launches-the-national-artificial-intelligence-research-resource-task-force.
[206] Sam Schechner and Kim Mackrael, "Tech Giants to Be Forced to Share More Data Under EU Proposal", *Wall Street Journal,* February 23 2022,https://www.wsj.com/articles/tech-giants-to-be-forced-to-share-more-data-under-eu-proposal-11645618258
[207] Soumyarendra Barik, "Centre considers seeking access to anonymised data of Big Tech firms", *Indian Express,* November 15 2023 https://indianexpress.com/article/india/centre-considers-seeking-access-to-anonymised-data-of-big-tech-firms-9026951/.

companies. A rare exception might be the 2023 National AI R&D updated plan, which recognizes an urgent need for "creating partnerships" for data sharing with tech companies, only to eventually concede that competitive challenges with such proposals will likely make them untenable.[208]

Although contesting existing data concentration within industry has been off the table, pushing for greater access to federal government data has been a centerpiece of strategic efforts. One prong of this is creating new infrastructure or exchanges for sharing these data resources. The Biden OSTP announced a new portal for AI researchers to create access to new government datasets and test-bed environments (but there have been few additional details since the announcement and the portal continues to give a 404 error message as of this writing); and the final NAIRR report also floats the idea of AI data commons and AI marketplaces ("social and technical architecture through which the user community contributes, documents, and shares data, codes, and models") as examples of models for enabling access.[209] Absent guardrails on how companies are allowed to use federal data, AI procurement mandates for government services (of the kind established by the 2019 and 2023 Executive Orders) might also end up giving technology companies privileged access to government data, especially in sectors where some of the largest companies have already accrued advantages due to strategic acquisitions.

Questions of data aren't just relevant for questions of competitive advantage and performance. Training datasets for AI is a crucial point of intervention for engineering social outcomes from AI systems, as well as for mitigating concerns around bias and discrimination, privacy, and intellectual property. While data-focused initiatives have primarily indexed on maximizing value extraction from data, rather than attending to the risks of its exploitation, the Biden administration's industrial strategy does integrate data provenance and bias mitigation strategies as part of how efforts like NAIRR are being envisioned, akin to government "pilots" for what "trustworthy AI" systems and processes might look like—but much of this is still theoretical. This will be crucial given that the reckless exploitation of personal data for AI training has already come under the scanner of regulatory agencies like the FTC, who propose remedies like "algorithmic disgorgement" or the deletion of

[208] Select Committee on Artificial Intelligence of the National Science and Technology Council, *National Artificial Intelligence Research and Development Strategic Plan 2023 Update*, May 2023, Executive Office of the President of the United States, https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf. The report finds that the competitive challenges with such proposals will likely make them untenable. The authors even note that such data sharing is "urgently needed"—but they bury the lede!
[209] National Artificial Intelligence Research Resource Task Force, Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem.

ill-gotten data for AI.[210] The AI R&D strategy also positions the use of federal data as a way of ensuring representation of underrepresented communities or AI use cases that are designed to avoid replicating discrimination (like using data from the Home Owners Loan Corporation in the 1930s that was used for redlining to avoid replicating it).[211]

Labor: Tackling Fears of AI-Driven Job Replacement through Workforce Development

Impacts on labor have not constituted the primary focal point for US industrial policy investments in AI, but job creation and preservation has frequently been used as a clear justification for public investment in the sector. These discourses are distinctive in the context of artificial intelligence, a domain in which fears of job replacement due to AI deployment have persisted since the 1960s.[212]

Labor provisions in AI industrial policy cluster around three primary types of policy interventions:

1. Mandates tying public investment to compliance with labor guidelines, such as Davis-Bacon requirements that tie funding to union wages or mandates to provide affordable childcare
2. Workforce development and upskilling measures
3. Immigration measures including fast-tracking visas for workers with particular skill sets in AI development

Public Investment Mandates and Workplace Protections

First are guarantees that public investment into the AI sector will be tied to company compliance with certain labor requirements and workplace protections. For example, provisions in the CHIPS Act require employers to pay Davis-Bacon

[210] Jevan Hutson and Ben Winters, "America's Next 'Stop Model!': Model Deletion." Georgetown Law Technology Review: https://ssrn.com/abstract=4225003; *Safeguarding Data And Innovation: Building The Foundation For The Use Of Artificial Intelligence, Before the House Committee on Energy, Commerce, Subcommittee on Innovation, Data, and Commerce,"* (2023) (Statement of Amba Kak, Executive Director, AI Now Institute), https://d1dth6e84htgma.cloudfront.net/Amba_Kak_Testimony_IDC_AI_Hearing_2023_10_18_e02d4b6f51.pdf.
[211] Select Committee on Artificial Intelligence of the National Science and Technology Council, *National Artificial Intelligence Research and Development Strategic Plan 2023 Update*, May 2023, Executive Office of the President of the United States, https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf.
[212] James Boggs, *The American Revolution* (New York: NYU Press, 2009), https://nyupress.org/9780853450153/american-revolution.

prevailing wage rates for the construction of CHIPS-funded facilities,[213] and mandate recipients of CHIPS funds "demonstrate significant worker and community investments, including opportunities for small businesses and disadvantaged communities."[214] Furthermore, rules set by the Department of Commerce dictate that recipients of funds must guarantee affordable and high-quality childcare for workers involved in building or operating plants.[215]

Union representatives were a central constituency in the passage of the bill: the White House held meetings with union leadership about the importance of passing the bill in advance of the floor vote, and union representatives were prominent at a number of flagship events. For example, at an event held with President Biden, Communications Workers Association President Chris Shelton tied the passage of the bill to creation of new jobs that would expand key elements of the union's base in semiconductor manufacturing, growing the union's power: "With the passage of this bill and the growing investment in semiconductor production, I'm expecting to be able to help organize thousands of additional workers. For those workers, this bill will be a ticket to a better life." He went on to tie these measures to competition with China: "I'm also glad that the bill includes key protections to prevent companies that receive the money from turning around and investing in semiconductor production in China instead of the United States."[216] But it's unclear whether the investment will deliver on these promises: for example, a report on one plant being constructed in Syracuse by the company Micron questioned the claim that Micron's investment would create "50,000 good-paying jobs" in the city, noting that estimates overinflated the impact on the local economy by including contingent and low-paying jobs.[217]

Implementation of the labor provisions of the CHIPS legislation remains turbulent, particularly for TSMC: CEO Morris Chang has been vocal in his opposition to the

[213] The Davis-Bacon and Related Acts outline a set of pay standards for construction workers that apply when building public buildings or public works. See United States Department of Labor, "Davis-Bacon and Related Acts," accessed February 13, 2024, https://www.dol.gov/agencies/whd/government-contracts/construction.
[214] White House, "FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China," August 9, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china.
[215] As outlined above, both of these provisions received pushback from TSMC, which asserted that labor protections and a generalized lack of work ethic among US workers were a significant hindrance to its plant construction—though this did not lead to any changes in the provisions themselves.
[216] White House, "Remarks by President Biden in Meeting with CEOs and Labor Leaders on the Importance of Passing the CHIPS Act," July 26, 2022, https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/07/26/remarks-by-president-biden-in-meeting-with-ceos-and-labor-leaders-on-the-importance-of-passing-the-chips-act.
[217] Glenn Coin, "Those 50,000 Jobs Micron Could Create in New York? We Dug into What That Really Means," syracuse.com, December 12, 2023, https://www.syracuse.com/business/2023/12/those-50000-jobs-micron-could-create-in-new-york-we-dug-into-what-that-really-means.html.

unionization mandates tied to receipt of federal funding, complaining the US lacks the necessary manufacturing talent[218] and work ethic: "If an engineer [in Taiwan] gets a call when he is asleep, he will wake up and start dressing," he said in a public statement. "His wife will ask: 'What's the matter?' He would say: 'I need to go to the factory.' The wife will go back to sleep without saying another word. This is the work culture."[219] For their part, workers involved in the construction of the plant allege safety violations, and that the construction of the facility has been marred by accidents and labor disputes.[220] The Arizona Pipe Trades 469 union petitioned against TSMC's application to fast-track visas for Taiwanese workers,[221] asserting Chang is inventing a skills shortage to justify the hiring of cheaper labor from abroad rather than comply with the labor requirements tied to federal funding.[222]

Despite these challenges, the Biden Administration reinforced its commitment to labor unions as a key constituency for AI industrial policy in its 2023 Executive Order on AI. "Supporting Workers" is outlined as a tentpole priority in the White House Fact sheet on the executive order, which outlines the need to mitigate risks to workers, "support workers' ability to bargain collectively, and invest in workforce training and development that is accessible to all."[223] Among the EO's provisions was a mandate for the Secretary of Labor to issue guidance "to make clear that employers that deploy AI to monitor or augment employees' work must continue to comply with protections that ensure that workers are compensated for their hours worked, as defined under the Fair Labor Standards Act and other legal requirements."[224] Though it's not explicitly outlined, this measure likely aims to address the emergence of fissured work mediated by artificial intelligence-driven interfaces. For example, one of the issues that platform-based workers have foregrounded is whether they are adequately paid for "time off tasks" that

[218] The Brookings Institution and Center for Strategic and International Studies, "Can Semiconductor Manufacturing Return to the US?" *Vying for Talent* (podcast), April 14, 2022, https://www.brookings.edu/wp-content/uploads/2022/04/Vying-for-Talent-Morris-Chang-20220414.pdf.
[219] Jacob Zinkula, "The World's Largest Chipmaker Promised to Create Thousands of US Jobs. There Are Growing Tensions over Whether US Workers Have the Skills or Work Ethic to Do Them," *Business Insider*, August 16, 2023, https://www.businessinsider.com/tsmc-jobs-taiwan-semiconductor-chip-worker-skills-work-ethic-2023-8.
[220] Michael Sainato, "'They Would Not Listen to Us': Inside Arizona's Troubled Chip Plant," *Guardian*, August 28, 2023, https://www.theguardian.com/business/2023/aug/28/phoenix-microchip-plant-biden-union-tsmc.
[221] "Stand With American Workers: Hold TSMC Accountable," Protect Arizona Workers (website), accessed February 13, 2024, https://protectazworkers.org.
[222] "Block TSMC Foreign Worker Visas," UA Local 469 (archived web page), accessed February 13, 2024. https://web.archive.org/web/20230807155212/https://www.votervoice.net/AZPipeTrades/Campaigns/106830/Respond.
[223] White House, "FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence," October 30, 2023, https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence.
[224] White House, "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence," October 30, 2023, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence.

algorithmic systems used by employers don't count as paid work, such as time spent by rideshare drivers while awaiting their next passenger.

Workforce Development and Reskilling

Another long-standing pillar of labor in AI industrial policy focuses on the need to develop the US workforce through "reskilling" programs that ensure workers have the tools they need for an AI-driven economy. These narratives frame AI development as inevitable engines of job displacement, positioning workers as disaffected and out of touch without the prodding engine of government intervention, rather than seeking to build worker autonomy and leadership in determining the course of AI development.

Many of these measures start from the need for additional research: for example, a proposed AI JOBS Act of 2019 would have authorized the Department of Labor to create a report analyzing the future growth of AI and its impact on the workforce.[225] The Trump administration's AI Executive Order similarly sought to commission recommendations on how STEM education needed to evolve in response to the demands of artificial intelligence, and prioritized instructional and training programs in addition to establishing a priority path for AI in existing federal fellowship and service programs.[226] The more recent Biden administration's Executive Order on AI builds on this set of mandates by requiring the Department of Labor to, again, research the labor market effects of AI and identify how federal funding can best be used to support workers,[227] developing principles and best practices to mitigate AI-driven harms and providing guidance "to prevent employers from undercompensating workers, evaluating job applications unfairly, or impinging on workers' ability to organize."[228]

The National AI Advisory Commission focused extensively on workforce development considerations, following the mandate in its charter to "prepare the present and future United States workforce for the integration of artificial

[225] Darren Soto, "New Democrat Coalition Endorses Rep. Soto's Bipartisan AI JOBS Act of 2019," press release, October 18, 2019, https://soto.house.gov/media/press-releases/new-democrat-coalition-endorses-rep-soto-s-bipartisan-ai-jobs-act-2019.
[226] National Archives, "Maintaining American Leadership in Artificial Intelligence," *Federal Register*, February 11, 2019, https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence.
[227] White House, "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence."
[228] White House, "FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence."

intelligence systems across all sectors of the economy and society."[229] This mandate is reflected in its recommendation to launch a "moonshot" on US literacy, numeracy, and problem-solving,[230] and to build a national campaign on lifelong AI career success targeted at later-in-life workers. This latter program is intended to "upskill" these workers through "myth-busting" about their capabilities to succeed in high-tech jobs, and conduct targeted outreach to these communities.[231]

These interventions also tend to prize particular types of skill sets—frequently articulated using language such as "AI expertise" or "STEM"—in ways that risk undermining the legitimacy of the subject-matter expertise and the value of normative decision-making more broadly. This extends to the government's own hiring; for example, the Office of Management and Budget guidance to agencies around the "workforce" prioritizes hiring for people with "AI interpretation skills" and could gut both the subject matter expertise of internal staff and their agency to make decisions independent of the recommendations of automated systems.[232]

Countering the "Brain Drain" through Immigration Measures

Concerns about a "brain drain" of talent in the AI sector is a persistent concern in industrial policy narratives. The NAIRR final report frames this in a particularly notable way, expressing concerns about diversity and equity in AI due to the heavy concentration of resources in large private-sector firms, well-resourced universities, and national labs.[233] The report articulates that the "brain drain" of top AI talent to a small set of well-resourced corporations has detrimental effects on US innovation and economic growth. "Extending access to AI research resources as broadly as possible, and incorporating a diverse set of viewpoints into the prioritization of investments, the review of resources and resource providers, and the evolution of the AI research ecosystem, are core to the NAIRR's diversity and capacity goals," the report states.[234]

[229] U.S. Department of Commerce, National Institute of Standards and Technology, National Artificial Intelligence Advisory Committee, *National Artificial Intelligence Advisory Committee Charter*, September 13, 2021, https://ai.gov/wp-content/uploads/2023/10/naiac-charter.pdf.
[230] National Artificial Intelligence Advisory Committee, "RECOMMENDATIONS: Second Chance Skills and Opportunity Moonshot," October 2023, https://ai.gov/wp-content/uploads/2023/11/Recommendations_Second-Chance-Skills-and-Opportunity-Moonshot.pdf.
[231] National Artificial Intelligence Advisory Committee, "RECOMMENDATIONS: National Campaign on Lifelong AI Career Success," November 2023, https://ai.gov/wp-content/uploads/2023/12/Recommendations_National-Campaign-on-Lifelong-AI-Career-Success.pdf.
[232] Office of Management and Budget, "Comment on OMB-2023-0020-0001," December 6, 2023, https://www.regulations.gov/comment/OMB-2023-0020-0077.
[233] National Artificial Intelligence Research Resource Task Force, *Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem*.
[234] Ibid.

The Biden administration's executive order shifts the "brain drain" framing into more conventional territory, placing emphasis on attracting skilled AI labor by streamlining visa criteria, interviews, and reviews.[235] Notably, the narrow focus on "experts in AI and other critical and emerging technologies" limits the effects of such measures in a manner that will have both class-based and likely geographic limitations, in contrast to a more broad-based approach to immigration records.[236]

R&D: Imaginations of AI for Good

> "The development of AI in the United States is concentrated in fewer organizations in fewer geographic regions pursuing fewer research pathways. Commercial agendas are dictating the future of AI and concentrating heavily in one discipline: machine learning (ML)."
> — NSCAI Report on AI, 2021[237]

This report from the NSCAI, authored by senior figures from both the defense and commercial technology industry, is notable for its damning critique of how private industry is setting the agenda on AI research and development. It stands in marked contrast to the Bush- and Clinton-era shift toward federal support for commercially oriented R&D carried out by the private sector, which Susannah Glickman highlights in her essay in Chapter 2. The vision then was imagining what "a civilian DARPA that could do for U.S. economic competitiveness what the old DARPA had done for military competitiveness."[238] Yet the NSCAI's indictment offered the narrow remedy of simply increasing public investment in AI (undergirding developments like the NAIRR and CHIPS Act) rather than meaningfully overcoming and correcting the overreliance on commercial incentives.

In fact, the allocation of public R&D funds earmarked specifically for AI under both the Trump and Biden administrations has been accompanied by the more generic policy narratives around basic research for pushing the frontiers of science and the public good, alongside more specific directives on using AI to strengthen US global competitiveness; mitigate potentially "catastrophic risks"; and overcome concerns

[235] White House, "FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence."
[236] White House, "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence."
[237] https://reports.nscai.gov/final-report/chapter-11.
[238] Alex Roland and Philip Shiman. *Strategic Computing: DARPA and the Quest for Machine Intelligence, 1983–1993* (Cambridge, MA: MIT Press, 2002), 7.

of algorithmic bias.[239] Under the Trump administration, the NSF announced $500 million over five years in research funding focused on "transformational advances" in sectors of societal impact like agriculture, climate, and education, citing examples such as tackling extreme weather preparedness to K–12 education. The grants were in partnership with the Department of Agriculture's National Institute of Food and Agriculture, the Department of Homeland Security's Science and Technology Directorate, and the Department of Transportation's Federal Highway Administration.[240] The contours of "AI for good" under the Biden administration, which allocated $700 million to AI research, highlight traditional national interest sectors like "agriculture, healthcare, manufacturing, critical infrastructure, and sustainability" as ripe for AI R&D. (National security isn't mentioned as a key use case, although "enhancing perceptual capabilities and sensorial data" has been a consistent thrust area,[241] with obvious relevance for military contexts.) Another theme in the 2023 R&D strategy is promoting AI as a tool to counter bias and advance equity; it's notable that these articulations of AI for good seem to borrow concepts from the burgeoning field of "sociotechnical" research on AI (exemplified by conferences like FaccT), which has platformed research on this kind of AI use case. A dominant critique of 'AI fairness' research, including from within FaccT, is an overemphasis on technically oriented questions of bias mitigation, and relatively less so on lenses that interrogate where AI might be used to entrench power dynamics or erode autonomy (as with workplace surveillance), or contribute to concentration of power in the tech industry.

Lawmakers have also called attention to the relatively low levels of public R&D investment compared to the billions of dollars spent by the tech industry.[242] Scholars of American innovation strategy have argued that there is no meaningful comparison because the pressure on firms to produce profits means that American industry barely pays for R&D that doesn't have longer-term horizons, even though on paper they have much larger R&D spend. This wildly different risk appetite for

[239] The FY2024 Biden Administration budget specifically mentions the latter two as drivers of the $700 million investment in AI funding for FY2023. The Budget also specifically allocates funding for AI to both the Department of Energy ($169 million) and NIST ($975 million meant to go toward AI, quantum, and cybersecurity efforts).
[240] National Science Foundation, "NSF Advances Artificial Intelligence Research with New Nationwide Institutes," press release, August 26, 2020, https://www.nsf.gov/news/special_reports/announcements/082620.jsp.
[241] The National Artificial Intelligence Research and Development Strategic Plan, National Science and Technology Council, Networking and Information Technology Research and Development Subcommittee, October 2016 https://www.nitrd.gov/pubs/national_ai_rd_strategic_plan.pdf.2023; Select Committee on Artificial Intelligence of the National Science and Technology Council, *National Artificial Intelligence Research and Development Strategic Plan 2023 Update*, May 2023, Executive Office of the President of the United States, https://www.whitehouse.gov/wp-content/uploads/2023/05/National-Artificial-Intelligence-Research-and-Development-Strategic-Plan-2023-Update.pdf.
[242] Anna G. Eshoo, "AI Caucus Leaders Introduce Bipartisan Bill to Expand Access to AI Research.".

public R&D, the argument goes, makes it particularly suitable for general-purpose innovation.[243]

However, at a time when the AI industry is uniquely influential in defining the notion of "breakthrough science," the assumption that public investment is necessarily better or differently placed to drive these advancements is increasingly shaky. The priorities of federal R&D appear to reflect (and potentially entrench) industry trends; the 2016 R&D strategy identified "narrow AI systems" as most ripe for advancements, whereas the latest 2023 R&D strategy flags "scalable general-purpose AI," the models responsible for the chatGPT-inspired AI industry boom, as an explicit priority for public research. This emphasis on large-scale general-purpose AI never acknowledges the market, financial, and environmental impacts that the compute and data dependencies of this trajectory entails. Scale is increasingly used as a proxy for progress and performance, with ever-larger-scale general-purpose AI models like LLMs often positioned by industry stakeholders as stepping stones to forms of so-called "artificial general intelligence" (AGI). The promise of AGI is also inextricably linked to national security dominance—whoever builds AGI first will win the AI race—making the commercial and national security goalposts all but meld into one another.

In other words, the nostalgic framing around transformative publicly funded "basic research" not only obscures the deep and structural dependencies on private technology companies at every layer of the AI stack (starkest when it comes to compute), but also the more fundamental ways in which the commercial AI industry limits the public imagination of what trajectory these technologies should take, and the interests they should serve. Recent state-led efforts like Empire AI, which attempt to "build their own" rather than license from private industry, demonstrate that it's a weakness that political actors recognize but are hard-pressed to overcome given the unprecedented amount of capital it will require to build genuinely public infrastructure for AI.

Sound industrial policymaking must proceed from a deliberate assessment that particular industries both accrue necessary benefits that serve the national interest, and that these benefits will not transpire absent additional resourcing and strategic support. The current approach to AI industrial policymaking fails on both accounts: first, it is far from clear that the tech industry lacks sufficient resources

[243] Weiss, Linda. *America Inc.? Innovation and Enterprise in the National Security State*. Cornell Studies in Political Economy. Ithaca ; London: Cornell University Press, 2014.

to proceed on its own, or that the structure and scale of these industrial policy interventions will meaningfully contest with monopoly dominance within the industry - if anything, they should be juxtaposed against the comparatively paltry funding granted to the regulatory agencies responsible for enforcing the antitrust laws. And it's abundantly clear that the promotion of AI development exists in tension with the Administration's stated policy goals of growing the middle class, empowering workers, and tackling the problem of climate change. The preoccupation with building larger- and larger scale AI has detracted from genuine reflection on how, if at all, AI systems can be designed to serve public interests beyond the incentives powering the commercial industry.

3. To Innovate or to Regulate? The False Dichotomy at the Heart of Europe's Industrial Approach

by Max von Thun

After decades of neglect, industrial policy once again finds itself at the heart of Europe's policy ambitions. The perceived need to accelerate the so-called "digital transition" is a core focus of these ambitions, driven in large part by fears about Europe being "left behind" in the global race for technological supremacy. Meanwhile, rising geopolitical instability and the combined economic impact of the pandemic and war in Ukraine have made Europeans painfully aware of their dependence on concentrated global supply chains for essential goods.

A key milestone in this ongoing revival of industrial policy was the publication, in early 2020, of the European Commission's first formal industrial strategy in many years. This was followed by a flurry of other measures, from legislation including the European Chips Act and the Net-Zero Industry Act to the relaxation of EU state aid rules and the creation of a €750 billion post-COVID economic recovery fund. These new tools build on a considerable arsenal of existing programs and powers, including the EU's competition regime, various public investment schemes, and initiatives at the national level.

In this chapter, the phrase industrial policy is used expansively to include not only traditional levers like direct state investments and subsidies, but also regulatory frameworks like competition law and other digital regulation that can be creatively wielded to produce an environment favorable to national companies. European policymakers—particularly at the national level—are increasingly intent on using industrial policy, as broadly defined here, to accelerate the development and uptake of AI. This trend has been hastened by the explosion of interest in AI triggered by the launch of ChatGPT in November 2022. This has not only resulted in increasing amounts of public funding being directed toward AI and related technologies, but has in some instances led policymakers to actively undermine efforts to impose regulatory guardrails, most notably in relation to the EU's AI Act. With European elections set to take place in 2024, these tense debates over Europe's economic relevance in AI will only grow in intensity.

The Rise and Demise of Industrial Policy in Europe: A Primer

Before diving further into the details of Europe's renewed commitment to industrial strategy and how that relates to AI, it is worth briefly considering the historical developments that led up to this point, and how they inform today's debate.

The rise of the European industrial state coincided with the major wars and economic disruption of the first half of the twentieth century, both of which greatly increased the need for state capacity and intervention. This was followed by the heyday of European industrial policy in the decades following the Second World War, as governments sought to rebuild the war-ravaged European continent upon more equitable socioeconomic foundations, drawing on substantial economic support

from the United States through the Marshall Plan. Industrial policy during the postwar era was highly interventionist, with governments seeking to "pick winners" through support targeted at specific sectors, and with state-owned firms representing a substantial share of economic activity.

From the 1980s onward, however, as the influence of neoliberal economic thinking and the "Washington Consensus" approached its zenith, industrial intervention was replaced by measures to unleash market forces and shrink the role of the state in the economy through privatization and deregulation. A key priority during these decades was the establishment of a European "single market" based on the free movement of goods, capital, and people. Industrial policy in this context was largely restricted to eliminating barriers to trade, promoting market competition, and investing in the research and development (R&D) and skills needed to remain globally competitive.[244] [245]

This consensus began to erode at the beginning of the twenty-first century, and has since almost entirely collapsed. The 2007–2008 financial crash, and the severe and protracted economic crisis it caused in Europe, greatly increased the willingness of European governments to intervene in the economy, from publicly funded retraining and job-creation programs to public investment in economically disadvantaged regions. While most intervention took place at the national level, there was also a marked shift (at least ideologically) at the EU level.[246] In recent years this shift has accelerated rapidly due to a number of factors outlined below, including the rise of China and the economic impact of the COVID-19 pandemic and Russia's invasion of Ukraine.

While this revival is not without contestation, especially from smaller countries that see calls for more industrial policy as cover for larger, richer member states to prop up domestic companies and industries,[247] it has been supercharged in the past few years by three key overlapping developments.

[244] Simone Tagliapietra and Reinhilde Veugelers, "The History of Industrial Policy in Europe," in *A Green Industrial Policy for Europe* (Brussels: Bruegel, 2020), http://www.jstor.org/stable/resrep28602.7.
[245] Sebastian Dullien and Jonathan Hackenbroich, "European Industrial Policy: A Crucial Element of Strategic Autonomy," Foundation for European Progressive Studies, May 2022, https://feps-europe.eu/wp-content/uploads/2022/05/esa_european-industrial-policy_ac1.pdf.
[246] In 2012, the European Commission launched a Strategy for the Re-Industrialization of Europe, which aimed at increasing the share of manufacturing in the European economy from 15 percent to 20 percent of GDP, through a combination of public investment, training programs, and better access to finance and markets.
[247] Although few are advocating for a full return to the laissez-faire approach of the past, some fear the continent risks throwing the baby out with the bathwater by going too far in embracing intervention. This tension can be seen in the relationship between the EU's larger members (especially France and Germany) and smaller northern, eastern, and Scandinavian countries. The latter have often interpreted calls for more industrial policy as cover for larger, richer member states to prop up domestic companies and industries, at the expense of the EU single market's "level playing field." See Gabriela Baczynska, "Eleven EU Countries Urge 'Great Caution' in Loosening State Aid Rules" Reuters, February 14, 2023, https://www.reuters.com/world/europe/eleven-eu-countries-urge-great-caution-loosening-state-aid-rules-2023-02-14.

First, both the rise of China as a major economic and political power, and the growing insularity and unpredictability of the US as a global actor, have made European policymakers far more aware of the continent's economic and geopolitical weaknesses. Industrial policy is thus seen as a means of reducing these dependencies and weaknesses, while at the same time strengthening Europe's global competitiveness.

Second, the economic disruption caused by the COVID-19 pandemic, and subsequently by Russia's invasion of Ukraine, highlighted Europe's precarious dependence on foreign markets and actors for critical supplies, from medical equipment to semiconductors and rare earths. These crises have shaken Europe's confidence in the capacity of global supply chains to meet its essential needs, and have led to calls for greater diversification of supply (including increased local and regional production) to strengthen the continent's resilience to external shocks.

The third factor is Europe's desire to be globally competitive when it comes to developing advanced technologies and tackling climate change. As in other places, the urgent need to reduce emissions—and the private sector's failure to meet the challenge—has opened up a clear role for industrial policy in steering and accelerating the green transition. Most recently, this urgency has been magnified by the perceived need to "keep up" with green industrial policy initiatives elsewhere (above all the US Inflation Reduction Act) amid fears that foreign subsidies will lure businesses and investment away from Europe.[248]

This logic of competitiveness is also increasingly being applied to technology. Frustration over Europe's failure to produce globally competitive technology firms (only one European company, ASML, figures among the world's twenty largest tech firms, and the continent has few leading tech startups[249]), as well as concerns that this history will repeat itself with AI and other emerging technologies, mean that digital now finds itself at the heart of the EU's emerging industrial policy agenda.

[248] Christian Scheinert, "Briefing: EU's Response to the US Inflation Reduction Act (IRA)," European Parliament, June 2, 2023, https://www.europarl.europa.eu/thinktank/en/document/IPOL_IDA(2023)740087.
[249] Monika Sherwood, Aneil Singh, and Alessio Terzi, "European Industrial Policy for the Green and Digital Revolution," *Science and Public Policy*, 50, no. 5 (October 2023): 842–857, https://doi.org/10.1093/scipol/scad018.

How Industrial Policy Is Being Used to Drive the EU's Digital and Green Objectives

A major milestone in the EU's renewed interest in industrial policy was the publication in March 2020 of the Commission's New Industrial Strategy for Europe, the bloc's first formal industrial strategy in many years.[250] At the heart of the strategy are the so-called "twin transitions" to a green and digital economy, alongside an explicit commitment to enhancing Europe's "open strategic autonomy." While the strategy contained few new policy measures, it provided an overarching intellectual framework for the EU's industrial policies that was previously lacking.

Another important step in the EU's expanding industrial policy arsenal was the creation of the Recovery and Resilience Facility (RRF) as a response to the economic shock of the pandemic. Through the RFF, the Commission took the unprecedented step of borrowing money directly on capital markets and then using the subsequent funds to distribute grants and loans to member states for their national economic recovery plans, with a heavy emphasis on investment in green and digital infrastructure and capabilities.[251] While intended as a one-off measure, the RFF set a major precedent with regard to the EU's centralized fiscal capabilities that is likely to be repeated in future economic crises, if not in times of stability.

Finally, the past few years have seen significant modifications to the EU's state aid regime.[252] The rules have been repeatedly loosened to give governments greater leeway to subsidize industry: first in response to the COVID-19 pandemic, then following the energy crisis triggered by Russia's invasion of Ukraine, and once more in response to the US Inflation Reduction Act.[253] Important Projects of Common European Interest (IPCEI)—which enable member states to join forces in using state

[250] European Commission, "European Industrial Strategy," accessed December 18, 2023, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en.
[251] The total amount allocated under the RFF is €723 billion, with a roughly fifty-fifty split between grants and loans. To receive support, member states were required to submit national plans allocating at least 37 percent of the funding to green measures and another 20 percent to digital initiatives, reflecting the "twin transitions" in the industrial strategy. These plans are in the process of being implemented across the EU, with governments having until December 2026 to make reforms and investments.
[252] The state aid rules, enshrined in Article 107 of the Treaty on the Functioning of the European Union (TFEU), require the Commission to approve or reject large subsidies provided by member states to national businesses. The regime is designed to prevent governments with greater financial resources from using subsidies, tax breaks, and other fiscal measures to favor domestic industry, given the distortive effect this would have on the EU's internal market.
[253] European Commission, "State Aid: Commission Adopts Temporary Crisis and Transition Framework to Further Support Transition towards Net-Zero Economy," press release, March 9, 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1563

aid to address market failures and promote innovation—have also become more prominent in recent years, with the Commission approving separate multibillion euro IPCEIs on chips, cloud computing, and hydrogen in the past two years alone.[254]

While each relaxation of the state aid rules has been temporary, certain member states, particularly France and Germany, have issued calls to extend them beyond their current deadlines.[255] This has been contested by smaller countries concerned about unfair advantages for their larger peers; data showing that nearly four-fifths of approved state aid was spent by France and Germany suggests they have a case.[256] The Commission's increasingly permissive approach to state aid has also raised alarm bells with civil society groups concerned about corporate capture and rising market concentration.[257]

The New Industrial Strategy, the Resilience and Recovery Fund, and the loosening of the state aid rules are three key developments in the EU's increasingly interventionist approach to industrial policy. But the EU has many other relevant tools in its industrial arsenal—from its competition, export control, and investment screening regimes to sizeable spending programs, including the €95 billion Horizon Europe R&D funding program, the European Regional Development Fund, the European Investment Bank, and the recently established European Innovation Council, which invests directly in innovative companies.

Much of the recent legislation passed by the EU also has a significant industrial policy flavor, including the European Chips Act (which seeks to increase the bloc's share in the global semiconductor market), the Critical Raw Materials Act (which aims to secure the EU's access to the raw materials needed in key sectors), and the Net-Zero Industry Act (intended to scale-up the manufacture of clean technologies in Europe). Meanwhile, many of the EU's flagship digital policy initiatives, including the Digital Markets Act (DMA) and the Data Act, have the explicit aim of boosting Europe's economic competitiveness and technological sovereignty.

[254] European Commission, "Approved Integrated Important Projects of Common European Interest," accessed December 18, 2023, https://competition-policy.ec.europa.eu/state-aid/ipcei/approved-ipceis_en.
[255] Varg Folman, Giorgio Leali, and Aoife White, "France and Germany Risk EU Rift over Energy Subsidies," *Politico,* October 26, 2023, https://www.politico.eu/article/france-joins-germany-in-pushing-for-energy-aid-exemption.
[256] Jorge Liboreiro, "Germany & France Account for Most EU Subsidies. Here's Why It's a Concern," Euronews, January 17, 2023, https://www.euronews.com/business/2023/01/17/germany-france-account-for-most-eu-state-aid-heres-why-its-a-concern.
[257] Open Markets Institute, "Letter to European Commission Warns against Subsidizing Large, Dominant Corporations at the Expense of SMEs in Clean Energy Transition," press release, March 13, 2023, https://www.openmarketsinstitute.org/publications/letter-to-european-commission-warns-against-over-subsidizing-large-dominant-corporations-at-the-expense-of-smes-in-clean-energy-transition.

AI and Industrial Policy

The EU's identification of AI as an economic opportunity and component of its future competitiveness is relatively recent.[258] The Commission's 2015 Digital Single Market Strategy failed to mention AI whatsoever, while its 2017 review of the strategy only included limited references. This began to shift with the 2018 European Strategy on AI, which focused more on opportunities than threats, and was cemented in 2021 by the Commission's Communication on Fostering a European Approach to Artificial Intelligence. The communication sets forth an ambition to turn the EU into a "world-class hub for AI" and notes the technology's "enormous potential to provide European industry with a competitive edge."[259]

Ambitious rhetoric aside, until very recently AI has been an important but not central part of the EU's industrial policy agenda. Many of the EU funding vehicles referenced above provide funding for AI research and industrial uptake, even if the technology is not their main focus. For example, the formal guidance to member states on the RRF includes AI R&D and deployment, as well as the use of AI in public service delivery, as valid targets for national investments.[260] Through Horizon Europe, the European Innovation Council, and other programs, the Commission channels billions of euros per year into AI research and innovation.

To bring greater coherence to these efforts, in January the Commission announced an AI innovation package designed to "support European startups and SMEs in the development of trustworthy AI that respects EU values and rules".[261] Though much of the package simply restates or reframes existing initiatives, it also fleshed out a commitment (made by Commission President Ursula von der Leyen in September 2023) to open up the EU's public supercomputers to European researchers and AI startups.The package also makes close to €3 billion of funding available for public computing infrastructure, startup incubation and accelerating industrial uptake of AI. While many of the above measures could foreseeably foster European alternatives to Big Tech's dominance, the package is also notable for its unreserved

[258] Zach Meyers and John Springford, "How Europe can make the most of AI," Centre for European Reform, September 14, 2023, https://www.cer.eu/publications/archive/policy-brief/2023/how-europe-can-make-most-ai.
[259] European Commission, "Communication on Fostering a European Approach to Artificial Intelligence," April 21, 2021, https://digital-strategy.ec.europa.eu/en/library/communication-fostering-european-approach-artificial-intelligence.
[260] European Commission, "Commission Staff Working Document: Guidance to Member States Recovery and Resilience Plans," January 22, 2021, https://commission.europa.eu/system/files/2021-01/document_travail_service_part1_v2_en.pdf.
[261] European Commission, "Commission Launches AI Innovation Package to Support Artificial Intelligence Startups and SMEs," press release, 24 January, 2024, https://ec.europa.eu/commission/presscorner/detail/en/ip_24_383.

endorsement of the data-intensive "generative AI" applications and large language models favoured by those same firms, as opposed to other forms of the technology.

Additional national funding for AI, and AI-related inputs and infrastructure, is also being channeled through the state aid framework discussed earlier. For example, a recently approved IPCEI on "Next Generation Cloud Infrastructure and Services" led by France, Germany, Italy, and four other member states will allocate €1.2 billion in state aid to projects implemented by nineteen companies, including Deutsche Telekom, Siemens, Orange, Atos, and SAP (only European companies were eligible to participate).[262] The goal of the initiative is to develop a "set of advanced cloud and edge services" that help achieve the EU's digital objectives, including but not limited to global leadership in AI. Indeed, upon announcing the initiative, former Competition Commissioner Didier Reynders suggested it could support the development of generative artificial intelligence models in languages other than English.[263]

Meanwhile, legislative measures such as the European Chips Act and the critical raw materials (CRMs) are intended to help the EU secure the advanced semiconductors (and the materials required to manufacture those chips) used to train and run cutting-edge AI models and applications.

AI also features prominently in the EU's digital policy agenda, in which industrial policy objectives are more implicit than explicit. The EU's flagship initiative in this area is the recently passed AI Act, which will impose a set of risk-based horizontal obligations on AI developers and providers.[264] "Unacceptable" use cases—including social scoring and manipulation—will be banned, while "high-risk" use cases—including worker surveillance and credit scoring—will be subject to stringent obligations on transparency, risk assessment and mitigation, high quality datasets and activity logging, and human oversight.

Even as the AI Act is primarily oriented around mitigating the risks associated with AI systems, there has been a parallel, and quieter, narrative that justifies its beneficial economic impacts for Europe. For example, the Commission has explicitly argued that trust in AI (which the legislation is intended to establish) is necessary

[262] European Commission, "Commission Approves up to €1.2 Billion of State Aid by Seven Member States for an Important Project of Common European Interest in Cloud and Edge Computing Technologies," press release, December 5, 2023, https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6246.
[263] Edith Hanock and Aiofe White, "Cloud and Edge Computing Cleared by EU to Get €1.2B Subsidy," *Politico*, December 5, 2023, https://pro.politico.eu/news/172563.
[264] European Commission, "Regulatory Framework Proposal on Artificial Intelligence," accessed December 18, 2023, https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai.

before the technology can be rolled out across society at scale. The recital to the Act claims that EU-wide regulation will facilitate AI uptake by preventing regulatory fragmentation, and that this will help the EU become a "global leader in the development of secure, trustworthy and ethical artificial intelligence." Moreover, a handful of provisions in the Act are specifically designed to encourage AI innovation, including regulatory sandboxes for testing novel AI systems and measures to lighten the regulatory burden on small businesses.

In fact, the economic impacts of the legislation found themselves front and center in the negotiations on the AI Act, where fears about Europe's lack of competitiveness in AI were whipped up to argue for a weaker regulatory regime. While some of these concerns were expressed by legislators working on the Act, the majority of the criticism—at least initially—came from industry, particularly large businesses. An open letter from June 2023, signed by companies including Siemens, Airbus, Renault, and Heineken, warned that the Act would "jeopardise Europe's competitiveness and technological sovereignty" and called for the legislation to be watered down.[265] A similar letter, signed primarily by associations representing large corporate interests (including lobby groups the Computer & Communications Industry Association, DOT Europe, and the Information Technology Industry Council), warned that amendments made during the legislative process risked "inhibiting the development and use of AI in Europe."[266]

In particular, the launch of ChatGPT and heightened public awareness of generative AI fueled debate over the AI Act's role in encouraging (or stifling) the development and uptake of the technology in Europe. While the Act was drafted before such models were widely available, their rapid introduction triggered a scramble to update the legislation in response. Led by the European Parliament, legislators pushed to introduce a new set of regulatory obligations targeted at "general purpose AI systems," an effort that was ultimately successful despite fierce opposition. These obligations are tiered and targeted at the most powerful and advanced models posing "systemic risk," with other applications and models being subject to lighter-touch transparency requirements.[267]

[265] Javier Espinoza, "European Companies Sound Alarm over Draft AI Law," *Financial Times,* June 30, 2023, https://www.ft.com/content/9b72a5f4-a6d8-41aa-95b8-c75f0bc92465.
[266] Computer & Communications Industry Association, "AI Act: Regulate High-Risk Use Instead of Technology, EU Negotiators Told by Industry," press release, September 29, 2023, https://ccianet.org/news/2023/09/ai-act-regulate-high-risk-use-instead-of-technology-eu-negotiators-told-by-industry.
[267] European Parliament, "Artificial Intelligence Act: Deal on Comprehensive Rules for Trustworthy AI," press release, December 9, 2023, https://www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai.

Despite their inclusion in the final text, these efforts to apply the AI Act to general-purpose AI systems faced stiff opposition from a number of member states worried about economic competitiveness. Led by France, Germany, and Italy, these governments argued that imposing strict regulatory requirements on foundation models would harm AI innovation in Europe and hamper the continent's ability to produce globally competitive AI companies. Instead, these member states proposed light-touch "codes of conduct" for general-purpose systems, while regulating downstream AI applications more comprehensively.

As a paper authored by the three countries argued, "the inherent risks lie in the application of AI systems rather than in the technology itself."[268] Reports suggested that the French and German governments were heavily lobbied by Mistral AI and Aleph Alpha—the leading French and German AI startups, respectively—to adopt this approach.[269] While this late push was ultimately a failure thanks to strong pushback from the European Parliament and civil society, French President Emmanuel Macron nonetheless warned following the agreement that the regulation would need to be "reevaluated" if it led to the loss of "AI pioneers and leaders,"suggesting that the controversy is likely to continue into the Act's implementation and enforcement.[270]

While not a prominent part of the debate so far, competition policy has an integral role to play in promoting openness in AI and ensuring the technology is used safely, fairly, and responsibly.[271] The EU's powerful competition policy toolkit—including the recently adopted Digital Markets Act (DMA), which gives the Commission powers to ban anticompetitive practices by dominant "gatekeeper" firms—could be used to promote a fairer and more diverse AI European ecosystem, by preventing Big Tech's accelerating efforts to dominate AI through monopolistic conduct and anti-competitive partnerships and acquisitions.

But this potential has so far been undermined by the absence of foundation models from the DMA's list of "core platform services" (to which the Act's obligations apply)

[268] Luca Bertuzzi, "France, Germany, Italy Push for 'Mandatory Self-Regulation' for Foundation Models in EU's AI Law," Euractiv, November 19, 2023, https://www.euractiv.com/section/artificial-intelligence/news/france-germany-italy-push-for-mandatory-self-regulation-for-foundation-models-in-eus-ai-law.
[269] Natasha Lomas, "France's Mistral Dials Up Call for EU AI Act to Fix Rules for Apps, Not Model Makers," *TechCrunch,* November 16, 2023, https://techcrunch.com/2023/11/16/mistral-eu-ai-act.
[270] W.G. and Agence France-Presse,"'Pas une bonne idée': Emmanuel Macron ne veut pas encadrer L'IA 'plus que les autres,'" BFMTV, December 11, 2023, https://www.bfmtv.com/tech/intelligence-artificielle/pas-une-bonne-idee-d-encadrer-l-ia-plus-que-les-autres-macron-conteste-la-regulation-europeenne_AD-202312110800.html.
[271] Barry Lynn, Karina Montoya, and Max von Thun, "AI in the Public Interest: Confronting the Monopoly Threat," Open Markets Institute, November 15, 2023, https://www.openmarketsinstitute.org/publications/report-ai-in-the-public-interest-confronting-the-monopoly-threat.

and the Commission's failure to include dominant cloud providers in its initial round of designations.[272] The Commission is already coming under pressure to fill these gaps, with MEPs in the European Parliament recently calling for it to investigate whether cloud computing and generative AI should be covered by the DMA.[273] In response. In response to this mounting pressure, in January the Commission launched a number of initiatives, including reviewing whether Microsoft's partnership with OpenAI is investigable under the EU's Merger Regulation, and launching a consultation on competition dynamics in generative AI, mirroring similar actions taken by the UK's Competition and Markets Authority and the U.S. Federal Trade Commission.[274]

FRANCE AND THE QUEST FOR NATIONAL UNICORNS

It is at the national level where the most explicit efforts to support AI through industrial policy are taking place in Europe. This is not in itself surprising, given the EU's limited fiscal resources, economic competition between member states themselves, and differing views across the bloc on both the benefits of AI and the merits of industrial policy. Under President Emmanuel Macron, France has not shied away from using industrial policy measures to pursue national and European leadership in AI. Aside from France, Germany has committed to spending close to €500 million on AI research and innovation in 2024, including investments in computing infrastructure, skills, and academic professorships.[275] Spain's national AI strategy, launched in 2020, envisioned the country spending €600 million between 2021 and 2023 on R&D, accelerating AI uptake in industry and the public sector, and creating an "ethical and normative framework" for AI (though a mere €8 million was allocated to this cause).[276]

[272] Max von Thun, "A Step Forward for the Digital Markets Act, But Big Questions Remain," *Tech Policy Press,* September 14, 2023, https://techpolicy.press/a-step-forward-for-the-digital-markets-act-but-big-questions-remain.
[273] Luca Bertuzzi, "MEPs Call to Ramp Up Big Tech Enforcement in Competition Review," Euractiv, December 5, 2023, https://www.euractiv.com/section/competition/news/meps-call-to-ramp-up-big-tech-enforcement-in-competition-review.
[274] European Commission, "Commission Launches Calls For Contributions on Competition in Virtual Worlds and Generative AI," press release, January 9, 2024, https://ec.europa.eu/commission/presscorner/detail/en/IP_24_85.
[275] David Matthews, "Germany Promises Huge Boost in Artificial Intelligence Research Funding and European Coordination," *Science Business*, August 31, 2023, https://sciencebusiness.net/news/ai/germany-promises-huge-boost-artificial-intelligence-research-funding-and-european.
[276] European Commission, *Spain AI Strategy Report*, accessed December 18, 2023, https://ai-watch.ec.europa.eu/countries/spain/spain-ai-strategy-report_en

The trajectory in France is worth detailing, and long predates the current generative AI frenzy, with Macron announcing an initial AI strategy back in 2018 accompanied by €1.5 billion in public funding. Macron framed the strategy as a means of turning France into a "startup nation" while also evoking geopolitical competition, warning that the country risked giving up its sovereignty if it "missed the start of the war."[277] Among other things, the strategy focused on the establishment of specialized research institutes, funding for startups, open data, and the fostering and recruitment of talent.

The strategy has been topped up several times with additional resources, first in 2021 and subsequently in 2023. The 2021 update provided an additional €1.5 billion in public funding and set precise targets for the training of students and France's future share of the global AI market. The 2023 update pumped over a billion euros of additional funding into AI "clusters," open-source AI, and state supercomputers, while also seeking to direct €7 billion worth of private institutional investment into AI. In remarks announcing the latest round of investments at tech industry conference VivaTech, Macron leaned heavily on the need to remain competitive with China and the US, including matching state support in those nations.[278]

The French government's AI industrial policies are part of a broader effort, largely driven by Macron, to establish France as a leading tech nation both within Europe and globally. His government frequently references the need to reduce France's dependence on US Big Tech firms as a core rationale for these measures. For example, in explaining France's public support for open-source AI, the country's ambassador for digital affairs referenced the need to avoid a "world with two or three or four monopolies" who "negotiate the rights to innovate."[279]

To some extent paradoxically, this apparent commitment to reining in Big Tech monopolies has been accompanied by aspirations to create national champions. In 2022 Macron called for France to create at least 100 "unicorns" (companies worth at least €1 billion) by 2023,[280] and in his remarks at VivaTech the President expressed his desire for AI

[277] Mathieu Rosemain and Michel Rose, "France to Spend $1.8 Billion on AI to Compete with U.S., China," Reuters, March 29, 2018, https://www.reuters.com/article/us-france-tech/france-to-spend-1-8-billion-on-ai-to-compete-with-u-s-china-idUSKBN1H51XP.
[278] Théophane Hartmann, "Macron Sets Out France's Ambition to Boost AI, Green Tech," Euractiv, June 15, 2023, https://www.euractiv.com/section/industrial-strategy/news/macron-sets-out-frances-ambition-to-boost-ai-green-tech.
[279] Mohar Chatterjee and Gian Volpicelli, "France Bets Big on Open-Source AI," *Politico,* August 4, 2023, https://www.politico.eu/article/open-source-artificial-intelligence-france-bets-big.
[280] Sudip Kar-Gupta, "Macron Aims for Surge in Number of French Tech Unicorns by 2030," Reuters, June 17, 2022, https://www.reuters.com/technology/macron-aims-surge-number-french-tech-unicorns-by-2030-2022-06-17.

"champions" in France.[281] Among other things, this has led to attempts (discussed earlier) to water down regulation to protect these perceived champions. Mistral AI, a company founded in 2023, has been one of the key beneficiaries of these efforts. The role of Cedric O—a former digital minister and now an investor in and adviser to Mistral—in lobbying the French government on AI regulation has been particularly controversial.[282]

The French government's willingness to prioritize industrial goals over safety is evident in multiple comments made by French officials in recent years. As a minister, O himself described as "nonsense" the European tendency to put "regulation before innovation,"[283] while O's successor Jean-Noël Barrot has warned that excessive regulation could kill Europe's ability to create its own leading generative AI players.[284] Similar concerns have been voiced by Macron himself, who has called for EU AI regulation to be "controlled, not punitive, to preserve innovation."[285]

Conclusion

With the next round of European elections scheduled for June 2024, followed shortly by the appointment of a new European Commission, debates about the EU's future strategic direction are reaching a fever pitch. The issue of European competitiveness in the global AI race finds itself at the center of these discussions, with former Italian Prime Minister Mario Draghi due to publish a report (requested by Commission President von der Leyen) on the topic later this year. Industry, including Big Tech, is using this opportunity to lobby aggressively for a much greater focus on competitiveness (equated by these actors with cutting regulation) under the next Commission, raising the specter of Europe's global irrelevance if this advice is ignored.[286]

[281] *Le Monde* and Agence France-Presse, "Macron Announces €500 Million in Funding for AI," *Le Monde*, June 14, 2023, https://www.lemonde.fr/en/france/article/2023/06/14/macron-wants-france-to-be-among-ai-leaders_6031624_7.html.
[282] Corporate Europe Observatory, "Byte by Byte: How Big Tech Undermined the AI Act," November 17, 2023, https://corporateeurope.org/en/2023/11/byte-byte.
[283] Matthieu Pollet, "French AI Strategy: Tech Sector to Receive over €2 Bln in Next 5 Years," Euractiv, November 9, 2021, https://www.euractiv.com/section/digital/news/french-ai-strategy-tech-sector-to-receive-over-e2-bln-in-next-5-years.
[284] Laura Kayali, "France Warns against Killing a European ChatGPT," *Politico,* June 6, 2023, https://www.politico.eu/article/france-warns-eu-parliament-against-killing-a-european-chatgpt.
[285] *Le Monde* and Agence France-Presse, "Macron Argues against 'Punitive' AI Regulation," *Le Monde,* November 17, 2023, https://www.lemonde.fr/en/european-union/article/2023/11/17/macron-argues-against-punitive-ai-regulation_6264452_156.html.
[286] Digital Europe, "Europe 2023: A Digital Powerhouse" November 2023, https://cdn.digitaleurope.org/uploads/2023/11/DIGITAL-EUROPE-MANIFESTO-2024-FULL.pdf.

When it comes to industrial policy—both in general and in relation to AI—the EU needs to decide which comes first: setting rules of the road that promote an economy and market structure in line with European values, or sacrificing these in an attempt to gain global market share. The (ultimately unsuccessful) effort to exempt foundation models from the AI Act was a clear manifestation of this tension, but it is far from the only one. For example, the EU's competition regime is facing growing pressure from governments and commercial interests that want to see it applied more lightly to European actors—in telecoms and rail, for example—in order to enable consolidation that they claim will strengthen Europe's global competitiveness.

A related risk is that a narrow deregulatory vision of competitiveness, combined with fragmentation in the EU's regulatory framework and zero-sum competition between member states, fuels a race to build up national champions that undermines the EU's single market while rewarding well-connected corporations and worsening market concentration. Here again, the fraught negotiations on the AI Act are instructive, given the role of French and German AI "champions" in lobbying their governments for preferential treatment. And while Intel is not a European company per se, the €10 billion in subsidies it received from the German government has raised the worrying prospect of an intra-EU subsidy race on semiconductors. One obvious antidote would be to create additional funding for industrial policy at the EU level, but this has so far been opposed by member states.

More fundamentally, there is a need to challenge the notion that less or weaker regulation naturally leads to greater competitiveness. For example, strict rules on AI safety can provide the public trust needed for mass uptake of AI technologies, while aggressive antitrust enforcement can create the conditions needed for the emergence of globally competitive European companies. And many other types of positive state intervention have a role to play in increasing global competitiveness, including subsidies, public procurement, and investment in infrastructure and education. This suggests that the problem is less the notion of competitiveness itself, and more how the term is defined—and potentially captured—by powerful actors.

Fortunately, there is also a more optimistic way to look at Europe's renewed interest in industrial policy. Instead of undercutting regulation, increasing market concentration, and fueling a race to the bottom on standards, a progressive

paradigm on industrial policy could be used to steer Europe's economy and technology sector in a more socially beneficial direction. This would entail using tools—including subsidies, taxation, competition policy, and digital regulation—in a joined-up way to promote overarching policy objectives, from ensuring technology is developed and rolled out in a human centric way to promoting a more open and decentralized digital economy.

4. Promises and Pitfalls of India's AI Industrial Policy

by Jyoti Panday and Mila T Samdub

In the last few years, the Indian government's commitment to AI has been on a steady ascent, evident in increased infrastructural investments, financial backing, and media attention directed toward AI initiatives.[287] Generally, Indian policymakers view technology as a critical tool for achieving economic and development priorities and a pathway for India to leapfrog to a leadership role on the global stage.

Although it taps into these aspirations, India's foray into AI development is more reactive than strategic, with ad hoc responses tailored to the prevailing geopolitical landscape. Amidst U.S.-China trade tensions, India is eager to position itself as a trustworthy ally and a regional tech powerhouse. Yet its quest to integrate into global AI supply chains is hindered by resource constraints, particularly in computing power and large-scale models. Balancing global aspirations with domestic priorities, the government navigates a complex AI development agenda,

[287] Government of India, *Budget 2023–2024: Speech of Nirmala Sitharaman, Minister of Finance*, February 1, 2023, https://www.indiabudget.gov.in/doc/bspeech/bs2023_24.pdf.

resulting in fragmented approaches to AI across various sectors.[288] Under the banner of sovereign AI, India is attempting to boost chip manufacturing and cloud compute capacity. At the same time, influenced by the apparent success of Digital Public Infrastructures (DPIs) over the past decade, India's AI industrial policy prioritizes data platforms and AI applications for socioeconomic development. A concurrent focus on ethical and responsible regulation enables India to grab headlines and project moral leadership while serving as a strategic maneuver that enables greater government control over AI development.

Sovereign AI

"We are determined that we must have our own sovereign AI," India's Minister of State for Electronics and Information Technology Rajeev Chandrasekhar[289] recently stated:

> We can take two options. One is to say, as long as there is an AI ecosystem in India whether that is driven by Google, Meta, Indian startups, and Indian companies, we should be happy about it. But we certainly don't think that is enough.[290]

Such statements reframe both "sovereignty" and AI.[291] According to Chandrasekhar,

> with sovereign AI and an AI compute infrastructure [...] the government is not looking to just compete with the generative AI type of model. It also wants to focus on real-life use cases in healthcare, agriculture, governance, language translation, etc, to maximise economic development."

[288] Several agencies are promulgating different kinds of policy. This chapter focuses on two of the most important: NITI Aayog, the successor institution to the Planning Commission, which attempts to set the agenda through principles and strategies; and the Ministry of Electronics and Information Technology, which is taking the lead on policy and regulatory interventions.
[289] A former Intel semiconductor engineer and a telecom billionaire, Chandrasekhar has been MoS for Electronics and Information Technology since 2021.
[290] Soumyarendra Barik, "India Is Building Its Own 'Sovereign AI'. What Does It Mean?" *Indian Express*, December 1, 2023, https://indianexpress.com/article/explained/explained-sci-tech/india-sovereign-ai-meaning-9048436.
[291] For a formal exploration of an expansive view of AI sovereignty in a context similar to India, see Luca Belli, *To Get Its AI Foothold, Brazil Needs to Apply the Key AI Sovereignty Enablers (KASE)*, Carnegie Endowment for International Peace, November 29, 2023, https://carnegieendowment.org/2023/11/29/to-get-its-ai-foothold-brazil-needs-to-apply-key-ai-sovereignty-enablers-kase-pub-91081.

As Chandrasekhar's statements reveal, India is attempting to define sovereignty in a way that moves beyond the hyper-technical focus on compute and large-scale models that has dominated on the global stage. India's championing of "Sovereign AI" appears bold, yet this strategy sidesteps key power dynamics in the current AI landscape.

The Doctrine of Self-Reliance

"Sovereign AI" is an extension of the current government's doctrine of self-reliance. The National Democratic Alliance government, which has been in power since 2014, believes that economic prosperity and national security require India to reduce its dependence on other countries.[292] This vision of "Atma Nirbhar Bharat," or "Self-Reliant India," is rooted in its state-centric approach to managing important domestic industries and is motivated by global aspirations and a larger geopolitical agenda. In the IT sector, self-reliance is chiefly promoted through two programs: Digital India, which aims for universal digital infrastructure; and Make in India, which pushes for indigenous production of IT hardware.

In AI, the call for self-reliance and sovereignty has been linked to efforts to promote manufacturing, including semiconductors, with generous incentives. Another goal is to encourage big cloud-computing providers to build more Indian data centers, where AI models are trained, and possibly to buy USD 1.2 billion worth of GPUs.[293] Although India is leading with a sovereignty-based approach to AI development, each AI system operates within a unique supply chain, influenced by industry sectors, specific use cases, stakeholders, and their decisions regarding system development and accessibility. Consequently, the pursuit of self-reliance across AI supply chains is challenging.

[292] The National Democratic Alliance is the ruling coalition led by the Bharatiya Janata Party (BJP) under Narendra Modi. It currently controls the central government and several state governments. It is worth noting that self-reliance has been a major principle guiding Indian industrial policy and technology development since the 1950s.
[293] Ameen Jauhar and Abhishek Gupta, "AI for AI – Developing Artificial Intelligence for an Atmanirbhar India," Vidhi Centre for Legal Policy (blog), February 23, 2021, https://vidhilegalpolicy.in/blog/ai-for-ai-developing-artificial-intelligence-for-an-atmanirbhar-india; Parminder Jeet Singh, "An 'Atmanirbhar' AI Will Benefit India. Here's Why," *Hindustan Times*, April 25, 2023, https://www.hindustantimes.com/opinion/india-must-prioritize-strong-ai-governance-for-data-sovereignty-and-promote-indigenous-innovation-parminder-jeet-singh-and-sharad-sharma-101682435000316.html; and "Welcome to the Era of AI Nationalism," *Economist*, January 1, 2024, https://www.economist.com/business/2024/01/01/welcome-to-the-era-of-ai-nationalism.

India is Not Competitive in Compute

With AI being promoted across diverse sectors—from healthcare and finance to agriculture and manufacturing—India's AI ambitions are linked to having access to cutting-edge compute. At the 2023 Global Partnership on Artificial Intelligence Summit in New Delhi, Prime Minister Modi announced the launch of an India AI Mission.[294] A key aim of the AI mission is "to get AI compute power which will help startups and innovators."[295] Compute refers to the combination of hardware and software that powers all kinds of AI today.[296]

Such highly publicized moves to build domestic compute capacity should be understood in two contexts: improving the international competitiveness of Indian firms towards integrating India into the global compute supply chain, and building domestic compute resources for Indian startups to access. A survey of the state of the industry and the proposed interventions reveals the former to be a distant dream and the latter to be difficult to achieve without dependence on foreign companies.

Chips

India's foray into chip manufacturing is linked to its AI ambitions by both policymakers and in the media.[297] Seeking to break its dependence on imports and facilitate the development of new high-value industries, India's National Semiconductor Mission is seeking to build a domestic chip industry and turn the country into a "Semiconductor Nation," notably through over $10 billion of "production-linked incentives" intended to jumpstart chip manufacturing.[298] A

[294] Adding to a general atmosphere of confusion around Indian AI policy, this new mission appears to be distinct from a preexisting National AI Mission which was launched in 2018 by the PM's Principal Scientific Advisor.
[295] "India to Launch AI Mission to Help Startups with Compute Power: PM Modi," MoneyControl, December 13, 2023, https://www.moneycontrol.com/news/business/startup/india-to-launch-ai-mission-to-help-startups-with-compute-power-pm-modi-11894211.html.
[296] Jai Vipra and Sarah Myers West, "Computational Power and AI," AI Now Institute, September 27, 2023, https://ainowinstitute.org/publication/policy/compute-and-ai#a0d31d2f-e17a-41c8-8001-7e2fd35e79f9-link.
[297] "Welcome to the Era of AI Nationalism," The Economist, January 1, 2024, https://www.economist.com/business/2024/01/01/welcome-to-the-era-of-ai-nationalism.
[298] As part of the government's broader aim to incubate an electronics industry (see National Policy on Electronics 2009), it has announced $10 billion as an incentive for building chip manufacturing and assembly, testing, and packaging (ATP) plants in India. This incentive will support up to 50 percent of the expenditure for setting up a plant. For a survey of India's current chipmaking efforts, see Sankalp Phartiyal, "India Chip Strategy Makes Progress With $21 Billion in Proposals," Bloomberg, February 26, 2024, https://www.bloomberg.com/news/articles/2024-02-26/india-chip-strategy-makes-progress-with-21-billion-in-proposals. The effectiveness of India's incentives-led industrial policy has been critiqued by many, including former Reserve Bank governor Raghuram Rajan. Smriti Mishra, "'Is India Really Manufacturing Mobile Phones?': Former RBI Governor Raghuram Rajan on PLI scheme," *Business Today*, May 31, 2023, https://www.businesstoday.in/latest/in-focus/story/is-india-really-manufacturing-mobile-phones-former-rbi-governor-raghuram-rajan-on-pli-scheme-383469-2023-05-30.

recent India visit by Nvidia CEO Jensen Huang was portrayed as a sign of "the country's AI chip making ambitions."[299] Most recently, Liu Young-way, the CEO of Foxconn has been conferred with the Padma Bhushan, India's third-highest civilian honor.

However, even by IT minister Ashwini Vaishnaw's admission, India is far from having the capability to manufacture the Graphics Processing Units, or GPUs, that have become the bedrock of AI development.[300] The manufacturing currently envisioned under the government's incentives scheme is limited to producing less sophisticated legacy chips like dynamic random-access memory (DRAM) chips, smartphone chips, car chips, and display panels. Even here, the scheme has been a nonstarter: not a single fabrication plant has been set up yet.[301] Despite splashy news that India is incubating a domestic AI chip industry, India's recent success in incubating electronics manufacturing does not extend to GPUs, which require sophisticated facilities, decades of experience, and large amounts of capital.

The historic trajectory of the Indian tech industry has focused on services rather than manufacturing, facilitating the emergence of a chip design sector in the last twenty years. Although 20 percent of the global chip design workforce is located in India, it almost exclusively works for international companies like Intel, Advanced Micro Devices (AMD), and Nvidia.[302] As far as chip design is concerned, the state has signaled its goal of creating more IP in India by funding more domestic AI design startups.[303]

[299] Adam Clark, "Nvidia CEO Heads to India. It's a Sign of the Country's AI Chip-Making Ambitions," *Barron's*, September 5, 2023, https://www.barrons.com/articles/nvidia-stock-ceo-jensen-huang-india-modi-chip-manufacturing-72345daf.
[300] Derek Robertson, "Davos and the Global State of Quantum," *Politico*, January 17, 2024, https://www.politico.com/newsletters/digital-future-daily/2024/01/17/davos-and-the-global-state-of-quantum-00136164.
[301] A highly publicized collaboration between Indian mining and oil conglomerate Vedanta and Taiwanese electronics manufacturer Foxconn fell through after Foxconn left the deal. In September 2023, construction began on a chip ATP plant owned by Micron. Ben Blanchard, Munsif Vengattil, and Aditya Kalra, "Foxconn Dumps $19.5 Billion Vedanta Chip Plan in Blow to India," Reuters, July 11, 2023, https://www.reuters.com/technology/foxconn-pulls-out-india-chip-jv-with-vedanta-2023-07-10. In February 2024, three chip plants were approved under the government's investment scheme: two set up by India's Tata Group, a third as a Japanese-Thai collaboration with an Indian company called CG Power. Jagmeet Singh, "India approves $15B in semiconductor plant investments," *TechCrunch*, February 29, 2024. https://techcrunch.com/2024/02/29/india-semiconductor-investments-fab-facility/.
[302] Konark Bhandari, "Is India 'Ready' for Semiconductor Manufacturing?" Carnegie Endowment for International Peace, May 23, 2023, https://carnegieindia.org/2023/05/23/is-india-ready-for-semiconductor-manufacturing-pub-89814; and Akhil George and Sujit John, "Intel's India engineers seek to beat Nvidia in gen AI chips," *Times of India*, August 9, 2023, https://timesofindia.indiatimes.com/business/india-business/intels-india-engineers-seek-to-beat-nvidia-in-gen-ai-chips/articleshow/102558826.cms.
[303] The Prime Minister made a strong pitch to global investors at the SemiconIndia 2023 conclave. The India Semiconductor Mission's Design Linked Incentive (DLI) Scheme reimburses up to 50 percent of expenditure for integrated circuits (ICs), chipsets, system on chips (SoCs), and systems and IP cores, hoping to grow twenty Indian chip R&D startups with a turnover of over Rs1,500 crore in the next five years. MeitY, *Gazette of India* CG-DL-E-21122021-232049, December 21, 2021, https://d2p5j06zete1i7.cloudfront.net/Cms/2022/May/05/1651757254_notification_dli.pdf.

Cloud Resources

India's aspiration toward digital sovereignty through the creation of DPIs includes a focus on increasing access to compute resources to spur innovation.

In 2023, the Indian government launched the AI Research Analytics and Knowledge Dissemination Platform (AIRAWAT), an AI-specific cloud computing infrastructure built by the government to provide compute to startups, academics, and researchers.[304] Following the model of Japan's AI Bridging Cloud Infrastructure (ABCI), the government built AIRAWAT in a centralized facility, rather than using a commercial cloud solution, in an attempt to avoid dependence on providers like Amazon's AWS or Microsoft's Azure. Built using Nvidia GPUs by Indian company Netweb, the AI supercomputer is housed at the Centre for Development of Advanced Computing in Pune.

While AIRAWAT's capabilities have been hyped by the government and media, its 656 GPUs pale in comparison with the supercomputers used by Meta and Microsoft to train their models, which contain more than ten thousand GPUs.[305] Although it may not have the capacity to support the development of large-scale models, AIRAWAT's pricing is currently competitive with that of comparable cloud providers, and it offers a discount to Indian startups.[306] More important, in a market where demand massively outstrips supply, it may provide an avenue for Indian companies to access compute at all, potentially providing a fillip to Indian startups engaged in AI development.

Recognizing the need for more compute, India's IT Ministry has put out a proposal to set up a cluster of twenty-five thousand GPUs through a public-private partnership model. Providing access to domestic startups and companies, the

[304] AIRAWAT is an acronym for "Artificial Intelligence Research, Analytics and knoWledge Assimilation plaTform." It was first proposed in NITI Aayog, January 2020, https://www.niti.gov.in/sites/default/files/2023-03/AIRAWAT-Establishing-an-AI-Specific-Cloud-Computing-Infrastructure-for-India.pdf.
[305] James Vincent, "Meta Has Built an AI Supercomputer It Says Will Be World's Fastest by End of 2022," *Verge*, January 24, 2022, https://www.theverge.com/2022/1/24/22898651/meta-artificial-intelligence-ai-supercomputer-rsc-2022. In May 2023, it was ranked as the seventy-fifth fastest supercomputer in the world.
[306] "Charges," AIRAWAT PSAI (web page), accessed February 13, 2024, https://airawat-psai.cdac.in/airawat/charges; CloudOptimizer (web page), accessed February 13, 2024, https://cloudoptimizer.io/?gpus%5B%5D=NVIDIA%20A100&gpus_max=1&isGpu=true; and Sergey Karayev and Charles Frye, "Cloud GPUs," The Full Stack, October 30, 2023, https://fullstackdeeplearning.com/cloud-gpus.

platform is pitched as a move that would bolster sovereignty.[307] However, this partnership model is likely to leave existing distributions of power largely in place.[308]

Data Centers

Globally, the cloud market is dominated by players like Microsoft's Azure, Amazon's AWS, and Google's GCS, which use Nvidia chips. In India, the major conglomerates Reliance and Tata have partnered with Nvidia, enabling them to build cloud data centers using Nvidia's latest chips.[309] Recently, the data center provider Yotta, part of the Hiranandani real estate empire, announced $1 billion worth of GPUs on order from Nvidia.[310] Domestic and foreign companies are currently vying for this segment of the AI supply chain in India.[311]

Large-Scale Models

Large-scale models have become the bedrock of AI development over the past five years. Recently, Ola (India's Uber rival) launched Krutrim, a family of multilingual AI models that is touted as "India's first full-stack AI solution"; however reports indicate that Krutrim may be a repackage of OpenAI's API.[312] Most Indian efforts to develop indigenous large-scale models do not hope to directly compete with US- and China-developed models, but rather to exploit the niche of Indian languages. These are covered in more detail in the section on "Social Inclusion and Economic Development."

[307] MeitY, "Working Group 6: IndiaAI Future Labs Compute", *IndiaAI 2023* (128–155), October 2023, https://indiaai.s3.ap-south-1.amazonaws.com/docs/IndiaAI+Expert+Group+Report-First+Edition.pdf.
[308] See critiques of the US government's similar proposal to set up a National AI Research Resource. AI Now Institute and Data and Society Research Institute, "Democratize AI? How the Proposed National AI Research Resource Falls Short," AI Now Institute, October 5, 2021, https://ainowinstitute.org/publication/democratize-ai-how-the-proposed-national-ai-research-resource-falls-short.
[309] Munsif Vengattil and Dhwani Pandya, "Nvidia Strikes Deals with Reliance, Tata in Deepening India AI Bet," Reuters, September 8, 2023, https://www.reuters.com/technology/nvidia-reliance-partners-develop-ai-apps-india-2023-09-08. Ironically, Nvidia has characterized these partnerships as a move to bolster India's sovereign AI; Sarvesh Mathi, "Working with Indian Government, Companies to Build Sovereign AI Infra: Nvidia Earnings Call," Medianama, November 23, 2023, https://www.medianama.com/2023/11/223-nvidia-earnings-call-q3fy24.
[310] Aditya Kalra, "Exclusive: India data centre firm Yotta's Nvidia AI chip orders to reach $1 bln -CEO," *Reuters*, January 11, 2024, https://www.reuters.com/technology/india-data-centre-firm-yottas-nvidia-ai-chip-orders-reach-1-bln-ceo-2024-01-11.
[311] On the concentration of power in the hands of politically connected big business, see Harish Damodaran, "From 'Entrepreneurial' to 'Conglomerate' Capitalism," Seminar, 2020, https://www.india-seminar.com/2020/734/734_harish_damodaran.htm; and Jairus Banaji, "Indian Big Business," *Phenomenal World*, December 20, 2022, https://www.phenomenalworld.org/analysis/family-business.
[312] Siddharth Jindal, "Why Ola's Krutrim is Showing OpenAI as its Creator", *Analytics India*, February 28, 2024, https://analyticsindiamag.com/why-olas-krutrim-is-showing-openai-as-its-creator.

Data as a National Asset

The Indian government's approach to AI cannot be divorced from its approach to data.[313] Enabling access to data and reducing data silos to create integrated large-scale data-driven platforms has been a major focus of Indian digital efforts over the past ten years, from the Aadhaar biometric identification project through the Unified Payments Interface to the current focus on DPIs. Data localization laws that restrict or create conditions for access to data have been a critical tool in India's efforts to exert control over data.

India is attempting to jumpstart AI development by building data platforms mediated and promoted by the state. Some technocrats have emphasized, data is more important than models for AI innovation in India. Nandan Nilekani, for example, advocates for organizing data in a model-agnostic manner, harnessing open-source models and the use of smaller models, fine-tuning them with high-quality and relevant indigenous data.[314] Government documents constantly stress the importance of building a data ecosystem for Indian AI development and highlight India's scale and diversity as giving it a natural data advantage. Despite the consensus on this data-driven approach, efforts have been fragmented.

The National Data Governance Framework Policy published by the Ministry of Electronics and Information Technology (MeitY) in 2022 emphasized that data collected by the government is a "public good."[315] Though this "public goods" approach has yielded results in identification and payments systems, it is not clear what it has to offer AI.

Data Platforms to Facilitate AI Development

With a decade of experience building various databases linked by APIs enabling private and public access—most prominently, the set of platforms called IndiaStack—integrated data systems have become India's default orientation

[313] Divij Joshi, "The Legal, Institutional and Technical Architecture of ADMS in India," AI Observatory, n.d., accessed February 13, 2024, https://ai-observatory.in/context.
[314] Carnegie India, "Global Technology Summit 2023 | Day 1," YouTube video, 4:55:41, December 4, 2023, https://www.youtube.com/watch?v=JJ_XGtWlWVI. Nandan Nilekani is the billionaire cofounder of Infosys, the architect of India's Aadhaar biometric identification platform, and a major figure in Indian IT. His not-for-profit People+ai is at the forefront of pushing for the application of DPIs to AI.
[315] MeitY, *National Data Governance Framework Policy (Draft)*, May 2022, https://www.meity.gov.in/writereaddata/files/National-Data-Governance-Framework-Policy.pdf.

toward its digital needs. Not surprisingly, building platforms and applications to enable sharing of datasets across stakeholders is a key component of India's approach to AI development. The government is also engaging with industry stakeholders and academia[316] to shape policies and guidelines around data sharing for AI development.

In 2019 an expert working group at MeitY proposed developing a National AI Resource Platform (NAIRP) as an "Open Data and Knowledge-cum-Innovation Platform" to enable training, research, projects by startups, and commercial development of AI for socioeconomic good.[317]

The India Datasets Platform is "a unified national data sharing exchange" program to manage access, licensing, and the standardization of data, metadata, artifacts, and APIs hosted by various government departments. The platform brings together datasets of anonymized personal data and creates an interface for data consumers to access and use data without compromising stakeholders' "business or social goals, or [...] privacy, security, and other concerns."[318] Data consumers are primarily imagined as "research institutions, startups, or organizations that utilize the data provided by government departments for application building, innovation, or research purposes."[319]

Although, as currently described, the stated goals of the system are to improve governance and decision-making through AI, the platform will facilitate the monetization of data held by the government. Considering Chandrasekhar has said that the platform would only be accessible to Indian startups, it might also be viewed as a potential industrial policy instrument that will enable the government to leverage access to Indian data to promote domestic AI development.[320] MeitY has proposed funding a National Data Management Office to independently operate the platform and whose remit will cover "govern[ing] data collection, management, processing, storage and access as well as conducting audits and making

[316] India Data Commons is an effort by the Robert Bosch Center for Data Science and Artificial Intelligence to highlight India-specific data in Data Commons knowledge graph. India Data Commons features datasets published by Indian ministries and governmental organizations and provides it through Data Commons knowledge graph. See India Data Commons, accessed February 13, 2024, https://datacommons.iitm.ac.in/about; and Robert Bosch Center for Data Science and Artificial Intelligence, accessed February 13, 2024, https://rbcdsai.iitm.ac.in.
[317] MeitY, *Report of Committee on Platforms and Data on Artificial Intelligence*, July 2019, https://www.meity.gov.in/writereaddata/files/Committes_A-Report_on_Platforms.pdf.
[318] MeitY, *India AI 2023*, October 2023, https://www.meity.gov.in/writereaddata/files/IndiaAI-Expert-Group-Report-First-Edition.pdf.
[319] MeitY, "Working Group 2: India Dataset Platform" in *IndiaAI 2023*, October 2023.
[320] Aditi Agrawal, "Monetise Govt's Non-Personal Databases, Recommends Working Group," *Hindustan Times*, October 15, 2023, https://www.hindustantimes.com/india-news/monetise-govt-s-non-personal-databases-recommends-working-group-101697307098365.html.

standards," in effect combining the functions of both an exchange and a regulator.[321]

Other proposals include the National Data Platform, a "complete data marketplace ecosystem" being developed by the National Informatics Centre; and the National Data and Analytics Platform to enable access to open government data being developed by the National Institution for Transforming India (NITI) Aayog.

Chandrasekhar has also stated that integrating AI will be part of the "innovation journey of India Stack."[322] Nilekani has tied AI to India Stack by suggesting that the adoption of DPIs like India Stack provides the bedrock for building AI-first systems from the ground up.[323] Generating vast amounts of data across its various use cases, the stack may provide training data for AI development as well as a new consumer base for AI solutions.

The state construction of software data platforms is an industrial policy intervention that sees the state taking on the cost and burden of constructing a so-called "public good" that can spur the broader development of an industry. But such platforms have come with significant costs when it comes to citizens' rights and state power. Where the model has been successful, it has facilitated the emergence of a domestic market subsidized by government spending.[324] Because such platforms require continued government subsidization, at best they may facilitate import substitution for the Indian market. But they have little hope of success in international markets that lack such a controlled and subsidized environment.[325]

[321] MeitY, *National Data Governance Framework Policy (Draft)*, Section 6.
[322] "India Stack 2.0 to Be More Nuanced, Intelligent: Rajeev Chandrasekhar," *Business Standard*, January 26, 2023, https://www.business-standard.com/article/technology/india-stack-2-0-to-be-more-nuanced-intelligent-sophisticated-rajeev-chandrasekhar-123012600253_1.html.
[323] Nandan Nilekani and Tanuj Bhojwani, *Unlocking India's Potential with AI*, International Monetary Fund, December 2023, https://www.imf.org/en/Publications/fandd/issues/2023/12/POV-unlocking-india-potential-with-AI-Nilekani-Bhojwani. iSPIRT, "Open House on DPI for AI #4: Why India is best suited to be the breeding ground for AI innovation!" Product Nation, December 20, 2023, https://pn.ispirt.in/open-house-on-dpi-for-ai-4-why-india-is-best-suited-to-be-the-breeding-ground-for-ai-innovation.
[324] It should be noted, however, that India's government-subsidized DPIs are considered much more profitable than they actually are. The same will likely be true of any implementation of AI that is integrated with DPIs.
For a thorough critique of the data platform model, see Jyoti Panday, "India Stack: Public-Private Roads to Data Sovereignty," Internet Governance Project, August 31, 2023, https://www.internetgovernance.org/research/india-stack-public-private-roads-to-data-sovereignty.
[325] Peter Drysdale and Rojan Joshi, "Import Substituting Industrial Policy Threatens India and Indonesia's Development Success," East Asia Forum, November 5, 2023, https://www.eastasiaforum.org/2023/11/05/import-substituting-industrial-policy-threatens-india-and-indonesias-development-success.

AI Applications for Social Inclusion and Economic Development

"To [unlock] India's potential with AI," Nilekani recently stated, "the trick is not to look too hard at the technology but to look at the problems people face that existing technology has been unable to solve." Chandrasekhar has referred to AI as a "kinetic enabler" for India's digital economy.[326]

As these statements suggest, the idea that economic development and social inclusion can be achieved simultaneously is one of the guiding principles shaping AI development and policy in India.[327] The most populous country in the world is largely rural, lacks access to quality healthcare, and has high rates of illiteracy—all issues that form part of the agenda for technological development, in AI as well as in other domains.

India's national AI strategy, #AIForAll, published by NITI Aayog in 2018, is distinct in its emphasis on economic growth combined with social inclusion.[328] It focuses on AI applications, creating a roadmap to adopt AI in sectors like healthcare, agriculture, education, smart cities, and smart mobility. Other major themes in the report include upskilling and the safe and responsible use of AI. The ministerial declaration adopted at the December 2023 GPAI Summit in New Delhi, for example, "embrace[d] the use of AI innovation in supporting sustainable agriculture as a new thematic priority."[329]

The pursuit of these goals manifests in efforts to make private firms find profitable solutions to entrenched socioeconomic problems. There are signs that the private sector is buying into the vision of social inclusion and economic development. Microsoft, for example, advertises that its Jugalbandi chatbot enables rural Indians

[326] Government of India, "AI Will Be Kinetic Enabler of India's Digital Economy, Make Governance Smarter and More Data-Led: MoS Rajeev Chandrasekhar," press release, Press Information Bureau, April 14, 2023, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1916645.
[327] This is in contrast to many definitions of AI for social good, which "often differentiate between economic impact and the societal impact and advantages." Doaa Abu-Elyounes and Karine Gentelet, "A New AI Lexicon: Social Good," AI Now Institute, November 4, 2021, https://ainowinstitute.org/publication/a-new-ai-lexicon-social-good-2.
[328] NITI Aayog, "National Strategy for Artificial Intelligence: #AIForAll," June 2018, https://indiaai.gov.in/documents/pdf/NationalStrategy-for-AI-Discussion-Paper.pdf.
[329] Global Partnership on Artificial Intelligence, *GPAI Ministerial Declaration*, 2023, https://gpai.ai/2023-GPAI-Ministerial-Declaration.pdf.

to gain easier access to government services.[330] And Google proudly states that it is "supporting changemakers deploying AI to improve agriculture outcomes."[331] But such declarations should also be understood as ways for firms—especially large foreign firms—to align themselves with the government.

Calls for AI for social inclusion and economic development are also a means to assert global leadership and provide a distinct model of development, particularly in Global South countries, which may provide markets for solutions incubated in India. A key call of NITI Aayog's AI national strategy is a recognition that India is behind in the "AI race" and that it should aim to become an "AI garage for 40% of the world," referring to the Global South, whose needs India hopes to fulfill.[332]

Linguistic Diversity as India's Strength

One of the key domains in which the Indian government has trumpeted its advantage in AI is in the linguistic diversity of the country, with 122 major languages.

Hoping to capitalize on this, MeitY has set up the Bhashini program as a DPI for linguistic data under the National Language Translation Mission. The Bhashini project is envisioned as providing startups and companies with linguistic data to develop AI tools for vernacular languages—a largely untapped market.[333] The government is also working on AI4Bharat, focusing on developing open-source language models like IndicBART and IndicBERT for Indian languages. The Reserve Bank of India has announced the introduction of AI-based conversational payments into United Payments Interface (UPI).[334] Given low literacy rates in India and a huge potential market, voice-based interfaces for AI in vernacular languages are likely to become a strategic focus in India.

Several private-sector efforts are also focusing on vernacular language models. Indian AI startup Sarvam AI has released OpenHathi, the first Hindi language model

[330] Chen May Yee, "With Help from Next-Generation AI, Indian Villagers Gain Easier Access to Government Services," Source Asia, Microsoft, n.d., accessed February 13, 2024 https://news.microsoft.com/en-in/features/with-help-from-next-generation-ai-indian-villagers-gain-easier-access-to-government-services.
[331] Sanjay Gupta, "Google for India 2023: Partnering India's Success in a New Digital Paradigm," Google, India Blog, October 19, 2023, https://blog.google/intl/en-in/partnering-indias-success-in-a-new-digital-paradigm.
[332] NITI Aayog, ""National Strategy for Artificial Intelligence.".
[333] A major contributor to Bhashini is Project Vaani, a Google collaboration with the Indian Institute of Science to collect and transcribe open-source speech data from across India. MeitY, "Bhashini's Purpose," web page, accessed February 13, 2024, https://bhashini.gov.in/about-bhashini.
[334] "RBI Announces AI-Powered UPI Payment Features," INDIAai, August 4, 2023, https://indiaai.gov.in/news/rbi-announces-ai-powered-upi-payment-features.

built on Meta AI's architecture. The startup also partnered with KisanAI to fine-tune its base model using conversational data they gathered from a GPT-powered bot engaging with farmers in different languages.[335] In collaboration with Bhashini, Bengaluru-based CoRover.ai has developed an indigenous model named BharatGPT that supports over twelve Indian languages. Tech Mahindra is planning to launch Indus, an open-source LLM for Hindi dialects, in early 2024. Indian software-as-a-service (SaaS) giant Zoho has unveiled a suite of generative AI extensions and integrations for its applications, all powered by ChatGPT, and has announced its plans to build smaller AI models for specific domain problems. Notably, most of these efforts are built atop proprietary large-scale models like Meta's LLaMA and Microsoft's GPT.

The Legacy IT Industry

The scale of consumer digital technology for social inclusion and economic development pales in comparison to India's legacy services exports industry, exemplified by outsourcing. Most private-sector AI development in India is occurring in enterprise services, the country's traditional strength in IT. A recent survey of over seventy generative AI startups, which have collectively raised over $440 million, for example, showed that 30 percent were working in the code and data sector (generating code, crafting documentation, and converting text to SQL); 27 percent were working in audio and video processing; and only 21 percent focused on text and chatbots.[336] The development of Indian AI applications, in other words, appears to be largely focused on software components for enterprise customers.

The large services export firms that continue to dominate the Indian tech sector are integrating AI into their traditional enterprise businesses. Infosys, for example, has signed a deal with Nvidia[337] to integrate its Nvidia AI Enterprise system with Infosys's Topaz to deliver solutions for its enterprise customers in domains like customer service and logistics. Wipro has announced a $1 billion investment in generative AI and plans to train all 250,000 members of its workforce in AI skills.[338]

[335] Arun Padmanabhan, "India's LLM Race Is Heating Up! Here's a Look at Who's Building What," MoneyControl, December 21, 2023, https://www.moneycontrol.com/news/technology/indias-ai-uprising-can-a-challenger-emerge-in-the-llm-marathon-11931681.html.
[336] Inc42, *India's Generative AI Startup Landscape Report*, 2023, https://inc42.com/reports/indias-generative-ai-startup-landscape-report-2023.
[337] "Infosys and NVIDIA Team to Help World's Enterprises Boost Productivity With Generative AI," press release, Nvidia, September 20, 2023, https://nvidianews.nvidia.com/news/infosys-and-nvidia.
[338] "Wipro Limited Q1 FY 2024 Earnings Conference Call," Wipro, July 13, 2023, https://www.wipro.com/content/dam/nexus/en/investor/quarterly-results/2023-2024/q1fy24/q1fy24-earnings-transcript.pdf.

Despite its size, India's enterprise sector has remained largely out of the limelight in discussions around digital policy in India. With its potential to automate various back-office functions, AI represents a major threat to this industry, which experienced a downturn in 2023. Yet India's AI industrial policy has largely lacked explicit engagement with its needs. With the possible exception of vernacular model development, the promise of social inclusion through AI applications is not aligned with the existing structural conditions of business and Indian startups working on AI development and adoption in India.

Regulatory Grandstanding

The Indian government has sought to claim space in the burgeoning global debate on regulating AI by both claiming leadership over issues of equity impacting the Global South and advancing frameworks for the governance of AI. But these efforts have been cursory and often contradictory. For example, in April 2023, Chandrashekhar stated that, to help create an enabling, pro-innovation environment India would not regulate AI.[339] Just two months later, making a U-turn from his earlier position, the minister began advocating for regulations for AI to prevent user harms.

There are multiple, often overlapping policy efforts and approaches to regulating AI. The NITI Aayog, the government's official policy think tank, is advocating for a principles-based, "Responsible AI" approach to address ethical, legal, and societal implications of AI technologies.[340] Centering on harms like misinformation, MeitY has proposed an overhaul of the existing legislative framework governing digital technologies and services in India to align them with the advancements in technology. Various ministries have established task forces and committees to

[339] "Why India Can Afford to Wait and Watch before Regulating AI," *Economic Times*, July 31, 2023, https://telecom.economictimes.indiatimes.com/news/internet/why-india-can-afford-to-wait-and-watch-before-regulating-ai/102279854.
[340] NITI Aayog, National Strategy for Artificial Intelligence (NSAI) #AIforAll, June 2018, https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf

study the implications of and recommend policy measures for AI.[341] Alongside domestic efforts, India is also exploring international partnerships for AI development and governance.[342]

Responsible AI

The political leadership's focus on AI ethics and "responsible AI" development is especially visible on the global stage. Speaking at the Business 20 (B20) Summit, Modi flagged concerns over the challenges of algorithmic bias and its impact on society to call for a global framework to ensure ethical considerations in data collection, processing, and usage of AI across different sectors.[343] At the 2023 UK AI Safety Summit, Chandrasekhar emphasized the need for robustness, safety, and international governance in AI. During this summit, India joined twenty-seven other nations in signing a declaration to work collaboratively to address the risks associated with AI. More recently at the Global Partnership on Artificial Intelligence Summit, Modi emphasized that a large part of the course of AI development will come through "human and democratic values."[344]

In 2021, in collaboration with the World Economic Forum, NITI Aayog released a two-part approach paper on the responsible use of emerging technologies.[345] These responsible AI (RAI) principles cover safety and reliability, equality, inclusivity and non-discrimination, privacy and security, transparency, accountability, and the protection and reinforcement of positive human values. They set out a risk-based framework that proposes self-regulation for low-risk applications and a noncommittal pledge that "the government may mandate responsible AI practices

[341] The Ministry of Commerce and Industry set up this Task force on Artificial Intelligence led by Kamakoti Veezhinathan Professor at IIT Madras to promote the use of AI for India's economic transformation. https://www.aitf.org.in
The Ministry of Defence (MoD), Department of Defence Production (DDP) have set up a multi-stakeholder Task Force under the Chairmanship of Sh. N Chandrasekaran, Chairman, Tata Sons to study strategic implications of AI in national security perspective. PIB Delhi, Task Force for Implementation of AI, March 2022 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1810442
The Ministry of Electronics and Information Technology has constituted four committees four committees to propose action in the areas of Platform and Data for AI, Leveraging AI for identifying National Missions in Key Sectors, Mapping Technological capabilities key policy enablers required across sectors, skilling and re-skilling R&D and Cyber Security, Safety, Legal & Ethical issues. Constitution of four Committees for promoting Artificial Intelligence (AI) initiatives and developing a policy framework, February 2018
https://www.meity.gov.in/writereaddata/files/constitution_of_four_committees_on_artificial_intelligence_0.pdf
[342] Through the Initiative on Critical Emerging Technologies, the United States and India have committed to fostering collaboration across various domains, including AI, high-performance computing, quantum technologies, and enhancing supply chain resilience, particularly in semiconductor cooperation.
[343] "B20 Summit 2023: PM Modi Calls on Ethical Use of Artificial Intelligence," *Mint*, August 27, 2023, https://www.livemint.com/news/b20-summit-2023-pm-modi-calls-on-ethical-use-of-artificial-intelligence-ai-supply-chain-cryptocurrency-11693122849876.html.
[344] Shouvik Das and Gulveen Aulakh, "GPAI Should Help Frame Sustainable AI Rules," *Mint*, December 12, 2023, https://www.livemint.com/ai/artificial-intelligence/gpai-should-help-frame-sustainable-ai-rules-pm-11702401229429.html.
[345] NITI Aayog, *Responsible AI*, *Part 1*, February 2021, https://psa.gov.in/CMS/web/sites/default/files/publication/Responsible-AI-22022021.pdf; and NITI Aayog, August 2021, https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf.

for high-risk use cases."[346] However, NITI Aayog does not address the determination of specific AI applications as high- or low-risk.

NITI Aayog's application of the RAI principles framework to the use of facial recognition technology (FRT) in India is instructive as to the impact of such policy.[347] The agency's report focused on the use of FRT in DigiYatra, a biometric identity management ecosystem active in Indian airports. Although NITI Aayog recommended adopting a strong legal framework for personal data protection and a whole-of-government approach to legislation and regulation, in reality these policy recommendations have not percolated down to DigiYatra's implementation. The initiative is being aggressively promoted by the government, and operates without transparency and accountability, even enrolling citizens without their consent.[348]

Legislating Safety and Trust

In 2022, MeitY announced that it is working on replacing the decades-old Information Technology Act with a contemporary legal framework for India's evolving digital ecosystem, the Digital India Act (DIA).[349] Consultations on the DIA by MeitY since March 2023 have been limited to selective stakeholders, excluding civil society, frontline workers, labor organizations, and users of these services. Though a draft has not been made public, the proposed law is being touted as promoting online safety, trust, accountability, and an open internet. In line with recent statements by Modi on the risks of deepfakes,[350] a public presentation on the DIA indicates that it conceives of AI harms primarily in terms of misinformation.[351] The government has indicated that the DIA will be tabled in Parliament after the 2024 general election.[352]

[346] NITI Aayog, *Responsible AI, Part 2,* August 2021, https://www.niti.gov.in/sites/default/files/2021-08/Part2-Responsible-AI-12082021.pdf.
[347] NITI Aayog, *Responsible AI for All: Adopting the Framework – A Use Case Approach on Facial Recognition Technology*. November 2022, https://www.niti.gov.in/sites/default/files/2023-03/Responsible-AI-AIForAll-Approach-Document-for-India-Part-Principles-for-Responsible-AI.pdf.
[348] Jagriti Chanda, "Centre's Digi Yatra Enrolment Takes Off as Airport Security Staff Sign up Flyers without Their Consent," *Hindu,* January 5, 2024, https://www.thehindu.com/news/national/passengers-say-cisf-and-airport-staff-are-collecting-biometric-data-without-consent/article67710134.ece.
[349] The new framework for digital technology regulation will additionally comprise Digital Personal Data Protection Act, Digital India Act Rules, National Data Governance Policy, and IPC Amendments for Cyber Crimes.
[350] Priya Singh, "IPC amendments for Cyber Crimes," *Business Today*, November 22, 2023, https://www.businesstoday.in/technology/news/story/ai-must-be-safe-for-society-pm-modi-expresses-concern-over-deepfakes-at-g20-summit-406739-2023-11-22.
[351] MeitY, Proposed Digital India Act, 2023, Digital India Dialogues, March 9, 2023, https://www.meity.gov.in/writereaddata/files/DIA_Presentation%2009.03.2023%20Final.pdf.
[352] Kamya Pandey, "Digital India Bill to Be Released Post Elections: IT Minister Rajeev Chandrasekhar Says," Medinama, December 1, 2023, https://www.medianama.com/2023/11/223-digital-india-bill-release-after-elections-mos-it.

MeitY is also considering amendments to the Information Technology Rules of 2021 to establish a regulatory framework for the use of AI technologies. Reports suggest that the government may mandate platforms using artificially intelligent algorithms or language models to train their machines to be free of "bias" of any kind.[353]

The limitations of the IT Act has not prevented the government from using it to exert control over companies developing and facilitating use of AI in India. MeitY relies on the IT rules to regulate deep fakes, instructing social media platforms to remove such content promptly. The government has also used IT rules to require platforms that use AI models for their services to ensure they are not hosting prohibited content or content that poses risks to electoral integrity and issue advisories informing users about prohibited content.

Following a recent uproar about Google Gemini making controversial statements about Modi, Chandrasekhar claimed that Gemini's failures were violations of the IT rules and provisions of the criminal code. MeitY issued a strict advisory stipulating that AI models can only be deployed for Indian users with explicit government permission. The advisory elicited criticism and dismay from AI companies and entrepreneurs. Although Chandrashekhar has stated that the advisory primarily targets large platforms and startups would not be subject to the same regulatory scrutiny, the advisory itself doesn't differentiate based on platform size.

The Indian government's attempts to regulate AI technology and data to ensure responsible development and use seem commendable on the surface. However, a closer examination reveals that instead of shielding from potential liability, focusing on ethics, responsibility, safety and trust enables the government to strategically exert control over AI companies and platforms in India. Despite their flawed performances and lack of readiness for widespread use, indigenous LLMs have not faced the same level of regulatory scrutiny as LLMs being developed by global players.[354] There also remains a significant gap between the proposed principles and the actual mitigation of the harms caused by technology implementation. India's extensive IT projects have faced criticism for consequences like compromised security, increased surveillance, and exploitation of citizen data.[355]

[353] Aashish Aaryan, "Govt May Amend IT Act to Add New Rules for AI, GenAI Models," *Economic Times*, January 4, 2024, https://economictimes.indiatimes.com/tech/technology/govt-may-amend-it-act-to-add-new-rules-for-ai-genai-models/articleshow/106524019.cms.
[354] Anjali Thakur, "Hillary Clinton Defeated Trump In 2014: Krutrim AI's Gaffe Goes Viral," *NDTV*, February 28, 2024, https://www.ndtv.com/feature/hillary-clinton-defeated-trump-in-2014-krutrim-ais-gaffe-goes-viral-5143739
[355] For example, India's large-scale biometric system Aadhaar has been criticized for excluding the most vulnerable citizens from governmental services, increasing government surveillance, and facilitating the extraction of citizens' data for commercial use. See Reetika Khera, Dissent on Aadhaar: Big Data Meets Big Brother (Hyderabad: Orient BlackSwan, 2019), https://orientblackswan.com/details?id=9789352875429; and Aria Thaker, "The New Oil," *Caravan*, May 1, 2018, https://caravanmagazine.in/reportage/aadhaar-mixing-public-risk-private-profit.

Yet such social and economic harms appear to be largely absent from the proposed trust and safety regulation. Similarly, instead of being an aim of governance, trust is conflated with acceptance of AI, and used as a narrative to convince citizens that AI is invariably good.

Streamlining Data Processing and Use

Another strategy of AI governance is encapsulated through policy interventions focused on streamlining access to data by the government as well as the private sector. These interventions should be understood in tandem with the government's ongoing promotion of data platforms.

A 2021 report by a committee of experts led by tech services entrepreneur Kris Gopalakrishnan called for a framework for the governance of non-personal data to include mechanisms for data sharing, rights, and obligations of data custodians and stakeholders. The report situated itself in the context of the data required by AI and machine learning systems and focused its recommendations on creating "a modern framework for creation of economic value from use of data."[356]

India has recently passed the Digital Personal Data Protection Act (DPDPA), which creates a framework for the processing of citizens' data by the state and corporations. Ignoring crucial problems that were flagged by civil society stakeholders over consultations spanning several years, the final, industry-friendly version of the law was passed without any public consultation. Among other concerns, the law has been critiqued for its weak notice requirements, restricted scope of data that is subject to protection, vague permissions for nonconsensual processing of data, and overbroad exemptions for private and government actors.[357] As one civil society commentator observes, rather than a data protection law, it should be thought of as a data processing law.[358]

The regulation of AI is fragmented, and robust mechanisms for ensuring transparency and data governance are absent, rendering government advisories and laws insufficient to effectively tackle AI-related harms and safeguard individual

[356] Udai Mehta and Amol Kulkarni, "Kahlil Gibran and Data Regulation," *Times of India*, August 28, 2020, https://timesofindia.indiatimes.com/blogs/voices/kahlil-gibran-and-data-regulation.
[357] For a critique of the law, see Anushka Jain and Prateek Waghre, "IFF's first read of the draft Digital Personal Data Protection Bill, 2023," Internet Freedom Foundation, August 3, 2023, https://internetfreedom.in/iffs-first-read-of-the-draft-digital-personal-data-protection-bill-2023.
[358] Justin Hendrix in conversation with Aditi Agarwal, Kamesh Shekhar, and Prateek Waghre, "Assessing India's Digital Personal Data Protection Bill," Tech Policy Press, August 13, 2023, https://www.techpolicy.press/assessing-indias-digital-personal-data-protection-bill.

rights. Indian policymaking on AI also lacks public consultations, resulting in the state and market players predominantly shaping the safety and responsibility agenda, leaving social harms unaddressed, particularly in areas such as workers' rights, exclusion, and bias.

Conclusion

Having hosted the G20 and the GPAI meetings in 2023 and given a broadly favorable geopolitical situation, India stands poised to exert significant influence on global AI development. In the context of an unsustainable global AI arms race that is concentrating capital, data and compute, India's DPI-influenced approaches may look like an attractive alternative.

While social inclusion and economic development are appealing narratives at the global level, on the ground they are accelerating uneven development. Invoking social inclusion and economic development enables the state to take the lead in setting up infrastructures for AI compute and data that will be used for private benefit. Despite the posturing around "Responsible AI", a permissive regulatory apparatus means that the state and companies can collect and process citizens' data with impunity. While India is also investing its resources in plans to promote domestic chip manufacturing and boost compute capacities in the name of sovereignty, in their current form it is not clear that these will provide a meaningful boost to AI development.

In closing, a caveat is in order when analyzing industrial policy in contemporary India. 2024 is an election year and policy in India is always also an act of political branding targeted at Indian voters. Under the present government, technocratic industrial policy is also part of a populist electoral strategy that ties development to a civilizational vision of a transformed India. The national strategy on AI comes hashtagged for viral consumption ("#AIForAll"); India's state-incubated generative AI model is called "BharatGPT";[359] and India's AI supercomputer is named after a divine elephant with four tusks and seven trunks from Hindu mythology

[359] "Bharat," the name for India in several Indian languages, has been at the center of considerable controversy recently as the government attempts to increase its adoption. "India or Bharat: What's behind the dispute over the country's name?" *Aljazeera*, September 6, 2023, https://www.aljazeera.com/news/2023/9/6/india-or-bharat-whats-behind-the-dispute-over-the-countrys-name.

("AIRAWAT"). Our analysis of India's AI policy in the context of a global resurgence of industrial policy should be read with an awareness of the electoral politics of policymaking in India today.

5. A Lost Decade? The UK's Industrial Approach to AI

by Matt Davies

Nearly ten years ago at time of writing, Google (now Alphabet) acquired London-based AI startup DeepMind, then famous for having made a number of breakthroughs in the field of deep reinforcement learning.[360] At the time, Google's new acquisition was met with relatively little fanfare in the domestic political arena. While doing the rounds in the business and tech press, it passed with scant mention from the commentariat and no formal statement from the government of the day. DeepMind's sole mention that year in Hansard (the official record of debates in the

[360] See Catherine Shu, "Google Acquires Artificial Intelligence Startup DeepMind for More than $500M," TechCrunch, January 26, 2014, https://techcrunch.com/2014/01/26/google-deepmind; and Samuel Gibbs, "Google Buys UK Artificial Intelligence Startup DeepMind for £400m," *Guardian*, January 27, 2014, https://www.theguardian.com/technology/2014/jan/27/google-acquires-uk-artificial-intelligence-startup-deepmind.

UK Parliament) was in a general debate on UK R&D investment in the House of Lords, several months after the acquisition had been finalized.[361]

Four years later, British investor and entrepreneur Ian Hogarth would query the wisdom of the UK government allowing the sale:

> With hindsight, would it have been better for the UK government to block this acquisition and help keep it independent? Even now, is there a case to be made for the UK to reverse this acquisition and buy DeepMind out of Google and reinstate it as some kind of independent entity?[362]

Hogarth's provocation came in an essay titled "AI nationalism," which claimed that AI was becoming an "omni-use technology that will come to touch all sectors and parts of society" and therefore also a strategic national resource.[363] Hogarth predicted an "AI arms race," in which countries would compete over AI and the factors that underpin its development: talent, compute, and access to data.

Hogarth's essay has proved prescient. In the six years since he wrote it, and in the near decade since DeepMind's sale, "AI arms race" narratives have become mainstream against the backdrop of a growing rivalry between the United States and China.[364] With it, AI has emerged as a core industrial concern for the UK, and technological sovereignty an important theme across the political spectrum.[365] In this context, DeepMind—now Google DeepMind[366]—has become a powerful symbol both of the UK's AI prowess and of the country's failure to truly compete at the frontier without US patronage.

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[361] UK Parliament, House of Lords, Hansard, "Scientific Research and Development," vol. 755, July 7, 2014, https://hansard.parliament.uk/Lords/2014-07-07/debates/14070742000334/ScientificResearchAndDevelopment?highlight=deepmind#contribution-14070742000031.
[362] Ian Hogarth, "AI Nationalism," *Ian Hogarth* (blog), June 13, 2018, https://www.ianhogarth.com/blog/2018/6/13/ai-nationalism.
[363] Ibid.
[364] See for example AI Now Institute, "Tracking the US and China AI Arms Race," April 11, 2023, https://ainowinstitute.org/publication/tracking-the-us-and-china-ai-arms-race.
[365] The term "technological sovereignty" was repeatedly used in relation to the controversy over Huawei's proposed role in providing Britain's 5G infrastructure, for example by opposition spokesperson Chi Onwurah. See Onwurah, "The Huawei Debacle Shows the Government's Failure to Invest in British Technology," New Statesman, January 30, 2020, https://www.newstatesman.com/politics/the-staggers/2020/01/huawei-debacle-shows-government-s-failure-invest-british-technology. More recently, "sovereign capabilities" have been invoked in relation to large language models (LLMs). See GOV.UK, "Initial £100 Million for Expert Taskforce to Help UK Build and Adopt Next Generation of Safe AI, press release, April 24, 2023, https://www.gov.uk/government/news/initial-100-million-for-expert-taskforce-to-help-uk-build-and-adopt-next-generation-of-safe-ai; Labour Party, "Prosperity through Partnership: Labour's Industrial Strategy," September 2022, https://labour.org.uk/wp-content/uploads/2022/09/Industrial-Strategy.pdf; Fiona Dennehy, "The Alan Turing Institute Responds to Government's New Foundation Model Taskforce," Alan Turing Institute, accessed January 11, 2024, https://www.turing.ac.uk/news/alan-turing-institute-responds-governments-new-foundational-model-taskforce; and Benedict Macon-Cooney et al, "A New National Purpose: AI Promises a World-Leading Future of Britain," Tony Blair Institute for Global Change, June 13, 2023.
[366] DeepMind remained an independent entity within Google for several years, before merging with Google Brain in 2023 to become Google DeepMind. See Sundar Pichai, "Google DeepMind: Bringing Together Two World-Class AI Teams," Google (blog), April 23, 2023, https://blog.google/technology/ai/april-ai-update. For the sake of brevity, references to the company in the remainder of this essay will use the short name.

Over the past decade, these narratives have led UK AI policy down a blind alley, providing at best only a partial solution to, and at worst a damaging distraction from, the UK's economic challenges. Instead of articulating a clear vision for the role that a domestic AI sector could play in the UK economy and how this can be achieved, the UK's industrial approach to AI has been motivated by a desire to excel within an existing framework, leading to a myopic focus on limited criteria for AI "success."

An "AI Superpower": Framing the UK's Industrial Approach to AI

The UK's industrial approach to AI is dominated by a desire to perform better than its global peers in an "AI arms race."[367] The UK government frequently claims to be "number 3 in the world on AI," behind the United States and the People's Republic of China: Secretary of State for Science, Innovation and Technology Michelle Donelan recently claimed that "we are among the top three nations in the world for AI – brushing shoulders with the US and China."[368]

This "best of the rest" status is borne out by a number of (relatively narrow) metrics: the UK boasts a high number of AI startups, is home to several world-leading academic centres of expertise in computing and data science, and consistently contributes a high number of citations to advanced AI research.[369] These metrics are routinely trotted out to buttress the UK's claims to be a "world leader"[370] and "global superpower" in AI.[371] However, enjoyment of this position is riven by a number of anxieties about the UK's role in the global AI economy.

The first of these concerns the narrowness of the UK's advantage in AI, which is closely tied to the presence of DeepMind. Discounting DeepMind, the UK's share of

[367] AI Now Institute, "Tracking the US and China AI Arms Race."
[368] Michelle Donelan, "Secretary of State Speech to AI Fringe," Department for Science, Innovation and Technology, November 13, 2023, https://www.gov.uk/government/speeches/secretary-of-state-speech-to-ai-fringe.
[369] See, e.g. Nathan Benaich, "State of AI Report," October 12, 2023, https://www.stateof.ai; and Serena Cesareo and Joseph White, "The Global AI Index," Tortoise Media, accessed January 12, 2024, https://www.tortoisemedia.com/intelligence/global-ai.
[370] Department for Business, Energy and Industrial Strategy, "UK Industrial Strategy," GOV.UK, 2017, https://assets.publishing.service.gov.uk/media/5a75559fe5274a3cb28699b5/uk-industrial-strategy-international-brochure-single-pages.pdf.
[371] See for example Department for Science, Innovation and Technology et al., "National AI Strategy," GOV.UK, September 22, 2021, https://www.gov.uk/government/publications/national-ai-strategy; and Department for Business, Energy and Industrial Strategy, "Establishing a Pro-Innovation Approach to Regulating AI," GOV.UK, July 18, 2022, https://www.gov.uk/government/publications/establishing-a-pro-innovation-approach-to-regulating-ai/establishing-a-pro-innovation-approach-to-regulating-ai-policy-statement.

citations in the top 100 recent AI papers drops from to 7.2 to 1.9 percent.[372] As noted in 2018 by Hogarth and by many others since, the UK is therefore in the peculiar position of boasting a "national champion" that is primarily based in London but owned elsewhere. Yet this statistic also suggests a further type of narrowness: that of judging AI "success" through frontier research alone. Evidence of business uptake of AI in the UK is uneven and, as we will see, support for commercialisation has become a recurring focus of government strategies. Beyond DeepMind,[373] the UK's AI sector continues to be centered on London and Cambridge, and dependent on a small number of other high-performing labs.

A second, related anxiety concerns the precarity of the UK's position in the long term due to relatively low levels of investment, notably in compute resources,[374] or to the failure to "unlock" the latent value of assets such as public-sector data.[375] Overall, the UK possesses only 1.4 percent of total global compute capacity, ranking tenth in the world behind countries such as Italy, Russia, and Finland.[376] This represents a significant decline from the country's placing of third in the world as recently as 2005, and can be viewed as a consequence of sustained low investment in science and technology compared with other large economies in the nearly two decades since.[377] Over the same period, reliance on compute resources has increased,[378] leaving UK firms reliant on private-sector rentiers, and vulnerable to pressures that incentivize acquisition: DeepMind, for instance, cited access to compute as a reason for choosing to be acquired by Google.

A third anxiety is dependence on other countries, both in economic and regulatory terms. DeepMind, of course, is owned by Google, but many other UK firms were founded by consortia led by US venture capital (VC) investment. In contrast to other countries, the UK lacks the institutional financing mechanisms to back these kinds of firms domestically, and steps to unlock this (such as moves to reform pension

[372] Anjana Ahuja, "World-Leading? Britain's Science Sector Has Some Way to Go," *Financial Times*, March 15, 2023, https://www.ft.com/content/470e9848-b2dd-4ad5-94cb-65e95c226545.
[373] Department for Digital, Culture, Media and Sport, "AI Activity in UK Businesses: An Assessment of the Scale of AI Activity in UK Businesses and Scenarios for Growth over the Next Twenty Years," GOV.UK, January 2022, https://assets.publishing.service.gov.uk/media/61d87355e90e07037668e1bd/AI_Activity_in_UK_Businesses_Report__Capital_Economics_and_DCMS__January_2022__Web_accessible_.pdf.
[374] For an argument that compute is likely to be a key constraint on the UK's AI ambitions going forward, see Department for Science, Innovation and Technology, "Independent Review of the Future of Compute: Final Report and Recommendations," GOV.UK, March 6, 2023, https://www.gov.uk/government/publications/future-of-compute-review/the-future-of-compute-report-of-the-review-of-independent-panel-of-experts.
[375] John Taysom, , "Health Data Could Form the Basis of a UK Sovereign Wealth Fund," *Financial Times*, February 17, 2023, https://www.ft.com/content/e9cc9889-5711-4842-8e3c-bcb752e2c598.
[376] Mark Sellman, Britain Falls Behind Russia, Italy and Finland in Computing Power, " Times, March 6, 2023, https://www.thetimes.co.uk/article/britain-falls-behind-russia-italy-and-finland-in-computing-power-mn0r9cv3m.
[377] Ibid.
[378] Jaime Sevilla et al. , "Compute Trends across Three Eras of Machine Learning," Epoch, February 16, 2022, https://epochai.org/blog/compute-trends.

funds) have faced delays.[379] In the context of the emerging regulatory race on AI,[380] it is unclear whether the UK is significant enough in market terms to shape or drive up standards, or even maintain any sort of meaningful regulatory independence from the European Union's "Brussels effect"[381]. The UK does not meaningfully influence the direction of AI development, either through investment or regulation, at the scale of the US, China, or the European Union—and this state of affairs is unlikely to change in the near future.

In reaction to these interlinked anxieties, the UK's rhetoric and strategies in this area have exhibited both boosterism and what David Edgerton has termed "declinism,"[382] marked by a deep insecurity about the UK's place in the world and (lack of) ability to play a driving role in the development of globally transformative technologies. Google DeepMind forms something of a metonym for both, representing at once the UK's success as an attractive destination for AI investment, and its failure to cultivate a world-leading "national champion" that is genuinely independent.

The UK's AI Strategies

Recent years have seen significant political churn at the top of UK government.[383] This has disrupted almost every policy area, and prevented the adoption of a consistent approach to industrial policy: as recently noted by the Institute for Public Policy Research, since the 2010 general election there have been "11 growth plans or industrial and economic strategies overseen by nine business secretaries and seven chancellors of the exchequer."[384]

[379] Josephine Cumbo, "UK Pension Funds Warn of Roadblocks to Mansion House Reforms," https://www.ft.com/content/51dd6da0-7a92-449e-8414-24182a2257ad.
[380] Natalie A. Smuha, "From a 'Race to AI' to a 'Race to AI Regulation': Regulatory Competition for Artificial Intelligence," Law, Innovation and Technology 13, no. 1 (March 23, 2021): 57–84, https://doi.org/10.1080/17579961.2021.1898300.
[381] Anu Bradford, "The Brussels Effect," *Northwestern University Law Review* 107, no. 1 (2012), https://ssrn.com/abstract=2770634.
[382] David Edgerton, "Yes, We're in a Bad Way. But to Wallow in Myths of British 'Declinism' Won't Help Us Thrive," Guardian, June 12, 2022, https://www.theguardian.com/commentisfree/2022/jun/12/yes-were-in-a-bad-way-but-to-wallow-in-myths-of-british-declinism-wont-help-us-thrive.
[383] The Institute for Government has referred to this as the "policy churn cycle" and has noted its acceleration in recent years. See Emma Norris et al., "Government Reshuffles: The Case for Keeping Ministers in Post Longer," Institute for Government, January 24, 2020, https://www.instituteforgovernment.org.uk/publication/report/government-reshuffles-case-keeping-ministers-post-longer.
[384] Sam Alvis et al., "Making Markets in Practice," IPPR, November 27, 2023, https://www.ippr.org/research/publications/making-markets-in-practice.

AI is no exception, with the development of the UK's approach marked by both evolution and discontinuity. The policies of the post-2010 Conservative-led governments can broadly be periodized into four eras:

- Pre-2016: focus on digital economy, digital government and "Big Data"
- 2016–2019: turn to sectoral "industrial strategy"
- 2020–2023: institutionalization of AI policy
- 2023: pivot to "AI safety"

What follows is a brief overview of each of these eras, focusing on the emergence of AI as an industrial focus for the UK through the framing lenses described above.

Pre-2016: Focus on Digital Economy, Digital Government and "Big Data"

Between 2010 and 2016—the period in which DeepMind was acquired by Google[385]—AI and other data-driven technologies did not yet enjoy the prominence they would later achieve. Data and AI were predominantly seen as verticals within the broader rubric of the "digital economy" rather than a strategic focus in their own right.

This era was characterized by a focus on government modernization initiatives, represented most prominently by the launch of gov.uk and the creation of Government Digital Services (GDS).[386] These initiatives aimed to improve public services, with the side effect of making government a smarter client for a burgeoning startup sector through the streamlining of internal processes, open sharing of government data and the breaking up of monopolies with a stranglehold on government procurement. Yet by the end of this period the ambition of GDS had been reined in, with key staff leaving the organization,[387] and the focus of other organizations such as the Open Data Institute—founded in 2012 with a remit to support businesses to innovate with government open data[388]—had drifted.[389]

[385] Gibbs, "Google Buys UK Artificial Intelligence Startup DeepMind for £400m."
[386] Chris Middleton, "Maude Sets Out 'Digital by Default,' Single-Platform Vision for UK Government," Computing, June 12, 2012, https://www.computing.co.uk/analysis/2183794/maude-sets-digital-default-single-platform-vision-uk-government.
[387] Derek du Preez, "Why Are Senior Staff Fleeing the Government Digital Service?" *Guardian*, August 12, 2015, https://www.theguardian.com/public-leaders-network/2015/aug/12/government-digital-service-staff-resignations.
[388] Cabinet Office, "Plans to Establish Open Data Institute Published," press release, GOV.UK, May 22, 2012, https://www.gov.uk/government/news/plans-to-establish-open-data-institute-published.
[389] Open Data Institute, "Knowledge for Everyone: ODI's Third Year," 2016, https://www.scribd.com/doc/311714343/ODI-s-3rd-Year-Annual-Report.

The scope for broader industrial interventions during this period was highly circumscribed by tight fiscal policy and a laissez-faire approach to the economy. The coalition government's austerity agenda—more severe than that adopted by any of the UK's European peers[390]—drove cuts to departmental budgets and dramatic falls in state investment, contributing to the UK's relative decline in access to underlying AI infrastructure such as compute. While ministers sang paeans to the potential of the "Big Data" revolution,[391] state support for technology consisted primarily in reforms to the tax system such as the introduction of the Seed Enterprise Investment Scheme (SEIS), the so-called "patent box" tax incentive, and enhancements to R&D tax credits. Evidence of impact for these initiatives is limited,[392] and UK business investment in R&D remains significantly lower than the Organisation for Economic Co-operation and Development (OECD) average.[393]

Ultimately, however, the role played by government here was chiefly that of an ambassador for businesses through the establishment of organizations like TechNation (in 2014), rather than that of a standards setter, regulator, or leader. The creation of the Catapult Network from 2012 onward marked a focus on commercializing technology that would persist in subsequent periods, with this program enjoying mixed success.[394]

2016–2019: Turn to Sectoral "Industrial Strategy"

Following the Brexit vote and under the leadership of Theresa May, the UK Government adopted more statist and interventionist rhetoric, epitomized by the creation of a new department for Business, Energy and Industrial Strategy.[395] However, this rhetoric was not always accompanied by greater government intervention in practice.

[390] See for example Harry Quilter-Pinner and Dean Hochlaf, Austerity: There Is an Alternative and the UK Can Afford to Deliver It," IPPR, April 19, 2019, https://www.ippr.org/blog/austerity-there-is-an-alternative-and-the-uk-can-afford-to-deliver-it.
[391] "The [Big] Data Revolution" was famously one of the "Eight Great Technologies", first set out in a speech by then-Chancellor of the Exchequer George Osborne, and later detailed by Minister of State for Universities and Science David Willets. See "Osborne champions science in a speech at the Royal Society," Royal Society, November 12, 2012, https://www.ippr.org/blog/austerity-there-is-an-alternative-and-the-uk-can-afford-to-deliver-it; and David Willets, "Eight Great Technologies", Policy Exchange, 2013.
[392] British Academy, "What Role Do R&D Tax Reliefs Play in Encouraging UK R&D?" accessed January 18, 2024, https://www.thebritishacademy.ac.uk/documents/207/What-role-do-RD-tax-reliefs-play-in-encouraging-UK-RD.pdf.pdf.
[393] Organisation for Economic Co-operation and Development (OECD), "Research and Development (R&D) – Gross Domestic Spending on R&D," https://www.oecd.org/sti/msti.htm.
[394] Ernst & Young , *UK SBS PS17086 Catapult Network Review*, November 17, 2017, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/662509/Catapult_Review_-_Publishable_Version_of_EY_Report__1_.pdf.
[395] "About Us," Department for Business, Energy and Industrial Strategy, accessed January 30, 2024, https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about.

There was some fiscal loosening in this period, but public investment remained far below the median for OECD countries.[396] There was also little willingness to use the tools of industrial policy to more aggressively shape industry behavior—as exemplified by the Government's decision not to block takeovers such as the acquisition of chip manufacturer ARM by SoftBank, despite calls from the opposition parties and voices within the tech sector.[397]

The language of "grand challenges" used in the government's industrial strategy aped that of prominent innovation economist Mariana Mazzucato, who briefly advised government.[398] Despite this, the approach to industrial strategy remained fundamentally sectoral rather than mission-led, with each of the government's four grand challenges broadly corresponding to areas of the economy.

While the rubric of "digital" persisted, with the government publishing a digital strategy, it was during this period that AI emerged as a concern in itself.[399] One of the industrial strategy's "grand challenges" was "Growing our Artificial Intelligence and Data-Driven Economy"; accordingly, strategies for AI were published including the 2017 Hall review[400] and the 2018 AI Sector Deal[401] that leaned into global competition narratives, pledging to "put the UK at the forefront of the AI and data revolution."[402] In each of these documents, the growth of the AI sector was taken as a paramount purpose, with emphasis placed on skills, access to data, research environment, and commercialization as means of achieving this end.

While the investments accompanying these strategies were relatively small, they did seed some institutions that would assume importance in the growth and

[396] Office for Budget Responsibility, "International Comparisons of Government Investment," March 2020, https://obr.uk/box/international-comparisons-of-government-investment.
[397] David Bond, Robert Cookson, and Lauren Fedor, 'UK Government Welcomes Arm Takeover but Tech Leaders Mourn Loss," *Financial Times*, July 18, 2016, https://www.ft.com/content/e5e0cf3e-4cc4-11e6-88c5-db83e98a590a.
[398] UCL Institute for Innovation and Public Purpose, 'A Mission Oriented Industrial Strategy: UCL-IIPP Commission Meets with Greg Clark,' March 7, 2018, https://www.ucl.ac.uk/bartlett/public-purpose/news/2018/mar/mission-oriented-industrial-strategy-ucl-iipp-commission-meets-greg-clark.
[399] Department for Science, Innovation and Technology, Department for Digital, Culture, Media and Sport, and Karen Bradley, "UK Digital Strategy," GOV.UK, March 1, 2017, https://www.gov.uk/government/publications/uk-digital-strategy.
[400] Wendy Hall and Jérôme Pesenti, "Growing the Artificial Intelligence Industry in the UK," Department for Science, Innovation and Technology, Department for Digital, Culture, Media & Sport, and Department for Business, Energy & Industrial Strategy, GOV.UK, October 15, 2017, https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk.
[401] Department for Business & Trade, et al., "AI Sector Deal," GOV.UK, May 21, 2019, https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal.
[402] Department for Business, Energy and Industrial Strategy, "The Grand Challenges," GOV.UK, updated January 26, 2021, withdrawn March 1, 2023, https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges.

institutionalization of UK AI policy: notably the Centre for Data Ethics and Innovation[403] and the Alan Turing Institute, which added AI to its remit in 2017.[404]

2020–2023: Institutionalization of AI Policy

The period from 2020 onward marked the institutionalization of AI policy in the UK. The 2020 National Data Strategy and 2021 AI Strategy framed data and AI as national assets to be stewarded and "unlocked" in order to yield benefits across the economy and "[to ensure that] AI benefits all sectors and regions."[405] In order to facilitate this, a premium was placed on public trust.[406] Major regulators, such as the Competition and Markets Authority (CMA) through its Digital Markets Unit, began to acquire strong data and AI capabilities.[407]

These developments, a consequence of the foundations laid in the previous "industrial strategy period," led to a proliferation of new institutions and government teams focused on data and AI. This stronger institutional landscape was, however, undermined by continued low resourcing and frequent refocusing of political objectives (illustrated by the replacement of the May government's industrial strategy with a post-COVID "Plan for Growth").[408]

One symptom of this was the Data Protection and Digital Information Bill, which was developed in this period and has yet to pass Parliament. The bill represents contradictory impulses: on one hand it aims to carry out a deregulatory strategy inspired by the Taskforce on Growth and Regulatory Reform,[409] while on the other it takes forward measures such as Smart Data more closely associated with the interventionist approach of the Furman Review.[410] Similarly, the 2023 AI regulation white paper published by the Department of Science, Innovation and Technology (DSIT) set out to empower regulators and enable a context-specific approach to AI

[403] "About Us," Centre for Data Ethics and Innovation, GOV.UK, accessed January 30, 2024 https://www.gov.uk/government/organisations/centre-for-data-ethics-and-innovation/about.
[404] "About Us," Alan Turing Institute, accessed January 30, 2024, https://www.turing.ac.uk/about-us.
[405] Department for Science, Innovation and Technology et al., "National AI Strategy."
[406] Frontier Economics, *Increasing Access to Data across the Economy*, March 2021, https://assets.publishing.service.gov.uk/media/6062e149d3bf7f5cde260991/Frontier-access_to_data_report-26-03-2021.pdf.
[407] Competition and Markets Authority, "Digital Markets Unit," GOV.UK, April 7, 2021, https://www.gov.uk/government/collections/digital-markets-unit.
[408] HM Treasury, "Build Back Better: Our Plan for Growth," GOV.UK, March 3, 2021, https://www.gov.uk/government/publications/build-back-better-our-plan-for-growth.
[409] Taskforce on Innovation, Growth and Regulatory Reform, Taskforce on Innovation, Growth and Regulatory Reform I*ndependent Report*, June 16, 2021, https://www.gov.uk/government/publications/taskforce-on-innovation-growth-and-regulatory-reform-independent-report.
[410] HM Treasury, *Unlocking Digital Competition, Report of the Digital Competition Expert Panel*, March 13, 2019, https://www.gov.uk/government/publications/unlocking-digital-competition-report-of-the-digital-competition-expert-panel.

governance, but was undercut by government's unwillingness to endow regulators with new statutory powers.[411]

During this period, UK funding for innovation policy increased, with the adoption of a target of 2.4 percent GDP[412] and the establishment of the Advanced Research and Invention Agency (ARIA),[413] modeled on the US's Defense Advanced Research Projects Agency (DARPA). Reflecting the increased role of compute in AI development,[414] and the UK's relative weaknesses in compute provision, compute resources came into focus as a key strand of UK AI policy with the commissioning of the Independent Review into the Future of Compute, and a change to R&D tax credits making compute investments eligible for tax relief.[415]

A Lost Decade? Recurring Themes in UK AI Policy

Ten years on from the DeepMind takeover, has the UK developed a coherent or distinctive industrial approach to AI? The discontinuity between these phases makes it difficult to claim so. Nonetheless, we can identify a number of common themes.

Throughout the past decade, the UK government has consistently advanced a shrewd assessment of the country's assets in relation to AI: namely a strong academic and research sector, an internationally significant industry cluster, and valuable public data held by the NHS and the other remnants of the postwar welfare state. It has, to a degree, successfully parlayed this into significant state and regulatory capacity: regulators such as the Information Commissioner's Office (ICO) and the CMA are considered global leaders in their fields, while DSIT now houses a significant number of AI policy experts and, following the establishment of the Frontier AI Taskforce and AI Safety Institute, increased technical expertise.

[411] Department for Science, Innovation and Technology and Office for Artificial Intelligence, , "A Pro-Innovation Approach to AI Regulation," UK.GOV, March 29, 2023, https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper.
[412] UK Parliament, House of Commons Library, *Research and Development Spending*, September 11, 2023, https://commonslibrary.parliament.uk/research-briefings/sn04223.
[413] Advanced Research and Invention Agency (ARIA), https://www.aria.org.uk, accessed January 30, 2024.
[414] See Jai Vipra and Sarah Myers West "Computational Power and AI," AI Now Institute, September 27, 2023, https://ainowinstitute.org/publication/policy/compute-and-ai; and Jaime Sevilla et al., , "Compute Trends across Three Eras of Machine Learning," Epoch, February 16, 2022, https://epochai.org/blog/compute-trends.
[415] HM Treasury, *Spring Statement*, GOV.UK, March 2022, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1062486/Spring_Statement_2022_Web_Accessible.pdf.

However, coordination between these different actors has often been weak and progress has been stymied due to competing agendas, institutional churn, and a fragmented regulatory landscape.[416] The relative weakness of central coordinating institutions and long-term technology horizon-scanning capabilities[417] cannot be ignored, leaving government technology strategy reliant on ministerial whim, unpredictable market coordination, and external expertise from industry. This institutional gap has meant that while the aspiration of joined-up government to marshal AI toward strategic challenges has often been expressed, in practice this has happened only infrequently. The design and implementation of public infrastructures to deliver these benefits has also been limited by consistently low resourcing due to fiscal restrictions, with even the 2023 public compute announcements relatively conservative in global terms.

But it also reflects the fact that central government has rarely, if ever, advanced a coherent vision for the role that a domestic AI sector should play within the UK economy. Strategic challenges and public benefits have frequently been invoked, from innovation in particular areas (such as new drug discovery and low carbon technologies) or specific economic goals (such as economic rebalancing or higher productivity). It is frequently assumed that a growing UK AI sector will lead to these outcomes; "promoting adoption" is the aim, not leading or shaping AI development. There has been little reflection on the type of AI sector that might achieve particular outcomes—notwithstanding the occasional allusion to the UK as an AI assurance hub,[418] or a center for "safe" or "responsible" AI. Success has usually been understood in crude terms related to the size of a relatively ill-defined sector: more AI startups, more "unicorns," greater private investment in "AI" understood broadly, and so on.

Consequently, the approach has often been to try to platformize the UK's assets—with perhaps the clearest example of this being public, and particularly NHS, data—so that they can better service a growing private sector. There has been little attempt to leverage access to these assets to shape industry behavior, or use other levers to shape industry (such as the introduction of hard regulation, the

[416] Notwithstanding, in the latter case, promising movement towards the coordination of a small number of leading regulators under the aegis of the Digital Regulation Cooperation Forum (DRCF). See Competition and Markets Authority, Information Commissioner's Office, Ofcom, and Financial Conduct Authority, "The Digital Regulation Cooperation Forum," GOV.UK, 10 March 2021, https://www.gov.uk/government/collections/the-digital-regulation-cooperation-forum.
[417] For a discussion of this, see for example Allan Nixon, Anna Dickinson, and Anastasia Bektimirova, *Wired for Success: Reforming Whitehall to Support Science and Technology*, Onward, August 1, 2023, https://www.ukonward.com/reports/wired-for-success.
[418] Cabinet Office, "Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy," GOV.UK, March 16, 2021, https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy.

blocking of takeovers, or the acquisition of public stakes in strategically important companies). Even the AI Safety Institute—heralded as a "startup within government"[419] and an attempt to do something different by building state capacity on AI—risks essentially becoming the provider of voluntary services to large incumbent companies.

In other sectors—and particularly those sectors considered to be of infrastructural importance, such as medicines and energy[420]—this approach would not pass muster. Instead, as seen through the international turn toward the "strategic state," governments are increasingly using industrial policy tools to shape and "direct" growth in key sectors toward societal benefits. This trend can be seen most clearly in the example of the energy transition. Both the Inflation Reduction Act in the United States[421] and the Net-Zero Industry Act in the European Union include measures to "crowd in" private investment toward goals linked to decarbonization. [422] Others have argued that such a market-shaping approach is warranted in the case of AI to "better align domestic investment and AI capability development with economic, societal and national security objectives."[423] While at times parts of government have made overtures to this school of thought—notably during the 2016 to 2019 period under Greg Clark as Secretary of State for Business, Energy and Industrial Strategy—the substantive policy commitments necessary to carry through such an approach have consistently been lacking.

Fantasies of Independence

Instead of assuming that any and all types of AI will produce economic growth and societal surplus with minimal state intervention, government needs to develop a

[419] Notably by Ian Hogarth in AI Safety Institute and Department for Science, Innovation and Technology, *Frontier AI Taskforce: Second Progress Report*, GOV.UK, October 30, 2023, https://www.gov.uk/government/publications/frontier-ai-taskforce-second-progress-report/frontier-ai-taskforce-second-progress-report.
[420] Julia Smakman, Matt Davies, and Michael Birtwistle, *Mission Critical: Lessons from Relevant Sectors for AI Safety*, Ada Lovelace Institute, October 31, 2023, https://www.adalovelaceinstitute.org/policy-briefing/ai-safety.
[421] White House, *Inflation Reduction Act Guidebook*, November 28, 2023, https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook.
[422] ""The Net-Zero Industry Act," European Commission, accessed January 30, 2024, https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en.
[423] Mariana Mazzucato, Marietje Schaake, Seb Krier, and Josh Entsminger, "Governing Artificial Intelligence in the Public Interest, UCL Institute for Innovation and Public Purpose, July 28, 2022, https://www.ucl.ac.uk/bartlett/public-purpose/publications/2022/jul/governing-artificial-intelligence-public-interest. The notion of a challenge-led approach to governing AI has also been articulated by, among others, Harry Farmer, *Regulate to Innovate: A Route to Regulation That Reflects the Ambition of the UK AI Strategy*, Ada Lovelace Institute, November 2021, https://www.adalovelaceinstitute.org/wp-content/uploads/2021/12/Regulate-to-innovate-Ada-report.pdf; and Francesca Bria, "Open, Sovereign, Independent AI: Europe's Greatest Challenge?" Medium, December 10, 2023, https://medium.com/@francescabria/open-sovereign-independent-ai-europes-greatest-challenge-6c8a899041ec.

clear articulation of what "public benefit" looks like in the context of AI and what sort of AI sector will deliver it. It also needs to understand how AI—as a general-purpose technology influencing the development of other sectors—impinges on other long-term priorities such as environmental obligations[424] and the concentration of power in the digital economy.[425]

This more strategic conception of industrial policy has renewed currency in many parts of the world today—but in the UK this has only manifested itself in fits and starts, and predominantly in rhetorical terms. The UK continues to perform relatively well against global peers on a number of narrow metrics related to frontier research. However, the succession of strategies adopted over the last 10 or so years has failed to alleviate the anxieties discussed above. The UK's AI economy remains narrow, larger on paper than in its footprint in our society. Those advantages it does enjoy over its European peers are precarious and in certain respects are being eroded by underinvestment. And the shape, pace, and direction of AI development in the UK is dictated not in Westminster or Whitehall, but overwhelmingly in the boardrooms and pitch decks of Silicon Valley.

This is at least in part because of our attachment to the founding myth of British AI policy: that of the arms race. Arms race narratives are implicitly linear, positioning individual states as able to influence the pace but not the direction of economic development and technological change. They take for granted that increased support for UK firms will lead to the UK becoming a global leader in AI development, and that achieving this position will—by virtue of "winner-takes-all" dynamics and the putative tendency of wealth to "trickle down"—deliver sustained value for the public.

The arms race offers a fantasy of independence that masks deeper structural dependence on a paradigm of AI development led by, and wholly dependent on, funding and infrastructures provided by Silicon Valley.[426] In this sense the question we started with from Ian Hogarth is misframed: it is not clear to what extent DeepMind ever represented a truly "independent entity," given how intertwined its

[424] Emily Clough, "Net Zero or Net Hero? The Role of AI in the Climate Crisis," Ada Lovelace Institute, September 15, 2023, https://www.adalovelaceinstitute.org/resource/climate-change-ai.
[425] Valentina Pavel et al., *Rethinking Data and Rebalancing Digital Power*, Ada Lovelace Institute, 2022, https://www.adalovelaceinstitute.org/project/rethinking-data.
[426] See David Gray Widder, Sarah West, and Meredith Whittaker, "Open (For Business): Big Tech, Concentrated Power, and the Political Economy of Open AI," August 18, 2023, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4543807; and Barry Lynn, Max von Thun, and Karina Montoya, *AI in the Public Interest: Confronting the Monopoly Threat*, Open Markets Institute, November 2023, https://www.openmarketsinstitute.org/publications/report-ai-in-the-public-interest-confronting-the-monopoly-threat.

early history was with US venture capital[427] and how wedded its aspirations were to the existing Silicon Valley model.

This model of AI development militates against many of the UK government's other stated policy aims and (in some cases) its legally mandated targets. It is highly resource intensive, monopolizing investment[428] and extracting huge ecological[429] and human[430] costs.[431] It concentrates power, with even "open" iterations and academic labs dependent on and shaped by corporate infrastructure,[432] and market entrants vulnerable to anticompetitive practices.[433] It drives harms such as misinformation, exploitation, and oversurveillance, with few incentives in existing law for developers or deployers to ensure their systems are "safe."[434] AI and other data-centric technologies often don't work as intended outside of deployed settings[435] and can deepen existing inequalities,[436] yet aggressive marketing campaigns led by the private sector often oversell their benefits, particularly in public-sector contexts.[437] It is far from clear that simply "Growing the AI industry in the UK"—as the 2017 Hall review was titled—will lead to positive outcomes for the UK.[438]

True "independence" would be to challenge this paradigm and articulate a vision of AI that links its functioning in the UK economy to a wider vision about the society we want to live in. By leveraging those strengths it does have, the UK could incentivize types of AI that preserve privacy, respect ecological boundaries, and create genuine societal benefit, from climate action to new drug discovery. This is

[427] See Cade Metz, Karen Weise, Nico Grant, and Mike Isaac, "Ego, Fear and Money: How the A.I. Fuse Was Lit," *New York Times*, December 3, 2023, https://www.nytimes.com/2023/12/03/technology/ai-openai-musk-page-altman.html.
[428] Perhaps the most pronounced in the example of compute costs: if model sizes continue growing along the current trajectory, some estimates place compute costs in excess of the entire US GDP by 2037. See Lennart Heim, "This Can't Go On(?) – AI Training Compute Costs," **.XYZ* (blog), June 1, 2023, https://blog.heim.xyz/this-cant-go-on-compute-training-costs; and Vipra and West, "Computational Power and AI."
[429] Clough, "Net Zero or Net Hero?"
[430] See for example Billy Perrigo, "OpenAI Used Kenyan Workers on Less than $2 per Hour to Make ChatGPT Less Toxic," *Time*, January 18, 2023, https://time.com/6247678/openai-chatgpt-kenya-workers. These effects typically accrue to workers in global majority countries; for more information, see Aditya Singh and Daniel Vale, "A New AI Lexicon: Existential Risk," AI Now Institute,October 8, 2021, https://ainowinstitute.org/publication/a-new-ai-lexicon-existential-risk.
[431] See Heim "This Can't Go On"; and Vipra and West, "Computational Power and AI."
[432] See Widder, Whittaker, and West, "Open (For Business)"; and Meredith Whittaker, "The Steep Cost of Capture," *Interactions* 28, no. 6 (November–December 2021): 50–55, https://doi.org/10.1145/3488666.
[433] As noted in Competition and Markets Authority, *AI Foundation Models: Initial Report*, GOV.UK, September 18, 2023, https://www.gov.uk/government/publications/ai-foundation-models-initial-report.
[434] AWO, "AWO Analysis Shows Gaps in Effective Protection from AI Harms," AWO (blog), July 17, 2023, https://www.awo.agency/blog/awo-analysis-shows-gaps-in-effective-protection-from-ai-harms.
[435] Inioluwa Deborah Raji et al., "The Fallacy of AI Functionality," *arXiv* 2206.09511, no. 2, July 1, 2022, https://arxiv.org/abs/2206.09511.
[436] The tendency of datacentric technologies to exacerbate existing socioeconomic inequalities is a key finding of the Ada Lovelace Institute's three-year program of work on healthcare in partnership with the Health Foundation. See for instance Anna Studman, "Access Denied? Socioeconomic Inequalities in Digital Health Services," Ada Lovelace Institute, September 18, 2023, https://www.adalovelaceinstitute.org/report/healthcare-access-denied.
[437] The secrecy of these practices makes them difficult to describe in detail, but their prevalence is well known and reported on. See for instance Adam Satariano, "Palantir Wins Major U.K. Health Contract Despite Criticism," *New York Times*, November 21, 2023, https://www.nytimes.com/2023/11/21/business/palantir-nhs-uk-health-contract-thiel.html.
[438] Hall and Pesenti, "Growing the Artificial Intelligence Industry in the UK."

not to adopt boosterish—some might say quixotic—narratives about leading the world, or beating the United States and China at their own games: the UK is a small market in global terms, facing profound challenges. It is equally to avoid declinism and be realistic about the assets the British state has and the agency that they bestow: to choose not to subsidize a trajectory of continual development but instead to think critically about whether and how we continue to embed these technologies in our daily lives.

Politicians on both sides of politics are currently preaching stability and "long-term" policymaking[439] as an antidote to the "age of insecurity."[440] The opposition Labour party, which—according to current polling—is likely to win this year's general election, has expressed a willingness to take a more proactive role in shaping technology toward public benefit. There is therefore an opportunity for 2024 to mark a reorientation of the UK's industrial policy for AI toward more concerted and strategic ends. To do so will require a rejection of the existing model of AI development, and the negotiation of a new partnership on more even terms.

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[439] In different guises: Prime Minister Rishi Sunak has adopted the rhetoric of "long-term decisions" while moving away from institutions such as the Committee on Climate Change that are designed to embed long-term perspectives in policymaking. (See Hannah White, "Rishi Sunak's 'wholly new kind of politics' does not bear scrutiny," Institute for Government, September 27, 2023, https://www.instituteforgovernment.org.uk/comment/sunak-politics-scrutiny.) Keir Starmer's Labour Party has similarly promised to end "sticking-plaster politics," but has promised to *create* new institutions of this nature akin to the Office for Budgetary Responsibility (OBR) and the Climate Change Committee (CCC). See Labour Party, "5 Missions for a Better Britain," 2023, https://labour.org.uk/wp-content/uploads/2023/02/5-Missions-for-a-Better-Britain.pdf; and Chris Smyth, "New Watchdogs Could See Labour's Promises Are Kept," *Times*, October 9, 2023, https://www.thetimes.co.uk/article/new-watchdogs-could-see-labours-promises-are-kept-rdh3tc26s.

[440] For a discussion of the "age of insecurity," see for example Labour Party, "Rachel Reeves: 'Securonomics'," press release, May 24, 2023, https://labour.org.uk/updates/press-releases/rachel-reeves-securonomics; and Labour Party, "Rachel Reeves Speech at Labour Conference," press release, October 9, 2023 https://labour.org.uk/updates/press-releases/rachel-reeves-speech-at-labour-conference.

6. Reflections on South Africa's AI Industrial Policy

by Sandra Makumbirofa

South Africa's positioning on industrial policy for the technology and AI sector is best understood within its broader economic history. Economic policy in SA has included an explicit commitment to rectifying historical injustices and, as such, a natural comfort with inclusive industrial policies as a means toward equitable development. The translation of this intention to reality has, however, been mixed, as I explore in the context of the technology sector.

The Recent History of the Tech Boom in South Africa

South Africa is classified as an upper-middle-income or emerging economy. As an emerging economy, innovation and technology are characterized by a framework that aims to "catch up" to standards set in developed countries. In terms of tech

ranking, South Africa is ranked seventy-fourth out of 134 countries on the Network Readiness Index[441] (following Kenya, which leads the region at seventieth), and seventy-seventh out of 193 countries in the 2023 AI Readiness Index[442] (after Mauritius at sixty-first, leading the region, and Egypt at sixty-second). Rankings have played a particularly influential role in shaping both how government narratives project South Africa's position and influencing capital flows into the region. However, standards such as these often flatten or disregard the nuanced domestic strides, challenges, and details that explain the country's growth trajectory. Moreover, the standards and frameworks employed in these rankings are not neutral, but reflect the perspectives and interests of the countries and institutions setting them. As such, rankings should be contested as they may not capture the multifaceted aspects of a given situation.

South Africa has firmly established itself as a prominent tech hub, with cities like Cape Town and Johannesburg emerging as key players in the startup landscape. Notably, startup funding in South Africa experienced significant growth, skyrocketing from$50 million in 2015 to nearly$350 million in 2021.[443] South Africa's status as a regional tech hub comes in part from the fact that big tech companies such as IBM, Cisco, Microsoft, Amazon, and others have established subsidiaries in the country, making it a supply base for their services and infrastructure for other African countries.[444] Google brought its first cloud region into Africa in South Africa in 2022.[445] Though Kenya, Nigeria, and Egypt frequently outpace South Africa in terms of securing funding for ventures, a noteworthy surge in startup funding nevertheless points to its attractiveness for investors, reflecting both the country's relatively developed economy and its strategic government policies.[446] The technological evolution has led to South Africa's foray into AI efforts, which have risen in recent years. In essence, the history of the tech boom in South Africa reflects a complex interplay between government initiatives and private-sector dynamism.

[441] Portulans Institute, "South Africa – Network Readiness Index," 2023, https://networkreadinessindex.org/country/south-africa.
[442] Oxford Insights, "Government AI Readiness Index," Oxford Insights, 2023, https://oxfordinsights.com/ai-readiness/ai-readiness-index.
[443] Nafisa Akabor, "The Rise of African Tech Hubs: How They Are Becoming the Silicon Valleys of the Continent," CNBC Africa, November 2, 2023, https://www.cnbcafrica.com/2023/the-rise-of-african-tech-hubs-how-they-are-becoming-the-silicon-valleys-of-the-continent.
[444] International Trade Administration, "South Africa Country Commercial Guide: Information Technology," 2024, https://www.trade.gov/knowledge-product/south-africa-information-technology.
[445] Annie Njanja and Tage Kene-Okafor, "Google Picks South Africa for Its First Cloud Region in Africa," TechCrunch (blog), October 5, 2022, https://techcrunch.com/2022/10/05/google-picks-south-africa-for-its-first-cloud-region-in-africa.
[446] Akabor, "The Rise of African Tech Hubs."

Overall, on the African continent, South Africa dominates the digital sector, with one of the largest markets in Africa. The telecommunications sector grew dramatically as a result of market liberalization, universal access, and deliberate government policies such as the Broad-Based Black Economic Empowerment (BBBEE) ICT Code.[447] The government's flagship BBBEE[448] policy was originally introduced in 2003 to promote a new class of Black-led businesses and investors. The BBBEE policy had set out a specific code dedicated to the technology and telecommunication (also known as the "Information and Communications Technology" or ICT) sector; in 2016, the government amended[449] the BBBEE ICT code to increase the minimum prescribed equity to be held by Black people from 25 percent to 30 percent. Overall, however, BBBEE has been critiqued for superficial results. For instance, gaps[450] in the legal requirements of enforcement allowed companies to achieve a good BBBEE rating (crucial in accessing financing and incentives) without real transformation in their leadership structures. In addition, concerns remain about the concentration of benefits[451] in wealthier Black households, and the reluctance to comply on the part of companies that do not directly conduct business with the government.

South Africa's decision to deregulate the telecommunications sector in the mid-1990s was a significant juncture in the country's economic development. Liberalization attracted[452] private investments, and the government's policies aimed at achieving universal access and infrastructure development paved the way for South Africa to be one of the regional tech hubs in Africa. Yet even as private enterprise flourished, relative to other regions in Africa, empirical evidence shows[453] that the digital divide persists for ordinary people with very limited computer ownership and digital skills, and that most digital consumption activities are restricted to social interactions and entertainment. In other words, most South Africans use the internet more for social media and watching movies than for business activities or facilitating engagement with their government.

[447] South African Government, "Information Communications Technology (ICT) Policy Colloquium Discussion Document," *South African Government National Gazette* 562, no. 35255 (April 13, 2012): 119.
[448] South African Government, "Broad-Based Black Economic Empowerment Act 53 of 2003," 2004, https://www.gov.za/documents/broad-based-black-economic-empowerment-act.
[449] BBBEE Commission, "B-BBEE ICT Sector," December 2017, https://bbbeecommission.co.za/wp-content/uploads/2017/12/B-BBEE-ICT-SECTOR-a.pdf.
[450] Jeannine van de Rheede, "Black Economic Empowerment in South Africa: Is Transformation of the Management Structures of Enterprises as Essential as It Should Be?," *Law, Democracy and Development* 26 (2022): 84–105, https://doi.org/10.17159/2077-4907/2021/ldd.v26.4.
[451] Neva Makgetla, "The Impact and Outcomes of BBBEE: A Preliminary Assessment," Trade and Industrial Policy Strategies, January 2021, https://www.tips.org.za/research-archive/trade-and-industry/economic-regulation/item/download/1999_7b2101d4b51883615939c16bbc55086b.
[452] Ewan Sutherland, "Telecommunications in South Africa: Enforcement of Competition," *SSRN Electronic Journal*, 2021, https://doi.org/10.2139/ssrn.1988136.
[453] Andrew Partridge, "Digital Inequalities in the Post-Pandemic Recovery: The Case of South Africa," November 3, 2023, https://researchictafrica.net/publication/digital-inequalities-in-the-post-pandemic-recovery-the-case-of-south-africa.

Current Government AI Initiatives and Narratives

The South African government has undertaken several initiatives in AI in the tradition of other industrial policy efforts.[454] These initiatives are characterized by a concerted effort to foster innovation, address socioeconomic challenges, and position the country competitively in the global digital landscape.

The South African government has been invested in positioning the country as a globally competitive player in tech. In 2019, the government established the Presidential Commission on the Fourth Industrial Revolution (PC4IR).[455] The PC4IR is structured to provide guidance to the President and the government regarding policies, strategies, and action plans emphasizing attributes such as intelligence, connectivity, and competitiveness. This marked a proactive step toward positioning South Africa as a globally competitive player, emphasizing inclusivity (regarding race, gender, disability, and poverty) and technological capabilities (though quotas are not explicitly mentioned), even in the face of significant skilled professionals needed for 4IR, infrastructure limitations, and historical governance issues. In December 2023, President Cyril Ramaphosa committed to investing $53 million (and up to $265 million by 2030 from pooling resources with the private sector) toward PhD programs focused on bringing "critical skills in areas like artificial intelligence research, advanced biotechnology, fuel cell development, batteries and other storage, and next-generation mining."[456] This comes against the backdrop of the misappropriation of public funds, with numerous cases of corruption in procurement currently under investigation.[457] In 2018, it was estimated that R27 billion, equivalent to about$1.4 billion, is believed to have been lost due to corrupt practices.[458]

On AI, the PC4IR warned that the industry was "seriously underperforming" relative to other high-tech sectors. The narrative also signals the idea of South Africa as a hub for regional leadership when it notes that the focus will be on identifying opportunities consistent with an "Africa-centric strategy for the future." The

[454] South African Government, "Presidential Commission on Fourth Industrial Revolution: Members and Terms of Reference" 646, no. 42388 (April 9, 2019): 12.
[455] Ibid.
[456] Munyaradzi Makoni, "Cyril Ramaphosa Unveils R1bn PhD Initiative," Research Professional News (blog), December 14, 2023, https://www.researchprofessionalnews.com/rr-news-africa-south-2023-12-south-africa-s-president-unveils-r1bn-phd-initiative.
[457] Zukiswa Kota, "South Africa's Corruption Busters: Short-Changed on Funding and Political Commitment," *Conversation*, December 8, 2021, http://theconversation.com/south-africas-corruption-busters-short-changed-on-funding-and-political-commitment-173072.
[458] Busisiwe Radebe, "Corruption Costs SA's GDP R27 Billion Annually," SABC News, June 29, 2018, https://www.sabcnews.com/sabcnews/corruption-costs-sas-gdp-r27-billion-annually.

PC4IR's Strategic Implementation Plan, responding to this diagnosis of underperforming high-tech sectors, recommended the establishment of a national AI institute.

True to this commitment, the AI Institute of South Africa (AIISA) was established (though only after three years) in 2022 with the overarching goal of cultivating a national and internationally recognized AI ecosystem that would foster research and technological advancements in the field of AI within Africa. The Institute explicitly outlined its focus on research and development, coupled with the practical implementation of AI capabilities. One of its stated objectives was to formulate an all-inclusive AI strategy for South Africa, suggesting a comprehensive approach that integrates diverse, ethical, and legal perspectives in shaping the country's path in AI development.

The Department of Communication and Digital Technologies, reporting to the Minister of Communications and Digital Technologies, plays a central role in spearheading these initiatives, collaborating with both public- and private-sector stakeholders. The Department of Science and Innovation (DSI), the Council for Scientific and Industrial Research (CSIR), the Technology Innovation Agency (TIA), and the Industrial Development Corporation (IDC) play a crucial role in advancing emerging technology development, uptake, and upscaling in South Africa. These agencies have been instrumental in funding research and commercialization efforts and providing guidance in technology development. However, business financing is still a significant concern due to poor coordination, unclear funding information, and complex application requirements.[459] Weak links between research organizations and the private sector hinder innovation despite expectations from agencies like the DSI and CSIR. Business support services have low awareness and quality, and policy coordination within the public sector faces challenges such as corruption and mismanagement.[460]

While there is an acknowledgement of the importance of considering the interests of all participants, particularly SMEs and marginalized groups, the implementation in practice appears questionable. Tangible efforts to create an equitable environment are not consistently evident beyond participation in forums and meetings. This could impede the envisioned extensive engagement and

[459] Rachel Alexander, "Assessing the Ability of the National Innovation System of South Africa to Facilitate the Fourth Industrial Revolution," SARChI Industrial Development, SARChI Industrial Development Working Paper Series, September 2021.
[460] Ibid.

participation, posing challenges to the overall effectiveness and sustainability of collaborative outcomes.

Nevertheless, inclusivity has been emphasized by the promotion of public-private partnerships, as recommended in the PC4IR, and the country's tech history, which involved a mix of private-sector investment and state efforts to create an environment conducive to technological advancements. Private companies, both domestic and international, have made substantial investments in South Africa's tech infrastructure.[461] Initiatives such as data centers, AI research, and educational programs have been launched by companies like Equinix, Google, and Vantage Data Centers.[462]

South Africa's National AI Institute: Industries of Focus

The key players driving the AI Institute of South Africa are its three cofounders: the Department of Communication and Digital Technologies (part of the Ministry of Communications and Digital Technologies), the University of Johannesburg, and Tshwane University of Technology (TUT). The University of Johannesburg and TUT hubs' stated goals are driving strategic AI projects in mining, government cloud (including upskilling and reskilling public servants in AI and digital skills), and motor industry infrastructure; AI Biometric Systems (to streamline the processing of tourist and business visas through the utilization of contemporary and secure identity authentication systems); criminal justice system development (to streamline the value chain and document management processes within the criminal justice system.); farming and food production; and healthcare and coal renewables that will convert coal to renewable energy. Investing in AI biometrics and the criminal justice system raises concerning implications, especially in the contentious domains of biometrics and criminal justice. The deployment of such technology will require careful consideration of ethical concerns, privacy issues, and potential biases to ensure responsible and fair use in these critical areas.

[461] International Trade Administration, "South Africa Country Commercial Guide: Information Technology," 2024, https://www.trade.gov/knowledge-product/south-africa-information-technology.
[462] Kelello Mashiane and Rethabile Molala, "Foreign Direct Investment Tracker: Fourth Quarter 2022," Trade and Industrial Policy Strategies, accessed January 16, 2024, https://www.tips.org.za/manufacturing-data/fdi-tracker/item/4543-fdi-tracker-q4-2022.

In the government's narrative, collectively these projects are aligned with its broader economic policy focus, as it envisions AI as a catalyst for job creation, skills development, and enhanced global competitiveness. However, no substantive evidence reports detailed information on use cases, budgets, or progress on these objectives. In addition, the PC4IR Strategic Implementation Plan does not address how the government plans to use emerging technologies to solve pertinent and long-standing social issues in South Africa, including crime, high unemployment, inequality, and unreliable electricity supply.

As South Africa heads toward a general election in 2024, the role of AI and technology in the political landscape cannot be overstated. The government's focus on tech initiatives serves to burnish its reputation and public image, and may be influenced by a desire to project a modern and technologically advanced service delivery. In response to persistent corruption concerns, in his annual African National Congress (ANC) statement in January 2023, Ramaphosa advocated using technology, including AI, to enhance transparency and accountability in government procurement processes. This also comes against the backdrop of several calls from the Democratic Alliance (DA) opposition party to cut the public-sector employment rolls. While the emphasis on technology might be considered part of a broader economic strategy, its effectiveness in addressing the country's pressing issues, such as high unemployment and racial inequality, requires careful scrutiny and remains untested.

Capacity Building for Public Servants

A look at the selection of projects that the AIISA is focusing on shows a heavy emphasis on capacity-building for public servants. This means enhancing their competencies, training, and overall capabilities to perform their duties effectively and efficiently. One could argue that this emphasis on capacity-building serves multiple purposes, some extending beyond the immediate realm of technology and skills development.

On one hand, the government frames its commitment to building AI capabilities within the public sector as an effort to modernize governance, improve service delivery, and enhance operational efficiency. Given the transformative potential often assigned to AI technologies, investing in the technological skills of

government employees aligns with global trends and the evolving nature of public administration.

On the other hand, one could interpret this emphasis on capacity-building as a strategic move to deflect attention from the opposition party, the Democratic Alliance,[463] from making calls for budget cuts and perceived failures in service delivery. By showcasing a commitment to technological advancement, the government may seek to shift the narrative away from criticisms of its performance in traditional service areas. It is therefore essential to note that overreliance on AI without addressing fundamental institutional issues of mismanagement and misallocations of funds, inadequate service delivery, or neglecting ethical considerations may not only fail to solve these issues, but may even exacerbate current economic and social challenges, as we'll see in the next section.

Considerations for Equity and Justice in South Africa's Tech Industrial Policy

The various AI initiatives across national, provincial, and local levels are not without potential unintended consequences, and they often showcase a top-down approach. Given the limited evidence of progress, questions arise about the true inclusion and representation of South Africa's diverse population in these endeavors. The dominance of white[464] male founders in the industry has sparked concerns about the further concentration of wealth in long-privileged groups emanating from apartheid. While the private sector has in the past driven innovation and investment in some areas of the economy,[465] questions linger about the equitable distribution of opportunities, particularly considering the historical context of apartheid.[466]

Furthermore, the emphasis on AI-driven economic growth may inadvertently exacerbate existing social disparities, particularly in terms of access to education and employment opportunities. South African learners exhibit myriad challenges,[467]

[463] Leon Schreiber, "DA Three-Step Guide to Solving the Public Sector Wage Impasse," Democratic Alliance, May 4, 2021, https://www.da.org.za/2021/05/da-three-step-guide-to-solving-the-public-sector-wage-impasse.
[464] Ventureburn, "Infographic: The 2018 Ventureburn Tech Startup Survey," 2018, https://ventureburn.com/2018/11/infographic-2018-ventureburn-survey.
[465] Philip Joubert, "State of South Africa's Software Developer Nation 2023," OfferZen, 2023, https://www.offerzen.com/reports/software-developer-south-africa-2023.
[466] Andreoni et al., eds., *Structural Transformation in South Africa*.
[467] Bongiwe Mbinqo-Gigaba, "Capacity Building of STEM Educators: DBE Briefing; with Minister & Deputy Minister," March 7, 2023, https://pmg.org.za/committee-meeting/36485.

especially in STEM subjects like mathematics and the physical sciences. Official records show that in the 2022 national exams, only 55 percent passed mathematics at the minimum threshold of 30 percent, with 37.8 percent achieving 50 percent or above. Similarly, only 35.3 percent attained 50 percent or more in the physical sciences. These low performance levels raise serious concerns about the workforce's preparedness for tech careers. To achieve the government's goal of positioning South Africa as a regional tech hub, addressing these educational challenges is imperative. An appropriately educated and gainfully skilled workforce is essential for the success of any tech hub, highlighting the urgent need for improvements in STEM education and appropriate upskilling that produces an internationally competitive workforce.

The digital divide, where rural areas face infrastructure limitations and limited intercity connectivity, remains a pertinent issue and creates a price-sensitive market that requires affordable services. The risk of reinforcing well-documented biases in AI algorithms,[468] if not meticulously addressed, poses profound ethical concerns. Foreign AI-focused companies use technologies trained on data that is not representative[469] of the African context.[470] Furthermore, the reliance on international collaborations may inadvertently lead to a dependence on external expertise, potentially hindering the development of a robust, locally driven AI ecosystem, a situation that already exists in many other industries across the African continent. Striking a balance between leveraging global knowledge and ensuring local autonomy is a critical consideration for the South African government.

Academic institutions, such as the University of Johannesburg and the Tshwane University of Technology, actively engage in AI research and development, driven by motivations ranging from becoming "a leading AI hub in Africa"[471] to supporting small and medium enterprises through enhancing their digital skills. However, there is a lack of defined metrics to assess how the nation intends to accomplish this objective. The apparent lack of emphasis on tailoring AI solutions to address local challenges and leaving the digital divide unaddressed raises questions about how aligned current academic efforts are with the broader socioeconomic landscape.

[468] Jade Abbott, Dossou Bonaventure, and Mbuya Rooweither, "Comparing Africa-Centric Models to OpenAI's GPT3.5," Lelapa AI, February 9, 2023, https://lelapa.ai/comparing-africa-centric-models-to-openais-gpt3-5-2.
[469] Arthur Gwagwa et al., "Artificial Intelligence (AI) Deployments in Africa : Benefits, Challenges and Policy Dimensions," *African Journal of Information and Communication* no. 26 (December 2020): 3–30, https://doi.org/10.23962/10539/30361.
[470] Abbott, Bonaventure, and Rooweither, "Comparing Africa-Centric Models to OpenAI's GPT3.5."
[471] University of Johannesburg, "UJ Set to Advance as the Hub of Artificial Intelligence in South Africa," *University of Johannesburg News*, January 16, 2018, https://news.uj.ac.za/news/uj-set-to-advance-as-the-hub-of-artificial-intelligence-in-south-africa-2.

Finally, global tech companies like Equinix, Google, and Vantage Data Centers are making substantial investments in AI infrastructure in South Africa.[472] Equinix alone is investing $160 million in a local data center; in 2022, Google promised to establish a new Google Cloud region (no investment numbers were announced at the time). This influx of foreign investments raises concerns about the control and influence exerted by foreign companies, in the process monopolizing a nascent industry and potentially shaping the tech landscape according to global, rather than domestic, priorities.

The South African government's initiatives around AI reflect both a strategic alignment with broader economic policy objectives and a response to critiques of its past performance. The deliberate targeting of specific AI projects that the government is promoting through the AI Institute, the collaboration with diverse stakeholders, and the emphasis on innovation are an indication of the government's desire to make the country both a target for investment and a regional hub in the burgeoning AI infrastructure industry. However, unintended consequences, such as the potential to exacerbate social disparities and continued external dependencies, highlight the necessity for vigilance around democratic governance,[473] inclusion and empowerment of civil society in this process, and ethical considerations in the pursuit of the government's goal.

A Look at the Effectiveness of Government Efforts

The disconnect between the initiation and scale-up of AI initiatives in South Africa is a multifaceted challenge encompassing several critical factors. The foremost impediment lies in resource constraints,[474] primarily limited funding. Many pioneering AI pilot projects encounter difficulties securing the financial backing necessary for the expansive infrastructure, comprehensive testing, and sustained development needed for scaling.[475] For example, evidence from a study conducted

[472] Kelello Mashiane and Rethabile Molala, "Foreign Direct Investment Tracker: Fourth Quarter 2022," (Trade and Industrial Policy Strategies, accessed January 16, 2024, https://www.tips.org.za/manufacturing-data/fdi-tracker/item/4543-fdi-tracker-q4-2022.
[473] Research ICT Africa, "Online Consultation: What Will a Just Global Digital Compact Look Like for Africa?," April 3, 2023, https://researchictafrica.net/2023/04/03/online-consultation-what-will-a-just-global-digital-compact-look-like-for-africa.
[474] Emile Ormond, "Artificial Intelligence in South Africa Comes with Special Dilemmas – plus the Usual Risks," *Conversation*, January 27, 2023, http://theconversation.com/artificial-intelligence-in-south-africa-comes-with-special-dilemmas-plus-the-usual-risks-194277.
[475] Joubert, "State of South Africa's Software Developer Nation 2023."

by the University of Johannesburg[476] showed that though there are various incentives and funding initiatives from different government entities to support agri-industrial development, advancements in health and mining, encompassing funding for startups, trials, prototyping, and infrastructure, anecdotal insights show that there is a significant gap in funding at the commercialization stage, potentially hindering the development of technologies within the country. This has also led to instances where technologies developed in South Africa were sold, implemented, and profited from by foreign companies, as was the case with a desalination technology adopted by Israeli companies.[477] This suggests that while funding initiatives are reported, there is a critical gap in funding support for the crucial commercialization phase, impacting the potential success of AI technology businesses in South Africa.

This funding shortfall at such a critical stage not only curtails the reach of these projects, but also impedes their potential impact on the broader socioeconomic landscape. Another pivotal factor contributing to this disconnect is the prevalent skills gap, specifically the scarcity of a skilled workforce proficient in AI and related fields. Bridging this gap necessitates the establishment of robust programs for skills development, education, and training both within academic institutions and the existing workforce.

Finally, the aforementioned inadequate technological infrastructure, particularly in remote or underserved areas, poses a substantial hindrance to the deployment and scalability of AI solutions. To put it simply, the paucity of reliable infrastructure hampers the accessibility of AI technologies to broader population segments, exacerbating existing disparities. As I'll explore in the next section, the uncertain regulatory environment compounds these challenges, with the absence of clear and supportive frameworks for AI technologies creating an atmosphere of uncertainty. This regulatory ambiguity not only inhibits substantial investment, but also dampens the enthusiasm of organizations to scale up their initial pilot projects.

[476] UJ-TRCTI, "Emerging Technologies in South Africa: A Landscape Analysis," University of Johannesburg, June 3, 2022, https://www.uj.ac.za/wp-content/uploads/2022/02/uj-emtech-digital.pdf.
[477] Ibid.

Regulatory Guardrails (or Lack Thereof) For AI

While the government's focus on inclusive policies and localization aligns with historical industrial policy goals, this has not been paired with a comprehensive policy position on AI governance. This raises concerns about potential oversight in addressing the multifaceted risks associated with AI technologies. The government's historical emphasis on self-sufficiency and economic growth seems to extend to cutting-edge technologies.[478] In addition, the government's apparent reluctance to formulate a comprehensive AI policy risks prioritizing short-term innovation over long-term risk mitigation. This suggests that the government, in its pursuit of technological advancement and economic growth, might be inclined to embrace the benefits of AI without adequately addressing the associated risks and ethical considerations.

The minimal mention of AI in policy documents, fleeting references in government engagements, and the absence of dedicated AI policy initiatives could be interpreted as either an oversight or a deliberate choice to downplay the multifaceted risks associated with AI technologies. The acknowledgement by government ministers[479] of the lack of AI regulation, coupled with concerns about how the country can regulate AI without a clear policy position, underscores a potential gap in the government's strategic planning. While South Africa has personal data protection, intellectual property, and copyright laws, all of which could be applied to the tech industry, these regulations might not be sufficiently adapted to address the nuances of novel AI applications. The need for legislative changes to ensure holistic protection for data subjects highlights a regulatory lag, potentially leaving individuals vulnerable to privacy infringements and various forms of harms resulting from the unbridled use of AI. Until the government legislates clear policy on the use and deployment of AI, this will continue to be an issue.

[478] Andreoni et al., eds., *Structural Transformation in South Africa*.
[479] South African Government, "Minister Khumbudzo Ntshavheni: Artificial Intelligence Regulation While Encouraging Innovation," November 4, 2021, https://www.gov.za/news/speeches/minister-khumbudzo-ntshavheni-artificial-intelligence-regulation-while-encouraging.

It is essential to note the Competition Commission's Online Intermediation Platforms Market Inquiry,[480] initiated in 2021 due to concerns that certain features of these platforms, including e-commerce, online travel agencies, food delivery, app stores, and property/automotive classifieds, were hindering competition in South Africa. The Commission aimed to promote the participation of small and medium enterprises (SMEs) and historically disadvantaged persons (HDPs) in these markets, and it concluded its market inquiry in July 2023 with enforceable remedies these platforms must adhere to. These remedies are the first in the African context to confront the power of Big Tech. They range from disallowing platforms such as Google to self-preference their products over smaller South African platforms, to Booking.com ceasing narrow price parity practices. Following this announcement, Google quickly announced a partnership with SA's tourism department to improve travel directories online.[481]

The Commission also encourages the government to prioritize the development and implementation of comprehensive AI governance policies to ensure ethical AI practices, protect privacy, and address biases.[482]

Conclusion

South Africa's historic industrial policy outcomes acknowledge the limitations of orthodox economic reforms and aims for a more integrated approach. However, the slow mobilization of support instruments and policy alignment continue to hobble efforts toward this desired approach.

As South Africa navigates the growth of AI technologies, its context and history emphasize that critical considerations must include addressing historical imbalances, fostering diversity, bridging the digital divide, and formulating comprehensive AI governance policies. Given the capital-intensive nature of these endeavors and the stated development goals, South Africa requires the collaboration and convergence of public- and private-sector efforts to shape its

[480] James Hodge et al., "Online Intermediation Platforms Market Inquiry: Summary of Final Report Findings and Remedial Actions," Competition Commission, July 2023, https://www.compcom.co.za/wp-content/uploads/2023/07/CC_OIPMI-Summary-of-Findings-and-Remedial-action.pdf.
[481] Selene Brophy, "Google Partners with South Africa to Fix Unfair Search Results for Small Travel Operators," Skift, November 14, 2023, https://skift.com/2023/11/14/google-partners-with-south-africa-to-fix-unfair-search-results-for-small-travel-operators.
[482] Nqobile Dludla, "South Africa to Probe Meta, Google Competition with News Publishers," Reuters, October 17, 2023, https://www.reuters.com/world/africa/south-africa-probe-meta-google-competition-with-news-publishers-2023-10-1.

future technological trajectory. Still, only vigilant attention to inclusive development and risk management will ensure sustainable and equitable growth.

Neva Makgetla has eloquently emphasized the need to "decolonise industrial policy."[483] Investment in the improvement and expansion of technological infrastructure, particularly in underserved regions, is paramount to ensuring its equitable access and scalability. This entails targeted and sustained efforts to enhance technological accessibility in remote areas and mitigate existing disparities. Additionally, achieving regulatory clarity through establishing clear and supportive guidelines is imperative and urgent. A transparent regulatory environment that centers equity, democracy, and "a growing, deconcentrated and inclusive economy"[484] instills confidence in society and its citizens, and eventually in investors and organizations seeking to scale their AI projects, fostering an environment conducive to sustained development.

So far, AI policy in South Africa has focused on limited government initiatives and some targeted research efforts (such as the Artificial Intelligence Institute of South Africa). Yet there is an urgent need for increased financial support, with the encouragement of both public- and private-sector investment in AI projects. Financial incentives and grants can play a pivotal role in facilitating the scaling of successful pilot technologies, fostering an environment conducive to innovation.

Ethical concerns surrounding bias and discrimination, particularly in datasets used for AI technologies, demand critical attention. The perpetuation of existing social biases through biased datasets poses significant ethical challenges, potentially reinforcing societal inequities.[485] Privacy concerns related to the collection and use of personal data in AI applications add another layer of complexity.[486] Striking a delicate balance between innovation and safeguarding individual privacy is a paramount challenge in the evolving AI landscape. Additionally, the proliferation of digital innovations increases the risk of cybersecurity threats and breaches.[487] Ensuring the robust security of AI systems becomes imperative to safeguard

[483] Neva Makgetla, "Industrial Policy and The COVID-19 Pandemic: The South African Experience," ECIDC Project Paper (UNCTAD, April 2022), https://unctad.org/system/files/official-document/BRI-Project_RP26_en.pdf.
[484] The Competition Commission (website), accessed February 13, 2024, https://www.compcom.co.za.
[485] University of Johannesburg, "UJ Set to Advance as the Hub of Artificial Intelligence in South Africa," *University of Johannesburg News*, January 16, 2018, https://news.uj.ac.za/news/uj-set-to-advance-as-the-hub-of-artificial-intelligence-in-south-africa-2.
[486] Amba Kak, "Remarks from AI Now ED Amba Kak on Day 2 of the UK AI Safety Summit," AI Now Institute (blog), November 2, 2023, https://ainowinstitute.org/publication/remarks-from-ai-now-ed-amba-kak-on-day-2-of-the-uk-ai-safety-summit.
[487] Heloise Pieterse, "The Cyber Threat Landscape in South Africa: A 10-Year Review," *African Journal of Information and Communication* 28 (2021): 1–21, https://doi.org/10.23962/10539/32213.

against malicious activities that could compromise the integrity and functionality of these technologies.

Finally, the need for government regulation cannot be overstated. Clearly setting out an AI policy that enshrines democratic governance of emerging technologies, promotes inclusion, and protects privacy should be a priority.

7. Beyond Techwashing: The UAE's AI Industrial Policy as a Security Regime

by Islam Al Khatib

"The UAE will build an AI economy, not wait for one," writes the world's first AI minister, Sheikh Mohammed bin Rashid Al Maktoum, in his foreword to UAE National Strategy for Artificial Intelligence 2031.[488] Rather than narrate AI as a tool or factor influencing the economy, the idea of an "AI economy" captures a self-fulfilling vision of AI shaping an economy in which it occupies a central, all-encompassing role. As Mckenzie Wark writes in Capital is Dead,[489] there is a difference "between 'information' as a force of production and information as a dominant force of

[488] United Arab Emirates, Artificial Intelligence Office, *UAE National Strategy for Artificial Intelligence 2031*, July 2021, https://ai.gov.ae/wp-content/uploads/2021/07/UAE-National-Strategy-for-Artificial-Intelligence-2031.pdf.
[489] McKenzie Wark, *Capital is Dead* (London: Verso Books, 2019), 46.

production." Similarly, AI is no longer simply a market to monopolize, but rather a monopoly that will marketize other sectors.

The overarching preoccupation of the United Arab Emirates has been with the larger project of achieving dominance and strengthening its geopolitical positioning, and as AI is widely heralded as the digital infrastructure of the future, the country is making swift moves to establish its relevance in this new era. According to the UAE's AI Office, they hope to "transform the UAE into a world leader in A.I. by investing in people and industries" that are critical to their success, which also aligns with the UAE's Centennial Strategy 2071[490] goal of making the UAE the "best country in the world" by 2071 through innovative approaches to technology and infrastructure. This exaggerated emphasis on technology and becoming "the best" is also linked to eradicating any potential threat that might impede this "progress" and growth. With COP28[491] taking place in the UAE at the end of 2023, the UAE's AI industrial policy is not only meant to secure prosperity, but also to guarantee a "post-oil future." In other words, just as the UAE is in charge of the oil present, it is positioning itself to be ahead in the post-oil, likely AI-fueled future.

As outlined in its policies, the UAE seeks to transform itself into a "into a world leader in AI by investing in people and industries that are key" to the country's success.[492] The UAE's AI interventions cover different aspects of everyday life - it is expected[493] that the government will adopt new and developing generations of digital governance (currently labeled "Gov 3.0"); in the health industry, where AI is being used to predict chronic and dangerous diseases; in transportation, where the Dubai Autonomous Transportation Strategy is seeking to transform 25 percent of mass transit into self-driving transport by 2030; and in energy, where the hope is to optimize energy production, distribution, and consumption.[494] The broad emphasis seems to be on making labor more efficient by maximally automating governance functions—in other words, to build a whole new AI-embedded infrastructure for governance.

[490] United Arab Emirates, "UAE Centennial Plan 2071," accessed February 13, 2024, https://uaecabinet.ae/en/uae-centennial-plan-2071.
[491] Human Rights Watch, "UAE: Mass Surveillance Threatens Rights, COP28 Outcome," November 30, 2023, , https://www.hrw.org/news/2023/11/30/uae-mass-surveillance-threatens-rights-cop28-outcome.
[492] United Arab Emirates, Artificial Intelligence Office, *UAE National Strategy for Artificial Intelligence 2031*. See also "Policies | The Official Portal of the UAE Government" (web page), accessed December 20, 2023, https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/policies.
[493] Mohanad Halaweh, "Viewpoint: Artificial Intelligence Government (Gov. 3.0): The UAE Leading Model," *Journal of Artificial Intelligence Research* 62 (June 2018): 269–272, https://jair.org/index.php/jair/article/view/11210/26421.
[494] T"2024–2030" (web page), Official Portal of the UAE Government, updated August 15, 2023, accessed December 22, 2024, https://u.ae/en/more/uae-future/2021-2030.

The approach to industrial strategies in AI follows the centralized and highly controlled structure replicated by the government in other parts of the economy, often referred to as its tendency to "produce and perpetuate vertical policies."[495] However, this goes hand in hand with labor practices. Trade unions are restricted in the UAE;[496] therefore, workers cannot contest their precarity as they grapple with restricted leverage stemming from indebtedness and unstable residency statuses. Workers on the Expo 2020 project reported violations such as passport confiscation, racial discrimination, and nonpayment of wages, revealing a structural reality that spans industry borders.[497] This complex reality of exploitation and structural racism has resulted in the forced silencing and repression of trade unions that can contest such policies.

The AI and tech sectors are not immune to labor exploitation that exists in other sectors, and the reality of workers in the UAE raises the questions of working conditions not only in the industry, but also in areas where AI is being deployed, particularly with the massive inflow of tech workers since 2021, which has fueled the UAE's AI ambitions. As of September 2023, there were 120,000 people working in AI or related areas, up from 30,000 two years before.[498] With the present stifling structures in the UAE, determining how workers and individuals engage through labor relations and other interactions with emerging AI and digital transformation is difficult. This is worsened by the Code of Crimes and Punishments which maintains severe limitations on free speech and assembly and includes a provision prohibiting unauthorized distribution of government information. Article 178 specifically prohibits sending government "information" to any organization without a license.[499] For example, in June 2022, Al Roeya, a daily newspaper owned by Deputy Prime Minister Mansour bin Zayed Al Nahyan's firm, sacked the majority of its employees for reporting on popular displeasure with rising energy prices, highlighting the limited climate for freedom of expression and a free press.[500].

[495] Mustapha K. Nabli, Jennifer Keller, Claudia Nassif, and Carlos Silva-Jáuregui, "The Political Economy of Industrial Policy in the Middle East and North Africa," in *Economic Development in the Middle East and North Africa*, ed. Ahmed Galal (Cairo: American University in Cairo, 2008), 109–136, https://www.jstor.org/stable/j.ctt15m7jxf.10.
[496] Business & Human Rights Resource Centre (BHRRC), *A Wall of Silence: The Construction Sector's Response to Migrant Rights in Qatar and the UAE*, 2016, https://respect.international/a-wall-of-silence-the-construction-sectors-response-to-migrant-rights-in-qatar-and-the-uae.
[497] Pete Pattison, "Allegations of Worker Exploitation at 'World's Greatest Show' in Dubai, *Guardian*, February 2, 2022, https://www.theguardian.com/global-development/2022/feb/02/allegations-of-worker-exploitation-at-worlds-greatest-show-expo-2020-dubai.
[498] beer Abu Omar, "Minister Backs Altman's Idea to Turn UAE into AI Testing Ground," Bloomberg, February 15, 2024, https://www.bloomberg.com/news/articles/2024-02-15/minister-backs-altman-s-idea-to-turn-uae-into-ai-testing-ground.
[499] Amnesty International, *Amnesty International Report 2022/23: The State of the World's Human Rights*, March 27, 2023, https://www.amnesty.org/en/documents/pol10/5670/2023/en.
[500] "Dubai Newspaper That Ran Story on High Fuel Prices Dissolved,"' Al Jazeera, September 13, 2022, https://www.aljazeera.com/news/2022/9/13/dubai-newspaper-that-ran-story-on-high-fuel-prices-dissolved.

A key feature of the UAE's AI positioning has been the encouragement of both private and state-owned corporations that engage on behalf of the state in geopolitical arenas; Group 42, or G42, is the most prominent of these. Established in 2018 in Abu Dhabi, G42 operates as an arm of the state in multiple ways: chaired by the UAE's national security adviser, Sheikh Tahnoon bin Zayed al-Nahyan, it routinely markets the UAE as a new AI power. G42 has been facilitating "public-private" partnerships, as in the case of Hassantuk,[501] where the UAE Ministry of Interior and Injazat Data Systems, a G42 company, collaborate on civil defense by leveraging Internet of Things (IoT) technologies. G42 was also recently under fire for its ties to the TikTok messaging app, which was used for spying and mass surveillance, as I will explore later in this essay.[502] Several G42 "subsidiaries," such as Bayanat,[503] Core42,[504] HayatBiotech,[505] and M42,[506] among others, have been adopted by the government, to the point where G42 consistently and centrally figures in almost all AI applications across different sectors in the UAE.

The alignment of the national security apparatus with the broader push for industrial policy on AI is not incidental; rather, it is central to how AI industrial strategies are being designed and deployed. This is due not only to the current and potential applications of AI in predictive security and surveillance systems, but also to the association of AI with fantasies of "absolute sovereignty,"[507] "progress," and the persistent belief that "future wars" will be centered around data and information rather than land and resources, a sentiment proven false by the ongoing attacks on Palestine, Sudan, Congo, and Tigray, in which the UAE's foreign policy has been explicitly and implicitly complicit.[508]

[501] Ministry of Interior of the United Arab Emirates (website), accessed February 13, 2024, https://home.moi.gov.ae/en/index.html.
[502] Jon Gambrell, "Co-Creator Defends Suspected UAE Spying App Called ToTok," Associated Press, January 2, 2020, https://apnews.com/general-news-67165c626c35ab0cca1ef9cbf6cea274.
[503] G42 "G42 Announces the Acquisition of Bayanat," press release, January 14, 2020,. https://www.g42.ai/resources/news/g42-announces-the-acquisition-of-bayanat.
[504] "G42 Launches Core42 to Deliver National-Scale Enterprise Cloud and AI Capabilities," press release, October 16, 2023, https://www.zawya.com/en/press-release/events-and-conferences/g42-launches-core42-to-deliver-national-scale-enterprise-cloud-and-ai-capabilities-fwk9cdrl.
[505] "We Are Hayat Biotech; Reshaping the Future of Life" (web page), Hayat Biotech, accessed February 21, 2024, https://hayatbiotech.com/about.
[506] "G42 and Mubadala Announce the Launch of M42," press release, Mubadala, April 17, 2023, https://www.mubadala.com/en/news/g42-and-mubadala-announce-the-launch-of-m42.
[507] Roberto Reale, "Towards Sovereignty in AI: A 7-Tier Strategy for Europe's Technological Independence in Generative Artificial Intelligence," European AI Alliance, May 26, 2023, https://futurium.ec.europa.eu/en/european-ai-alliance/blog/towards-sovereignty-ai-7-tier-strategy-europes-technological-independence-generative-artificial.
[508] Neil Quilliam and Sanam Vakil, "The Medicis of the Middle East?" *Foreign Affairs*, December 29, 2023, https://www.foreignaffairs.com/united-arab-emirates/medicis-middle-east.

UAE's AI Geopolitics: Pushing for Multipolarity within the US-China AI Race

While the geopolitics of AI is frequently reduced to a conversation about "bad" AI models (exemplified by China from a Western perspective) and "good" or "democratic" AI models, this flattens the complicities and complexities of AI industrial policies, which are better understood as a multipolar terrain, where state economic interests might create alternate pathways that shift this terrain. The UAE's AI strategy, for example, is about strengthening its geopolitical positioning and playing "both sides" vis-à-vis the so-called US-China AI Arms Race. G42 has had to make a pivotal decision, epitomizing the dilemma faced by many in the region: a choice between partnering with the US or with China. G42's CEO, Peng Xiao, announced a shift away from Chinese hardware to secure access to US-made chips, citing the need for caution amid signals from the US government and partners.[509]

The UAE, keen to navigate these turbulent waters to establish itself as a leading AI force, is seen as doubling down on its relationship with the US, emphasizing cooperation with American partners. But G42's past dealings with Chinese firms, including tech giant Huawei, have raised concerns in the US.[510] In November 2023, the New York Times reported that American spy agencies had issued warnings about G42's work with large Chinese companies.[511] G42 strongly denied accusations highlighted in the New York Times article and the letter from US lawmaker Mike Gallagher, chairman of the House China Select Committee,[512] and insisted that it has "aligned commercially with U.S. partners since 2022," avoiding engagement with Chinese companies.[513] Gallagher's letter expressed concerns about G42's connections to blacklisted Chinese firms like BGI Group (formerly Beijing Genomics Institute) and potential risks to US university research. He indicated that his

[509] Michael Peel and Simeon Kerr, "UAE's Top AI Group Vows to Phase out Chinese Hardware to Appease US," *Financial Times*, December 7, 2023, https://www.ft.com/content/6710c259-0746-4e09-804f-8a48ecf50ba3.
[510] Edward Wong, Mark Mazzetti, and Paul Mozur, "Lawmakers Push U.S. to Consider Trade Limits with A.I. Giant Tied to China," *New York Times*, January 9, 2024, https://www.nytimes.com/2024/01/09/us/politics/ai-china-uae-g42.html.
[511] Mark Mazzetti and Edward Wong, "Inside U.S. Efforts to Untangle an A.I. Giant's Ties to China," *New York Times,* November 27, 2023, https://www.nytimes.com/2023/11/27/us/politics/ai-us-uae-china-security-g42.html.
[512] Select Committee on the Chinese Communist Party, "Gallagher Calls on USG to Investigate AI Firm, G42, Ties to PRC Military, Intelligence-Linked Companies," press release, January 9, 2024, https://selectcommitteeontheccp.house.gov/media/press-releases/gallagher-calls-usg-investigate-ai-firm-g42-ties-prc-military-intelligence.
[513] G42, "Statement on the New York Times Article and the Letter from the United States Congress House Select Committee on the CCP," January 11, 2024, https://web.archive.org/web/20240112102208/https://www.g42.ai/resources/news/Statement-on-the-New-York-Times-article-and-the-letter-from-the-United-States-Congress-House-Select-Committee-on-the-CCP.

committee found evidence of G42's links to a network of Emirati and Chinese entities involved in human rights abuses and supportive of Beijing's military. Yet, the specific documents Gallagher referred to were not disclosed in his letter.

This controversy brings to light selective stirring of human rights and ethical values, often surfacing as a tactical response to the looming presence of economic rivals (e.g., the Chinese threat in "acquiring' a key US partner in the Middle East). It also underscores that UAE companies are going to be expected to follow broader political allegiances even in supposedly apolitical deals in the corporate sphere. Here, G42's public pledge gained prominence as a form of realignment against "Chinese interests," against the backdrop of the UAE hosting five thousand US military personnel, many of whom are stationed at Abu Dhabi's Al Dhafra Air Base, where American drones are stationed.[514] In this context, an AI industrial policy operates within a shifting geopolitical terrain.

But the UAE is far from pledging a singular alliance with the US, instead playing the field opportunistically so it can push toward a multipolar world order in which it operates as a key power center. One way it does this is by swaying between the US and China, thus retaining some degree of autonomy over decision-making. In March 2023, G42 acquired a stake over $100 million in ByteDance, the owner of TikTok, at a valuation of $220 billion. This move, part of G42's strategy through its 42X Fund, came amid TikTok's consideration of separation from ByteDance to mitigate US national security concerns related to user data and Chinese government access.[515] This balance gets significantly trickier when it comes to the domain of advanced chips for AI development—G42 and Microsoft have expanded their partnership with a plan to make sovereign cloud offerings available to the UAE, collaborate on advanced AI capabilities, and expand data center infrastructure.[516]. The UAE has entered the semiconductor industry through partnerships with figures such as Sam Altman and leading chip manufacturers TSMC and Intel[517] in order to strike a balance between maintaining geopolitical relationships with the US and growing the AI industry as a business through trade deals with China.[518] Altman's attempt to

[514] "US to Send destroyer, Fighter Jets to UAE amid Houthi Attacks," Al Jazeera, February 2, 2022, https://www.aljazeera.com/news/2022/2/2/us-to-send-destroyer-fighter-jets-to-uae-amid-houthi-attacks.
[515] "Abu Dhabi's G42 Buys ByteDance Stake at $220 Bln Valuation, Report Says," CNBC, March 15, 2023, https://www.cnbc.com/2023/03/15/abu-dhabis-g42-buys-bytedance-stake-at-220-bln-valuation-report-says.html.
[516] "G42 and Microsoft Unlock New Opportunities for Digital Transformation with Joint Sovereign Cloud and AI Offering," Microsoft News Center, September 5, 2023, https://news.microsoft.com/en-xm/2023/09/05/g42-and-microsoft-unlock-new-opportunities-for-digital-transformation-with-joint-sovereign-cloud-and-ai-offering.
[517] Steve McDowell, "Is Sam Altman Entering the Chip Business?" *Forbes*, January 22, 2024, https://www.forbes.com/sites/stevemcdowell/2024/01/22/is-sam-altman-entering-the-chip-business.
[518] "Saudi Arabia and UAE Race to Buy Computer Chips," *Financial Times*, August 18, 2023, https://www.ft.com/content/b33c7e2a-6d16-407f-956f-01f248ff8dfe.

lessen OpenAI's dependency on Nvidia by launching a new semiconductor business is consistent with the UAE's aims to negotiate the difficult terrain of global chip production amid "chip monopoly" worries. This initiative, which sought early financing from Middle Eastern institutions such as Saudi Arabia's Public Investment Fund (PIF) and Mubadala Investment Company, demonstrates the UAE's dynamic role not only as a talent magnet but also as a sought-after location for unregulated business transactions. The capital dependency of AI firms on the UAE highlights a fundamental facet of the global tech landscape:[519] beyond Big Tech, the UAE has emerged as a critical, yet neutral (as in neither Chinese nor American) destination for the resources required to develop computing capabilities.

Aside from the "US-China AI race," the UAE finds itself entangled within another geopolitical maze where it also sides with an oppressor: the Abraham Accords (Israel-UAE peace deal) and its close partnership with the Israeli occupation, which have also made a mark on its tech investments.The geopolitical landscape in which the UAE operates, and particularly the violence with which it has built and presented itself as "the best country for tech and progress," has ultimately created a policy that seeks to reproduce this violence in every single detail, within the nodes of its economic and political structure. Both the UAE and the Israeli occupation present themselves as tech hubs, as new nodes of progress in the "Middle East," and their partnerships, within the AI market, blossomed and became more and more cemented: what the UAE lacks (cybersecurity and militarized AI), Israel has supplied; what Israel lacks (tech for "smart cities" and, in Israel's case, smart tech to efficiently build settlements), the UAE has provided.

When it comes to the UAE's AI industrial policy and geopolitics, it would be quite misleading not to mention the Abraham Accords. In a #NoTechForApartheid panel in November 2023, Antony Loewenstein said that "the Abraham accords were an arms deal,"[520] where the Israeli occupation and the UAE signed arms deals worth billions of dollars and the UAE purchased the infamous Israeli NSO spyware. In examining the trajectory of UAE-Israel relations, particularly through the prism of the Pegasus spyware saga,[521] there is a clear shift in terms of cooperation, where the integration of Pegasus into UAE's security arsenal symbolized a mending of erstwhile fissures,

[519] Keach Hagey and Asa Fitch, "Sam Altman Seeks Trillions of Dollars to Reshape Business of Chips and AI: OpenAI Chief Pursues Investors Including the U.A.E. for a Project Possibly Requiring Up to $7 Trillion," *Wall Street Journal*, February 8, 2024, https://www.wsj.com/tech/ai/sam-altman-seeks-trillions-of-dollars-to-reshape-business-of-chips-and-ai-89ab3db0.
[520] Timnit Gebru, "#NoTechForApartheid," DAIR Institute, 2023, accessed February 13, 2024, https://www.dair-institute.org/blog/NoTechForApartheid.
[521] Dan Sabbagh, David Pegg, Paul Lewis, and Stephanie Kirchgaessner, "UAE Linked o Listing of Hundreds of UK Phones in Pegasus Project Leak," *Guardian*, July 21, 2021, https://www.theguardian.com/world/2021/jul/21/uae-linked-to-listing-of-hundreds-of-uk-phones-in-pegasus-project-leak.

leading to a consolidated alliance as evidenced by the Abraham Accord in 2020.[522] This progression from a tenuous to a strategic partnership encapsulates the dynamic interplay of geopolitical shifts and mutual security interests that have come to define the UAE-Israel nexus.

EDGE Group officials and representatives have met with prominent foreign defense companies to build partnerships that could give them access to new and tested AI military technologies.[523] For example, the Emirati Ministry of Defence is negotiating AI-based defense initiatives with the French Ministry of Defense and French defense companies.[524]

Falcon, Jais, and the Illusion of Openness

The UAE's strategy extends beyond championing efficiency and innovation narratives to highlighting transparency and openness as key parts of its AI platform. In step with the highly mainstreamed AI policy discourse globally, where "open-source" AI has renewed currency as a potentially pro-competitive and innovative domain, G42 has unveiled Jais ("the world's most advanced Arabic LLM"[525]) and Falcon[526].

Jais is not just a public relations exercise directed at the Global North; it also offers a unique value proposition by providing 400 million Arabic speakers access to generative AI technologies. Jais and Falcon are part of a series of steps taken by the UAE to promote itself as a leader, including the recently established Artificial Intelligence and Advanced Technology Council (AIATC) set up to oversee policies and strategies for AI and advanced technology research, infrastructure, and investments in Abu Dhabi.[527] In developing Jais, the UAE partnered with a range of well-recognized global universities including Carnegie Mellon University, Ecole

[522] Andrew England and Simeon Kerr, "The Abu Dhabi Royal at the Nexus of UAE Business and National Security," *Financial Times*, January 25, 2021, https://www.ft.com/content/ce09911b-041d-4651-9bbb-d2a16d39ede7.
[523] "UAE: EDGE Prioritizing Cooperation on AI Technologies," Tactical Report, October 25, 2023, https://www.tacticalreport.com/daily/62277-uae-edge-prioritizing-cooperation-on-ai-technologies.
[524] "UAE-France Defense Relations: Talks on Projects for AI-Based Systems," Tactical Report, September 26, 2023, https://www.tacticalreport.com/daily/62208-uae-france-defense-relations-talks-on-projects-for-ai-based-systems.
[525] G42, "Meet Jais, the World's Most Advanced Arabic LLM Open Sourced by G42's Inception," August 30, 2023, https://www.g42.ai/resources/news/meet-jais-worlds-most-advanced-arabic-llm-open-sourced-g42s-inception.
[526] Lisa Barrington, "Abu Dhabi Makes Its Falcon 40B AI Model Open Source," Reuters, May 25, 2023, https://www.reuters.com/technology/abu-dhabi-makes-its-falcon-40b-ai-model-open-source-2023-05-25. See also https://www.businesswire.com/news/home/20230607005466/en/Falcon-40B-World%E2%80%99s-Top-AI-Model-Rewards-Most-Creative-Use-Cases-in-Call-for-Proposals-with-Training-Compute-Power.
[527] Deema AlSaffar Patterson, "UAE Establishes Artificial Intelligence and Advanced Technology Council," Al Arabiya English, January 22, 2024, https://english.alarabiya.net/News/gulf/2024/01/22/UAE-establishes-Artificial-Intelligence-and-Advanced-Technology-Council.

Polytechnique, Hamad Bin Khalifa University, Université Sorbonne Paris Nord–LIPN, New York University Abu Dhabi's CAMeL Lab, and the University of Edinburgh, among others.[528]

The UAE's AI projects are being framed within open-source networks, especially after the Technology Innovation Institute (TII) has waived royalties on Falcon's commercial and research use.[529] Yet, "openness" and "transparency" are often used as marketing terms rather than as functional technical descriptors. G42 is leveraging open-source AI to bolster its position in the face of growing interest in AI regulation, as evidenced by Falcon 180B's approach to "open access," which some view as confusing and overly complex.[530] The model is licensed under a bespoke version of the Apache 2.0 license, incorporating restrictions that aim to control the use of Falcon 180B by cloud hosting providers like Amazon Web Services. However, the licence itself prohibits hosting.[531] Due to the Apache Licence 2.0's no-hosting provision, access to shared Falcon 180B instances and their fine-tunings cannot be monetized via an API, whether for inference or other reasons.[532] This limitation goes against the ethos of open-source AI frameworks, which aim to allow users to freely utilize services/softwares for a variety of in-house purposes. Currently, this would require explicit licensing rules.

The UAE has succeeded in promoting itself as a bulwark against "monopolization" by collaborating with figures like Altman, who hailed Abu Dhabi's foresight; the UAE is being recognized not only as the present of AI, but also as its future.[533] By leveraging geopolitical tensions and regulation debates among prominent corporations, the UAE is marketing itself as "open" and "welcome" when it comes to the AI industry, which is ultimately being led by the same corporate structures (G42, for example) that it claims to diverge from.

All in all, the UAE's promise of being the "best" is being associated with the language of openness and inclusivity that is rooted in the work of tech organizers and digital rights activists,—people who have spent the past two decades weaving together ways to dismantle tech monopolies, to dream of worlds where tech is a

[528] "Meet 'Jais', the World's Most Advanced Arabic Large Language Model Open Sourced by G42's Inception," Mohamed bin Zayed University of Artificial Intelligence, August 30, 2023, https://mbzuai.ac.ae/news/meet-jais-the-worlds-most-advanced-arabic-large-language-model-open-sourced-by-g42s-inception
[529] "UAE's Falcon 40B Is Now Royalty Free," Technology Innovation Institute, May 31, 2023, https://www.tii.ae/news/uaes-falcon-40b-now-royalty-free.
[530] Alek Tarkowski, "Falcon 180B, Open Source AI and Control Over Compute," Open Future (blog), October 25, 2023, https://openfuture.eu/blog/falcon-180b-open-source-ai-and-control-over-compute.
[531] "Apache License 2.0," Apache Software Foundation https://www.apache.org/licenses/LICENSE-2.0.
[532] Falcon Live Learning Management, "FAQs", https://falconllm.tii.ae/faq.html
[533] "Sheikh Maktoum Meets OpenAI CEO Sam Altman during His UAE Visit," June 7, 2023, https://www.arabianbusiness.com/industries/technology/sheikh-maktoum-meets-openai-ceo-sam-altman-during-his-uae-visit.

public tool, and where AI isn't tied to some tech fantasy but to actual processes of democratization and inclusion. This supposed "openness" not only masks a corporate monopoly of the AI sector, but also the fact that it is an openness built on erasure. Jais, "the Arabic LLM," uses "multiple sources including web pages, Wikipedia articles, news articles, Arabic books, and social network content."[534] As in English-language systems, the fear around what is available also applies to Arabic content, particularly because the UAE is known for the content it has manipulated by creating automated social media accounts that spew rhetoric surrounding the coup in Sudan and the war on Yemen.[535] Behind this apparent openness lurks the question of a new industrialization, a new monopoly fueled and funded by US corporate interests—a new regional turned global power.

Conclusion

Given the importance of high-performance compute resources in achieving AI domination, the UAE is now stockpiling thousands of state-of-the-art machines that are being built above any regulated capacity, as well as planning to manufacture its own. This was underlined by the UAE's Minister of State for Artificial Intelligence, Omar Al Olama, who sees the UAE as a "regulatory sandbox, " or a testing ground for AI advancements and the construction of experimental regulatory frameworks.[536]

The UAE is actively recalibrating its power through its AI industrial policy, moving to solidify its position as a global AI leader by balancing its geopolitical partnerships. This policy is part of the UAE's larger aim to promote growth and progress through comprehensive collaborations that go beyond economic impact and touch on complex political relationships and regional dynamics. The UAE's recalibration reflects the country's political approach to the AI sector, which goes beyond regulating tech advancement and innovation to consider the broader implications of the ongoing "US-China race;" and the UAE's position within it in the backdrop of regional geopolitical shifts such as the impact of Israel's genocide against Palestinians in Gaza. This industrial turn and focus on AI underscores the UAE's

[534] "Jais: a New Pinnacle in Open Arabic NLP," Inception, accessed February 13, 2024, https://www.inceptioniai.org/jais/docs/Whitepaper.pdf.
[535] Marc Owen Jones, "The New, Unsustainable Order of Arab Digital Autocracy," Carnegie Endowment for International Peace, May 3, 2023, https://carnegieendowment.org/2023/05/03/new-unsustainable-order-of-arab-digital-autocracy-pub-89525.
[536] Abeer Abu Omar, "Minister Backs Altman's Idea to Turn UAE into AI Testing Ground," Bloomberg, February 15, 2024, https://www.bloomberg.com/news/articles/2024-02-15/minister-backs-altman-s-idea-to-turn-uae-into-ai-testing-ground.

plan to use AI not only as a tool for economic progress, but also to influence international and regional political landscapes.

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